Critical Aspects of Action Learning: Results of Integration Between University and Brazilian Startups

Aspectos Críticos na Aprendizagem pela Ação: Resultados da Integração entre Universidade e Startups Catarinenses

Rogério Tadeu de Oliveira Lacerda
Mayara Lucia Bernardes
Bianca dos Santos Simon

ABSTRACT

This article aims to highlight the critical factors in the application of an action learning method in an extension project at the Federal University of Santa Catarina. The practical procedures proposed by the project are based on the constructivist approach to learning. A qualitative approach was used for data collection and the applied method of a case study. As a result, it was possible to observe some student behavioral events, the search for an optimal and generic problem solution from scientific literature, or similar examples. Another aspect observed was students' understanding that internal organization and learning management are more important than the technical solution itself. The uniqueness of the startup problem, coupled with limited facts and data, led the group to decide more about studies at an on-site startup than generic bibliographic research on the problem. The practical implications of this research include the contribution to educators and facilitators dealing with problems of uncertain and dynamic nature.
Keywords: Action learning. Constructivism. Performance evaluation. EBTs. Uncertainty.

RESUMO

Este artigo visa evidenciar os fatores críticos na aplicação de um método de aprendizagem pela ação em um projeto de extensão na Universidade Federal de Santa Catarina. Os procedimentos práticos propostos pelo projeto são baseados na abordagem construtivista de aprendizagem. Utilizou-se a abordagem qualitativa para coleta de dados, sendo o método aplicado de estudo de caso. Como resultados, foi possível observar alguns fenômenos quanto ao comportamento dos alunos, a busca de uma solução ótima e genérica de problemas a partir da literatura científica ou de exemplos semelhantes. Outro aspecto observado foi o entendimento, por parte dos alunos que a organização interna e o gerenciamento de

Submitted: 12/10/2019
Accepted: 04/25/2020

Rogério Tadeu de Oliveira Lacerda
rogerlacerda@gmail.com
PhD in Business Production engineering - UFSC
Doutor em Administração - UFSC
Universidade Federal de Santa Catarina
Florianópolis/SC - Brazil

Mayara Lucia Bernardes
mayaralbernardes@gmail.com
Msc. in Business Administration - UFSC
Mestre em Administração - UFSC
Universidade Federal de Santa Catarina
Florianópolis/SC - Brazil

Bianca dos Santos Simon
ssimon@gmail.com
Bachelor in Business Administration - UFSC
Bacharel em Administração - UFSC
Universidade Federal de Santa Catarina
Florianópolis/SC - Brazil

RESUMO

aprendizado são mais importantes do que a solução técnica em si. A singularidade do problema de startup, aliada à limitação de fatos e dados, levou o grupo a decidir mais sobre estudos *in loco* na startup do que em pesquisas bibliográficas genéricas sobre o problema. Como implicações práticas desta pesquisa destaca-se a contribuição para educadores e facilitadores que lidam com problemas de natureza incerta e dinâmica.
Palavras-chave: Aprendizagem pela ação. Construtivismo. Avaliação de desempenho. EBTs. Incerteza.

Introduction

Currently, increasingly differentiated skills are required from companies so that they stand out in the current competitive scenario (TEECE, 2012). This new demand for differentials is intensified in dynamic environments, mainly for companies that have technology as their core business, here referred to as Technology-Based Companies - EBTs (LACERDA et. Al., 2017; ZOTT; AMIT, 2017).

However, even from these new demands, EBTs present challenges in terms of management, and especially smaller companies, face difficulties for growth (HUDSON; SMART; BOURNE, 2001). In this way, more and more these companies are looking for professionals in universities, prepared to assume managerial positions. And, given this new need, educational institutions are required to train professionals prepared for the new reality (BENI et al., 2017).

In this challenging context, the importance of reflecting on teaching and learning methods applied in educational institutions emerges. As a result, as teaching in management evolves, the use of new resources, as a way of facilitating learning, as well as representations of the experience to be lived, constitutes a promising didactic field (CANOPF et al., 2018).

Thus, one of the teaching methods that has been gaining ground within the teaching of management is learning by action. Action learning suggests that students do meaningful learning activities and think about what they are doing (PRINCE, 2004) and thus contribute to the development of competence through direct contact with real problems, encourages reflection on the relationship of action and its consequences, sharing experiences and teamwork (MARQUARDT, 2005).

Thus, from the context in which these EBTs are inserted, there is a need for research and extension projects that assist in the training of students to help these companies to use new concepts, trends and tools for their business success, in context of a university program that focuses on an active learning approach (CALVETTI; LACERDA; BERNARDES, 2019).

Given the above, this research aims to highlight the critical factors in the application of learning by action method in an extension project at the Federal University of Santa Catarina, with the following specific objectives: i) proposing an active learning method to improve competencies in undergraduate students; ii) explain the results of the execution of an extension project using the action learning method; iii) triangulate evidence to propose critical aspects of the method inductively.

Theoretical Foundation

ACTION LEARNING

More and more, to transform students into prepared professionals, undergraduate courses, in addition to the technical skills of their areas of knowledge, need to prepare professionals for the labor market for the intense use of creativity, communication, teamwork, and problem structuring complex, uncertain and conflicting.

Because of this need for a professional profile derived from a competitive market based on innovation, the change in teaching methods becomes essential, since traditional teaching methods do not contribute to the development of these required skills (PERRITON; REYNOLDS, 2018). Passive learning approaches, based mainly on content verbalization, have proven to be an inefficient teaching strategy (MARQUARDT, 2005; LEONARD, 2015).

In this sense, Leonard and Lang (2010) argue that the revitalization of the teaching-learning process allows students to be the main agent for the construction of their knowledge and not just a receiver of data and information. Therefore, students must develop their critical, conceptual, and autonomous skills by performing high-level mental tasks, such as analysis, synthesis, and evaluation (BARON, 2016). Thus, from the reflections presented above, the first theoretical construct of this research emerges:

Construct 01: As a way of effective learning, students need to develop their critical, synthesis, conceptualization, and autonomy skills by performing high--level mental tasks, such as analysis, synthesis, and evaluation.

Thus, one of the teaching methods that has been gaining ground within the teaching of management is learning by action (BENI et al., 2017; PERRITON; REYNOLDS, 2018). In short, action learning - APA establishes that students do meaningful learning activities and reflect on what and how they are performing. In other words, learning by action contributes to the development of skills through direct contact with the object of study, reflection on the relationship of action and its consequences, sharing of experiences, and teamwork (KRAKAUER; DOS SANTOS; DE ALMEIDA, 2017).

