DIANE APARECIDA DOS REIS SILVA FARINA

Entrepreneurship education through the lenses of entrepreneurial competences, intention, and confidence

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Supervisor: André Leme Fleury

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Dedico este trabalho
aos meus familiares.

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RESUMO

Atualmente as organizações enfrentam grandes desafios no desenvolvimento de inovações e, neste contexto, as conexões entre inovação e empreendedorismo são cada vez mais relevantes, uma vez que o empreendedorismo é reconhecido como um grande catalizador da inovação. Nesse cenário, é relevante a realização de estudos em pequenas organizações emergentes, ou mesmo em unidades individuais de grandes organizações, uma vez que essas organizações são reconhecidas como mais ágeis e radicais no desenvolvimento de inovações. O empreendedorismo é reconhecido por políticos e economistas como promotor do crescimento econômico, apoiado por investidores e governos. O empreendedorismo também é reconhecido como catalisador econômico, criador de empregos e promotor do progresso tecnológico.

No entanto, o empreendedorismo também é reconhecido como uma área de estudo que demanda extensa pesquisa, com foco no desenvolvimento e consolidação de práticas e frameworks. Foram identificadas diferentes lacunas de conhecimento, incluindo o atual estado da arte da educação para o empreendedorismo, o papel e os resultados das iniciativas de educação empreendedora, bem como as melhores práticas para o ensino do empreendedorismo. Além disso, existe a necessidade de consolidar os laços entre a educação para o empreendedorismo e o comportamento e a intenção empreendedora, considerando as competências adquiridas.

Esta pesquisa contribui para o conhecimento acadêmico sobre educação empreendedora por meio do desenvolvimento, aplicação e validação de frameworks conceituais e abordagens práticas, capazes de identificar, medir, analisar e avaliar a eficácia de iniciativas de educação para o empreendedorismo, considerando a evolução ao longo do tempo das competências empreendedoras, intenção e confiança.

Para atingir os objetivos desta pesquisa foram realizadas iniciativas que resultaram em seis artigos acadêmicos, evidenciando um amplo interesse em compreender a educação empreendedora, as formas de ensinar o empreendedorismo e como aumentar os resultados positivos dos cursos de educação empreendedora. Os resultados específicos incluem o desenvolvimento de uma lista de competências empreendedoras, uma lista de critérios para comparar diferentes iniciativas de cursos de empreendedorismo e formas de avaliar os resultados da educação para o empreendedorismo, resultando em diferentes propostas para a avaliação eficaz de cursos que ensinam os futuros empreendedores.

Palavras-chave: ensino do empreendedorismo; Startup Garage Innovation Process; Startup Owner’s Manual; competências empreendedoras; intenção empreendedora.

ABSTRACT

Currently organizations face big challenges in the development of innovations, and in this context, the connections between innovation and entrepreneurship is increasingly relevant, since entrepreneurship is recognized as a great innovation propeller. In this scenario, it is relevant to conduct studies on emerging small organizations, or even on individual units of large organizations, since these organizations are recognized as more agile and radical in the development of innovations. Entrepreneurship is recognized by politician and economists as a promoter of economic growth, supported by investors and governments. Entrepreneurship is also recognized as an economic catalyst, a job creator, and a promoter of technological progress.

However, entrepreneurship is also recognized as an area of study that demands extensive research, with focus on the development and consolidation of practices and frameworks. Different gaps of knowledge have been identified, including the current state of the art of entrepreneurship education, the role and the outcomes of educational entrepreneurship initiatives, as well as the best practices for teaching entrepreneurship. Moreover, there is the need to consolidate the ties between entrepreneurship education and entrepreneurial behavior and intention, considering the resulting acquired competences.

This research contributes to the academic body of knowledge about entrepreneurship education with the development, application and validation of conceptual frameworks and practical approaches, capable to identify, measure, analyze and evaluate the effectiveness of entrepreneurship educational initiatives, considering the evolution over time of entrepreneurial competences, intention, and confidence.

In order to achieve the objectives of this research some initiatives where conducted resulting in six academic papers, evidencing a broad interest in understanding the entrepreneurship education, the ways of teaching entrepreneurship and how to increase the positive outcomes of entrepreneurship education. Specific results include the development of a list of entrepreneurial competences, a list of criteria to compare different initiatives of entrepreneurship courses, and ways to evaluate the outcomes of entrepreneurship education, resulting in different proposals for the effective evaluation of courses that teach the futures entrepreneurs.

Keywords: entrepreneurship education; Startup Garage Innovation Process; Startup Owner’s Manual; entrepreneurs’ competences; entrepreneurs’ intention.

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LIST OF ABBREVIATIONS

BMC – Business Model Canvas

DT – Design Thinking

HDE – Hypothesis-Driven Entrepreneurship

JCR – Journal Citation Report

LS – Lean

MVP – Minimum Viable Product

SLR – Systematic Literature Review

WoS – Web of Science

SUMMARY

PART I – INTEGRATIVE THESIS OVERVIEW

1 INTRODUCTION

Innovation is the implementation of a new or even significant better product, service, marketing method or organizational method, capable of transforming organizational practices (BIANCOLINO; MACCARI; PEREIRA, 2013; MANUAL DE OSLO, 1997), and an important driver of organizational development and economic growth (BONAZZI; ZILBER, 2014). Innovations lead the production of the new, incorporating social and technical advancements, representing the abandonment of the past (DRUCKER, 1980). In a scenario where established organizations have as a high priority the creation of successful innovations (FREDERIKSEN; BREM, 2017), it is possible to verify a strong need to expand the possibilities for their creation and development (EDISON et al., 2018).

There is a strong relationship between innovations and entrepreneurship (FREDERIKSEN; BREM, 2017; SCHUMPETER, 1934), and in a context where emergent startups have the potential to reshape market dynamics (RIES, 2011), research concerning innovation should not be restricted to large organizations. Small organizations and specific single units, of large organizations, that follow agile approaches, have been recognized because of their capabilities of generating radical innovations, in environments of high uncertainty and complexity, generally establishing new markets and promoting the emergence of disruptive technologies (SALERNO et al., 2015). These small organizations are also recognized as more agile in developing innovations (WEIBLEN; CHESBROUGH, 2015), a significant competitive advantage when compared to large organizations (REIS et al., 2017).

Entrepreneurship is one major driver for innovation development. Research conducted with politicians and economists, of developed countries, evidenced that the promotion of the economic growth must be based on innovations, and that creating innovations require entrepreneurship (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010). Currently, entrepreneurship receives broad support from governments and investors (MARTIN; MCNALLY; KAY, 2013), since it is considered an economic catalyst and a powerful tool for job creation, innovation development, technological progress, and economic development (ACS et al., 2016; AL-ATABI; DEBOER; 2014; GUEDES,

2015; OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013; VON GRAEVENITZ; HARROFF; WEBER, 2010).

The entrepreneur archetype is characterized as a good solver for different challenges (OBSCHONKA et al., 2013), and entrepreneurship importance has been recognized academically, since the social sciences started to study entrepreneurship and entrepreneurs (OBSCHONKA et al., 2013; REZAEI-ZADEH et al., 2014). Currently, we are experiencing a period when the interest in entrepreneurship education programs is greater than ever (FAYOLLE; GAILLY, 2015; NABI et al., 2017; NECK; GREENE, 2011). This fast-growing academic interest usually has focus on the understanding of the outcomes of the entrepreneurial processes (MARTIN; MCNALLY; KAY, 2013), and the role performed by entrepreneurs (LIÑÁN; CHEN, 2009).

Entrepreneurship is associated with relevant positive outcomes (MARTIN; MCNALLY; KAY, 2013), and is acknowledged for its capability to generate jobs (PREMAND et al., 2016), acting as a catalyst for economic growth (ACS et al., 2016; RAUCH; HULSINK, 2015), and increasing economic activity and benefits (O'CONNOR, 2013). Entrepreneurship has the ability to transform ideas into results, promoting a large number of new businesses and evidencing its relevance to individuals, organizations, and society (NECK; GREENE; BRUSH, 2014).

Entrepreneurship education is positively associated with entrepreneurial behavior (KARIMI et al., 2016), and intention (WALTER; BLOCK, 2015). Entrepreneurship education can provide creativity and skills for the entrepreneurial success, since these are not inborn abilities of the individual, being abilities that can be developed (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013).

The effective diffusion of entrepreneurial intention can occur with the development of knowledge and skills associated with entrepreneurship (BAE et al., 2014), reinforcing the relevance of academic curriculum that emphasizes the entrepreneurial process, facilitating and promoting the emergence of effective entrepreneurs, generating radical innovations and value through the connection between academia and businesses (O'CONNOR, 2013; REIS; FLEURY; CARVALHO, 2019). Entrepreneurship education increases entrepreneurial intention (SÁNCHEZ, 2013), and is an effective driver to motivate students to begin their own business (BAE et al., 2014), and an opportunity for educators to influence the entrepreneurial aspirations (FIET, 2000). Research evidences an increasing interest in the concepts of entrepreneurial intention and its

antecedents, due to its capability for evidencing, analyzing, and understanding possible patterns for the prediction of the entrepreneurial behavior (FAYOLLE; GAILLY, 2015). Entrepreneurship is not a predictable process, but has a method (NECK; GREENE, 2011), that can be taught, considering a portfolio of techniques and theories, for the creation of thematic practical experiences, that promotes action and reflection, leading the search for success (FIET, 2000; NECK; GREENE, 2011; SCHON, 1983).

1.1 Justification

The way of teaching entrepreneurship has changed significantly during the past decade (NECK; GREENE; BRUSH, 2014), and it has no longer as its main focus the elaboration of an extensive business plan, detailing the future possibilities for a new business (SEBRAE, 2013). Currently, universities are performing a relevant role in the promotion of entrepreneurial thinking and acting, generating initiatives that can contribute to the economic and social development, affecting even the growth of cities, regions, and countries (GUERRERO; URBANO; FAYOLLE, 2016). This fact highlights the relevance of the emergence of new approaches, such as the Hypothesis-Driven Entrepreneurship (HDE) approach, which is based on the effectuation concept proposed by Saravasthy (2001), advocating experimentation in connection with theory and the development of testable propositions about how the future will be.

The HDE approach has emerged during the last decade, renewing the process of new business development due to its rapid prototyping and iterative learning approach, proving to be more effective in environments of high uncertainty, when compared to traditional approaches (EISENMANN; RIES; DILLARD, 2011) and, consequently, revolutionizing traditional methodologies of teaching entrepreneurship (BLANK; DORF, 2012; RIES, 2011). However, nowadays, there is still little research about the diffusion of the HDE approach and other similar approaches. When the subject are the results obtained with the application of these approaches the researches are even more rare, evidencing the relevance and originality of this research; therefore, the main focus of this thesis is the identification, evaluation and analysis of the impacts of HDE, considering both theoretical and empirical aspects, aiming to contribute for the improvement of entrepreneurship education with the development, application and validation of conceptual frameworks and practical approaches to identify, measure,

analyze and evaluate the effectiveness of entrepreneurship educational initiatives, considering the evolution over time of students` entrepreneurial competences, intention, and confidence.

1.2 Knowledge gaps and objectives

It is necessary to create a comprehensive perspective about entrepreneurship education (FAYOLLE; GAILLY, 2015), especially when it is possible to verify a scenario where the study of entrepreneurship education receives less attention than it deserves (GRIMALDI et al., 2011) and entrepreneurship remains as a challenge (LIMA et al., 2015). There is a demand for research with focus on the proper development of entrepreneurial activity to stimulate the entrepreneurial behavior (RAUCH; HULSINK, 2015) and, in this context, it is necessary to understand the best outcomes of entrepreneurship education (FAYOLLE; GAILLY, 2015; MARTIN; MCNALLY; KAY, 2013). There is a growing concern about the development of effective entrepreneurship initiatives (LIÑÁN; CHEN, 2009), and bodies of knowledge concerning entrepreneurship are spreading fast, being widely applied and obtaining recognition throughout the world (LIMA et al., 2015; NECK; GREENE, 2011). Since the interest of academic institutions in entrepreneurship education is increasing (FAYOLLE; GAILLY, 2015; NABI et al., 2017; NECK; GREENE, 2011), academics and practitioners have agreed that a curriculum with emphasis on entrepreneurship improves the quality of the resulting entrepreneur, who will be able to generate business value and innovations, connecting business and learning, also promoting self-employment (O'CONNOR, 2013; ROBINSON; SEXTON, 1994; SOUITARIS; ZERBINATI; AL-LAHAM, 2007).

This research contributes for the creation of a holistic perspective about entrepreneurship education, considering a scenario of transition and consolidation of different ways to teach and to practice entrepreneurial methods and tools. The improvement of entrepreneurship education results in the generation of new business, based on innovative products and services, bringing aggregated value to the entrepreneurial ecosystem and to the society.

The main objective of this study is to contribute for the development of entrepreneurship students, who will create their own new businesses, contributing with other entrepreneurs for the creation of new business, or even work in existing

organizations, but with focus on the creation of the “new”. For this, this research tackles knowledge gaps concerning the development of entrepreneurial competences, intention, and confidence.

This article-based thesis has as General Objective (GO):

Contribute for the improvement of entrepreneurship education with the investigation of current educational entrepreneurship theories and practices, considering the identification, measurement, analysis and evaluation of the effectiveness of these initiatives from a student` perspective, aiming to contribute with the proposal of new frameworks and approaches to improve entrepreneurial competences, intention, and confidence.

The specific knowledge gaps that this research tackle is associated with different Specific Objectives (SO), as follows:

The #P1 focused on agile approaches and their application in order to identify opportunities and structure initial operations of new businesses, evidencing that entrepreneurship is changing and there exists something “new”, resulting in an academic curiosity about how is possible to teach entrepreneurship to disseminate this “new”. This “new” was evidenced in the literature and originated #P2.

a. It is necessary to create a new landscape concerning entrepreneurship education, including both practical and theoretical aspects. The research on entrepreneurship is constantly evolving (AUTIO; ACT, 2010; MAIR; MARTÍ, 2006), resulting in renewed bodies of knowledge, which spread fast and are widely recognized and applied (LIMA et al., 2015; NECK; GREENE, 2011), especially in contexts in which the impact of education concerning entrepreneurship success is considered historically as a relevant research topic (ROBINSON; SEXTON, 1994). There is an increasing interest of academic institutions in entrepreneurship education (FAYOLLE; GAILLY, 2015; NABI et al., 2017; NECK; GREENE, 2011).

SO1: identify the current scenario concerning entrepreneurship education, including the "state of the art" about entrepreneurship education.

This Specific Objective is connected with article #P1 and article #P2.

The #P2 evidenced an increasing interest in entrepreneurship education as a field of research that still demand studies, with a latent necessity of identifying the most interesting approaches to teach entrepreneurship, also emerging the curiosity to investigate if is possible to measure the effectiveness of the approaches considering the evolution of the students` entrepreneurial competences, generating the investigating about entrepreneurial competences in the #P3.

b. Currently, there is a lack of substantial theoretical foundations about the most relevant entrepreneurial competences (BYGRAVE; HOFER, 1991; THOMAS; MUELLER, 2000), evidencing a knowledge gap concerning the identification of meta-competences that can facilitate the design of initiatives that aims to improve the development of entrepreneurial capabilities (TAJEDDINI; MUELLER, 2009), including the identification of personal characteristics that lead to success (CANTU-ORTIZ et al., 2017).

SO2: identify, classify, analyze, and summarize the most relevant entrepreneurial competences described in the academic literature.

This Specific Objective is connected with article #P3.

#P3 achieved a list of entrepreneurial competences that can be clustered into meta-competences to assist in the entrepreneurs` evolution, originating the need for investigating the different templates applied to teach entrepreneurship, #P4 and #P5, to future search to understand how the students` entrepreneurial competences evolve in a comparison with pre and post-course perspective, #P6.

c. Entrepreneurship transforms ideas into innovative services and products, resulting in many new businesses that are relevant for individuals, organizations, and societies (NECK; GREENE; BRUSH, 2014). However, an

expressive volume of new ventures fails in their initial steps of structuration (NIRWAN; DHEWANTO, 2015), evidencing the need of analyzing the outcomes obtained in relevant educational initiatives, considering promising ideas and proposed solutions (BROWN, 2008).

SO3: investigate the current entrepreneurship education proposals that enable students to evolve with entrepreneurial competences, confidence and intention.

This Specific Objective is connected with article #P4 and #P5.

The #P4 evidenced how the students` projects of new business can be evaluated and deep explored, in a case of study, considering the Startup Garage Innovation Process as a template for a course that search to teach entrepreneurship, fostering the interest in study more courses templates, leading to the development of the #P5.

The #P5 discovered that both templates present similar results and lead to the evolution in the students` entrepreneurial intention, remaining for study in the #P6 a framework and its application to measure the evaluation of the students` in relation of entrepreneurial competences, confidence and intention over time.

d. The key to develop a successful new business is to stimulate entrepreneurial intention (BIRD, 1988; TAJEDDINI; MUELLER, 2009). Research has evidenced that greater entrepreneurial intention can be observed when participants present more diversified and balanced competences (LAZEAR et al., 2005; MOOG et al., 2015), a combination that results in the creation and development of sustainable businesses models (BIRD, 1995; MICHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2010), because of the acquisition of good business performance due to the harmonic balance between the combined competences (MAN; CHAN, 2002; OBSCHONKA et al., 2013).

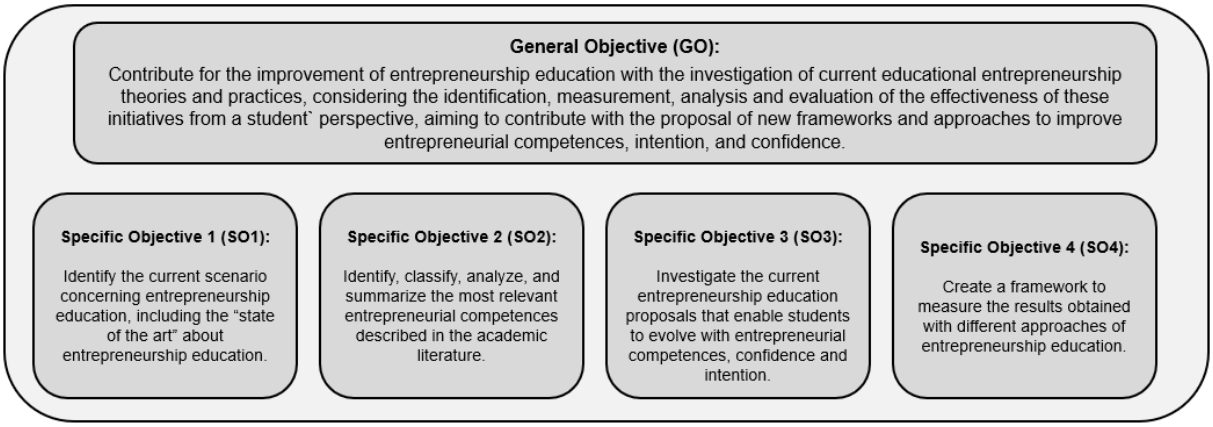
SO4: create a framework to measure the results obtained with different approaches of entrepreneurship education.

This Specific Objective is connected with article #P6.

The #P6 propose and applied a questionnaire that can be useful as framework to measure the students` evolution of entrepreneurial competences, confidence and intention over time.

These objectives were independently tackled, but harmonically connected in the different papers developed for this PhD research (#P1, #P2, #P3, #P4, #P5, #P6). When considered together these papers evidence a broad research about entrepreneurship education. The article-based thesis format was adopted because of its specific structure to better connect the obtained papers in the form of a single study. Figure 1 illustrates the objectives of this thesis.

Figure 1 - Thesis objectives



Source: Authors.