And, in this sense, the APA has as premises and principles: (i) to establish a relationship between action and learning; (ii) maintains that learning is most effective when it is an active and not a passive process; (iii) establishes an effective relationship between practice and theory; (iv) emphasizes the experimental nature of learning and problem solving, sees change as an iterative process (LEONARD, 2015). Specifically, Edmonstone (2015) lists the benefits of action learning at the individual level:

- A greater breadth of understanding, as a basis for building relationships;
- Better ability to make sense of ambiguous data and situations and solve complex problems;
- Ability to understand and initiate organizational changes;
- An improved focus on what makes a difference in a given situation;
- Individuals more focused on action and proactive in delivering results;
- Greater self-awareness of personal impact on others, contributing to an improved ability to work in teams.

Thus, strategies that promote active learning can be defined as activities that occupy the student in doing something, and at the same time, leads him to think about what he is doing. And at this point, there are two fundamental aspects of the

action learning approach: (i) the student's control over their learning; and (ii) inductive learning (BELL; KOZLOWSKI, 2008).

The first aspect concerns the control that the student himself exercises over his learning, that is, the student takes primary responsibility for important decisions that will influence his learning, such as choosing learning activities that he wants to perform, monitoring and evaluating his progress (DE LIMA et. al., 2012; URIAS; AZEREDO, 2017). In contrast, passive learning approaches focus on the limitation and control of students, where the main controlling agent must be the teacher, and the latter assumes primary responsibility for learning decisions (BELL; KOZLOWSKI, 2008). Thus, it can be highlighted as the second theoretical construct of this research:

> *Constructo 02: The student must take responsibility for decisions that influence his learning, so he must have a choice about the learning activities he wants to perform, monitoring, and evaluating his progress.*

Regarding the second aspect of action learning, it stands out that it promotes an inductive learning process for students (PATON; CHIA; BURT, 2014). That is, students, explore and experience a task to infer the rules, principles, and strategies for effective performance. In contrast, passive approaches to learning assume that people acquire knowledge by passing it on to them from some external source.

Regarding the action learning process, Leonard (2015) presents seven phases in which it breaks down. Each phase has a specific objective that must be fulfilled in the problem-solving process and the typical obstacles that must be overcome by the team and must be considered critical aspects for the students' learning.

Table 1 Stages, objectives, and obstacles in the action learning process.

Stage	Objective	Typical obstacles
Problem identification	Identify critical and urgent problems needing a solution	Inappropriate issues identified
Selecting a problem	Select one of the identified problems	Apathy, resistance to withdrawal from a problem
Analysis and definition of the problem (causes and framework)	Understanding the main causes of the selected problem and formulating the problem label to be solved	Premature and incomplete analysis of the problem Establish the problem as an objective without identifying or understanding the causes
Generation of ideas	Identification of ways to move the problem from the current situation to the delimited future state	Excessive judgment Premature closure of the idea generation process Unequal team participation Excessive judgment Premature closure of the idea generation process Unequal team participation
Evaluation of ideas	Evaluation of the pros and cons of the ideas generated Deciding which ideas can be implemented	Lack of an effective process to consolidate, organize and evaluate ideas Unequal influence of team members Failure to specify criteria for inclusion or exclusion of ideas
Implementation of the best ideas	Develop an implementation plan	Vacant planning, without defining criteria for monitoring actions, responsibilities, success criteria and schedule
Evaluation of results	Develop a plan to evaluate the results	Lack of a plan to evaluate the results generated by the team Lack of a comprehensive analysis of the entire process

Source: Adapted from Leonard (2015).

Still in this sense, the author points out that when identifying that students faced an obstacle during the learning process, the facilitator can create questions that encourage the team to reflect on that obstacle, assess what the impact of the challenge is and encourage students to decide what needs to be done to achieve the goal.

Finally, it is emphasized that technological advances help, nowadays, activities outside and inside the classroom are much easier and friendlier to students, thus providing another tool to encourage active learning (BARBOSA; DE MOURA, 2013; BENI et al., 2017). Currently, students can share files and create content discussion channels, so it is possible to establish, along with teachers, virtual communities focused on learning (BENI et al., 2017). Given the above, the third theoretical construct presents that:

> *Constructo 03: Based on technological advances, students can be provided with tools to carry out activities as a technique to encourage learning, such as, for example, discussion channels, content forums, and file sharing.*

TECHNOLOGY-BASED BUSINESS MANAGEMENT - EBTS

Currently, business competition is influenced by some factors such as the capacity for innovation, organizational flexibility, and the capacity for change (TEECE, 2012). These factors are intensified in dynamic and uncertain environments, mainly for companies that have technology as their core business, here referred to as Technology-Based Companies - EBTs (LACERDA et al., 2017; ZOTT; AMIT, 2017).

In this context, uncertainty is an inherent characteristic of the decision-making process and refers to situations in which the decision-maker is unaware of all possible options and their consequences (ARTINGER et.al., 2015; PICH; LOCH; MEYER, 2002). As the complexity of the decision increases, the solutions become more and more prone to errors, the means become more important than the ends and rationalization replaces rationality, thus differentiating itself from 'risk' situations, where outcome probabilities are known and the ideal option can be calculated (O'CONNOR; RICE, 2013).

In this sense, O'Connor and Rice (2013) proposed the differentiation of four types of uncertainty, the market, technological, organizational, and resource. Market

uncertainties refer to market aspects such as customer needs, the size of the market to be served, their specificities, among others.

Technical uncertainties, on the other hand, refer to the degree to which the scientific knowledge underlying the company is understood and can be converted into a reliable, economical and manufacturable technological platform, that is, uncertainties inherent to product and performance characteristics. Then, organizational uncertainty involves the risk inherent in the advancement of new technologies or the creation of new market spaces and the organizational structure. And, finally, resource uncertainty refers to the attraction of the necessary resources (both financial and based on competences) for the development and commercialization of the product (O'CONNOR; RICE, 2013).

In addition to this categorization of uncertainties, another contribution of this approach is to consider the initial planning of a new company as a phase of reducing uncertainty through experiments, in which value is created when entrepreneurs convert assumptions into learning (GOMES et. Al ., 2018). An entrepreneur may be able to institute a new model, but not be able to fully rationalize and articulate it, so experimentation and learning are necessary (TEECE, 2010).

At this point, it is important to highlight that management practices for EBTs can only be recommended based on the consideration of their specificities, that is, their unique characteristics (CHANDLER; BROBERG; ALLISON, 2014; LACERDA et. Al., 2017; TEECE, 2010). In this sense, it can be highlighted as the fourth theoretical construct of this research:

> *Construct 04: The proposed management practices for EBTs should be recommended based on the consideration of the specifics of their context.*

THE CONSTRUCTIVIST DECISION SUPPORT APPROACH

The present work is based on the convictions and problems of the constructivist decision support approach. Working under a constructivist conviction, the working methods allow taking into account the subjective aspects of a group of decision-makers, often permeated with conflicts of interest arising from different points of view on the same problem (LACERDA et.al., 2016).