1.3 Thesis structure

This thesis adopts the article-based format and has two main parts: Part I - Integrative thesis overview and Part II - Thesis' papers. Part I of this document includes five main sections. Section one, Introduction, describes the context of this research, contextualizes the research topics and their relevance, and evidences the most important knowledge gaps that guided our research efforts for the development of the distinct research initiatives. Section two, Main Concepts, presents the most relevant concepts that create the theoretical foundations of this article-based thesis, in order to promote a common understanding about them. Section three, Research Approach and Methods, details this thesis method, specially the use of systematic literature review, including bibliometrics, networks, and contents analysis, complemented with the

fundamentals of case studies, experts' panel, and survey. These different methods were applied in distinct research initiatives to obtain the proposed objectives for this research, and to contribute with the construction of academic and practical knowledge. Section four, Results, presents the main results obtained with this research, connecting results with papers (#P1, #P2, #P3, #P4, #P5, #P6). Section five, Conclusion, presents the conclusions of this research, considering its implications, limitations, and opportunities for future researches. Part II - Thesis' papers includes the resulting six papers. #P1 was published in the IEEE Transactions on Engineering Management, #P2 was published in the International Journal of Engineering Education, #P3 was published in the International Journal of Entrepreneurial Behavior & Research, #P4 was published in the Gestão & Produção, #P5 was submitted in the RAE – Revista de Administração de Empresas, and the #P6 was submitted in the International Entrepreneurship and Management Journal. Table 1 illustrates these papers associate with methods, objectives and authors.

Table 1 - Publications that compose the basis of this article-based thesis

#	Paper Title	Method	Objective	Authors	Journal	JCR	Qualis III Engineering	Status
1	Towards a recursive stage-based framework for supporting startup business initiation: An exploratory study with entrepreneurs	Experts' panel and Survey		Reis, Fleury, Carvalho	IEEE Transactions on Engineering Management	2,784	B1	Published
2	Contemporary trends in engineering entrepreneurship education	Systematic literature review		Reis, Fleury, Carvalho	International Journal of Engineering Education	0,653	B1	Published
3	Consolidating core entrepreneurial competences: towards a meta-competence framework	Systematic literature review		Reis, Fleury, Carvalho	International Journal of Entrepreneurial Behavior & Research	3,529	-	Published
4	Application of new agile approaches at University of São Paulo innovation agency's entrepreneurship and innovation course	Case study		Reis, Fleury, Bento, Fabbri, Ortega, Bagnato	*Gestão & Produção*	-	B3	Published
5	A comparison between hypothesis-driven entrepreneurship education approaches	Case study		Reis, Fleury	*RAE – Revista de Administração de Empresas*	0,404	B2	Submitted
6	Student's entrepreneurial intention and competences: a before and after-course survey	Case study and Survey		Reis, Fleury	*International Entrepreneurship and Management Journal*	3,472	-	Submitted

Source: Authors.

2 MAIN CONCEPTS

This section presents an overview of the main concepts addressed by this article-based thesis research: (i) Entrepreneurs and Entrepreneurship; (ii) Entrepreneurship education; (iii) Entrepreneurial competences, intention, and confidence. The objective is to promote a common understanding about the most relevant aspects that will guide the research initiatives.

2.1 Entrepreneurs and Entrepreneurship

Entrepreneurs are people with focus on the identification of business processes that are not performing well and market inefficiencies, trying to revolutionize the market conditions by introducing new products and services, according to #P2 (section 4.1, paragraph 1), (ACS et al., 2016). Entrepreneurs have the capability to assume risks (LAZEAR et al., 2005), performing many different tasks (OBSCHONKA et al., 2013), being recognized as hardworking professionals (HOFER; SANDBERG, 1987). Entrepreneurs are people able to make intense efforts to face and mitigate the risks of starting new businesses, according to #P3 (section 1, paragraph 1), (OBSCHONKA et al., 2013). According to #P2 (section 4.1, paragraph 1), success in entrepreneurship demands the identification and exploration of emerging opportunities that can be tackled with solutions that results in viable, profitable, and sustainable businesses models (LANS; BLOK; WESSELINK, 2014). For this, entrepreneurs have to have the capability of risk taking, resilience, and opportunity seeking, according to #P2 (section 4.1, paragraph 2), (KURATKO, 2005), and also an entrepreneurial mindset (MAN; CHAN, 2002; OBSCHONKA et al., 2013; ESPÍRITU-OLMOS; SASTRE-CASTILLO, 2015).

The individual circumstances are powerful drivers in the emerging of new entrepreneurs, such as economic, cognitive, emotional, cultural, and physical, according to #P3 (section 1, paragraph 2), (MITCHELMORE; ROWLEY, 2010; MILLER; LE BRETON-MILLER, 2016). The entrepreneurship is an essential part of the innovation process, possessing the power to redesign the market structure, by impacting in the competition basis, according to #P6 (section 2.1, paragraph 2), (LIMA et al., 2015).

The entrepreneurship process is characterized for being chaotic, non-linear, and complex, according to #P2 (section 4.1, paragraph 2), (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010; KURATKO, 2005). According to #P1 (section 2.1, paragraph 1) and #P6 (section 2.1, paragraph 1), entrepreneurship can be defined as a way of thinking in the search for business opportunities (TEECE, 2007), offering the different (ALDRICH; FIOL, 1994), aiming to identify an innovative idea that meet the customers' unknown needs and provide competitive advantage (GANDHI; DEARDOFF, 2014). Entrepreneurship is usually associated with some issues, such as innovation, economic growth, and employment generation, according to #P5 (section 1, paragraph 1) and #P6 (section 1, paragraph 4), (ACS et al. 2016; AL-ATABI; DEBOER, 2014; GUEDES, 2015; OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013; VON GRAEVENITZ; HARHOFF; WEBER, 2010).

According to Schumpeter (1934), entrepreneurship demands a set of behaviors to manage and to raise resources to create value and, according to #P2 (section 4.3, paragraph 4), it is necessary to improve the entrepreneur`s effectiveness, stimulating an intentional and planned behavior (HERRON; ROBINSON, 1993; MICHELMORE; ROWLEY, 2010; SÁNCHEZ, 2010). Entrepreneurship is a research field that still demands in-depth research (KISS; DANIS; CAVUSGIL, 2012; SALERNO et al., 2015), and because of its learning nature, reflecting is also a fundamental component of entrepreneurship education (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010). According to #P2 (section 4.1, paragraph 4), different authors evidenced entrepreneurship as important for attending and discovering market needs, and entrepreneurship education is the provider of knowledge and developer of competences useful for those who are in the search for create their own business (REIS; FLEURY; CARVALHO, 2019). In this scenario, it is relevant to explore the thematic of entrepreneurship education, many times associated with the development of entrepreneurial competences.

2.2 Entrepreneurship education

As evidenced by #P2 (section 4.2, paragraph 3), the first entrepreneurship class took place in 1947, in the United States of America, conducted by Prof. Myles Mace; since then, the number of classes in the subject has grown exceptionally, revealing a new

research agenda, involving academics and non-academics, with focus on the impact of education on the success of new entrepreneurs (ROBINSON; SEXTON, 1994).

The teaching of entrepreneurship seeks to improve the management capabilities of small businesses, leading to greater resilience of entrepreneurs, by improving their entrepreneurial attitudes and personality, according to #P2 (section 4.2, paragraph 2), (FULLER-LOVE, 2006). Entrepreneurship education focus on the development of the competences and skills required for entrepreneurs, according to #P4 (section 2.1, paragraph 2), (FULLER-LOVE, 2006). Entrepreneurship education promotes the employability of students, #P2 (section 1, paragraph 3), (ROBINSON; SEXTON, 1994; SOUITARIS; ZERBINATI; AL-LAHAM, 2007), but is still experimenting the recent diffusion of specific bodies of knowledge, which are not still completely consolidated. Therefore, there is opportunity to identify, analyze, improve and promote entrepreneurial approaches, methods, and tools, in contexts where the simultaneous involvement of non-academics and academics results in the creation of new businesses, leading to the economic development (DUVAL-COUETIL, 2013). Policy-makers and economists generally defends that higher levels of innovation and economic growth are possible with the diffusion of the entrepreneurship, reinforcing the relevance of improving educational entrepreneurship programs as a way to stimulate the development of successful entrepreneurs, according to #P3 (section 2.1, paragraph 1), (SÁNCHEZ, 2010; 2013; THOMAS; MUELLER, 2000).

Entrepreneurship education basically consists of teaching entrepreneurial attitudes and skills (REIS; FLEURY; CARVALHO, 2019), with focus on the development and improvement of entrepreneurial competences, actions and attitudes, that results from the combination of knowledge, resources, and skills that differentiate entrepreneurs from other professionals, according to #P2 (Section 1, paragraph 3), (REIS; FLEURY; CARVALHO, 2020). Entrepreneurship education is essential to integrate quantitative and qualitative initiatives to develop innovative entrepreneurs, improving people entrepreneurial attitudes, skills, and capabilities, according to #P6 (Section 1, paragraph 5), (BAE, 2014; NECK; GREENE, 2011).

Currently, the diffusion of the Hypothesis-Driven Entrepreneurship (HDE) approach has gained prominence because of its effectiveness in assisting entrepreneurs in the development of new services and products, starting with the identification of hypotheses, which will be tested with potential customers, aligning the new service or

product with the desires and needs of the customers, with the validation being more valuable than the elaboration of the complete business plan, according to #P4 (section 1, paragraph 2), (BLANK, 2013; EISENMANN; RIES; DILLARD, 2011; RIES, 2011). The Hypothesis-Driven Entrepreneurship approach brought innovation into the core of project-based academic initiatives, revealing the prominent importance of Universities in the entrepreneurial ecosystem and the need to revolutionize their structure and role in order to lead the implementation of the new paradigms for teaching entrepreneurship, according to #P4 (section 4.2, paragraph 1), (GUERRERO; URBANO; FAYOLLE, 2016; KALAR; ANTONCIC, 2015; GIBB, 2002).

According to #P2 (Section 4.2, paragraph 1), when the subject is entrepreneurship education, it is also important to explore the entrepreneurial Universities, because they are responsible to create an appropriate environment for the entrepreneurial initiatives that are developed and conducted (REIS, FLEURY, CARVALHO, 2019). Universities contribute for the development of entrepreneurial thinking and acting, reinforcing informal factors such as attitudes towards entrepreneurship and role models (GUERRERO; URBANO; FAYOLLE, 2016). According to #P2 (Section 1, paragraph 3), every day more academic institutions are interested in entrepreneurship education (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010; NABI et al., 2017), a growth mainly related with the entrepreneur`s capability in generating relevant innovations (O'CONNOR, 2013; PREMAND et al., 2016), since entrepreneurial behavior can be positively associated with entrepreneurship education (KARIMI et al., 2016).

Entrepreneurship classes are growing exponentially, incorporating the traditional discussion between academics and non-academics about the impact of education on entrepreneur's success. In terms of entrepreneurship, the connection between business and learning is evidenced when the educational curriculum that emphasize entrepreneurial activities improves the quality of the results of the entrepreneurs, according to #P2 (Section 1, paragraph 2), (O'CONNOR, 2013).

According to #P2 (section 1, paragraph 4), with the use of entrepreneurship education it is possible to stimulate the student's intention to start new businesses (SÁNCHEZ, 2013; BAE et al., 2014), resulting in opportunities to influence aspirations of entrepreneurship, by the educators (FIET, 2000). Entrepreneurship education effectively increases the students' attitudes and perceived behavioral control,

stimulating entrepreneurial behavior, according to #P2 (section 4.3, paragraph 1) and #P4 (section 1, paragraph 1), (RAUCH; HULSINK, 2015). Successful entrepreneurship education programs effectively transforms and stimulates students' behavior, improving entrepreneurial attitudes, according to #P2 (section 4.3, paragraph 1), (BAE et al., 2014; RAUCH; HULSINK, 2015), and deconstructing the myth that entrepreneurs are born with innate characteristics that differentiate them from others, which are difficult or even impossible to be developed or even promoted, according to #P2 (section 4.3, paragraph 5) and #P4 (section 2.1, paragraph 2), (REIS; FLEURY; CARVALHO, 2019; NECK; GREENE, 2011). There is a mix of entrepreneurial competences differentiating entrepreneurs from others, in a unique combination of knowledge, resources, and skills, according to #P2 (Section 4.3, paragraph 2), (FIET, 2000). According to #P6 (section 1, paragraph 6), entrepreneurship education fosters the improvement of entrepreneurial confidence and intention (BAE et al., 2014), and the development of entrepreneurial competences (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013).

2.3 Entrepreneurial competences, intention, and confidence

Entrepreneurial competences are high-level abilities that align skills, knowledge, and personal characteristics, allowing the entrepreneur to successfully perform different and complex tasks, according to #P3 (section 1, paragraph 4), (BIRD, 1995; LAZEAR et al., 2005; MITCHELMORE; ROWLEY, 2010; MOOG et al., 2015; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2010). A new business demands a broad combination of different competences from the entrepreneur in order to create value, especially in the early stages of development, and requires the combination of tangible and intangible resources, according to #P3 (section 2.2, paragraph 1), (RASMUSSEN; MOSEY; WRIGHT, 2011). Entrepreneurial competences can be classified in three main categories (REIS, FLEURY; CARVALHO, 2020):

I. **personal traits and attributes** – inherent characteristics or qualities of an individual;
II. **abilities/skills** – the expertise to do something well; and
III. **experience/knowledge** – including required information, ability and capability, acquired through educational initiatives, practical contacts or even from the observation of relevant events.

According to #P3 (section 2.3, paragraph 1), there is a vast number of academic researches aiming to capture the diversity of entrepreneurial competences, that are considered as necessary for someone to become a successful entrepreneur, with focus on consolidating definitions and proposing different models and frameworks (MICHELMORE; ROWLEY, 2010). Entrepreneurial competences can be defined considering different perspectives, resulting in distinct definitions, leading to different interpretations and meanings. In common, it is possible to identify a shared vision of the abilities and characteristics that enables the entrepreneurial behavior, highlighting the inclusion capability of identify opportunities and maintain the business development. Author differentiate managerial and entrepreneurial competences, associating the second with better results in the evaluation of opportunities, identification of valuable and critical resources and better strategy formulation (HERRON; ROBINSON, 1993; HOFER; SANDBERG, 1987; MICHELMORE; ROWLEY, 2010; TIMMONS et al., 1987; VENKATARAMAN, 2000; MAN; CHAN, 2002).

Entrepreneurial competences are recognized as highly important for business success and growth, a set of skills required for entrepreneurs to transform ideas into profitable ventures, reinforcing the development of sustainable business models, according to #P3 (section 2.3, paragraph 2), (BIRD, 1995; MICHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2010). Entrepreneurial competences are also defined as abilities or characteristics that allows appropriate entrepreneurial behavior, including issues such as the capability to sustain business development and opportunity identification (BIRD, 1995; BOYATZIS, 1982; MICHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2010). Entrepreneurs' competencies combine resources, skills and knowledge that differentiate entrepreneurs from the other people, according to #P2 (section 4.3, paragraph 2), (FIET, 2000).

There are a vast number of identified entrepreneurial competences, creating the need of clustering these competences into meta-competences that can assist in the definition of groups of competences. Tajeddini and Mueller (2009) and Duffy et al. (2006) studied and agreed that the identification and use of meta-competences facilitate the development of the entrepreneurial capabilities, leading to the entrepreneurial success. Meta-competences assist the development of other competences, being generic and overarching; examples include creativity,

communication, analysis, self-development, and problem-solving (CHEETHAM; CHIVERS, 1996), learning, adapting, anticipating, judgement, teamwork, communicativeness, confidence, and creating change (KEARNEY, 2005; OXFORD, 2018; TALBOT, 2004). In this thesis, paper #P3 researched about the meta-competences to cluster the entrepreneurial competences discovered in the literature, evidencing a convergent set of meta-competences. According to #P3 (section 2.4, paragraph 5), Cha and Maytorena-Sanchez (2019), Le Deist and Winterton (2005), Kotzab et al. (2018), Uhlenbrook and Jong (2012), and Yazdani and Yadollahi (2019) agree in four meta-competences:

1. **Personal and Behavioral Meta-Competence (PBMC)** – during the creation of the new business, are the ability to adopt appropriate behaviors;
2. **Functional Meta-Competence (FMC)** – in the search to obtain success in the creation and deployment of new business, are the ability to perform different business-related tasks;
3. **Knowledge and Cognitive Meta-Competence (KCMC)** – master technical and theoretical knowledge of the business field and have the ability to apply this knowledge into practice;
4. **Values and Ethical Meta-Competence (VEMC)** – have the ability to make sound judgments and the possession of appropriate professional values.

When it comes to entrepreneurial intention and confidence, there is a broad defense that it is positively correlated to the teaching of entrepreneurship and can be stimulated, according to #P2 (section 4.4, paragraph 2; Section 4.5, paragraph 2), (SOUITARIS; ZERBINATI; AL-LAHAM, 2007).

According to #P2 (section 1, paragraph 4), the entrepreneurial intention is receiving growing attention, mainly in the identification and understanding of the entrepreneurial behavior, and in understanding the development of intentions (FAYOLLE; GAILLY, 2015). It is known that students develop higher entrepreneurial intention when attending entrepreneurial courses, according to #P2 (section 4.4, paragraph 1 and 2), (RAUCH; HULSINK, 2015; SOUITARIS; ZERBINATI; AL-LAHAM, 2007), with a positive correlation between entrepreneurial intention and entrepreneurship education, according to #P2 (section 4.4, paragraph 2) and #P3 (Section 1, paragraph 3), (WALTER; BLOCK, 2015; FAYOLLE; GAILLY, 2015; REZAEI-ZADEH et al., 2014),

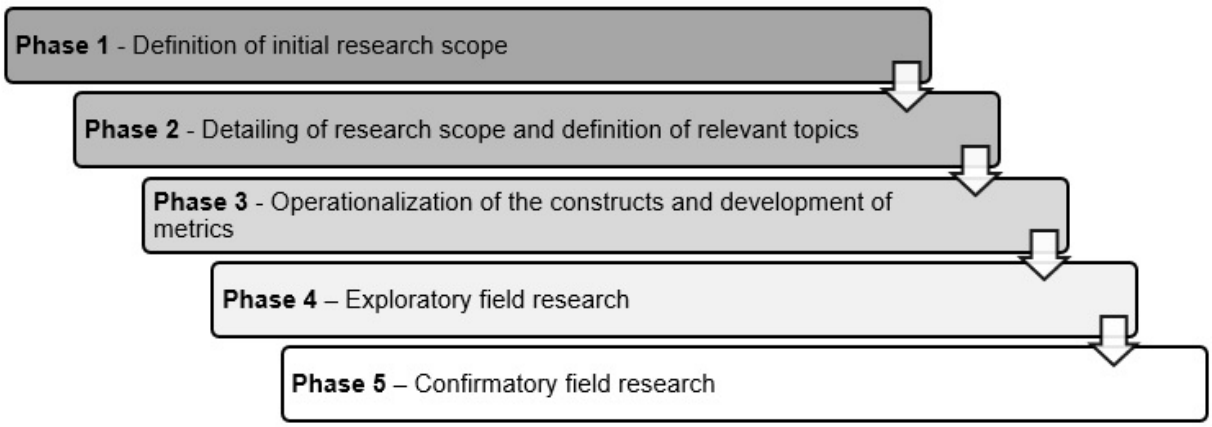
since this is a positive environment because it supply entrepreneurs with relevant resources, according to #P3 (section 1, paragraph 4), (MAN; LAU; CHAN 2002; SANSONE et al., 2019). It is possible to conclude that different circumstances can affect the level of entrepreneurial intention because of the modification in the level of entrepreneurship knowledge, according to #P2 (section 4.4, paragraph 2) and #P3 (section 1, paragraph 3), (HERRON; ROBINSON, 1993; LIÑÁN; CHEN, 2009). The entrepreneurial intention is also affected by the educational level, since people with higher educational level are more willing to start a new business, since higher educational level demands money and time, resulting in higher expectations about the future and opportunity costs, and people with higher educational level are more inclinable to scenarios of uncertainty, according to #P2 (section 4.4, paragraph 3), (AUTIO; ACS, 2010; REIS; FLEURY; CARVALHO, 2019).

3 RESEARCH APPROACH AND METHODS

This section presents the research approach and methods that have been applied to develop and conclude this article-based thesis, following the academic production model of thesis based on scientific papers. Therefore, each proposed objective was tackled in a research initiative, which results were analyzed and summarized with the development and submission of a scientific paper. These papers were submitted in distinct relevant journals and some of them are already accepted for publication and even published. Research initiatives combined qualitative and quantitative approaches, including experts' panel, systemic literature reviews, case studies, and surveys. In a scenario where research in Operations Management has focus on the consolidation of relevant knowledge for theory building, this thesis resulted in the investigation of technical and behavioral dimensions concerning the specific context of entrepreneurship (WACKER, 2004), a relevant theme that contributes with Operations Management researchers that have, focus on getting better information about the reality to develop a better and more complete theory (MCCUTCHEON; MEREDITH, 1993).

Figure 2 presents the main phases of the research conducted for the development of this thesis.

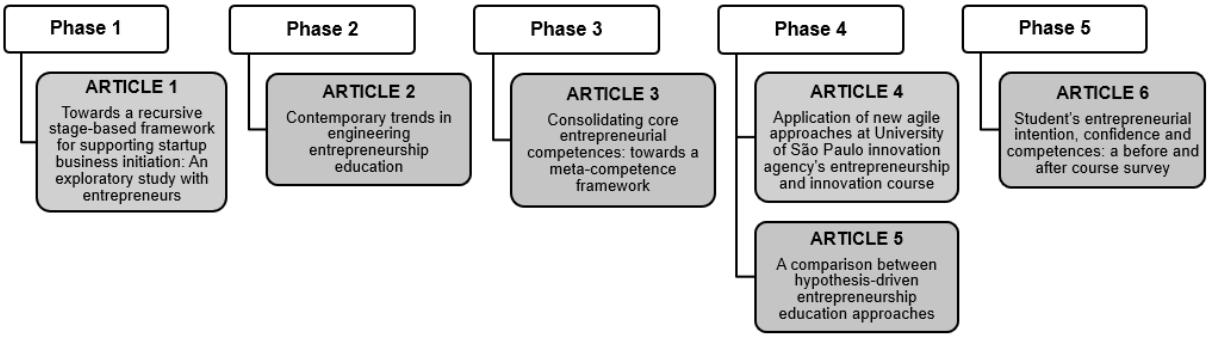
Figure 2 - Thesis main phases of research



Source: Author.

As shown in Figure 2, this article-based thesis research included five main phases, which together achieved the proposed research objectives. Figure 3 evidences the papers that resulted from each phase of this thesis' research.

Figure 3 - Papers for phase



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Next sections present details, justifications and structures of each phase.

3.1 Phase 1 - Definition of initial research scope

Phase 1 included the definition of the initial research scope, considering the interest of the author in improving entrepreneurial educational initiatives, resulting in the construction of the initial foundations of this research. This motivation was identified in a scenario where innovations attract increasing attention among practitioners and academics (BITENCOURT; KAYNAK, 2017). A growing number of large organizations has the objective of simultaneously acquiring productive excellence and developing innovations (EDISON, 2015) and, for this purpose, these organizations are structuring programs to identify, select and support startups, providing financial incentives and partnership opportunities (STARTUP GENOME, 2017). Startups emerged as a recent phenomenon (KISS; DANIS; CAVUSGIL, 2012), recognized for developing differentiated business models working with limited resources, pursuing exponential results, in environments of great uncertainty (RIES, 2011; BLANK, 2012; THIEL; MASTERS, 2014; LEUNG et al., 2006).

Entrepreneurship approaches have evolved significantly during the last decade and currently research concerning entrepreneurial approaches lacks in-depth studies (KISS; DANIS; CAVUSGIL, 2012; SALERNO et al., 2015), a fact that can be attributed to the uncertainties that are inherent to the contemporary entrepreneurial process, a process that is often neglected by the literature (BYLUND; MCCAFFREY, 2017).

Considering this research scope, the first paper of this thesis (#P1) presents a framework that identifies the most relevant activities conducted by entrepreneurs for the generation and refinement of concepts, pursuing the structuration of the initial operations of new startups. Research initiatives included initially a literature review,

that resulted in a first version of a framework of relevant entrepreneurial activities, that was submitted for validation in an experts' panel, composed by eight experts, and that resulted in the framework second version, which was in turn validated in a survey with eighty seven Brazilian entrepreneurs that successfully conducted their startups into acceleration programs.

The research resulted in a recursive stage-based framework to support startup initialization, that combines concepts and tools from Lean Startup, Business Model Canvas and Design Thinking approaches, and incorporates a recursive learning loop. This framework is mainly composed of ten stages (1. Immersion, 2. Analysis & Synthesis, 3. Customer Discovery, 4. Ideation, 5. Value Proposition Canvas and Minimum Viable Product, 6. Costumer Validation, 7. Costumer Creation, 8. Implementation, 9. Business Model Canvas and Prototyping, and 10. Business Model Canvas and Organization Construction), clustered in three phases (Ideas Generation, Conversion, and Diffusion).

As previously mentioned, the first research method applied was an experts' panel. Experts' panel is an approach recognized for analyzing specific issues, about specific fields, in which participants have recognized expertise and can generate good insights to improve the quality of the previous results (SUSSENBACH et al., 2014), ensuring a good connection with the participants (FLICK, 2004). By designing a scenario where opposite opinions can be compensated and false and radical opinions can be eliminated, shared ideas can be assessed and successfully analyzed (PATTON, 1990), leading to a consensus and to the systemic structuration of knowledge as the final result (ROQUE; MELO, 2010). The experts' panel should be conducted as a set of interviews and should not be considered as a discussion forum (PATTON, 1990). It is used to gain knowledge, not requiring confrontation, something that can be achieved maintaining the expert's anonymity (LUCENA; CASACA, 2013).

The second method applied in this research was a survey. Survey was selected because it is a tool that aims to contribute to the knowledge of a certain area, using tools such as data collection, information about people and environments (MIGUEL, 2010). Survey is a powerful tool since it includes a rich set of techniques which, when applied, evidence information related to several points, such as individual attitudes, behaviors, values, opinions, knowledge, and even circumstances (RASINSKI, 2005). Surveys are widely accepted in the Operations Management area for its ability to

investigate concepts, to test theories, and to verify the adherence to the reality of the proposed scenarios (KLASSEN; JACOBS, 2001; RASINSKI, 2005). Surveys allow the overcoming of limiting factors, such as time and cost, when collecting data from a broad population (FORZA, 2002). It should be noted that surveys were positively impacted by the diffusion of personal computers and Internet (SORENSEN; MATTSON; SUNDBO, 2010).

Considering the obtained result, a proposal of a framework that contribute for the generation, identification and beginning of innovative business and assists in the process of refinement and structuring of initial operation at startups, emerged the curiosity in how is possible to teach entrepreneurship and if the literature evidences the new approaches evolving the entrepreneurship education.

3.2 Phase 2 - Detailing of research scope and definition of relevant topics

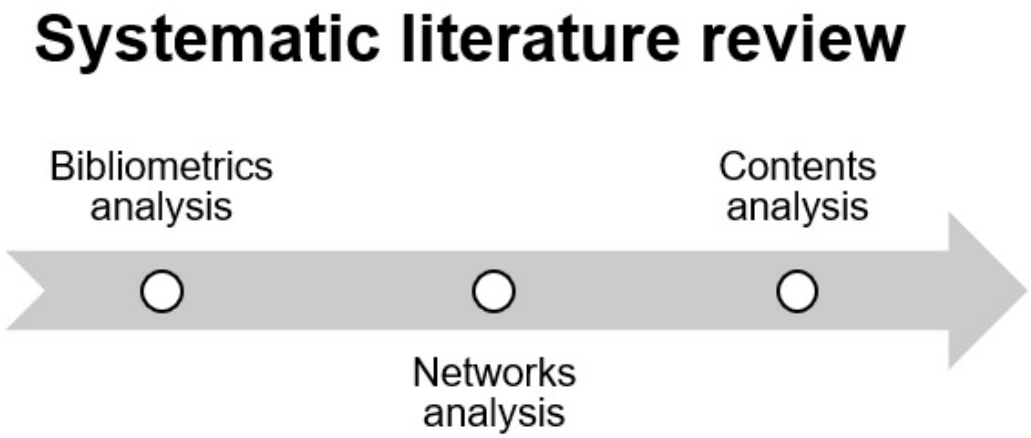
Phase 2 consisted of detailing the research scope and defining its relevant topics. For this, it was first identified the interest in studying more deeply entrepreneurship, aiming to create a broader perspective about the subject, and based on the readings of related papers on the subject, relevant knowledge gaps were evidenced, specially the research topic of entrepreneurship education, a subject that is constantly being renewed, consolidating a second research topic, entrepreneurship education.

The second paper (#P2) of this thesis aimed to identify the current scenario concerning entrepreneurship education and the “state of the art” about the subject, and in this search tackled the subject of entrepreneurship education and resulted in a systematic literature review, including bibliometrics, networks, and contents analysis, a method that was also applied in future initiatives of this thesis. The Systematic Literature Review (SLR) was selected because of the interest in discovering the “state of the art” about entrepreneurship education, and is recognized as capable of identifying this “state of the art” and highlighting the limitations and knowledge gaps of a given subject. As a consequence, SLRs reveals the relevance of a subject and evidences future research opportunities (PALMARINI et al. 2018; LIMA-JUNIOR; CARPINETTI, 2017; MAIER; MEYER; STEINBEREITHNER, 2016; DIKICI; TURETKEN; DEMIRORS, 2018; SARKA; IPSEN, 2017), identifying and synthesizing the significant knowledge of a specific research field, resulting in the synthesis of the available high-quality contents (IRSHAD; PETERSEN; POULDING, 2018; WEISSBRODT; GIAUQUE, 2017).

Moreover, a SLR allows the construction of databases that will help in future research, as well with the drawing of causes, effects, structures, and process (MAIER; MEYER; STEINBEREITHNER, 2016; DIKICI; TURETKEN; DEMIRORS, 2018).

Figure 4 presents the SLR approach applied in this article-based thesis, used to review and to explore the evolution of a specific topic of interest with the application of complementary techniques, such as bibliometrics, contents, and networks analysis (CARVALHO; FLEURY; LOPES, 2013). The bibliometrics analysis makes it possible to identify and to understand the relevant publications about a theme, evidencing research trends, as well as the characteristics of the publications of the scientific literature, exploring the characteristics of the global research (CHEN et al., 2017; SALMERÓN-MANZANO; MANZANO-AGUGLIARO, 2017; ZHANG et al., 2017; YU et al., 2016; KOLLE et al., 2017; YANG; WU, 2017). In a global exploration of a specific field of research and considering empirical outcomes (NEELY, 2015), a SLR evidences current and future researches, and summarizes the most important research topics and trends (ZHANG et al., 2017; YU et al., 2016; KOLLE et al., 2017), as well as the development and growth of these topics (MAO et al., 2016), creating a landscape view about the research theme (ZANGUELINI et al., 2016). Computational techniques were applied to analyze publications (MEJIA; KAJIKAWA, 2017), together with the quantification and visualization of the subjects from a scientific field (MARX; HAUNSCHILD; BORNMANN, 2017). Finally, a SLR evidences the most cited papers, insights, and interest of the institutions, as well as patterns of collaboration (MARX; HAUNSCHILD; BORNMANN, 2017; TCHUIFON; FU; HO, 2017).

Figure 4 - Systematic literature review illustration



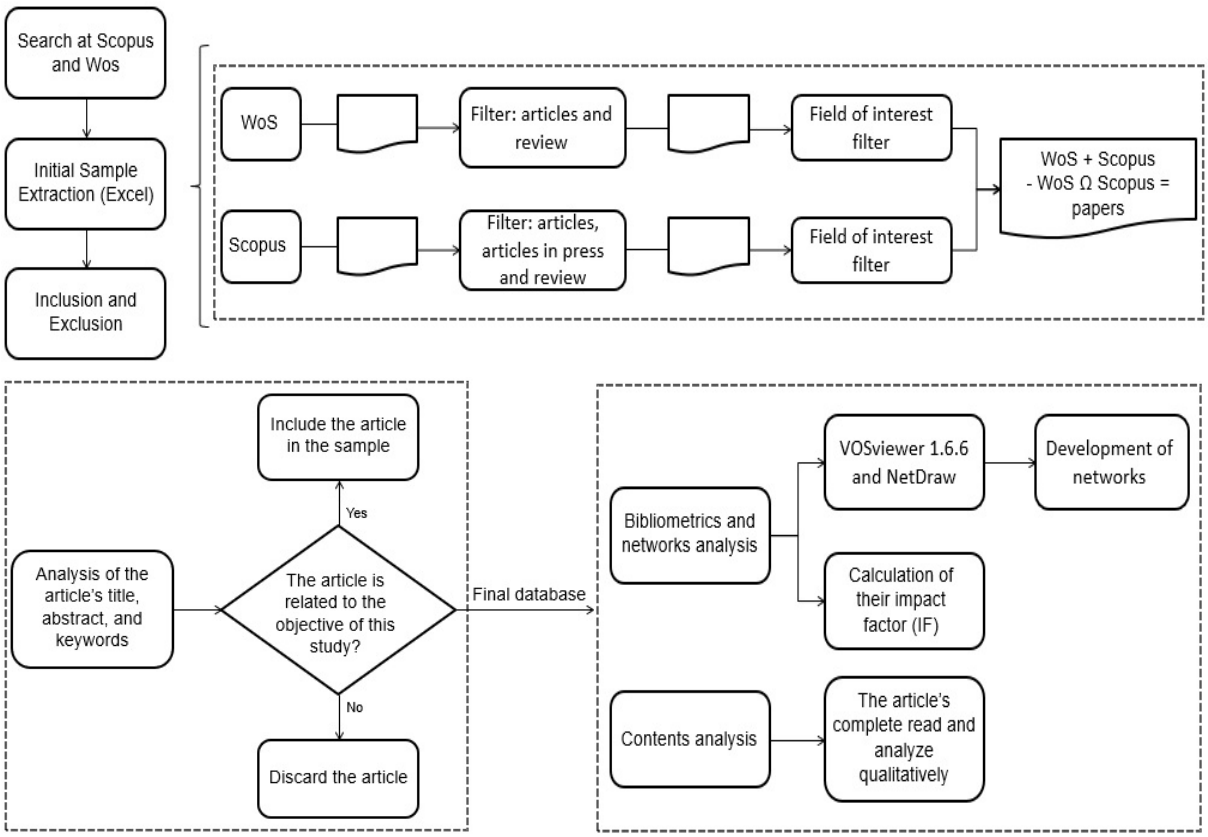
Source: Author.

Another technique applied in the SLR was the networks analysis, that made it possible to understand publications patterns, based on the researched databases (TAKEY; CARVALHO, 2016). The application of both techniques, bibliometrics and networks analysis, leads to an indispensable guide and evidences the script of a research theme, and its aspects (YATAGANBABA; OZKAHRAMAN; KUTBAS, 2017). SLRs evaluate the literature database and characterize the literature, resulting in clusters of information about journals, countries, institutions, categories of subject, type of publication, citations, and even analysis of contents based on keywords (DU et al., 2015). Results include number of papers, number of publications by countries, the most active authors and relevant subjects for a journal, together with the evolution of the publications over the years, and important collaborations (YATAGANBABA; OZKAHRAMAN; KUTBAS, 2017; YU et al., 2016).

After the bibliometrics and networks analysis a contents analysis was performed, conducting to the identification of relevant research approaches (ALLEN et al., 2014) and contributing with the collection of data and with the analysis of publications (WASIKE, 2017; ARSLAN, 2012). Obtained results were also used for the conceptualization of the research questions (ALLEN et al., 2014), comparing and contrasting different findings from the SLR (HAZEN; OVERSTREET; BOONE, 2015).

Searches for database construction for the SLR were conducted in two main databases, Scopus and Web of Science (WoS). Scopus database was selected, because it grants access to the largest number of world-reviewed peer-reviewed citations and abstracts. The WoS database was chosen, because it includes papers indexed with relevant impact factor (JCR - Journal Citation Report) (TAKEY; CARVALHO, 2016). The search and selection of papers for the SLR followed the workflow illustrated in Figure 5.

Figure 5 - Systematic literature review workflow



Source: Author.

As presented in Figure 5, the SLR begins with a search in the Scopus and the WoS databases. For this, database filters were applied in order to identify papers related with the search theme and to identify the total number of published papers. Identified papers were reviewed considering their titles, abstracts, and keywords, allowing the selection of papers that were appropriately aligned with the research theme. SLRs finished with the application of bibliometrics, networks, and contents analysis, resulting in a complete panorama about the research theme. VOSviewer 1.6.6 software was used for visualizing and analyzing the networks, and the NetDraw software was used for analyzing and editing the networks. When the obtained number of papers for the content analysis was very high, the Impact Factor (IF) of the publications was considered based on Equation 1, as suggested by Carvalho, Fleury and Lopes (2013), making possible to select only the most relevant papers for full reading.

Equation 1 - Impact Factor

$$IF = C\ * (JCR + 1)$$

Source: Carvalho, Fleury and Lopes (2013).

In Equation 1, C - is the number of citations and JCR - the impact factor of the journal in which the paper was published, based on its Journal Citation Report (JCR).

As previously discussed, the Phase 2 of this thesis resulted in a paper (#P2), with focus on the development of a systematic literature review, including bibliometrics, networks, and contents analysis, considering the topics “entrepreneurship” and “education”. In order to search the databases, the keywords "entrepreneurship" and "education" were used and, after applying the systematic literature review workflow presented in Figure 5, the final database for this research initiative included a sample of 324 papers.

Considering the creation of a global landscape concerning researches in the theme, and evidencing its “state of the art”, a deep comprehension of the variables that are mandatory for the construction of this thesis was obtained. Results evidenced that the theme “entrepreneurship” is more relevant than ever, revealing the relevance of the theme “entrepreneurship education” and its exponential growth. The paper also evidenced the “state of the art” about entrepreneurship education, highlighting the most relevant trends and theories from the literature. It is important to note that research is advancing to a more confirmatory phase, with most publications applying empirical research (67%), with the use of surveys (42%).

This paper evidenced a growing interest in the analysis of students' entrepreneurial competences, emerging the curiosity in investigating if it is possible to measure the effectiveness of approaches that search to teach entrepreneurship, by the evolution of the students` entrepreneurial competences, a theme that guided the research initiatives that resulted in #P3, in Phase 3. Another relevant identified theme was the comparison of students’ performance before and after ending entrepreneurship courses, #P6, which will be presented as Phase 5.

3.3 Phase 3 - Operationalization of the constructs and development of metrics

After the completion of Phase 2 and considering the growing interest in the analysis of students' entrepreneurial competences, Phase 3 tackled the operationalization of the constructs and development of metrics for the identification of the most relevant entrepreneurial competences, evidenced in different researches, around the world. This research initiative included a systematic literature review, including bibliometrics, networks, and contents analysis, as previously presented in Figure 5.

Obtained result is a paper that assists practitioners and academics in the construction of the theoretical foundation of entrepreneurship, considering that entrepreneurial competences can be taught and entrepreneurial intentions can be stimulated. This systematic literature review provides a consolidated set of competences, including competences already discussed in the literature as well as the conceptualization of new entrepreneurial competences, therefore, advancing the “state of the art” about entrepreneurial competences.

However, after the completion of this study, we perceived the need of investigating the different approaches applied to teach entrepreneurship, #P4 and #P5 from the Phase 4, and the comparison of entrepreneurship education courses considering pre and post-tests with students, in order to evidence the development of entrepreneurial competences, that were acquired during the course and, as a result, to create metrics to evidence the effectiveness of these courses in developing entrepreneurial competences, intentions, and confidence, subject of article #P6, in Phase 5.

3.4 Phase 4 – Exploratory field research

Considering the importance of obtaining in-depth contextual evidences, Phase 4 focused in an empirical field research about a specific entrepreneurship course, that was analyzed based on the applied methods and obtained results, considering the final results of the developed projects from these courses. Therefore, this initiative investigated the current proposal of an entrepreneurship education course as a way to teach entrepreneurship, evidencing proposals that enable students to create a sustainable businesses models.

A case study approach was selected as the research method. Case study research provides a better understanding of the real world, analyzing events that cannot be manipulated, or that can only be manipulated a little, by the researchers (MCCUTCHEON; MEREDITH, 1993). Case study analysis can result in the development of generic models (MARTIKAINEN; NIEMI; PEKKANEN, 2013), that considers evaluations and decisions (CHOUDHARI; ADIL; ANANTHAKUMAR, 2012). By demonstrating the knowledge of the current reality in an appropriate way and within a specific context, case study is a research strategy composed of a unique combination of methods, which may be quantitative or qualitative (EISENHARDT, 1989;

CHOUDHARY; ADIL; ANANTHAKUMAR, 2012). Case studies may be single or multiple (MCCUTCHEON; MEREDITH, 1993).