It is noteworthy that, the decision approaches present premises and paths, according to the type of problem to be solved and the epistemological view adopted. In this view, Roy (1993) presents four decision-making approaches: normativism, descriptivist, prescriptivist, and constructivist.

The normativism approach allows us to define and analyze problems based on established criteria (ROY, 1993). Dias and Tsoukiàs (2003) argue that this results from a rational model, where it is possible to generate, ponder, select alternatives, implement, and evaluate the decision. This approach gives the decision-maker the task of selecting which theoretical model to use in the process and for the chosen model to collect context data and determine the optimal solution to the problem (ENSSLIN et.al., 2010; ROY, 1993)

Like the normativism approach, descriptivism is also considered a rational model. Both approaches use existing knowledge, with little intervention by the decision-maker, and are applied to universal situations (ENSSLIN et al., 2010; ROY, 1993). According to Dias and Tsoukiàs (2003), descriptivism starts from the observation of how decision-makers make their decisions and link the way decisions are made with the quality of the result obtained.

In contrast, the prescriptive and constructivist approaches aim to generate knowledge from the decision-maker and are applied to singular situations (DIAS; TSOUKIÀS, 2003; ROY, 1993). In prescriptivism, Dias, and Tsoukiàs (2003), show that the approach seeks to identify issues and provide a complete description of the problem seeking to assist in the search for information for decision making.

The constructivist approach seeks to build models specific to the context of the decision-maker (LACERDA et. Al., 2018). The approach serves to build knowledge in the decision-maker since the model is built on a specific context and allows visualizing the impact of actions, conflicting responses are learning opportunities, expanding knowledge throughout the process (LANDRY, 1995; MARAFON et. Al. , 2015; ROY, 1993).

When choosing the constructivist approach as a worldview to be followed, it means stating that the decision-maker has a fundamental role, as he is the person who has the responsibility and authority necessary for decision making in the organization (ROY, 1993; MARAFON et al ., 2015; LACERDA et al., 2017).

Construct 05: The decision-maker has a fundamental role, as he is the person who exercises the responsibility and authority necessary for decision making in the organization.

In this context, the facilitator has the function of building knowledge in the decision-maker and can make use of the tools he deems most convenient so that the decision-maker understands the impacts of the current situation in his value system, as well as the evolution caused by his decisions in the organization's goals (ROY, 1993).

Once the facilitator has created the conditions for the decision-maker to expand his understanding of his values and preferences, then he will work on making this knowledge available so that the decision-maker can visualize the effects of his decisions within the context in question (ROY, 1993; MARAFON et al., 2015; LACERDA et al., 2017).

Thus, the knowledge built will support the decision-maker in identifying the consequences of the current situation and its evolution, according to his decisions based on his strategic objectives, thus generating a recursive learning process (CALVETTI; LACERDA; BERNARDES, 2019).

UNIVERSITY-ENTERPRISE INTEGRATION

Universities can establish links with the productive structure that allow the acceleration of the transfer of knowledge and technology (MOWERY, 2005). Thus, the presence of an entrepreneurial university, whose professors and students actively seek the useful results of their research is a key innovation factor (ETZKOWITZ; ZHOU, 2017).

The entrepreneurial university is a catalyst in a knowledge-based economy and an important driver of social development. Consequently, an entrepreneurial university is not only a promoter of multiple measures to support entrepreneurship, but also a developer of techniques, strategies, and competitive postures (GUERRERO; URBANO, 2012). It is a fundamental piece to develop the space of knowledge and, increasingly, the spaces of innovation and entrepreneurship.

Cooperation between university and company is configured in different ways, such as: acting as an entrepreneur on the university board of directors; visits by re-

presentatives of universities to companies; participatory advisory board composed of different segments of society; technological research in partnership; outstanding business partners that are relevant in the interaction with the institution; services provision; consultancy and data collection services through field research; round tables for curricular discussions and innovative approaches; teacher internships in companies, equipment sharing between company and university; activities involving graduates who work in companies; systematization of support for hiring interns; hubs, parks, incubators and trades; improvement courses; technological management programs; continuing education and distance education programs; use of supervised curricular internship as a discipline for knowledge exchange and consolidation of partnerships (LEMOS; CARIO, 2017).

In this sense, it can be said that the existing cooperation between universities and companies is characterized as an essential interinstitutional arrangement in promoting scientific research and development that enables competitive advantages with lower costs and risks (GUERRERO; URBANO, 2012). These alliances become increasingly important due to factors such as the speed of technological innovations, the need for new possibilities and innovations in the face of scarcity of resources, and the increase in global competitiveness (LEMOS; CARIO, 2017).

Methodological Procedures

This section explains: (i) the methodological framework of this research; (ii) the technical procedures for conducting the case study; and, (iii) the technical procedures of the SolutionUp project.

RESEARCH FRAMEWORK

The present research is characterized as descriptive as to its objectives, has a qualitative approach, and as a research strategy the case study was used.

According to the objectives, descriptive research is carried out from a first approach to the theme. From the survey of the known characteristics that make up the phenomenon, the objective of descriptive research is to portray an accurate profile of people, events, or situations (SAUNDERS et al., 2009).

About the approach used, this study can be classified as qualitative since it seeks to examine perceptions for improving the understanding of social and human activities, using a subjective character (SAUNDERS et al., 2009).

Finally, as a research strategy, the case study will be used to deepen the knowledge about the research object to expand and detail the knowledge necessary to achieve the proposed objectives (YIN, 2015). Thus, the procedures performed for conducting the case study are detailed in the next section, such procedures are based on the methodology proposed by (CAUCHICK MIGUEL, 2007).

TECHNICAL PROCEDURES FOR CONDUCTING THE CASE STUDY

Cauchick Miguel (2007) presents a proposal for conducting a case study, contemplating the following steps: (i) Definition of a theoretical-conceptual structure; (ii) case planning; (iii) data collection; (iv) data analysis; and, (v) preparing the report.

Thus, the first step in conducting a case study consists of defining a conceptual-theoretical framework for the work, thus resulting in a mapping of the literature on the subject studied (CAUCHICK MIGUEL, 2007).

For this research, the mapping of the literature on the subject took place through research in the theoretical bases Scopus and Google Scholar with the keywords “active learning”, “active learning”, “management of technology-based companies” and “ Small-to medium-sized enterprises ”.

From the structuring of the bibliographic portfolio and literature review, it was possible to identify the theoretical constructs, elements extracted from the literature that represents a concept to be empirically verified (CAUCHICK MIGUEL, 2007). In this research, based on the literature review regarding business models, it was possible to show 05 constructs that will be verified empirically. From this study, at the end of the work, it is important to compare the theoretical constructs with the data collected in the field.

At the end of the planning stage, the choice of units of analysis is passed, that is, of the cases to be studied (YIN, 2015). The case selected for this study is a startup incubated at MIDI Tecnológico.

With the selection of the case finalized, the methods and techniques for both the collection and analysis of the data must be determined (CAUCHICK MIGUEL, 2007; YIN, 2015). For this research, semi-structured interviews and document analy-

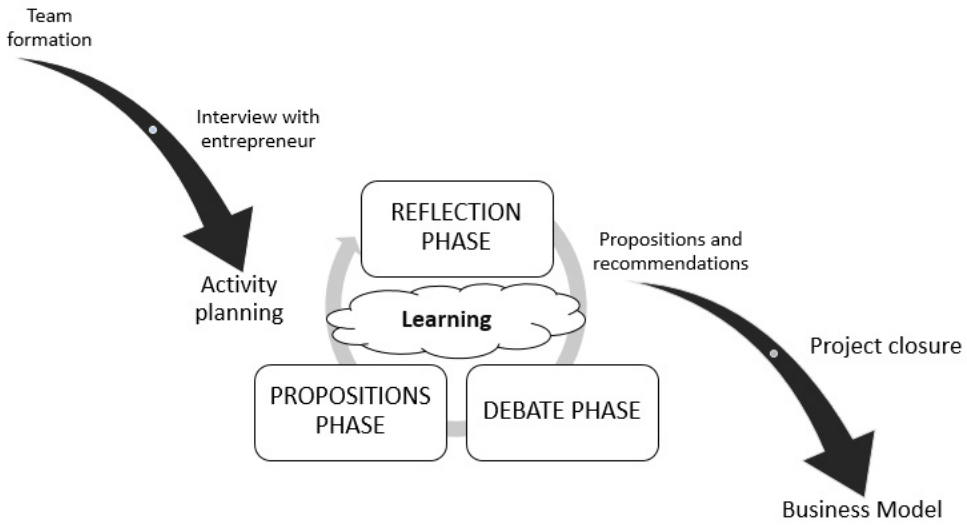
sis were carried out. The document analysis consists of documents provided by the company and the memoirs of the meeting.

Finally, from the set of data collected, the researcher must then prepare the final report, in this case, the final article (CAUCHICK MIGUEL, 2007; YIN, 2015). In this report, comparisons between theory and practical observations are made, that is, the comparison of theoretical constructs evidenced by the literature review and the data collected in the field.

TECHNICAL PROCEDURES OF THE SOLUTIONUP PROJECT

Regarding the procedures adopted for the execution of the Solutionup project, they were based on the steps defined by Marquardt (2005), which offers principles and practices that served as a guide for empirical application, such practices referred to in Figure 1.

Figure 1 Learning in Action Method.



Source: Adapted from Maquardt (2005).

In the first phase, called the formation of the work team where it occurs: (i) the prospecting of an external actor (entrepreneur) who is interested in sharing

an organizational problem; and, (ii) selection of students who will be part of the project cycle.

From the formation of the team, the phase of contact with the problem passes. For this, the external actor makes a summary presentation about his context and the difficulty of managing his company that he believes needs to be resolved. With this presentation, students ask open questions to the external actor. At this point, the teacher-facilitator must instigate students about which subjects in the curriculum or areas of knowledge would be useful to help structure the problem.

In this way, after the stabilization of the knowledge areas related to the problem reported by the external actor, the planning of activities starts. This occurs when students are encouraged to organize themselves in groups, here called "commissions", according to their affinity and interest for each selected area of knowledge.

The committees discuss the next steps, including:

I. Conduct a technical visit to the organization;
II. Select bibliographic references on the topic;
III. Benchmarking;
IV. Request support from master's, doctoral or graduates;
V. Request testimonials from those who have already gone through a similar situation;
VI. Request lectures by experts on the topic;
VII. Make financial or operational plans;
VIII. Preparation of models of documents or processes;
IX. Preparation of immediate recommendations;
X. Requesting new information from the external actor;
XI. Preparation of presentations to explain to the external actor how he should proceed.

Next, the first phase of reflection begins, where the teacher-facilitator promotes reflections in students about what they have learned at each meeting, where it is documented in a mental map (cognitive map), such as theoretical and practical reflections, risks, pending issues due to lack of time, unanswered questions, and polarization of opinions among students.

In the next phase, called the debate and argumentation phase, the teacher--facilitator guides students in the search for the necessary knowledge to prepare the recommendations, where weekly meetings are held so that students expose their doubts and questions to others. Students are encouraged to look for related materials, such as news, videos, similar cases, articles from business magazines, exposure of personal and professional experiences.

Each working group prepares presentations to defend its arguments, while the other students ask questions, objections, and proposals for improvements. The group of students decides which elements should become propositions and which should be removed.

In the proposition phase, the external actor is invited to attend the students' presentations, and interactively asks questions and objections to the recommendations made by the students. Through a constructive debate, mediated by the teacher-facilitator, the objections are accepted or transposed through theoretical and / or creative arguments.

The group defines the priorities that each recommendation accepted by the external actor, so the next meeting is agreed with the external actor, considering the project schedule, so that a significant set of intervention actions can be implemented and feedback can be given. students about the results and obstacles that the intervention actions face. At this point, if necessary, the cycle returns to the stage of debate and reflection until the recommendations are stabilized.

The case is closed when: (i) the project's workload ends; (ii) when students understand that there are no more learning opportunities; (iii) when the teacher-facilitator understands that the problem is not related to knowledge from Administration's knowledge areas; or, (iv) when the external actor understands that the problem has been satisfactorily addressed. In the end, lessons learned are developed by a group of students.

Finally, this project has some work premises that are used by this research: (i) multidisciplinarity; (ii) experiential learning (constructivism); (iii) collaboration; (iv) working with real cases; (v) teacher as a facilitator; (vi) promoting research; (vii) fostering creativity and innovation; (viii) integration of the University with Society (CALVETTI; LACERDA; BERNARDES, 2019).

Results

Next, the historical evolution of the SolutionUp project and the main relevant aspects of the case studied in this article will be presented.

HISTORICAL EVOLUTION OF SOLUTIONUP

In 2015, at the Federal University of Santa Catarina, in the Department of the Administration course, a project called "Learning in Action" aims to integrate university and technology-based startups in Santa Catarina, in which, initially, undergraduates of the Administration course aim to solve a management problem of these companies in up to 12 weeks.

In this context, due to the demand of many students and who were no longer limited to just the Administration course, in 2017 some modifications were made to the project's modus operandi and, thus, we started to work with a multidisciplinary team of students from different courses at UFSC, changing its name to SolutionUp.