Considering the fast and successful diffusion of the Hypothesis-Driven Entrepreneurship approach for teaching and learning entrepreneurship concepts, experimenting with entrepreneurial methods and tools, experiencing the creation of products and services, developing entrepreneurial competences and fostering entrepreneurial intentions, in this moment the focus of this research process was the analysis and comparison of obtained results considering two different Hypothesis-Driven Entrepreneurship educational methodologies:

- The Startup Garage Innovation Process approach, which is oriented towards the identification of potential users and relevant needs and for this includes a combination of Design Thinking (BROWN, 2008), Value Proposition Canvas (OSTERWALDER; PIGNEUR, 2010) and Lean Startup (BLANK; DORF, 2012). Design Thinking helps with its tools for understanding the current reality of potential customers and generating ideas (BROWN, 2008), Lean Startup contributes to obtain feedback from potential customers, test hypothesis, and develop Minimum Viable Product (MVP) (RIES, 2011; BLANK, 2012). Finally, the Value Proposition Canvas details how the product or service create value for potential customers and relieves their “pains” (OSTERWALDER et al., 2014);
- The Startup Owner’s Manual approach, which is oriented towards the creation of new business models based on technological prototypes and combines the proposal of Ries (2011) and Blank and Dorf (2012). Blank (2005) proposed that, initially, the entrepreneur should consider that the business model is only based on assumptions that should be empirically tested with potential customers, for validation or not. Therefore, the process starts with the development of a Business Model Canvas (BMC), followed by the development of a Minimum Viable Product (MVP) that will be reviewed by customers for obtaining feedback. The central point is the interaction with potential customers, considered the best source for feedback and data collection (RIES, 2011; BLANK, 2012; EISENMANN; RIES; DILLARD, 2011).

Obtained results include article #P4 and article #P5, both in-depth evaluations of the results obtained with Hypothesis-Driven Entrepreneurship courses conducted at the University of São Paulo (USP), during the years of 2016 and 2018.

Article #P4 describes the application of the Startup Garage Innovation Process approach in an entrepreneurship education course with focus in the development of sustainable business models, summarizing the obtained results in a case study. The bibliographic review conceptualizes the two main themes, entrepreneurship education and agile approaches to entrepreneurship education, the latter divided into Design Thinking, Lean Startup, and Business Model Canvas. The course is summarized and the final projects presented by the students are analyzed considering four main aspects: objective and target audience, value proposition, Minimum Viable Product (MVP), and obtained validations. The paper resulted in contributions that go beyond the simple presentation of the results obtained with the course, and provides a list of criteria for the evaluation of the final solutions considering their desirability for potential customers, technical feasibility, considering available technological solutions, and financial viability, considering the proposed businesses models (IDEO, 2012). It was possible to observe that the application of the Startup Garage Innovation Process approach is an effective mechanism for the development of projects with good evaluation, evidencing future research possibility, based on the classification of projects of courses that teach entrepreneurship.

Article #P5 compares the application of the Startup Owner's Manual approach with the application of the Startup Garage Innovation Process approach. Both approaches are based the Hypothesis-Driven Entrepreneurship approach, proposed for Eisenmann, Ries and Dillard (2011), but with two different focus, as proposed for Yock, Brinton and Zenios (2011) and previously explained in this section. The major effort was to identify eventual differences that resulted from the execution of the courses, and their impact on the entrepreneurial intention of the students, considering presented concepts, project templates, student’s perception about the acquired knowledge, group dynamics, and final results of the projects. For this, was applied pre-course and post-course questionnaires.

Considering the evolution of this research initiative in other scenarios and with other metrics to evaluate courses that search to teach entrepreneurship, article #P6 developed and applied a framework to evaluate and compare the students`

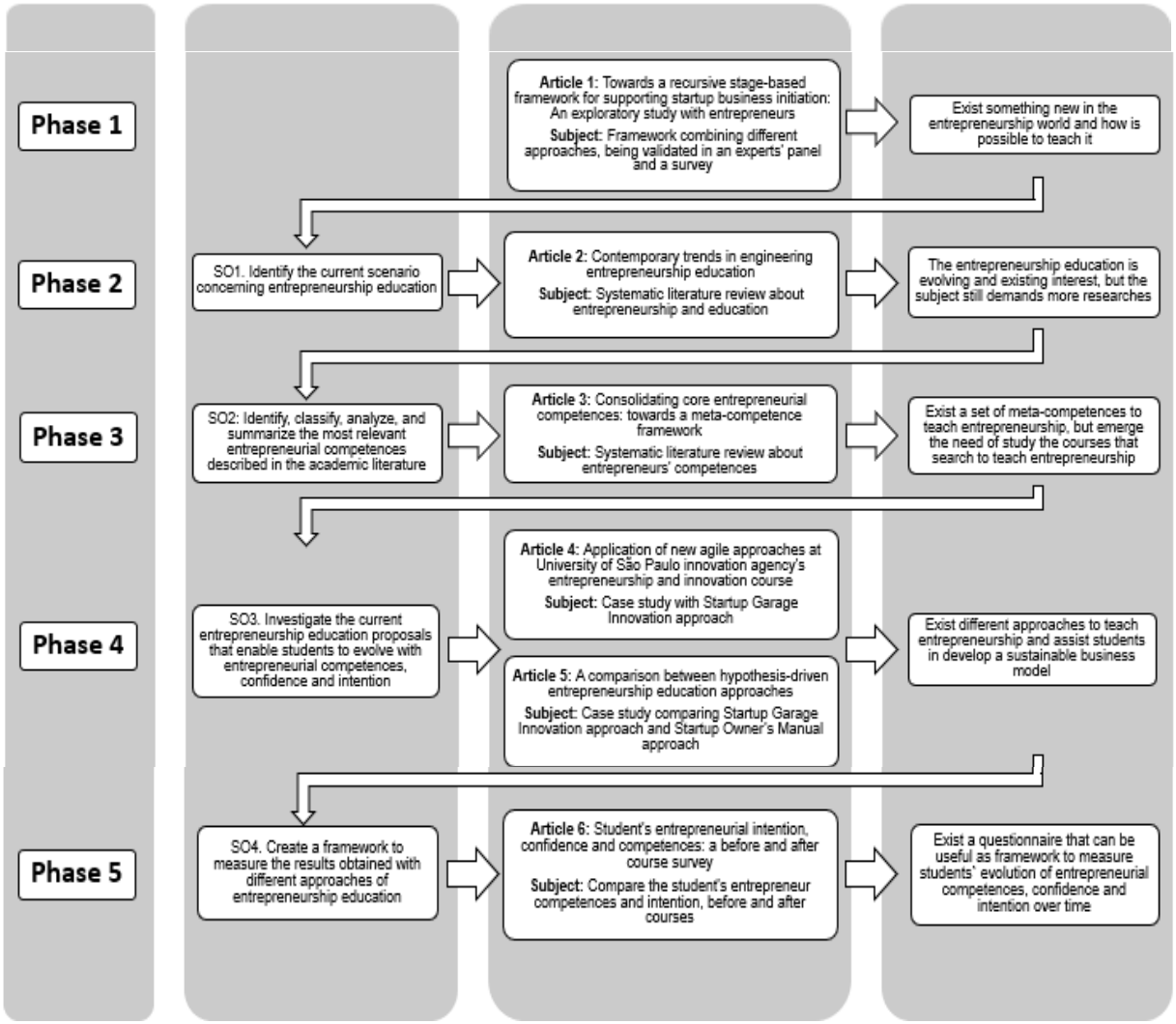
entrepreneurial competences, intentions, and confidence, before and after entrepreneurship courses that search to teach entrepreneurship, and will be presented in next section.

3.5 Phase 5 – Confirmatory field research

Phase 5 consists of the confirmatory field research and included the article #P6, which studied the students' entrepreneurial competences, intention, and confidence, before and after taking entrepreneurship courses, and for this was applied pre and post-test questionnaires. Selected research methods included case study and survey, previously presented in this article-based thesis. Article #P6 resulted in the proposition of a framework that allows the analysis of the results from entrepreneurship courses. Obtained results apply statistics to evidence the students' evolution over time, in terms of entrepreneurial competences, intention, and confidence. Students that took the course presented an evolution of this variables over time, evidencing the approach as effective teaching entrepreneurship, as a final result, article #P6 presents a framework with methods and tools for evaluating the results obtained in entrepreneurship educational initiatives that can be applied in other contexts, with a model of pre and post-test questionnaire present in the Appendices A, of this thesis.

Figure 6 summarizes the research workflow and obtained results of this PhD research initiative.

Figure 6 - Research workflow and obtained results



Source: Author.

4 RESULTS

This section presents the results obtained with the different research initiatives detailed in section 3 and analyses their alignment considering the proposed research objectives. For this, we initiate with the analysis of each proposed Specific Objective (SO) and conclude with analysis of the General Objective (GO).

Specific Objective 1 was to identify the current scenario concerning entrepreneurship education. For this, the research initiative presented in article #P1 revealed a combination of tools and methods originated in different areas of knowledge and that are consistently and systematically applied by successful entrepreneurs to create and to sustain the evolution of their startups, evidencing a new scenario for entrepreneurship education where it is possible to experience entrepreneurship, stimulate the curiosity of students and direct their future efforts for the creation of new products, services and businesses, also originating the curiosity about how is possible to teach entrepreneurship, and if the new was evidenced in the literature that guided the development of #P2. Therefore, article #P2, revealed that we live in an era of complex problems, in which entrepreneurship education is of growing importance and relevance. The resulting systematic literature review, including bibliometrics, networks, and contents analysis, also evidenced the growing interest in entrepreneurship education, with a large number of interested scholars publishing on the subject. The paper also evidenced gaps of knowledge about the subject and proposed directions for more in-depth studies related with the possibility of measure the effectiveness of approaches that search to teach entrepreneurship, by the evolution of the students` entrepreneurial competences.

Specific Objective 2 was to evidence the most relevant entrepreneurial competences, identified throughout time, from different researches conducted around the world. For this, the research initiative presented in article #P3 conducted a systematic literature review, including bibliometrics, networks, and contents analysis and presents a robust understanding and definition of entrepreneurial competences, evidencing the state of the art in the field, presenting as final result a list of essential competences clustered into meta-competences for entrepreneurs. This final list of competences was the basis for a new research initiative concerning entrepreneurial competences that resulted in article #P6, that presents a comparison considering students' competences before and after taking an entrepreneurship course. This initiative also explored a broader

perspective and analyzed aspects related with entrepreneurial intention and confidence. Evidencing the need of investigated the different templates applied to teach entrepreneurship, #P4 and #P5.

Specific Objective 3 was to investigate the current entrepreneurship education proposals that enable students to evolve with entrepreneurial competences, confidence and intention. Article #P4 presented a case study that investigated the obtained results of a course that applied the Startup Garage Innovation Process approach, describing the course and detailing the products and services that resulted from the projects and were presented by the students, at the end of the course. Obtained results also reinforce the effectiveness of this educational approach for the development of good projects, resulting in more sustainable businesses models. A list of criteria for the evaluation of student projects is proposed, including its desirability, feasibility, and viability. Finally, the research initiative also revealed a list of criteria for comparing entrepreneurship courses, including objectives, characteristics, student profiles, expected results, course duration, project dynamics, and final project results

The outcomes obtained with the research initiative presented in article #P4 also contributed for the evaluation of the resulting projects from distinct courses that teach entrepreneurship, applying distinct variations of the Hypothesis-Driven Entrepreneurship approach. Guiding the #P5 that obtained results evidenced that distinct entrepreneurship teaching initiatives, at the University of São Paulo, obtain similar results, a fact that we explain because entrepreneurship is an abdutive process, and the obtained results are not strictly connected with the selected initial phase of the process of development of successful products, services, and businesses models. Considering that we could not identify relevant differences that could be justified by the specificities of the selected entrepreneurial educational approach, was decided to focus our efforts in the specificities of the students. Remaining for study the comparison of the courses considering the evolution if the students` entrepreneurial competences, confidence and intention.

Therefore, to answer Specific Objective 4, was created a systematic to measure obtained results from different proposals of entrepreneurship education initiatives, article #P6 presents this framework, including methods and tools, to measure the students' evolution throughout the course, including their entrepreneurial competences, intention, and confidence. Being developed a pre and a post-test

questionnaire and conducted the survey among course students. Obtained results have been validated and the framework can be replicated in other contexts.

This way, the General Objective of *"Contribute for the improvement of entrepreneurship education with the investigation of current educational entrepreneurship theories and practices considering the identification, measurement, analysis and evaluation of the effectiveness of these initiatives from a students` perspectives, aiming to contribute with the proposal of new frameworks and approaches to improve entrepreneurial competences, intention, and confidence "* was achieved.

5 CONCLUSIONS, LIMITATIONS AND IMPLICATIONS

Considering the obtained results, it is possible to draw some conclusions. Currently the scenario is very favorable for this research theme, with great interest for better understanding entrepreneurial education, in order to better teach entrepreneurship, to stimulate future entrepreneurs and to increase the analysis and understanding about obtained results. Considering this growing interest, this research contributed to the discussions about entrepreneurship education and assisted in the construction of a framework to assist in measure the effectiveness of the courses that search to teach entrepreneurship, considering the lenses of entrepreneurial competences, intention, and confidence.

In addition to the concern of developing better entrepreneurs, there is also a need to develop methods, tools, and frameworks to evaluate projects developed by the entrepreneurs, their initial business concepts, and their first formulation of a business idea. The development of a list with criteria to assist in the design of better projects, possible to be replicated and to make possible the comparison of different initiatives about education for entrepreneurs supported by a final list of entrepreneurial competences, and criteria to evaluate the businesses projects, contributes for this end.

As limitations, the research focused mainly on startups and students, not involving big organizations, since it was conducted in a moment when big organizations were still initiating their investments in startups and small unities. The study not deepened in the subjects relating entrepreneurship with economy and politics, also letting for futures researches the impact of gender in the entrepreneurs` initiatives and a better exploration about entrepreneurial intention and more variables that affect the entrepreneur`s evolution of intention, confidence and competences.

The research had as field research the University of São Paulo ecosystem and the specific reality of the Brazilian context, and, more specifically, the courses involving the Hypothesis-Driven Entrepreneurship approach, remaining for future studies the deepening in other approaches in additional to the Hypothesis-Driven Entrepreneurship, also considering a current photograph of a moment that certainly will change over time, therefore not being possible to be considered as definitive or permanent. However, this specific photograph certainly has potential to serve as basis

for future researches, contributing for discussions about the development of entrepreneurship and entrepreneurship education.

It is expect that this study will have implications in the practical aspects of entrepreneurship education and, more specifically, in the development of students with entrepreneurial interests, abilities and competences, that will make them contribute for the development of the Brazilian society, resulting in the creation of new businesses and with the evolution of established companies, contributing to generate more employability, income and better quality of life for the Brazilian people.

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PART II – THESIS' PAPERS

6 #P1: Towards a Recursive Stage-Based Framework for Supporting Startup Business Initiation: An Exploratory Study with Entrepreneurs

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Abstract

The recent success of startups resulted in an increasing interest concerning entrepreneurship approaches. However, there is a lack of studies with focusing on the understanding of how entrepreneurs experience these concepts and tools in practice. This study investigates how entrepreneurs apply new entrepreneurship methodologies to create new businesses. Moreover, it aims at identifying the most important phases and activities. The research design is survey-based research with a sample of 87 Brazilian startup entrepreneurs. As a result, a recursive stage-based framework for supporting startup initiation that combines concepts and tools from the lean startup, the business model canvas, and design thinking approaches are incorporated in recursive learning loops.

Index Terms - Entrepreneurship; Lean Startup; Design Thinking; Business Model Canvas; Value Proposition Canvas.

1 INTRODUCTION

There is an emerging entrepreneurship paradigm (EISENMANN; RIES; DILLARD, 2013) that has revolutionized traditional approaches (BLANK; DORF, 2012), which has been receiving increasingly attention among academics and practitioners (BITENCOURT; KAYNAK, 2017), looking for “instilling the entrepreneurial spirit” (MARION; DUNLAP; FRIAR, 2012) of successful startups, inside and outside of the engineering field (NABI et al., 2017).

Startups are a recent phenomenon (KISS; DANIS; CAVUSGIL, 2012), recognized for developing differentiated business models, working with limited resources in environments of great uncertainty (RIES, 2011; BLANK, 2012; LEUNG et al., 2006), in the pursuit of exponential results (THIEL; MASTERS, 2014). It is relevant to highlight that small startups have similar project needs when compared to large established organizations (MARION; DUNLAP; FRIAR, 2012).

Developing innovations is a key organizational capability (DAS; JOSHI, 2012) since successful innovations guarantee improved commercial returns (NARAYANAN; LÉVESQUE, 2014). There is a strong intersection between innovations and entrepreneurship (SHEPHERD; PATZELT, 2017) and most entrepreneurial activities occur at startups (SHANE; VENKATARAMAN, 2000). Thus, currently a growing number of large organizations structure programs to identify, select and support startups, providing financial incentives and partnership opportunities (STARTUP GENOME, 2017), aiming to tackle two large and eventually contradictory challenges: acquiring productive excellence and developing innovations (EDISON, 2015).

However, entrepreneurship research still lacks in-depth studies (KISS; DANIS; CAVUSGIL, 2012; SALERNO et al., 2015), mainly about the uncertainties concerning the entrepreneurship process, many times neglected by the specialized literature (BYLUND; MCCAFFREY, 2017). Besides, future entrepreneurial research should explore the varying dimensions of this novelty (MARVEL; PATEL, 2018) and a list of essential steps to get a sustainable and profitable new startup (PICKEN, 2017), in which entrepreneurial decision making has a core step in the evaluation of opportunities (ÇANAKOGLU; ERZURUMLU; ERZUMUMLU, 2018).

In this context, this paper aims at contributing to the literature by presenting a framework for analyzing the most relevant activities performed by entrepreneurs for

the generation and refinement of concepts and for the structuration of the initial operations of startups, driven by the following research questions:

- What are the phases and stages proposed by the literature effectively performed by startup entrepreneurs?
- What are the phases and stages proposed by the literature recommended by startup entrepreneurs?
- What are the most important recommendations of phases and stages that should be included in a framework considering the perspective of the startup entrepreneurs?

For answering these questions, the research design is a survey-based research with 87 Brazilian start-up entrepreneurs. As a result, a recursive stage-based framework is presented that contributes to minimize the knowledge gap concerning the essential steps for a new startup to obtain a profitable and sustainable growth, especially at its early stages (THIEL; MASTERS, 2014; PICKEN, 2017). These results also contribute with the proposition of more stable and fixed entrepreneurial process to promote the development of innovations for new products and services (ÇANAKOGLU; ERZURUMLU; ERZUMUMLU, 2018). The framework is based on the hypothesis driven entrepreneurship approach (EISENMANN; RIES; DILLARD, 2011) and considers that a given set of means can result in possible and desirable effect (SARASVATHY, 2001). The framework combines emerging agile methodologies including Design Thinking and Lean Startup as experimental approaches in the search for a business model aligned with market opportunities (ZENIOS, 2016). The Lean Startup approach contributes with concepts and techniques such as prototyping, flexibility, agility and continuous customer feedback (RIES, 2011; BLANK, 2012), promoting rapid experimentation and failure-based-learning (MUÑOZ; COHEN, 2017), developing business models that can sustain subsequent scaling (STILL, 2017). The framework also incorporates Design Thinking techniques to understand the motivations of human behavior in its complexity to create benefits for customers and value for business (BROWN, 2008; DORST, 2011; KOZLOWSKI; SEARCY; BARDECKI, 2018). It also incorporates both the value proposition and the business model canvas because of their ability to structure valuable business models and identify organizational competitive advantages (OSTERWALDER et al., 2014).