In this sense, to exemplify the changes made, Chart 2 presents a retrospective of the main information of the companies that have already been served by the project and shows the growing increase in demand from students.

Thus, the case of the company served in 2017.1 will be described below, presenting the main relevant aspects of the development of the project.

SOLUTIONUP 2017 / 1– COMPANY C

In the first half of 2017, a volunteer team of 16 students attended a company that offers products and services applied to quality control in the industry through computer vision.

The first stage of the project, called the formation of the work team, takes place with the first contact between team members is for the internal organization of activities, such as, for example, defining how and which means of communication will be used. Therefore, students chose to use the tools Slack and Trello. Slack was used as an environment for mutual knowledge exchange, as students were posting materials and documents that were attractive to the project and this became positive because it was a collaborative way of exchanging knowledge. Figure 2 explains this fact.

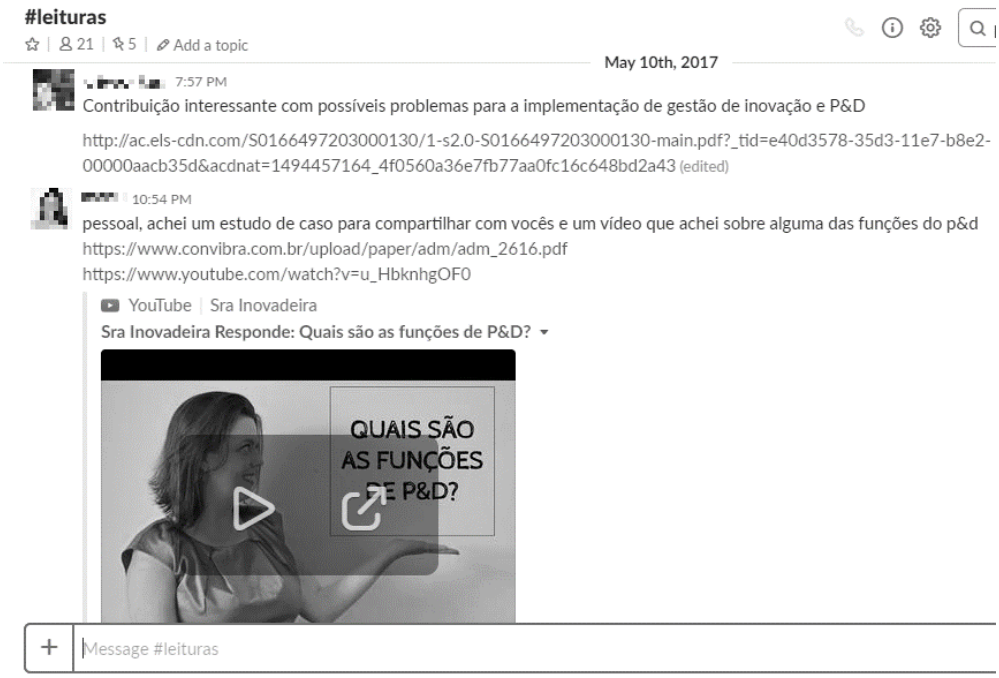
Table 2 Summary of the historical evolution of the project.

	Empresa A	Empresa B	Empresa C	Empresa D	Empresa E
Semester	2015.1	2015.2	2017.1	2017.2	2018.1
Segment	Big Data	Robotics and Automation	Technology	Technology	Technology
Problem to be solved	Lack of a process for selecting market opportunities and improving the sales pitch for a selected niche.	Absence of clear criteria for choosing which projects should be prioritized.	Absence of an R&D measurement model.	Need to improve management.	Difficulty in launching a new product on the market.
Skills / methodologies	**Skills:** Leadership, Teamwork, Communication, Problem-solving **Methodology:** Multicriteria decision support methodology integrated with the Lean Startup method.	**Skills:** Leadership, Teamwork, Communication, Problem-solving **Methodology:** Multicriteria decision support methodology integrated with the Lean Startup method.	**Skills:** Leadership, Teamwork, Communication, Problem-solving **Methodology:** Multicriteria decision support methodology - R&D evaluation model.	**Skills:** Leadership, Teamwork, Communication, Problem-solving **Methodology:** Business Process Management.	**Skills:** Leadership, Teamwork, Communication, Problem-solving **Methodology:** The project is in the beginning and still does not have a defined methodology.
No. of students enrolled	18	37	89	88	92
No. of participants	12	15	16	25	23

Source: Elaborated by the authors.

Administração: Ensino e Pesquisa
Rio de Janeiro v. 21 nº 2 p. 112–141 Maio-Ago 2020
DOI 10.13058/raep.2020.v21n2.1719
ISSN 2358-0917

Figure 2 Slack as a collaborative knowledge exchange environment.



Source: Research data (2017).

Trello was used to manage the activities that were assigned to someone, and in this way, provide greater efficiency in the assignment of tasks and monitoring of team members, since through this tool it is possible to monitor the evolution of activities.

From this, the contact phase with the problem begins, where the company's managers meet with the project team. The managers talk about what may be the problem that the company has been facing and for this meeting to occur most efficiently, the team of students previously elaborates a script of questions that will guide the interview. This serves to prevent students from rambling during the meeting and, thus, it is possible to collect relevant information so that they can begin to structure the problem faced by the company.

However, the company served had a particularity, one of the company's managers has an academic background in Administration, and the meetings ended

up becoming a class given by the manager because the students had difficulty in positioning themselves. Upon losing control of the meeting, the students transmitted insecurity, giving the false impression that they do not know what they are doing, in addition to being influenced by the thoughts and intentions of the company manager.

In many situations, the manager was already directing the propositions of solutions, which harmed the team. This difficulty permeated some meetings with the manager, that is, the team had great difficulty in identifying the moments when someone needed to intervene so that the meeting would not lose its focus.

Thus, from the information gathered in the interviews, the activity planning phase begins, students labeled the problem to be solved as: "operationalize the strategy and structure the internal management". So the students were divided into commissions - small groups of students to carry out specific tasks - to study how the problem would be solved. In this first moment, the commissions of human resources, strategy, marketing and, management of processes and operations were appointed. Table 3 below summarizes the subjects studied by the committees.

Table 3 Areas of knowledge studied by the commissions.

Commission	Subject addressed
Process and operation management commission	• 5W2H • Gut Matrix • BASIC matrix • Ishikawa diagram
Human Resources commission	• People management - innovation environment - SCRUM (manage products) • Knowledge management - democratic knowledge • Tools: drive + Trello and Scrum
Strategy Commission	• OKR
Marketing Commission	• Pricing - Value-based • Customer support - Delphi Technique • Create a CRM - Customer Support • Structuring a sales funnel using personal selling - complex product

Source: Project meeting memoirs.

These commissions had a period of one week to carry out their research and, thus, they made a presentation of the results at the next meeting. And so, to guarantee the efficiency of the commissions, the recommendation of not ending the meeting without organizing the committee, with the definition of leader, days, times, and meeting places, was passed on, to ensure that there would be no disagreements later. However, despite the recommendations, students were disorganized and carried out activities very close to the next meeting, often occurring when the agenda for the meeting and the decision of what will be presented was taken in the hours before the meeting, and this fact was repeated repeatedly throughout the project.

Then, each commission made a presentation with the information collected from each area of knowledge and techniques that can be applied to propose actions to the company. Thus, the debates begin with the purpose of identifying which area of knowledge would meet the problem presented.

However, during the debates and arguments with the presence of managers, they explained that although there are flaws in their management, what keeps the company is the Research and Development - R&D sector. In one of the meetings, the manager clarified:

> *"... management is our 20%, R&D is our 80%, so we need help with our 80 because the 20 we can fix later".*

From this, the team had to structure a new problem, carry out new research, and can verify that the company did not have metrics for monitoring the R&D sector. In this way, the new labeling of the problem that was validated by the managers: "Structuring the R&D measurement model". Here a new journey for students began, as the focus of the commissions would have to change.

The new phase of debates and arguments started with the development of the participants' knowledge about performance evaluation. The students researched indicators and criteria for success in the management of R&D and selected those that best suited the reality of the company. From this moment on, the proposition phase begins.

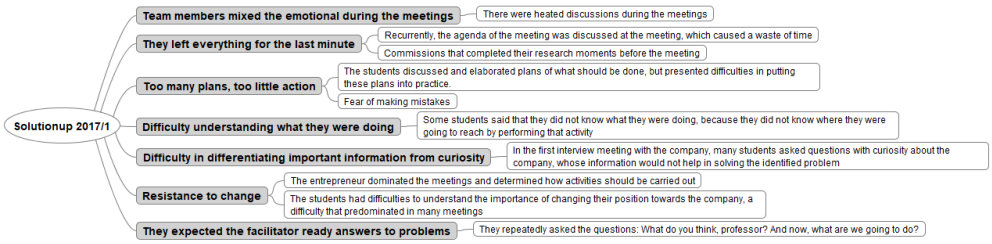
After selecting the indicators and criteria, they were validated with the managers. The managers also defined scales and prisoners for each criterion for the construction of the evaluation model. Finally, students present managers with the performance evaluation model for the proposed R&D management.

Along with the model, a report was also presented presenting the management system developed for the company's R&D, explaining the nature of the indicators, their respective scales, and weights. Also, the report contains a manual for using an excel spreadsheet for the calculations necessary to update the proposed tool.

Case Discussion

As the project unfolded, the researchers were able to observe that the student team exhibited some behaviors, which can be seen in figure 3.

Figure 3 Mind map: Behaviors observed between members.



Source: Elaborated by the authors.

As shown in figure 3, one of the behaviors observed by the researchers in the students was the difficulty of putting the plan into practice. The team planned the activities and had difficulty putting them into practice due to the intention to do without errors on the first attempt. However, an important aspect of this characteristic of planning and not putting into practice is that based on the error, the solution to a problem is found and that not wanting to demonstrate weakness or assuming an error creates barriers that can prevent success.

Similar to this situation, another noticeable behavior is to continue in meetings even without understanding what was happening, because even with the project already advanced, there were still students who did not know the purpose of the activities. This had an impact on the progress of the project, but mainly on the student's learning, as they developed the activities in a mechanistic manner free from criticism for not understanding what was going on.

In this sense, it is important that students are encouraged to develop a critical sense and that knowledge is the result of an action, that is, only by going to the field and carrying out some research can doubts be answered. It is not up to even a more experienced person or even successful entrepreneurs to provide answers, but rather the search for ways and methods for the student, by himself, to get his answers that provoked his motivation to continue learning.

Another observed behavior was the students' disorganization of the internal activities of the project. Procrastination was observed frequently, many activities were carried out on the eve of the stipulated delivery date and in many situations, the decision on meeting minutes was taken minutes before this. These facts made the meeting inefficient and had reduced the time to organize what should have been done before.

In this sense, many times, students had difficulty mediating meetings with the company. Upon losing control of the meeting, the students transmitted insecurity, giving the false impression that they do not know what they are doing, in addition to being influenced by the thoughts and intentions of the company manager. Thus, among the students a leader needed to emerge who can carry out this mediation by making the appropriate interventions.

Another important behavior observed was that, in warm situations, in which spirits were exalted, due to differences of opinion, students were unable to leave the personal side and highlight the professional, causing personal discussions in the middle of a meeting. Exalted spirits and people upset about something that was said without intention are big obstacles in decision making.

Finally, from the case presented, and the main behaviors identified during the application of the method proposed by the project, it is possible to perform the data analysis based on the theoretical constructs previously identified and to identify the main lessons learned, as shown in Chart 4.

Table 4 Lessons learned from the project.

Construct	Practical evidence	Lessons learned
Construct 01: As a way of effective learning, students need to develop their critical, synthesis, conceptualization, and autonomy skills by performing high-level mental tasks, such as analysis, synthesis, and evaluation.	In practice, it was observed that many students were able to develop their critical capacity throughout the development of the project. The facilitator was seen as the source of answers to the difficulties that were encountered and thus, many students had difficulty understanding what was being done and how the difficulty could be overcome.	**"We must make mistakes, and not just once, the error must be constant."** It is from the error that the solution to the problem is found. Problems exist for everyone, nobody is perfect, but nobody wants to show weakness or assume that they can make mistakes, and that ends up creating barriers that can prevent success.
Construct 02: The student must take responsibility for decisions that influence his learning, so he must have a choice about the learning activities he wants to perform, monitoring, and evaluating his progress.	The dynamics of the project encouraged students to participate in commissions according to their affinity and curiosity about the research topic. The commissions made a presentation with the information collected from each area of knowledge and techniques that could be applied to propose actions to the company. And so, the debates were based on knowledge and information obtained by these students.	**"We are a team and the help of all members is of paramount importance"** It takes commitment from the team above all. Also, the incentive for members to participate allows them to be conductors of their knowledge, researching on topics of their interest, they can acquire theoretical and practical knowledge that often cannot be acquired in the classroom.