The framework was designed in six phases. A literature review for the discovery of entrepreneurship current methods and tools resulted in the framework first version. This initial version was submitted in an experts' panel with eight experts, selected accordingly to their experience with startups, resulting in the framework second version. This new version was submitted in a survey to verify the reality adherence of the framework with startup entrepreneurs. The results obtained were analyzed qualitatively and quantitatively and the framework final version was obtained, incorporating the main phases and stages that are recommended by experts and startup entrepreneurs and used by startup entrepreneurs for the generation of ideas and initial structuration of operations in startups.

This paper starts with the research context and motivation. The second section presents the literature review in the subjects of interest (entrepreneurship, lean startup, business model, business model canvas and Design Thinking). The third section details the research method. The fourth section presents and discuss the results obtained. The fifth section describes and details the framework final version. The sixth section concludes the research.

2 LITERATURE REVIEW

In order to create a framework capable of assisting startups in the generation of ideas and structuration of their initial operations, a literature review concerning the main related approaches were conducted, mainly including Lean Startup, Business Model Canvas and Design Thinking.

2.1 Entrepreneurship and Lean Startup

Currently the business world is experiencing an era of entrepreneurship with a number of entrepreneurs, never seen before, competing for developing the best innovations (MAURYA, 2012). Entrepreneurship is defined as a way of thinking for identifying business opportunities (TEECE, 2007), i.e., entrepreneurship has the objective of identifying an innovative idea that provides competitive advantage, creating businesses that meet the customers' unknown needs (GANDHI; DEARDOFF, 2014), offering the different (ALDRICH; FIOL, 1994).

There is little literature related to entrepreneurship even considering its significant global growth (KISS; DANIS; CAVUSGIL, 2012); however, in the last few years, an approach strongly related with entrepreneurship and startups has been gaining prominence, the Lean Startup (LS) approach and its hypothesis-driven principles, characterized by the application of experimental techniques such as prototyping, customer' feedback, flexibility and agility (BLANK, 2012; EISENMANN; RIES; DILLARD, 2011). This movement began at software companies in 2000 (RASMUSSEN; PETERSEN, 2017) and diffused to other segments (RIES, 2011). It is centered on the user and its interactions, applying creativity and experimentation in the search for innovations (BALDASSARRE et al., 2017), transforming ideas into innovative processes (TRAUBE et al., 2016). The Lean Startup approach applies lean thinking to create new businesses (RIES, 2011), aiming to reduce waste during the development process and eliminating unnecessary research and development (BATOVA; CARD; CLARK, 2016; RASMUSSEN; PETERSEN, 2017).

The Lean Startup approach is an agile methodology that has as main focus the translation of the entrepreneurs' vision into hypotheses that will be tested during the creation of the new product, in conjunction with the related business model (RASMUSSEN; TANEV, 2015; RASMUSSEN; PETERSEN, 2017). The Lean Startup

approach allows entrepreneurs to validate their hypotheses using techniques such as interviews with early adopters to obtain feedback (BATOVA; CARD; CLARK, 2016; LENARDUZZI; TAIBI, 2016; EDISON; WANG; ABRAHAMSSON, 2016; TRAUBE et al., 2016), helping entrepreneurs to refine “what” and “for whom” to develop (POPPENDIECK; CUSUMANO, 2012).

In the Lean Startup, product and customer development processes occur in parallel (BLANK, 2005), a unique characteristic (BATOVA; CARD; CLARK, 2016), translating customers' preferences into product features (JOHNSON et al., 2014), minimizing the risk of new business establishment (NIRWAN; DHEWANTO, 2015), Lean Startup also reduces the risks during the creation of new business, prioritizes experimentation over detailed planning, applies iterative design instead of traditional development approaches, and works based on customers' opinion over entrepreneurs' intuition (BLANK, 2012; RASMUSSEN; PETERSEN, 2017).

2.2 Business Model

The initiation of a new business is complex because the focus is to develop a marketable product or service, structuring a viable Business Model (BM) (TRIMI; BERBEGAL-MIRABENT, 2012). The design of a consistent BM is critical for a startup (GARCIA-GUTIERREZ; MARTINEZ-BORREGUERO, 2016), providing knowledge for entrepreneurs to make better decisions, increasing the chances of success (OSTERWALDER; PIGNEUR, 2010), facilitating their process of reasoning (LIMA; BAUDIER, 2017), and providing tools for identifying and experimenting new opportunities (CHESBROUGH, 2010; MCGRANTH, 2010; TEECE, 2010; TRIMI; BERBEGAL-MIRABENT, 2012). A BM maps and describes how the organization operates (FRICK; ALI, 2013; DALY, 2017), allowing the planning of the organizational competitiveness and the identification of improvement points (LONG; BLOK; POLDNER, 2017). When effective it is an important innovation catalyst (AMIT; ZOTT, 2001; CAETANO et al., 2016; LONG; BLOK; POLDNER, 2017) because it illustrates how the business connect the functions (ZOTT; AMIT, 2008; DEMIL; LECOCQ, 2010; LONG; BLOK; POLDNER, 2017).

BMs are also recognized as fundamental resources for the creation of value for the organization, customers, suppliers, partners, and stakeholders (AMIT; ZOTT, 2001; HEDMAN; KALLING, 2003; TEECE, 2010; CASADESUS-MASANELL; RICART,

2010; LIMBURG et al., 2015), highlighting what has to be done in order to increase the value delivered to customers, guiding how the organization has to be managed and what investments are required to enable its sustainability (TRIMI; BERBEGAL-MIRABENT, 2012), reflecting the organizational strategy (CASADESUS-MASANELL; RICART, 2010; CHEN; CHENG; MEHTA, 2013), and facilitating its communication and understanding (MARTIKAINEN; NIEMI; PEKKANEN, 2014). Among the different frameworks for representing BMs, the Business Model Canvas (BMC) has received significant attention (OSTERWALDER; PIGNEUR, 2010).

Developed in the first decade of the 21st century, the Business Model Canvas is a graphical framework that synthesizes the organizations' logic to perform business analyses, resulting in a schematic representation of how a business can operate to create value for its customers, highlighting relationships and establishing the business logics (OSTERWALDER; PIGNEUR, 2010; TRIMI; BERBEGAL-MIRABENT, 2012; BANCHIERI; BLASCO; CAMPA-PLANAS, 2013; SLEUWAEGEN, 2013; CABANELAS; OMIL; VÁZQUEZ, 2013; CHERIF; GRANT, 2014; CIRJEVSKIS, 2017; FRANÇA et al., 2017; LIMA; BAUDIER, 2017). These analyses highlight key points in order to achieve superior value delivery and to develop competitive advantages (OSTERWALDER; PIGNEUR, 2010; REHMAN et al., 2016).

The Value Proposition Canvas is a simplified version of the Business Model Canvas (OSTERWALDER et al., 2014) and its main purpose is to focus on the initial steps for the creation of company value. To focus on value creation, it applies different tools (SLEUWAEGEN, 2013; MAGLIO; SPOHRER, 2013), including value proposition design (OSTERWALDER et al., 2014).

2.3 Design Thinking

The term Design Thinking (DT) was initially popularized by Rowe (1987), who defined design as the fundamental approach by which architects and planners perceive and conceive ideas of buildings and public spaces. After Rowe' publication, an increasing interest from other professional segments in the approach was observed and currently its practices are applied by both designers and non-designers (BROWN, 2009; MARTIN, 2009). In this context Johansson-Sköldberg, Woodilla and Çetinkaya (2013) define designerly-thinking as the academic construction of the practice and professional competence of the designer, including the reflective process on how to

interpret and characterize this non-verbal competence and that is located in the academic field of design (CROSS, 2001; 2006; SCHÖN, 1983; SCHON; WIGGINS, 1992; CHRISTIAANS; VENSELAAR, 2005) together with Design Thinking, the use of designers' practices and skills beyond the design context, by people with no formal academic education in design, and, therefore, becoming a simplified version of "designerly-thinking" (LEIFER; PLATNER; MEINEL, 2014; FLEURY; STABILE; CARVALHO, 2016).

The first decade of the 21st century was marked by a wide popularization of the Design Thinking approach to promote the development of incremental and radical innovations in products and services (BROWN, 2008; KIMBELL, 2011; SEIDEL; FIXSON, 2013; HENIZE et al., 2018). It is an excellent approach to being innovative and creative, characterized by the application of an abductive process, looking for perceived value from the customers' point of view, before conducting creative activities (CROSS, 2011). Therefore, its main focus is the application of specific design methods and tools for the development of innovations (BUCHANAN, 1992), starting from the understanding of the motivations of human behavior and its complex reality (BROWN, 2009). This evolves through a complex process of questioning and learning from obtained results (DYM et al., 2005), resulting in desirable, possible and profitable products and services (MARTIN, 2009), by the combination of ideas generation as results from evaluations to analyze and to develop improvements based on customers' feedback (DUNNE; MARTIN, 2006).

3 RESEARCH METHOD

To develop the framework for the identification of the most relevant activities for the generation and refinement of concepts and structuration of the initial operations of startups, this study investigated theoretically and empirically how entrepreneurs identify new business models to create startups, pinpointing the most relevant phases and stages, based on feedback learning loops. For this, a framework based on the literature review of entrepreneurship current approaches was elaborated, validated and improved from an experts' panel and a survey with startup entrepreneurs.

3.1 Literature Review and Framework First Version

The process of structuring the framework first version was deployed from the development of a literature review, methodological approach recognized for enabling advances of knowledge (WEBSTER; WATSON, 2002), with the application of content analysis (TRANFIELD; DENYER; SMART, 2003).

The literature review sampling procedure was based on a research strategy of databases selection, search strings, search filters, and logic operators. The selected database for identifying the initial sample was the Web of Science Core Collection, because it comprehends all indexed journals with impact factor available in the Journal Citation Report (JCR) (TAKEY; CARVALHO, 2016). Three filters were applied to select relevant publications: language (English), document types (published "articles", “reviews” and “articles in press”) because of the peer review evaluation process (CARVALHO; FLEURY; LOPES, 2013), and Web of Science Categories (Management Or Business Or Operations Research Management Science Or Business Finance). The search strings selected were "startup*" OR "start-up*" OR "start up*", to guarantee the focus on the subject. As second sampling step, snowballing was applied for identifying the key references cited in the initial sample (WOHLIN, 2014), resulting not only in articles, but also in core books, that were presented in the literature review and others results presents in section four.

3.2 Experts' Panel and Framework Second Version

To incorporate experts’ considerations the framework first version was exposed to an experts' panel. The experts’ panel approach was selected because it guarantees a

better connection with the interviewees' daily life (FLICK, 2004) and it is an approach recognized for generating better outcomes in the analysis of specific issues regarding the field of the participants' expertise (SUSSENBACH et al., 2014). In an experts' panel, opposite opinions can compensate each other, radical and false opinions can be eliminated, and shared ideas can be considered and evaluated (PATTON, 1990). Therefore, the final result is characterized by consensus and the systematic structuration of knowledge (ROQUE; MELO, 2010).

The experts' panel should be treated as a set of interviews and not as a discussion forum (PATTON, 1990); therefore, it can be used to obtain knowledge without confrontation, since anonymity is guaranteed to participants (LUCENA; CASACA, 2013). In an experts' panel, the researcher has the freedom to decide how to conduct research initiatives and how to evolve considering the research objectives (FLICK, 2004). In this research, the selection of experts incorporates experts in startups, including fifteen professionals, a number of experts aligned with the researchers conducted by Cucolo and Perroca (2015) and Roque and Melo (2010).

The experts received a questionnaire including thirty-eight structured questions; for each structured question, it also presented an open question in order to incorporate experts' qualitative considerations. For each structured question, a five-point Likert scale was proposed (very relevant - irrelevant). The results were qualitatively analyzed and considered the capability to explain the phenomena based on direct daily experience (DENZIN; LINCOLN, 1994), objective of apply an experts' panel considering the elaboration of the framework second version for the identification of the most relevant practices performed by successful entrepreneurs during the creation and development of their startups.

3.3 Survey and Framework Final Version

Surveys are powerful tools to obtain informations about behaviors, attitudes and opinions, applying principles of scientific sampling to specify significant population subsets, capable of evidencing relevant information concerning the characteristics of the population based on the evidencing of sample characteristics (FORZA, 2002; RASINSKI, 2005). This study survey selected population included entrepreneurs from startups from different sectors, already selected to participate in acceleration programs in Brazil, that could analyze the proposed framework phases and stages frequency of

application and recommendation. This criterion was chosen because corporate accelerators select for their acceleration programs startups that have proved to have significant value propositions for real customers (WEIBLEN; CHESBROUGH, 2015; KANBACH; STUBNER, 2016) and have gained prominence in the creation and formation of a new generation of Brazilian entrepreneurs (ABREU; CAMPOS, 2016). During the period of this research Brazil counted with forty accelerators and on average each accelerator accelerated fourteen startups per year. Up to January 2016, approximately 1,100 startups were accelerated, with an investment totaling approximately U$ 16 million (ABREU; CAMPOS, 2016). Thirty-four of the forty accelerators had published contact information on the internet and were contacted, resulting in 85% of representativeness of the population considering Brazilian accelerators.

The entrepreneurs received a questionnaire based on the results of the experts' panel, also including questions to characterize the respondent and the startup. The questionnaire included forty-five structured questions, since the objective of the survey was to analyze the diffusion of the practices identified in the literature and validated in an experts' panel, closed questions included a five-point Likert scale (I perform this practice in all projects - I perform this practice in no project) and binary scale (yes - no). The questionnaire also included open questions for the entrepreneur’s considerations inclusion.

The obtained data were analyzed quantitatively, allowing the construction of proposal models that explain the current practices of the operational processes (BERTRAND; WILL; FRANSOO, 2002), using descriptive statistics, mood median test and factor analysis, with the softwares SPSS Statistics 20 and Minitab 17. For the factor analysis, an orthogonal rotation was applied, because of its popular application and because the oblique rotation use was considered of little contribution, generating controversy (HAIR et al., 2010), selecting the VARIMAX, because of its maximum simplification and recognition as a successful approach for orthogonal factor rotation analysis (HAIR et al., 2010). Bartlett's Sphericity Test (BST) and Kaiser's Meyer Olkin Test (KMO) were performed to verify the existence of sufficient correlation between variables in order to consider valid the application of the factor analysis (FIGUEIREDO FILHO; SILVA JÚNIOR, 2010). To analyze open questions results a qualitative analysis was performed, because of its capacity to explain experiences in determinate subjects

(DENZIN; LINCOLN, 1994). The mood median test was applied to verify the median equality between two or more populations; the technique was chosen because it does not require populations characterized with normal distributions, which was the case of the distribution obtained in this study.

4 RESULTS

This section presents the results obtained with the development of the literature review that resulted in the framework first version. This initial version was refined in an experts' panel and the framework second version was analyzed during the survey development, resulting in the identification of the most relevant practices applied and recommended by successful entrepreneurs during the creation and development of their startups.

4.1 Literature Review

Aiming to identify and to characterize the proposed key phases and stages, based on leaning loops from the "entrepreneurship by trial-and-error" approaches for the structuration of startups, an inclusive literature review was developed. The results obtained were summarized in section two and identified key phases and stages are presented in Table 1, evidencing the results of the literature review content analysis.

Table 1 - Summary of approaches, phases and stages by authors

Approach	Phase	Stage	Authors
Design Thinking	**Ideas Generation**	**1** Immersion	Brown (2008); Brown (2009); Martin (2009); Cross (2011); Paton and Dorst (2011); Seidel and Fixson (2013); Fleury, Stabile and Carvalho (2016); Henize et al. (2018).
Design Thinking		**2** Analysis and Synthesis	Buchanan (1992); Dunne and Martin (2006); Kokotovich (2008); Martin (2009); Cross (2011); Dorst (2011); Kimbell (2011); Paton and Dorst (2011); Seidel and Fixson (2013); Fleury, Stabile and Carvalho (2016); Henize et al. (2018).
Lean Startup		**3** Customer Discovery	Blank (2005); Ries (2011); Blank (2012); Still (2017); Weissbrod and Bocken (2017).
Design Thinking	**Conversion**	**4** Ideation	Brown (2008); Brown (2009); Martin (2009); Cross (2011); Kimbell (2011); Seidel and Fixson (2013); Fleury, Stabile and Carvalho (2016).
Lean Startup		**5.1** Minimum Viable Product	Blank (2005); Ries (2011); Blank (2012); Johnson et al. (2014); Pease et al. (2014); Batova, Card and Clark

			(2016); Borba, Batista and Souza (2016); Edison, Wang and Abrahamsson (2016); Lenarduzzi and Taibi (2016); Traube et al. (2016); Rasmussen and Petersen (2017); Baldassarre et al. (2017); Still (2017); Weissbrod and Bocken (2017).
Business Model Canvas		**5.2** Value Proposition Canvas	Maglio and Spohrer (2013); Sleuwaegen (2013); Osterwalder et al. (2014); Kozlowski, Searcy and Bardecki (2018)
Lean Startup		**6** Customer Validation	Blank (2005); Ries (2011); Blank (2012); Still (2017); Weissbrod and Bocken (2017).
Design Thinking	**Diffusion**	**7** Implementation	Dunne and Martin (2006); Brown (2008); Brown (2009); Kimbell (2011); Seidel and Fixson (2013)
Lean Startup		**8.1** Prototyping	Blank (2005); Brown (2008); Brown (2009); Martin (2009); Cross (2011); Ries (2011); Blank (2012); Johnson et al. (2014); Pease et al. (2014); Fleury, Stabile and Carvalho (2016); Lenarduzzi and Taibi (2016); Baldassarre et al. (2017); Weissbrod and Bocken (2017); Kozlowski, Searcy and Bardecki (2018).
Business Model Canvas		**8.2** Business Model Canvas	Osterwalder and Pigneur (2010); Trimi and Berbegal-Mirabent (2012); Banchieri, Blasco and Campa-Planas (2013); Cabanelas, Omil and Vázquez (2013); Chen, Cheng and Mehta (2013); Sleuwaegen (2013); Maglio and Spohrer (2013); Martikainen, Niemi and Pekkanen (2014); Osterwalder et al. (2014); Cherif and Grant (2014); Iacob et al. (2014); Zolnowski, Weib and Böhmann (2014); Gelbmann and Hammerl (2015); Gabriel and Kirkwood (2016); Joyce and Paquin (2016); Li et al. (2016); Rehman et al. (2016); Díaz-Díaz, Muñoz and Pérez-González (2017); França et al. (2017); Lima and Baudier (2017); Long, Blok and Poldner (2017); Daly (2017).
Lean Startup		**9.1** Organization Construction	Blank (2005); Ries (2011); Blank (2012); Kanbach and Stubner (2016).