Constructo 03: Based on technological advances, students can be provided with tools to carry out activities as a technique to encourage learning, such as, for example, discussion channels, content forums, and file sharing.	For the project, the use of tools that assist in team communication and document sharing was of paramount importance. In this sense, when using these tools, contact between project members takes place not only during weekly meetings but daily. This agility in communication provides the team with a more agile problem-solving capacity, that is, if a problem occurs or a member faces some difficulty or has a question, it can be solved even immediately, without having to wait for the next one. meeting.	**"Define the management roles of the tools used at the beginning of the project. "** These individuals will be responsible for organizing the files and collecting the members. Having this organization and collection, no matter how exhausting it is at times, helps people to remember their commitments and to organize themselves. **"It is necessary that all project material is available to all members. "** All project members must have full access to all information. As a complement, every edited document must not overlap with its previous version, for this reason, each new version must be saved with the date of the edition day in the file name so that both versions can be used. This allows you to compare documents without losing information and documentation on the evolution of the project.

Construct 04: The proposed management practices for EBTs should be recommended based on the consideration of their specificities.	As noted in the case, the company's active participation during the project is essential. It is from the information presented by her that students obtain subsidies to identify the problem to be solved and which technique can be adapted to the context of the company. However, the team must be able to delimit the company's partition during the development of the project. Too much participation and too much information can lead to delays and even blur the attention of the real problem.	**"If possible, all members should participate in at least one technical visit to the company."** On-site monitoring brings company members closer to the project team and makes their processes more tangible for the team. **"Meetings should not be held without the presence of the company."** The interview with the client, as well as his participation in the meeting, enriches the discussion of details, examples, and makes processes (decision making, validation of decisions, etc.) more agile. Once the customer knows what is going on and monitors the preparation of the final product, he knows what to expect.
Constructo 05: The decision-maker has a fundamental role, as he is the person who exercises responsibility and the necessary authority for decision making in the organization.	Decision-makers' participation is essential during the process. As seen in the case, it was from the weekly presentations of the development of the processes that the decision-maker can identify that the real problem to be solved was another, and thus, adjustments to the focus and intended results of the project can be made.	

Source: Elaborated by the authors.

Final Considerations

From the context in which these EBTs are inserted, there is a need for research and extension projects that help these companies to use new concepts, trends and tools for their business success, in the context of a university program that focuses on an approach of active learning (CALVETTI; LACERDA; BERNARDES, 2019).

Thus, this research was intended to highlight the critical success factors in the application of learning by action method in an extension project at the Federal University of Santa Catarina, with the following specific objectives: i) proposing an active learning method for improving skills in undergraduate students; ii) explain the results of the execution of an extension project using the proposed method; iii) triangulate evidence to propose critical aspects of the method inductively.

The first specific objective can be observed in the methodological procedures section, where the technical procedures of the SolutionUp project were highlighted. The proposed method is based on the premises of active learning, which is presented in the section on theoretical foundations.

Then, the results of applying the method, presented in the results section, were presented. For this, first, a time retrospective of the developed project was presented, exemplifying the skills and methodologies already worked, as well as quantitative and qualitative data of the enrolled and participating students.

Thus, in the first half of 2017, a volunteer team of 16 students, a company that offers products and services applied to quality control in the industry through computer vision. As it is a technology company, its core business is technological innovation.

The third specific objective, on the other hand, could be observed in the results discussion section, in which it was sought to identify the critical aspects of success for the application of the active learning method. One of the difficulties presented by the students was the fear of failure presented by the students, caused by the search for an optimal and generic solution of the problem based on scientific literature or similar examples, typical of traditional learning methods.

In this sense, it is important that students are encouraged to develop a critical sense and that knowledge is the result of an action, that is, only by going to the field and carrying out some research can doubts be answered. It is not up to even a more

experienced person or even successful entrepreneurs to provide answers, but rather the search for ways and methods for the student, by himself, to get his answers that provoked his motivation to continue learning.

The singularity of the problem, coupled with the limited data and knowledge, led the group to decide more about on-site studies than generic bibliographic research on the problem or the search for similar solutions. In this way, the challenges to be overcome emerge inductively, that is, students are in direct contact with the problem and need to be proactive about proposing recommendations and what actions should be taken, thus stimulating critical thinking, the ability to solve problems and continuous learning.

Thus, when identifying these behaviors, and from the practical evidence from the realization of the case study, it is possible to observe that the dynamics proposed by the project stimulates the development of a practical vision of problem-solving in students. The project allowed students to understand the dynamics of a startup, the challenges, and decisions in building a business model in addition to stimulating learning. Action learning aims at making the student the main agent for the construction of his / her knowledge and not just a receiver of data and information. In this sense, the incentive to this student must be done regularly, and thus subsidize the necessary tools. so that he can develop not only his theoretical knowledge but also his practical skills.

Finally, as opportunities for future research, it is recommended to exemplify other cases of application of the proposed method, to identify other relevant behaviors, as well as a detailed synthesis of the main challenges faced by students during the process. It is also possible to carry out a transversal and longitudinal analysis of the cases and to compare and present variations of the method applied to each case.

Acknowledgments

This work was carried out with support from CNPq, National Council for Scientific and Technological Development - Brazil and with support from the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES) - Financing Code 001.

Bibliographic References

ARTINGER, F. et al. Heuristics as adaptive decision strategies in management. *Journal of Organizational Behavior*, v. 36, n. S1, p. S33-S52, 2015. DOI: 10.1002/job.1950

BARON, L. Authentic leadership and mindfulness development through action learning. Journal of Managerial Psychology, v. 31, n. 1, p. 296-311, 2016. DOI 10.1108/JMP-04-2014-0135

BELL, B. S.; KOZLOWSKI, S. W. Active learning: effects of core training design elements on self-regulatory processes, learning, and adaptability. *Journal of Applied psychology*, v. 93, n. 2, p. 296, 2008. DOI:10.1037/0021-9010.93.2.296

BENI, P. F. et al. Processo de ensino-aprendizagem e a interação de professores e alunos em um curso de graduação em Administração de Empresas. *Administração: Ensino e Pesquisa*, v. 18, n. 2, p. 345-374, 2017. DOI: https://doi.org/10.13058/raep.2017.v18n2.565

CALVETTI, E. S.; LACERDA, R. T. O.; BERNARDES, M. L. Um estudo bibliométrico sobre avaliação de desempenho no processo de desenvolvimento ágil de software sob a perspectiva do construtivismo. *Revista Brasileira de Gestão e Inovação*, v. 6, n. 3, p. 1-28, 2019. DOI: 10.18226/23190639.v6n3.01

CANOPF, L. et al. Prática docente no ensino de administração: analisando a mediação da emoção. Organizações & Sociedade, v. 25, n. 86, p. 371-391, 2018. DOI: 10.1590/1984-9250862

CAUCHICK MIGUEL, P. A. et al. Estudo de caso na engenharia de produção: estruturação e recomendações para sua condução. *Revista Produção*, v. 17, n. 1, p. 216-229, 2007. DOI: http://dx.doi.org/10.1590/S0103-65132007000100015

CHANDLER, G. N.; BROBERG, J. C.; ALLISON, T. H. Customer value propositions in declining industries: Differences between industry representative and high-growth firms. *Strategic Entrepreneurship Journal*, v. 8, n. 3, p. 234-253, 2014. DOI: https://doi.org/10.1002/sej.1181

DE LIMA, T. B. et al. Dimensões de um sistema de aprendizagem em ação para o ensino de administração. *Administração: ensino e pesquisa*, v. 13, n. 1, p. 11-46, 2012. DOI: https://doi.org/10.13058/raep.2012.v13n1.97

GOMES, L. A. de V. et al. How entrepreneurs manage collective uncertainties in innovation ecosystems. *Technological Forecasting and Social Change*, v. 128, p. 164-185, 2018. DOI: https://doi.org/10.1016/j.techfore.2017.11.016

DIAS, L. C.; TSOUKIÀS, Alexis. On the constructive and other approaches in decision aiding. In: *Proceedings of the 57th meeting of the EURO MCDA working group*. 2003.