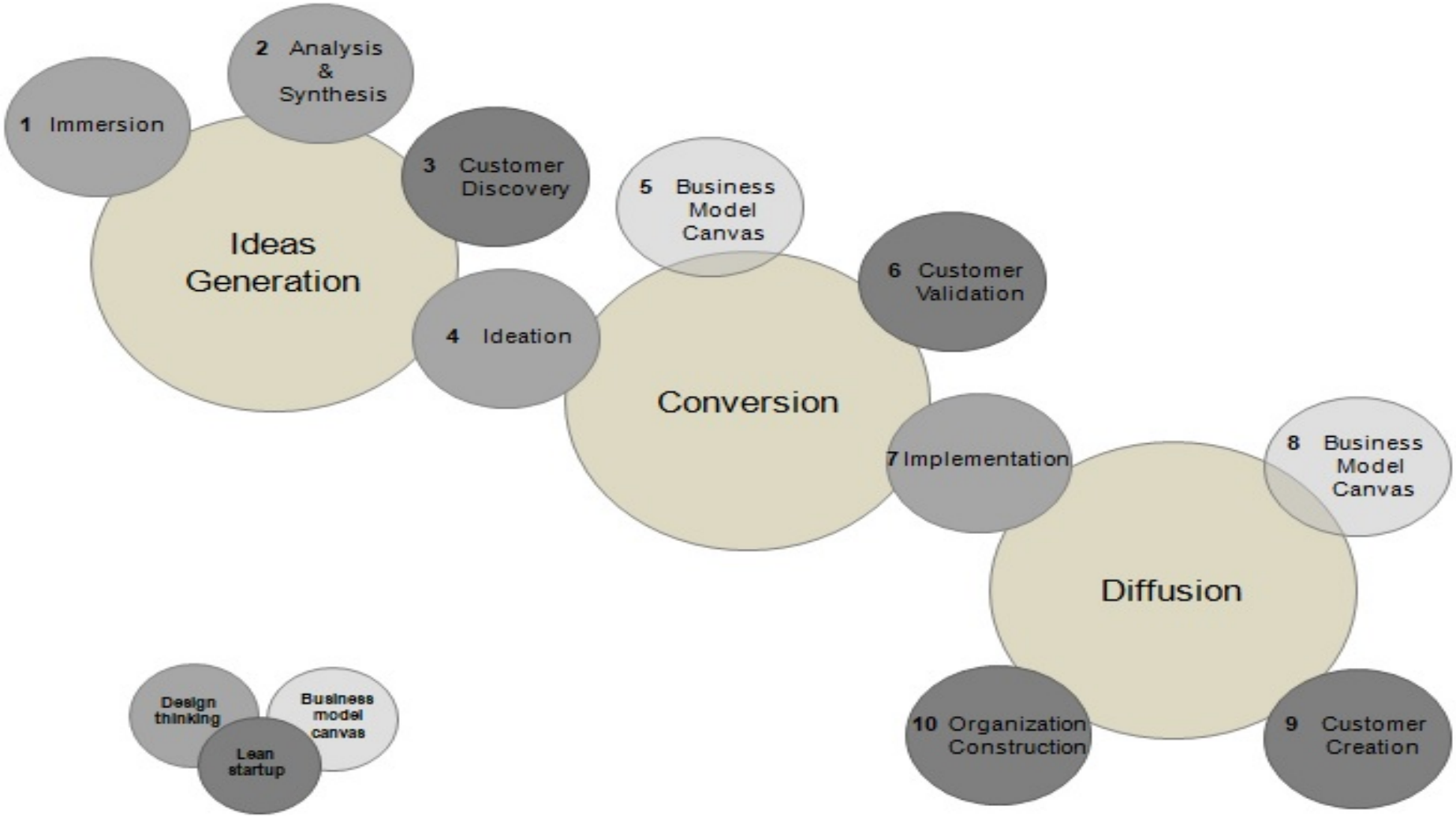
Business Model Canvas	**9.2** Business Model Canvas	
Lean Startup	**10** Customer Creation	Blank (2005); Ries (2011); Blank (2012).

Source: Authors.

Based on the results of the literature review the framework first version was elaborated (see Figure 1), incorporating the Design Thinking approach for generating the startup initial guiding concepts (BROWN, 2008), and mapping customers' needs and desires (VIANNA et al., 2011), the Lean Startup approach, including prototype development, hypothesis testing, customers' feedback and continuous learning (BLANK, 2012) and the Business Model Canvas, to structure business plans and identify organizational competitive advantage (OSTERWALDER et al., 2014). It is important to mention the expected results from each of the mentioned phases:

- **Ideas Generation** - understand the current situation, consolidate the knowledge about customers' and generate solutions to their needs and desires;
- **Conversion** - elaborate a positioning matrix, supporting the design of the business plan, which will be tested to validate the customer' value;
- **Diffusion** - an effective development of the business' validation and market are expected.

Figure 1 - Framework first version



Source: Authors.

4.2 Experts' Panel

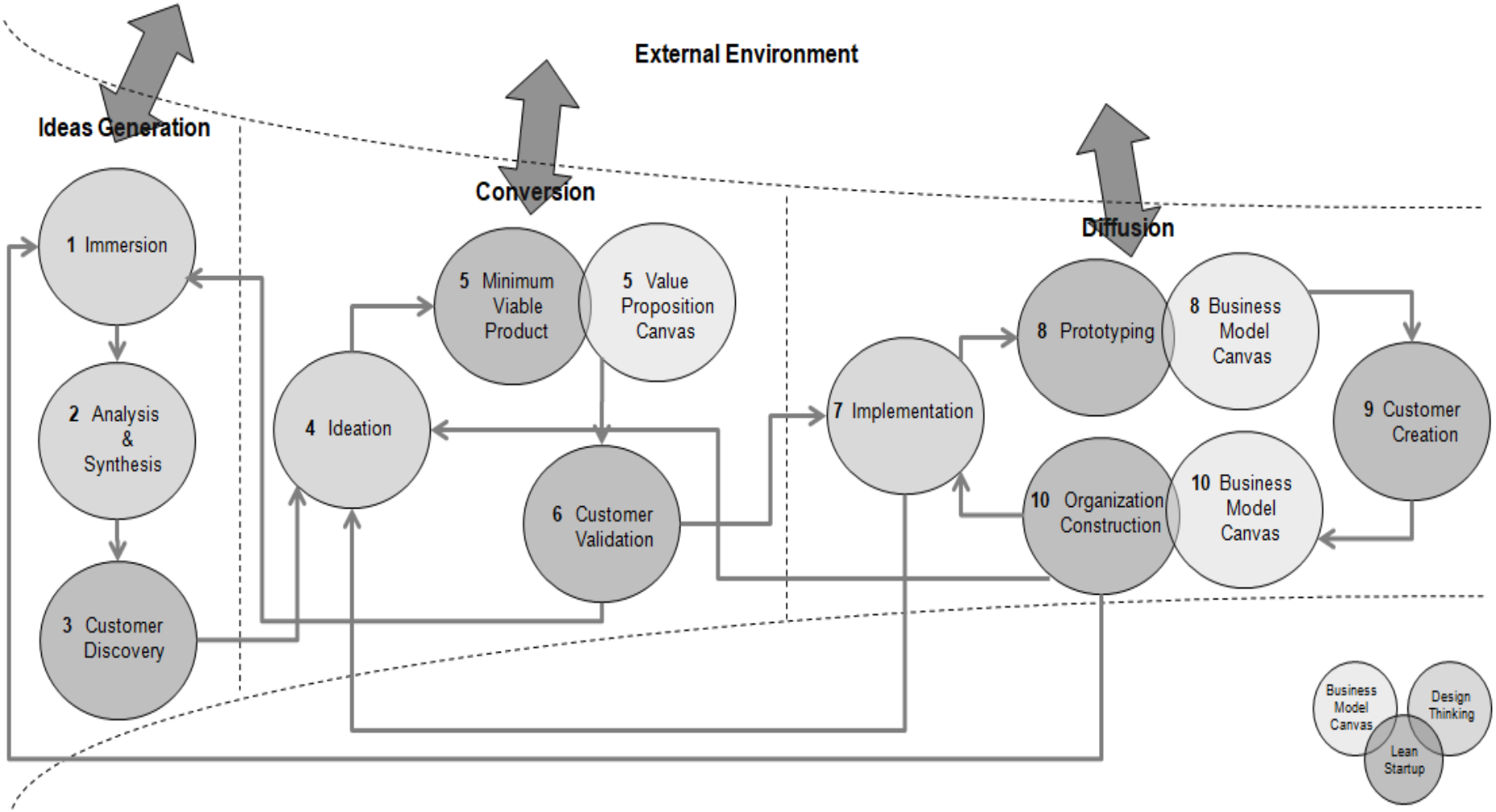
To validate the framework first version a questionnaire was sent to fifteen experts. Eight experts responded, resulting in a 53% rate of return, an appropriate number considering the initiative reported by Cucolo and Perroca (2015). The average age of the respondents was 45, ranging from 26 to 59 years old. All the respondents are male. The average number of years working with startups is 14 years, ranging from 3 to 30 years. All the experts are highly respected professionals in their areas, including technology, innovation, entrepreneurship, product and software development. Apart from their context of origin, all the experts are heavily involved with the startup universe.

Several considerations were obtained as result of the experts' panel and the most relevant results were incorporated into the framework, resulting in the framework second version (see Figure 2). Detailing and summarizing the expected results for the phases:

- **Ideas Generation** - the proposed stages received five experts' agreements and no objection was recorded. The experts reinforced that, in this phase, it is necessary to identify the industry bottlenecks and it is important to experience a moment when entrepreneurs demystify entrepreneurship. The experts also considered that in the phase of startup structuration there are other moments that demand the generation of ideas and, as a consequence, there is no clear limit for this phase; therefore, the proposed framework is useful as a guide, but should not be considered as a set of mandatory practices;
- **Conversion** - the proposed stages received five experts' agreement and no objection was recorded. Experts added that in this phase the entrepreneur should also consider building the startup team and designing the business model and its initial architecture. One expert considered that the vision proposed by the framework is useful;
- **Diffusion** - the proposed stages received five experts' agreement, however three experts disagreed because they considered that there are so many stages in this phase that it is not possible to develop a unique list, with a highly complex movement during the transition from the prototypes to the business

model scale. Experts emphasized the importance of developing customers, starting sales and validating the prototypes developed.

Figure 2 - Framework second version



Source: Authors.

4.3 Survey

The survey was conducted with startup entrepreneurs already selected for acceleration programs at Brazilian accelerators. From the obtained results the framework final version was consolidated and evidenced the most relevant phases and the stages used and recommended by entrepreneurs for initiating startups. Considering the identified 34 accelerators, 856 entrepreneurs were invited to participate using e-mail and phone calls and 87 responded to the survey, resulting in a rate of return of 10%. The sample characterization is presented in Table 2.

Table 2 – Sample characterization

Dimension		Value(s)	N	%
AGE	Age	33 (mean), 9 (standard deviation)		
STU	Study level	Graduate level	35	40%
		Postgraduate level	21	24%
		Master level	20	23%
		Doctorate level	4	5%
		Others	2	2%
GEN	Gender	Male	78	90%
		Female	9	10%
EMP	Years of work as an entrepreneur	5 (mean), 5 (standard deviation)		
NST	Number of startups that had worked in	1 (mean), 1 (standard deviation)		
AST	Years of acting in the current startup	2 (mean), 1 (standard deviation)		
EST	Years of startup existence	2 (mean), 1 (standard deviation)		
SST	Sector of startup	Technology & Software	40	46%
		Services & Health	21	24%
		Retail	12	14%
		Education	10	11%
		Non-Governmental Organization	4	5%
FUT	Federative unit of startup	São Paulo	42	48%
		Rio de Janeiro	15	17%
		Minas Gerais	14	16%
		Santa Catarina	8	9%
		Ceará	2	2%
		Paraná	2	2%
		Distrito Federal	2	2%
		Bahia	1	1%
		Rio Grande do Norte	1	1%
PST	Phase of startup	Accelerated	73	84%
		In Acceleration	14	16%

Source: Authors.

To analyze the obtained results the following initiatives were conducted. First, to identify "what are the phases and stages proposed by the framework effectively used by startup entrepreneurs?", a mood median test was performed to test the median equality. Descriptive statistics were applied to provide a statistical summary capable

of answering the question "what are the phases and stages of the proposed framework recommended by startup entrepreneurs?". To analyze the research question "what are the recommendations for the composition of phases and stages for the framework, considering the perspective of the startup entrepreneurs", a factor analysis was performed considering standards and determining the ideal set stages for the framework phases. Finally, a qualitative analysis of the open answers was performed to complement the proposal framework description.

4.3.1 Descriptive results

The analysis of the results started with the answers obtained from the structured questions considering the frequency of phases and stages used and recommended by entrepreneurs. For this, Likert-scale answers "in all projects" and "in most projects" were summed up and the results are presented in Table 3.

Table 3 - Framework stages use and recommendation

		Use of phases proposed for the framework		**Recommendation of phases proposed for the *framework***	
		Frequency	**%**	**Frequency**	**%**
	Ideas Generating				
IMS	Immersion	71	82%	84	97%
ANS	Analysis & Synthesis	62	71%	78	90%
CUD	Customer Discovery	64	74%	79	91%
	Conversion				
IDE	Ideation	65	75%	78	90%
MVP	Minimum Viable Product	68	78%	85	98%
VPD	Value Proposition Design	47	54%	76	87%
CUV	Customer Validation	67	77%	82	94%
	Diffusion				
IMP	Implementation	66	76%	83	95%
PRT	Prototyping	66	76%	82	94%
BMC	Business Model Canvas	53	61%	76	87%
CUC	Customer Creation	60	69%	78	90%
OCO	Organization Construction	61	70%	80	92%
BMC_2	Business Model Canvas	53	61%	76	87%

Source: Authors.

Table 4 presents obtained means and standard deviations. The mean was used to characterize the sample central tendency and the standard deviation to verify the mean variation. The results highlight high value means, ranging from 3.425 to 4.264

(maximum of 5) and the standard deviation presents values between 1.019 and 1.411, revealing no significant variation.

Table 4 - Framework stages recommendation

Phase		Median	S. D.
	Ideas Generating		
IMS	Immersion	4.092	1.019
ANS	Analysis & Synthesis	3.849	1.223
CUD	Customer Discovery	3.977	1.191
	Conversion		
IDE	Ideation	3.954	1.247
MVP	Minimum Viable Product	4.264	1.105
VPD	Value Proposition Design	3.425	1.344
CUV	Customer Validation	4.081	1.200
	Diffusion		
IMP	Implementation	4.174	1.065
PRT	Prototyping	4.011	1.307
BMC	Business Model Canvas	3.586	1.411
CUC	Customer Creation	3.904	1.367
OCO	Organization Construction	3.929	1.232
BMC_2	Business Model Canvas	3.586	1.411

Source: Authors.

Table 5 presents the Pearson correlations considering the effective use of phases and stages, indicating strengths and directions of the variable linear relationships. According to Hair *et al*. (2010) the results obtained show a strong correlation (greater than 0.7) between *Analysis & Synthesis* (ANS) and *Immersion* (IMS) (0.734); moderate correlation (between 0.5 and 0.7) between *Immersion* (IMS) and *Customer Discovery* (CUD) (0.615), *Analysis & Synthesis* (ANS) and *Customer Discovery* (CUD) (0.528), *Minimum Viable Product* (MVP) and *Customer Validation* (CUV) (0.550), *Value Proposition Design* (VPD) and *Business Model Canvas* (BMC) (0.628), *Value Proposition Design* (VPD) and *Business Model Canvas* (BMC_2) (0.628) and, finally, *Customer Validation* (CUV) and *Customer Creation* (CUC) (0.695). The results reveal relevant relationships among the identified phases and stages, revealing the diffusion and adoption of the practices that compose the proposed framework, highlighting the framework-practice alignment with the startups' reality.

Table 5 - Startups Pearson Correlation

Construct	IMS	ANS	CUD	IDE	MVP	VPD	CUV	IMP	PRT	BMC	CUC	OCO
IMS												
ANS	0.734**											
CUD	0.615**	0.528**										
IDE	0.342**	0.371**	0.406**									
MVP	0.298**	0.177	0.420**	0.287**								
VPD	0.285**	0.238*	0.311**	0.206	0.213*							
CUV	0.271*	0.144	0.424**	0.331**	0.550**	0.262*						
IMP	0.095	0.130	0.033	0.025	0.108	0.131	0.295**					
PRT	0.113	0.067	0.097	0.136	0.272*	0.057	0.270*	0.301**				
BMC	0.116	0.133	0.285**	0.181	0.183	0.628**	0.206	0.121	0.072			
CUC	0.238*	0.099	0.301**	0.265*	0.409**	0.327**	0.695**	0.269*	0.327**	0.283**		
OCO	0.305**	0.236*	0.288**	0.365**	0.256*	0.136	0.222*	0.443**	0.249*	0.146	0.413**	
BMC_2	0.116	0.133	0.285**	0.181	0.183	0.628**	0.206	0.121	0.072	1.000**	0.283**	0.146

N = 87. * = $p < 0.05$. ** = $p < 0.01$. S.D. = standard deviation, the single-item constructs already appear in the table 4.

Source: Authors.

4.3.2 Mood median test

The mood median test was applied considering a confidence level of 95% or more and p-values to provide evidence of the concordance level, see Table 6, comparing the recommendation (dependent variable) and the use (independent variable) of the proposed framework. The results highlight concordance, however, existing discordance for the stages of *Ideation* (IDE), *Value Proposition Design* (VPD) and *Prototyping* (PRT).

Table 6 - Mood Median Test

Phase		Median	Chi-Square	Mood Median (p-value)
	Ideas Generating			
IMS	Immersion	4	1.38	0.240
ANS	Analysis & Synthesis	4	1.51	0.219
CUD	Customer Discovery	4	3.48	0.062
	Conversion			
IDE	Ideation	4	4.33	0.037*
MVP	Minimum Viable Product	5	0.10	0.749
VPD	Value Proposition Design	4	10.24	0.001**
CUV	Customer Validation	4	1.84	0.175
	Diffusion			
IMP	Implementation	5	3.49	0.062
PRT	Prototyping	5	0.42	0.517
BMC	Business Model Canvas	4	4.88	0.027*
CUC	Customer Creation	4	1.44	0.230
OCO	Organization Construction	4	3.10	0.078
BMC_2	Business Model Canvas	4	13.98	0.000**

Note: * 95% **99%
Source: Authors.

4.3.3 Factor analysis

The factor analysis was performed in this research to verify standards between relationships among the proposed stages of the framework and to determine the ideal composition of phases according to the respondents' opinions. For this purpose, the Bartlett's Sphericity Test (BTS) and the Kaiser's Meyer Olkin Test (KMO) were conducted and provided evidence of the existence of sufficient correlation between the variables, allowing the continuity of the factor analysis (FIGUEIREDO-FILHO; SILVA JÚNIOR, 2010). The observed BTS result is statistically significant ($p<0.05$) and the observed KMO sample value is 0.703, higher than the critical value of 0.60, making it possible to conclude that the sample is appropriate to be used in a factor analysis.

In this study, the first two components of the proposed framework (*Immersion* and *Analysis & Synthesis*) accumulated an explanation of 48% of the variability among the components (framework stages) and, considering the accumulation obtained with the first four components (*Immersion*, *Analysis & Synthesis*, *Customer Discovery* and *Ideation*), it is possible to obtain an explanation level of 69%, considered as a good explanation according to Figueiredo Filho and Silva Júnior (2010). Considering the variables' commonality, there are reduced explanations for *Ideation* (0.408) and *Prototyping* (0.441). It is relevant to note that for commonality the minimum accepted value is 0.50 and, in the case of lower values, it is recommended to exclude the variables and repeat the factor analysis (FIGUEIREDO FILHO; SILVA JÚNIOR, 2010); therefore, the factor analysis was repeated excluding the variables *Ideation* and *Prototyping*.

In the new factor analysis obtained, BTS was significant ($p<0.05$) and the same KMO was obtained (0.694), demonstrating again an appropriate sample for factor analysis. Considering the variance explanation, the first two components this time accumulated 53% of explanation and the first four components accumulated 77% of explanation. Considering the commonality level, in this analysis all variables presented values higher than 0.6.

Table 7 presents the components obtained without factor rotation and it is possible to verify that most of the framework stages are justified by the first two components and stages which relate to the component with higher values. In Table 8, a rotation was performed, obtaining better order and distribution of the factors, revealing no need for new removal or rotation of factors. Therefore, Table 8 presents the ideal stages for the composition of each framework phase, that are better presented and illustrated in the section five.

Table 7 - Framework stages component matrix

		Component			
		1	2	3	4
IMS_U	Immersion	0.691	-0.589		
ANS_U	Analysis & Synthesis	0.580	-0.666		
CUD_U	Customer Discovery	0.760	-0.347		
MVP_U	Minimum Viable Product	0.635			-0.479
VPD_U	Value Proposition Design	0.582		0.662	
CUV_U	Customer Validation	0.689	0.391		-0.389
IMP_U	Implementation	0.356	0.357	-0.407	0.594
BMC_U	Business Model Canvas	0.483		0.696	
CUC_U	Customer Creation	0.686	0.471		
OCO_U	Organization Construction	0.550		-0.396	0.460

Source: Authors.

Table 8 - Framework stages component matrix with rotation

		Component			
		1	2	3	4
IMS_U	Immersion	0.886			
ANS_U	Analysis & Synthesis	0.889			
CUD_U	Customer Discovery	0.714	0.428		
MVP_U	Minimum Viable Product		0.761		
VPD_U	Value Proposition Design			0.871	
CUV_U	Customer Validation		0.881		
IMP_U	Implementation				0.872
BMC_U	Business Model Canvas			0.911	
CUC_U	Customer Creation		0.748		0.339
OCO_U	Organization Construction				0.753

Source: Authors.

4.4 Final results

The application of a survey with startup entrepreneurs revealed that the stages identified in the literature review and validated in the experts' panel were effectively used by at least half of the surveyed entrepreneurs and recommended by at least 87% of the respondents. Highlighting that, although the entrepreneur had not experienced the stage, his further experience recommends its use. It is important to mention that the least used stage (54%) and least recommended stage (87%) was the *Value Proposition Design*, justifiable because the approach is new.

Considering the proposed framework stages, the descriptive analysis resulted in high means, providing evidence that entrepreneurs effectively applied the identified stages. Results reveal no mean lower than 3.425 (in about half of the projects), making it possible to conclude that in at least half of the projects all the proposed stages were used. Considering the sample standard deviation, the highest value was *Business Model Canvas* (1.411), showing less alignment between the respondents in relation to

this stage. In general, standard deviations were reduced, revealing the significant use of the proposed stages. With the application of the mood median test it was possible to provide evidence for a high concordance for the use and recommendation of the proposed stages.

The factor analysis was responsible for verifying the standard relationship between the proposed framework stages, and the obtained results determine the ideal phase composition, resulting in the following factors presented in Table 9.

Table 9 - Factors resulting from the factor analysis

Factors	Composition
Factor 1	Composed by the stages of *Analysis & Synthesis*, *Immersion* and *Customer Discovery*. All stages are included in the **Ideas Generation** proposed phase.
Factor 2	Represents the **Conversion** phase, including the stages of *Customer Validation*, *Minimum Viable Product* and *Customer Creation*.
Factor 3	Composed by the auxiliary stages of *Value Proposition Design* and *Business Model Canvas.*
Factor 4	Factor that represents the **Diffusion** phase and it is composed by the stages of *Implementation* and *Organization Construction*.

Source: Authors.

The obtained stages are aligned between the framework proposal and the factor analysis, except for *Customer Creation*, which consists of building effective customer markets for the organization and was indicated as belonging to the **Conversion** phase and not the **Diffusion** phase, as the original framework proposed. After reflection the authors decided to follow the factor analysis recommendation.

It also occurred that the commonality for the *Ideation* and *Prototyping* stages were reduced, so the variance of these variables presented reduced any explanation but, nevertheless, the authors chose to maintain them, because they are considered essential for the framework and were not far below the ideal value.

5 FRAMEWORK PROPOSITION: MOST RELEVANT PERFORMED AND RECOMMENDED ACTIVITIES

Figure 3 presents the proposed framework with its most relevant phases and stages for the generation and refinement of concepts and for the structuration of the initial operations of startups. Detailing the figure, the phase of **Ideas Generation** includes *Immersion* comprehending a deep understandings of the customer' needs for generating ideas, usually obtained by interviews and observations, aiming for a systemic understanding of the context. The duration of this stage should not be long but should allow the development of a broad research with potential customers to understand what their needs and expectations are. *Analysis & Synthesis* consist of the analysis of the findings obtained during *Immersion*. Therefore, at this moment all obtained knowledge should be consolidated in order to develop standards and connections and to reveal potential insights. *Customer Discovery* activities emphasize the importance of the GOOB (Get Out of Building) concept, i.e., promoting empathetic interaction of the entrepreneur with potential customers in order to present prototypes, test hypothesis and to validate obtained learning.

At the end of the **Ideas Generation** phase, it is expected that the potential entrepreneur will have obtained an appropriate understanding of the target situation and of the potential customers. As a result of this deep understanding of the market and of the customer, entrepreneurs should be able to effectively generate relevant business ideas. If the entrepreneur is not secure at the end of the phase it is necessary to pivot, i.e., restart context research and customer contacts. However, if ideas have potential and have been initially validated by customers, the next step consists of the derailment of the business idea in the **Conversion** phase.

The **Conversion** phase includes *Ideation* with the application of the positioning matrix to improve the development of ideas and related tests. As a consequence, at this moment the initial startup concept is created and its value proposition must be evaluated considering a broader perspective. Therefore, the creation of *Minimum Viable Products* has the objective of developing something tangible that can be tested with potential customers aiming to establish a continuous flow of learning based on experimentation and validation. In order to test and validate the scalability of the proposed idea, an entrepreneur should *also* use the *Value Proposition Design* in conjunction with the *Minimum Viable Product,* dynamic and complementary initiatives

to validate the value proposition and to potentialize future efforts to deliver value to customers. In this context, *Customer Validation* activities aim to verify if the organization has effectively established a value proposal that matches with the wishes and the needs of the potential customers. As a result, the positioning matrix is obtained and assists in the design of the business plan and tests with customers. Finally, *Customer Creation* verifies the capability of the value proposition of the solution to solve "customer pains", revealing the value of the proposed solution.

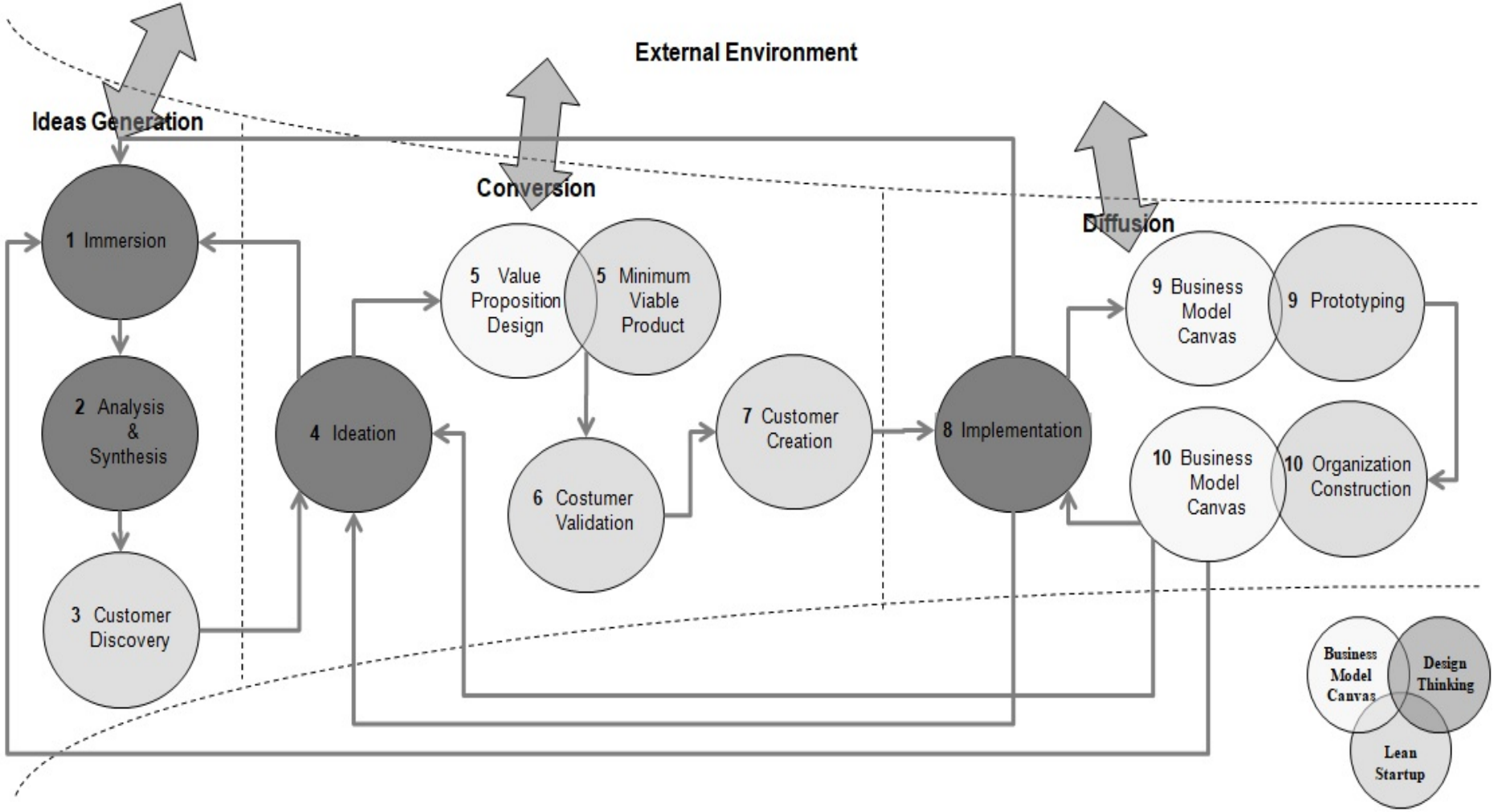
At the end of the **Conversion** phase, entrepreneurs should have obtained a final version of the initial solution, a first version of the business model and the validation of both solution and business model with potential customers. The development of *Minimum Viable Products* combined with *Value Proposition Canvas* should have validated the business proposal and scalability, highlighting the potential of the target market. However, if the proposal has not been validated, then it is necessary to pivot, i.e., to revise the startup foundations. If the market opportunities have been validated, then it is necessary to return to the *Ideation* stage; however, if the market opportunities have not been validated by customers, then it is necessary to return to the *Immersion* phase.

When the proposal has been validated, then the startup moves to the **Diffusion** phase which includes activities of *Implementation* when considering the previous validations of the minimum viable products, it is the moment to develop the final products and services, one of the most important activities to obtain a business scale. The selected ideas are transformed into tangible artifacts to promote better evaluations and to incorporate customer feedback. These continuous *Prototyping* activities assist in customer validation and generate savings in product development, defining interfaces of the products and services, demonstrating its usability and allowing its validation before the final development. *Prototyping* activities should be conducted in conjunction with the *Business Model Canvas* development, creating, testing and validating broader business hypotheses based on the obtained feedback. During *Organization Construction* the startup has successfully evolved during previous phases and moves to consolidation, developing potential partnerships, building the team, establishing its physical structures, building its mission, vision and values, and defining its relevant objectives. Therefore, during *Organization Construction* the startup should also

maintain the development of its *Business Model Canvas* to establish competitive advantages.

During the **Diffusion** phase the startup validates and improves its business model and creates its market presence. Therefore, this is the design of the final business model that has to be validated before heavily investing in the business development. This is the final framework proposition and the entrepreneur has to decide between scaling the operations of the startup (becoming an established small business) or restarting the startup creation process, looking for new business opportunities and generating and validating new ideas (at the *Immersion* stage) or validating business initial concepts (at the *Ideation* stage).

Figure 3 - Framework for new startup concept generation and refinement, and initial operation structuring



Source: Authors.

6 CONCLUSIONS

The results obtained contribute to fill the identified knowledge gap for the generation, identification and beginning of innovative business since the proposed framework contributes to the process of refinement and structuring of initial operation at startups. Considering the verification of adherence to the reality of the proposed framework, it is possible to conclude that it incorporates the phases and stages used and recommended for experts' and startup entrepreneurs' that have survived at least in the first year of operations and, therefore, contributes to the construction of sustainable startups. Based on the alignment and integration of Lean Startup, Business Model Canvas and Design Thinking approaches, the proposed framework, validated with a consistent methodology, contributes to the literature concerning agile approaches, a relevant research area because of its potential for innovation. It also contributes with the theory about entrepreneurship since the framework combines the view of experts and entrepreneurs, obtained with the combination of different research methods. Therefore, the proposed framework assists in minimizing the knowledge gap of a list of essential steps for a new startup get a sustainable and profitable growth, presented for Thiel and Masters (2014) and Picken (2017), and contributes as an in-depth study related to entrepreneurship, a research need highlighted for Kiss, Davis and Cavusgil (2012) and Salerno et al. (2015).

However, it is important to note that entrepreneurship research is continuously evolving area, and, therefore, practices applied by entrepreneurs to identify opportunities and to structure the initial operations of their startups are evolving. In this context, the application of emerging technologies for structuring new enterprises in increasingly complex environments continually changes the ecosystem and, for this reason, demands new research with applied focus on the specific reality of the different ventures.

Concerning the research limitations, it is relevant to note the analyzed sample is limited only to some experts and startups accelerating or accelerated by Brazilian accelerators. Another limitation is that the framework focused only on some approaches of interest and, as this is a dynamic research area, it can be improved based on future research results. Thus, the presented research initiative can be replicated with the participation of different samples and tested for the refinement of

ideas and structuring of startups. Other aspects that can be explored in future researches include how entrepreneurs can be assisted with the application of techniques that help in startup construction and the development of specific measurement tools for startups and the improvement of the elaboration strategies for startups in the phases and stages of the proposed framework.

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7 #P2: Contemporary Trends in Engineering Entrepreneurship Education

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Abstract

This study investigated the contemporary dimensions concerning engineering entrepreneurship education, creating a landscape of the most important theories and trends found in the literature, detailing what are the most important research methods, authors, countries, and relevant journals, publishing about engineering entrepreneurship education. The research methodology included a systematic literature review, combining bibliometric, network and content analysis. A sample of 324 articles was extracted from ISI – Web of Science database and Scopus database, and were analyzed, using as time range papers from 2001 to 2017, in the engineering field. The results obtained evidenced an exponential growth of interest in the study of engineering entrepreneurship education and measures its results, being a field that demands studies, for being a recent field of research, but which is a promise field of research. Evidencing the entrepreneurship as an economic catalysis, for its capability in develop jobs for the people and value for the business. As results this research also evidence a collection of graphics and networks about the papers, evidencing standards and highlights about methods used, authors and countries publishing in the field, and journals, giving a photography of the researches in engineering entrepreneurship education.

Keywords: entrepreneurship; entrepreneurship education; systematic literature review; bibliometric.

1 INTRODUCTION

Creating successful innovations is currently one of the most important and challenging tasks for established companies (FREDERIKSEN; BREM, 2017). There is a strong relationship between innovation and entrepreneurship (SHEPHERD; PATZELT, 2017), and the emergence of the hypothesis-driven entrepreneurship paradigm (EISENMAN; RIES; DILLARD, 2013), based on the effectuation principles proposed by Saravasthy (2001), revolutionizing traditional entrepreneurship methodologies, because of its fast prototyping (BLANK; DORF, 2012) and iterative learning (RIES, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010). As a consequence, entrepreneurship research is consistently growing (MAIR; MARTÍ, 2006; AUTIO; ACS, 2010), resulting in renewed bodies of knowledge that are spreading fast, and being widely recognized and applied (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010; LIMA et al., 2015).

At the macro-level, economists and politicians argue that a higher level of entrepreneurship is positively associate with a higher success rate of innovations, economic growth, and technological progress (VON GRAEVENITZ; HARHOFF; WEBER, 2010; SÁNCHEZ, 2013). Entrepreneurs act as job creators and economic growth catalysts and can benefit from incentive policies (ACS et al., 2016), facts that stimulate the growth of related bodies of knowledge concerned with the creation and the development of effective entrepreneurship initiatives (LIÑÁN; CHEN, 2009). A research with politicians from the United States of America and Europe evidenced that promoting economic growth based on the exploration of innovations requires entrepreneurship (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010). Additionally, providing an educational curriculum that emphasizes entrepreneurial activities improves the quality of the resulting entrepreneurs, who will generate radical innovations and business value, connecting business and learning (O'CONNOR, 2013).

Universities perform a relevant role in the promotion of entrepreneurial thinking and acting, resulting in initiatives that can contribute to social and economic development, impacting the growth of regions and cities (GUERRERO; URBANO; FAYOLLE, 2016). Entrepreneurship education influences entrepreneur success and promotes self-employment (ROBINSON; SEXTON, 1994; SOUITARIS; ZERBINATI; AL-LAHAM, 2007). As a consequence, the impact of education on entrepreneurial business

success is historically a relevant research theme (ROBINSON; SEXTON, 1994). Currently academic institutions are increasingly interested in entrepreneurship education (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010; 20; NABI et al., 2017), especially because of entrepreneurs' capability to generate relevant innovations for markets, economies, and countries, being an academic widely discussed subject, with a growing number of programs, inside and outside of the engineering field (O'CONNOR, 2013; PREMAND et al., 2016). Entrepreneurship education is positively associated with entrepreneurial behavior (KARIMI et al., 2016) and more effective educational programs impact economic development (RAUCH; HULSINK, 2015) and benefit economic activity (O'CONNOR, 2013). There is a need for a better comprehension of the outcomes of entrepreneurship education (MARTIN; MCNALLY; KAY, 2013; FAYOLLE; GAILLY, 2015), aiming to analyze entrepreneurship as an effective diffuser of entrepreneurial intention and a developer of desirable entrepreneurial knowledge and skills (BAE et al., 2014).

Research concerning entrepreneurship education is growing rapidly across the world, evidencing relevant results and supporting public and private investments (MARTIN; MCNALLY; KAY, 2013). The core idea is that entrepreneurship education can promote the development of adequate skills and competencies for a student to become a successful entrepreneur, contradicting the idea that entrepreneurial skills and competencies are innate personality traits (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013). Entrepreneurship education stimulates a student's intention to start a new business (SÁNCHEZ, 2013; BAE et al., 2014) and results in opportunities for educators to influence aspirations of entrepreneurship (FIET, 2000). The concept of entrepreneurial intention is receiving growing attention, particularly in understanding its development and in identifying entrepreneurial behavior and in the understanding of the development of intentions (FAYOLLE; GAILLY, 2015). Entrepreneurship educational methods combine learning theoretical concepts and experimenting with a portfolio of techniques, in order to create assumptions and practices that will assist thoughts and actions in the search for success (FIET, 2000; NECK; GREENE, 2011).

However, despite of the new possibilities that emerged with the adoption of the hypothesis-driven entrepreneurship approach, with the application of design methods for research and for creation, and with the use of fast prototyping techniques to create

and to validate products and services with potential customers, there is no research aiming to clarify the most important concepts, approaches, methods, and techniques of the contemporary entrepreneurship education. Therefore, this research aims to contribute to the landscape of knowledge regarding contemporary entrepreneurship education, and the following research questions were proposed (RQs):

RQ1: What are the dimensions of the contemporary entrepreneurship education?

RQ2: Considering the identified landscape, what are the most important research methods, authors, countries, and relevant journals concerning engineering entrepreneurship education?

Aiming to answer the proposed questions, a systematic literature review was performed (CARVALHO; FLEURY; LOPES, 2013), combining bibliometric, networks and content analysis, including papers concerning education and entrepreneurship, published at the ISI – Web of Science database and at the Scopus database. The research approach was chosen because of its capability in synthesizing high quality materials (WEISSBRODT; GIAUQUE, 2017), evidencing relevant material from a research area (IRSHAD; PETERSEN; POULDING, 2018). Obtained results evidence the most relevant themes considered in entrepreneurship education research, the most important conceptual research approaches applied by academics and practitioners, and evidence current and future research opportunities concerning entrepreneurship education, contributing for the research agenda of entrepreneurship research centers.