ENSSLIN, L.. et al. Avaliação do desempenho de empresas terceirizadas com o uso da metodologia multicritério de apoio à decisão-construtivista. *Pesquisa Operacional*, v. 30, n. 1, p. 125-152, 2010. DOI: http://dx.doi.org/10.1590/S0101-74382010000100007

ETZKOWITZ, H.; ZHOU, C. Hélice Tríplice: inovação e empreendedorismo universidade-indústria-governo. Estudos avançados, v. 31, n. 90, p. 23-48, 2017. DOI: 10.1590/s0103-40142017.3190003

GUERRERO, M.; URBANO, D. The development of an entrepreneurial university. The journal of technology transfer, v. 37, n. 1, p. 43-74, 2012. DOI: 10.1007/s10961-010-9171-x

HUDSON, M.; SMART, A.; BOURNE, M. Theory and practice in SME performance measurement systems. *International journal of operations & production management*, v. 21, n. 8, p. 1096-1115, 2001. DOI: https://doi.org/10.1108/EUM0000000005587

KRAKAUER, P. V.; DOS SANTOS, S. A.; DE ALMEIDA, M. I. R. Teoria da aprendizagem experiencial no ensino de empreendedorismo: um estudo exploratório. *Revista de Empreendedorismo e Gestão de Pequenas Empresas*, v. 6, n. 1, p. 101-127, 2017. DOI: http://dx.doi.org/10.14211/regepe.v6i1.353

LACERDA, R. T. de O. et al. Research opportunities in business process management and performance measurement from a constructivist view. *Knowledge and Process Management*, v. 23, n. 1, p. 18-30, 2016. DOI: 10.1002/KPM.1495

LACERDA, R. T. de O. et al. Innovative integration between incubated startups and universities to achieve continuous competitive advantages in dynamic environments. *Navus-revista de gestão e tecnologia*, v. 7, n. 2, p. 78-96, 2017. DOI: 10.22279/NAVUS.2017.V7N2.P78-96.497

LACERDA, R. T. de O. et al. Perspectivas de pesquisa sobre avaliação de desempenho e gerenciamento de projetos. *Revista de Gestão e Secretariado*, v. 9, n. 2, p. 96-125, 2018. DOI: https://doi.org/10.7769/gesec.v9i2.680

LANDRY, M. *A note on the concept of problem*. Organization Studies, v. 16, n. 2, p. 315-343, 1995.

LEONARD, H. S. Understanding the causal path between action, learning, and solutions: maximizing the power of action learning to achieve great results. *Action Learning: Research and Practice*, v. 12, n. 1, p. 22-36, 2015. DOI: https://doi.org/10.1080/14767333.2014.977222

LEONARD, H. S.; LANG, F. Leadership development via action learning. *Advances in Developing Human Resources*, v. 12, n. 2, p. 225-240, 2010. DOI: 10.1177/1523422310367800

LEMOS, D. C.; CARIO, S. A. F. Os sistemas nacional e regional de inovação e sua influência na interação universidade-empresa em Santa Catarina. REGE-Revista de Gestão, v. 24, n. 1, p. 45-57, 2017. DOI: 10.1016/j.rege.2016.05.002

MARAFON, A. D. et al. The effectiveness of multi-criteria decision aid methodology: A case study of R&D management. *European Journal of Innovation Management*, v. 18, n. 1, p. 86-109, 2015. DOI: 10.1108/EJIM-10-2013-0106

MARQUARDT, M. *O poder da aprendizagem pela ação: como solucionar problemas e desenvolver líderes em tempo real*. Tradução Anna Lobo. Rio de Janeiro: Ed. Senac Rio, 2005.

MOWERY, D. C. Universities in national innovation systems. Georgia Institute of Technology, 2005.

O'CONNOR, G. C.; RICE, M. P. A comprehensive model of uncertainty associated with radical innovation. *Journal of Product Innovation Management*, v. 30, p. 2-18, 2013. DOI: https://doi.org/10.1111/jpim.12060

PERRITON, L.; REYNOLDS, M.. Critical Management Education in challenging times. Management Learning, v. 49, n. 5, p. 521-536, 2018. DOI: https://doi.org/10.1177/1350507618795090

PICH, M. T.; LOCH, C. H.; MEYER, A. D. On uncertainty, ambiguity, and complexity in project management. *Management Science*, v. 48, n. 8, p. 1008-1023, 2002. DOI: https://doi.org/10.1287/mnsc.48.8.1008.163

ROY, B. Decision science or decision-aid science?. *European journal of operational research*, v. 66, n. 2, p. 184-203, 1993.

SAUNDERS, M. NK. *Research methods for business students*, 5/e. Pearson Education India, 2011.TEECE, David J. Business models, business strategy and innovation. *Long-range planning*, v. 43, n. 2-3, p. 172-194, 2010. DOI: https://doi.org/10.1016/j.lrp.2009.07.003

TEECE, D. J. Dynamic capabilities: Routines versus entrepreneurial action. *Journal of management studies*, v. 49, n. 8, p. 1395-1401, 2012. DOI: https://doi.org/10.1111/j.1467-6486.2012.01080.x

URIAS, G. M. P. C.; DE AZEREDO, L. A. S. Metodologias ativas nas aulas de administraçao financeira: alternativa ao método tradicional de ensino para o despertar da motivaçao intrínseca e o desenvolvimento da autonomia. *Administração: Ensino e Pesquisa*, v. 18, n. 1, p. 39, 2017. DOI: https://doi.org/10.13058/raep.2017.v18n1.473

YIN, R. K. *Estudo de Caso: Planejamento e métodos*. Bookman editora, 2015.

ZOTT, C.; AMIT, R. Business model innovation: How to create value in a digital world. *GfK Marketing Intelligence Review*, v. 9, n. 1, p. 18-23, 2017. DOI: 10.1515/gfkmir-2017-0003