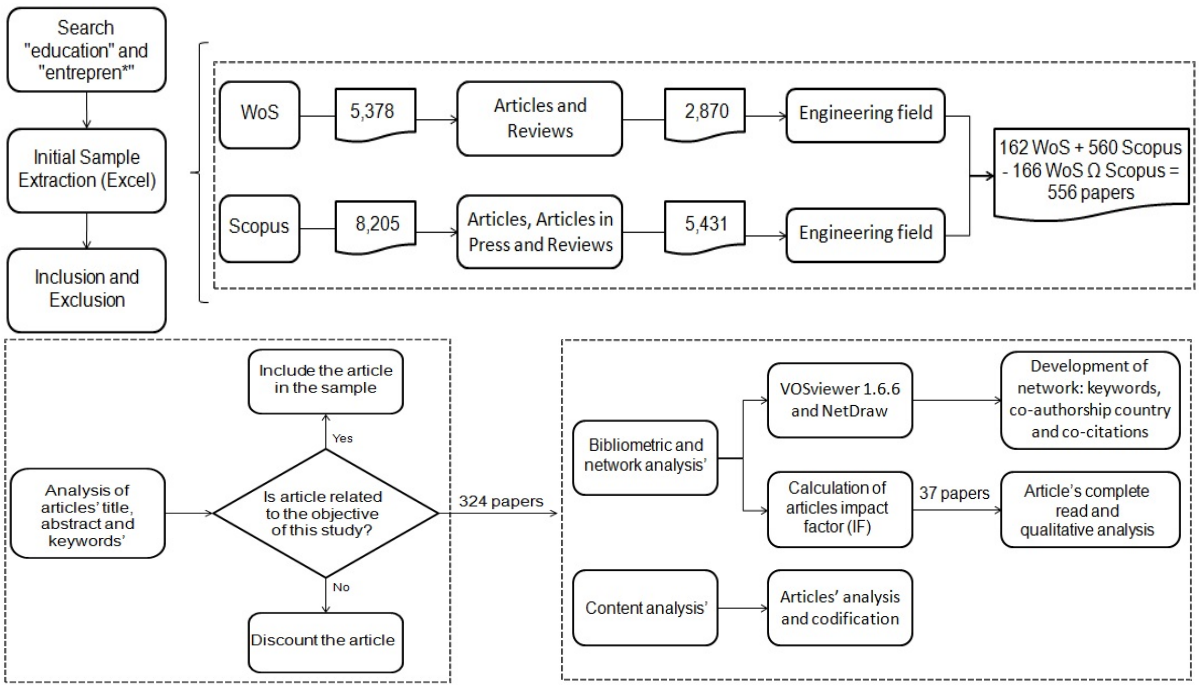
This article is structured in six sections. Section 1 presents the context of the research, entrepreneurship education. Section 2 presents the research design, a systematic literature review including bibliometric, network, and content analysis. Section 3 provides the results obtained from the application of the quantitative methods, bibliometric and network. Section 4 gives the results of the qualitative method, content analysis. Section 5 discusses the results and possible future research directions. Section 6 concludes the study and highlights its contributions.

2 RESEARCH METHODS

A systematic literature review was performed to analyze the current state of entrepreneurship education publications and to evidence the connections between entrepreneurship and education. This systematic literature review explored the evolution of knowledge regarding the subject using bibliometric, networks, and content analysis, which are complementary methods (CARVALHO; FLEURY; LOPES, 2013). The papers considered regarding entrepreneurship and education were taken from ISI – Web of Science database and Scopus database.

A systematic literature review supports the identification and the synthesis of evidences from relevant studies of a research field (IRSHAD; PETERSEN; POULDING, 2018). It allows the construction of a database for future research, developing a roadmap that investigates causes, effects, processes, and structures, promoting the identification of research gaps and, as a consequence, future research opportunities (MAIER; MEYER; STEINBEREITHNER, 2016; DIKICI; TURETKEN; DEMIRORS, 2018). By structuring the current state of the art of a particular research area, limitations can be seen, as well as relevant research themes that are developing fast (PALMARINI et al., 2018). Figure 1 illustrates the systematic literature review workflow performed in this study.

Figure 1 - Systematic literature review workflow



Source: Authors.

2.1 Sample and Procedures

An initial search in ISI – Web of Science (WoS) and Scopus was performed to obtain the sample. The first database, ISI – Web of Science, was selected in order to identify papers from indexed journals with the relevant impact factor (JCR – Journal Citation Report) from different databases. The Scopus database was chosen as having access to the world' largest number of abstracts and citations of peer-reviewed research literature. Working with both databases allowed the development of bibliometric, network, and content analyses, including the summary, references, year of publication, citations number, country, institution, authors' name and impact factor.

The research strings were "education" and "entrepren*". The initial WoS search resulted in 5,378 papers at the end of 2017. The application of a "document type" filter, selecting only articles and reviews, reduced the search results to 2,870 papers. The application of a last filter selecting only papers related to engineering, obtained a sample with 162 papers. With the Scopus database, the application of the same search strings and time period resulted in 8,205 papers. The application of a filter selecting only articles, articles in press, and reviews, resulted in 5,431 papers. Applying the subject engineering field filter resulted in 560 papers. The engineering field was selected for being the field of interest of the researches of this study, and for being a degree course with a growing number of graduate students creating new firms after graduation.

The total number of papers from both databases was 722. From this, 166 papers were excluded as duplicates, being on both the WoS database and Scopus database. The number of papers for analysis, therefore, amounted to 556 papers. Titles, keywords, and abstracts were analyzed qualitatively to search for themes that concerned entrepreneurship education. Research themes which were not in alignment with the scope of this research included: entrepreneurship education as demographical data, the role of family in entrepreneurial life, entrepreneurial behavioral and the effect of gender, and the acceleration of startups in programs inside universities. These papers were withdrawn from the sample, because the focus of this research was better understanding the concept of entrepreneurship education and themes related to the subject. From this, 324 relevant papers were found.

2.2 Bibliometric and Network Analysis

In a bibliometric analysis it is assumed that the analyzed authors cited the most important documents from a specific research field, representing a collection of articles and resulting in a citation and co-citation analysis (RAMOS-RODRÍGUEZ; RUÍZ-NAVARRO, 2004). A bibliometric analysis enables the global exploration of a research field from empirical evidence (NEELY, 2005). This results in a summary of the most important research topics and trends (ZHANG, 2017; YU et al., 2016; KOLLE et al., 2017), providing a guide for current and for potential future studies (ZHANG, 2017). In bibliometric analysis data obtained from papers are studied (QAISER; AHMED; SYKORA, 2017), to show the development and growth of a research topic (MAO et al., 2016). This is useful for systematically assessing interdisciplinary research initiatives (ÁVILA-ROBINSON; SENGOKU, 2017) and for emphasizing the landscape of science publications through the statistical analysis of publications (ZANGUELINI et al., 2016). Network analysis allows a better understanding of pattern publication in the researched databases (TAKEY; CARVALHO, 2016). Applying both techniques results in an indispensable guide, drawing technological and scientific roadmaps of a research field, in order to investigate the activities of publications (YATAGANBABA; OZKAHRAMAN; KUTBAS, 2017).

The description of the sample, research procedures, and bibliometric and network analysis steps were as follows. First, the number of publications per journal and per year were analyzed, evidencing the journals that were interested in the theme and the evolution of the number of publications over the years. Next, all papers and references were analyzed to create three citation networks: keywords, co-authorship countries, and co-citations. Network analysis used VOSviewer 1.6.6 software for the construction and visualization of networks and NetDraw software for the visualization and editing of the social network data.

The bibliometric and network analysis evaluated the body of the literature, characterizing the literature by journals, institutions, countries, publication type, subject categories, citations, and content analysis using keywords (DU et al., 2015). The results from this included the analysis of publications by countries, the quantity of papers, the most active authors per journal, the most relevant subjects by journal, paper citations, subject categories, year of publication, journal country of origin, journal impact factor, relevant citations, and important collaborations (YU et al., 2016;

YATAGANBABA; OZKAHRAMAN; KUTBAS, 2017). Research initiatives also applied qualitative and quantitative techniques and included mathematical and statistical methods to evidence quantitative relationships, distributed architectures, quantitative management, and various patterns of documents. This made it possible to investigate the structures, patterns and characteristics of the underlying sciences (MAO et al., 2016).

As the next step was calculated an impact index of the papers, used to evidence the most-cited articles, following Carvalho et al. (CARVALHO; FLEURY; LOPES, 2013) and being named as Impact Factor (IF) in this study. For this, the research applied Equation 1, where (C) represents the number of the paper' citations, (CY) represents the current year and (PY) represents the paper' year of publication, evidencing the paper' citations pondered for years, with the (JCR) representing the impact factor of the journal in which the paper was published, based on its Journal Citation Report, in the year of 2017. This equation was selected for its capability in compare papers published in different journals, with different number of citations and years of publication, because the authors of this research believe that is necessary to consider all these criterions to priorate the papers detailed read. After the IF calculation the papers were organized in decreasing order of relevance, considering the IF. Inspired by the study of Takey and Carvalho (2016), a Pareto analysis was performed to select the papers representing at least 80% of the identified IF, resulting in 37 papers, as the 80% most-cited papers. These papers were considered in the qualitative content analysis, and the results are presented in Section 4.

Equation 1 – Calculus of Impact Factor (IF)

$$IF = \left(\frac{C}{\left(\frac{CY}{(CY - PY)} \right)} \right) \times (JCR + 1)$$

Source: Carvalho et al. (2013)

2.3 Content Analysis

The content analysis performs an important role in the identification of research approaches and can be applied in different research domains (ALLEN et al., 2014), helping in data collection and analysis (WASIKE, 2017; ARSLAN, 2012). It can be used

to conceptualize research questions in different new ways (ALLEN et al., 2014), to compare and contrast the findings from a literature review (HAZEN; OVERSTREET; BOONE, 2015), and to evidence common practices, constraints, or interpretations of the observed relationships (ALLEN et al., 2014), considering the account of frequency in a longitudinal assessment systematically collected and analyzed (PAULSON; O'GUINN, 2012).

The content analysis of this research is divided into two categories: quantitative and qualitative., The results of the quantitative analysis are presented in Section 3, and develops a coding scheme for the 324 papers. The qualitative research results are presented in Section 4, which is an in-depth investigation of 37 papers considered as outliers, based on the most-cited papers and the impact factor of the journals in which they were published.

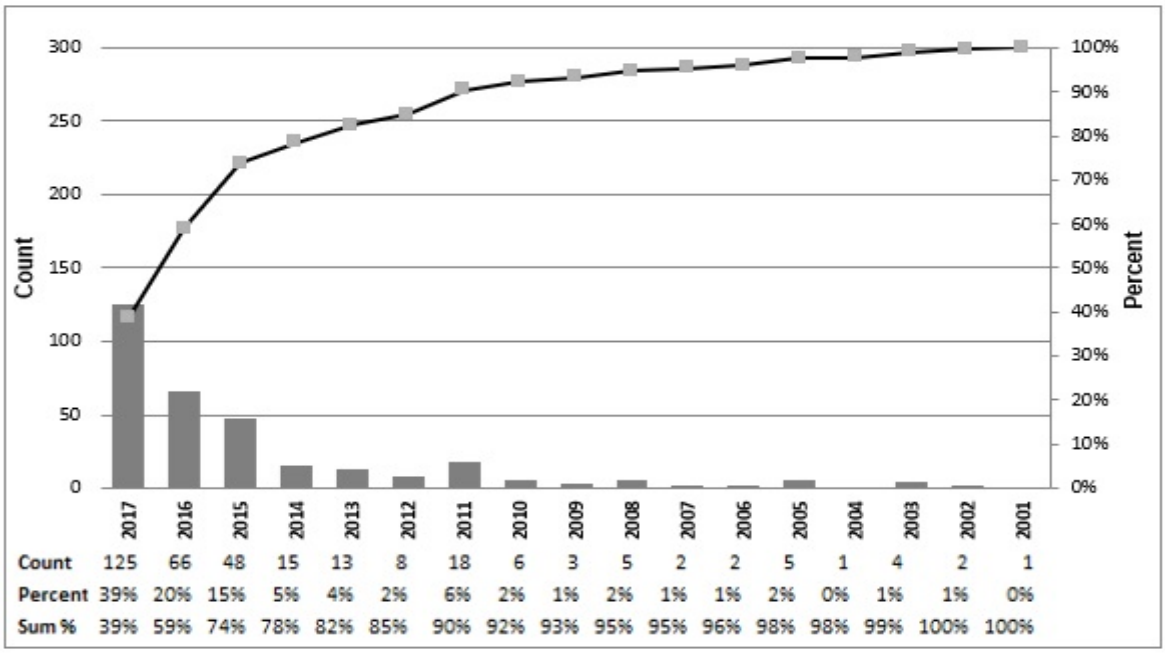
3 QUANTITATIVE RESULTS

This section presents the results of the quantitative analyze performed in this research, in the form of a bibliometric and a networks analysis.

3.1 Bibliometric and Networks Analysis

An initial overview based on descriptive statistics presents the number of publications year evolution regarding entrepreneurship education, in the engineering field. It is relevant that 74% of the sample was published in the last three years (2014–2017) and the most relevant year is 2017, evidencing a fast increase of interest in the subject, see Figure 2.

Figure 2 - Yearly evolution of publications in engineering entrepreneurship education (2001–2017)



	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
Count	125	66	48	15	13	8	18	6	3	5	2	2	5	1	4	2	1
Percent	39%	20%	15%	5%	4%	2%	6%	2%	1%	2%	1%	1%	2%	0%	1%	1%	0%
Sum %	39%	59%	74%	78%	82%	85%	90%	92%	93%	95%	95%	96%	98%	98%	99%	100%	100%

Source: Authors.

Considering the article sources, 135 different journals published papers concerning entrepreneurship education; however, about one third of the publications (32%) occurred only in six journals: *Education and Training*; *Journal of Technology Transfer*; *International Entrepreneurship and Management Journal*; *International Journal of Engineering Education*; *Advanced Science Letters*, and *Journal of Small Business Management.*

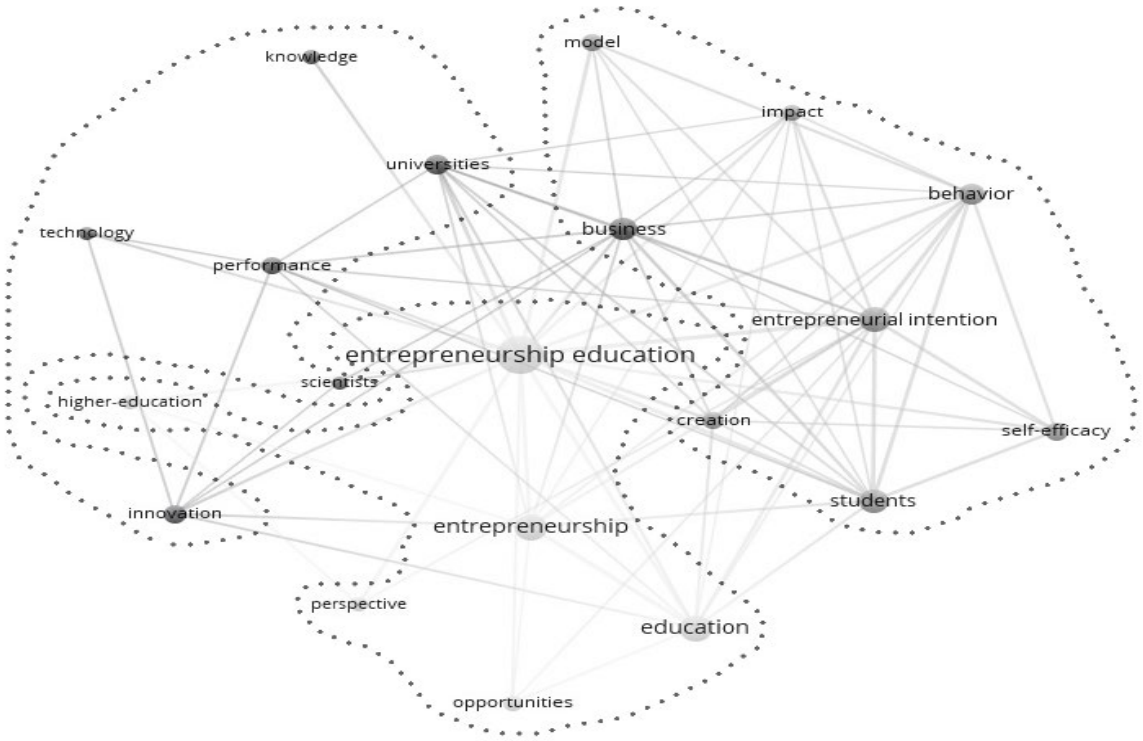
Table 1 - Evolution of main journals' publications per year

	Year													
Journal	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**	**Total**
EDUCATION AND TRAINING	17	7	11											35
JOURNAL OF TECHNOLOGY TRANSFER	14	4	2											20
INTERNATIONAL ENTREPRENEURSHIP AND MANAGEMENT JOURNAL	2	2	2	1	1		6							14
INTERNATIONAL JOURNAL OF ENGINEERING EDUCATION	2	3	1	1	1	2		1					1	12
ADVANCED SCIENCE LETTERS	8	1	2											11
JOURNAL OF SMALL BUSINESS MANAGEMENT		2	3		5		1							11
Total	43	19	21	2	7	2	7	1	0	0	0	0	1	103

Source: Authors.

The keywords network (see Figure 3) shows the most mentioned keywords obtained from the final paper sample, connected by lines. The strength of the line indicates the intensity of the identified relationships. After performing the network analyze, it was concluded that, to provide better visualization, the filter should have a minimum of six citations per keyword, leading to a final network with thirty-nine main keywords. Then, a Pareto' analyze was conducted to narrow the keywords analyze, summarizing only the 80% more representative, which are: entrepreneurship education, education, entrepreneurship, entrepreneurial intention, students, business, behavior, universities, innovation, self-efficacy, creation, performance, model, opportunities, impact, higher-education, perspective, knowledge, scientists, and technology.

Figure 3 - Keywords network of entrepreneurship education

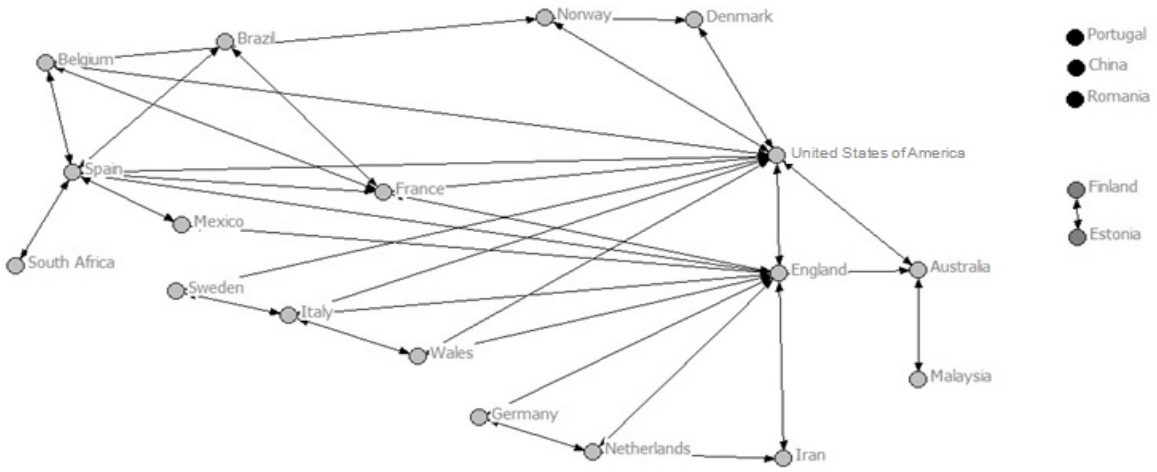


Note: Output from Software VOSviewer 1.6.6

The analysis of Figure 3 evidenced three clusters of keywords. The first cluster is related to the development of students' competencies and behaviors (model, impact, business, behavior, creation, entrepreneurial intention, students and self-efficacy). The second cluster evidences the effective assumption of entrepreneurship education (entrepreneurship education, entrepreneurship, perspective, education and opportunities). Finally, the last cluster represents the key variables related to entrepreneurship education, including: the most important universities in this business field; the most important places where entrepreneurship education happens, the sources of technology, that are applied in the educational process, types of innovation, relevant scientists, performance measures, and created knowledge. Specifically analyzing the most relevant connections, it is possible to highlight the connections between entrepreneurship education and entrepreneurial intention, entrepreneurial intention and students, entrepreneurial intention and behavior, entrepreneurship education and creation, creation and students, and entrepreneurship and education.

The sample included in the network co-authorship analyze showed research conducted in sixty different countries. To highlight the most relevant ones, only countries with more than four articles were considered, resulting in a network with twenty-three countries, presented in Figure 4. In this figure it is possible to visualize three main clusters. One cluster evidencing the United States of America and England as key nodes, connected to many different countries (Australia, Belgium, Brazil, Denmark, France, Germany, Iran, Italy, Malaysia, Mexico, Netherlands, Norway, South Africa, Spain, Sweden, Wales); it is possible to observe that this is the main cluster in entrepreneurship education. The most important identified connections occurred between the United States of America and England, England and Wales, England and Germany, and United States of America and France. Another cluster is composed of Finland and Estonia, two countries geographically close presenting entrepreneurship educational initiatives conducted together. Finally, the last cluster includes "isolated countries", i.e., countries whose research presents no connection with other countries (China, Portugal, and Romania).

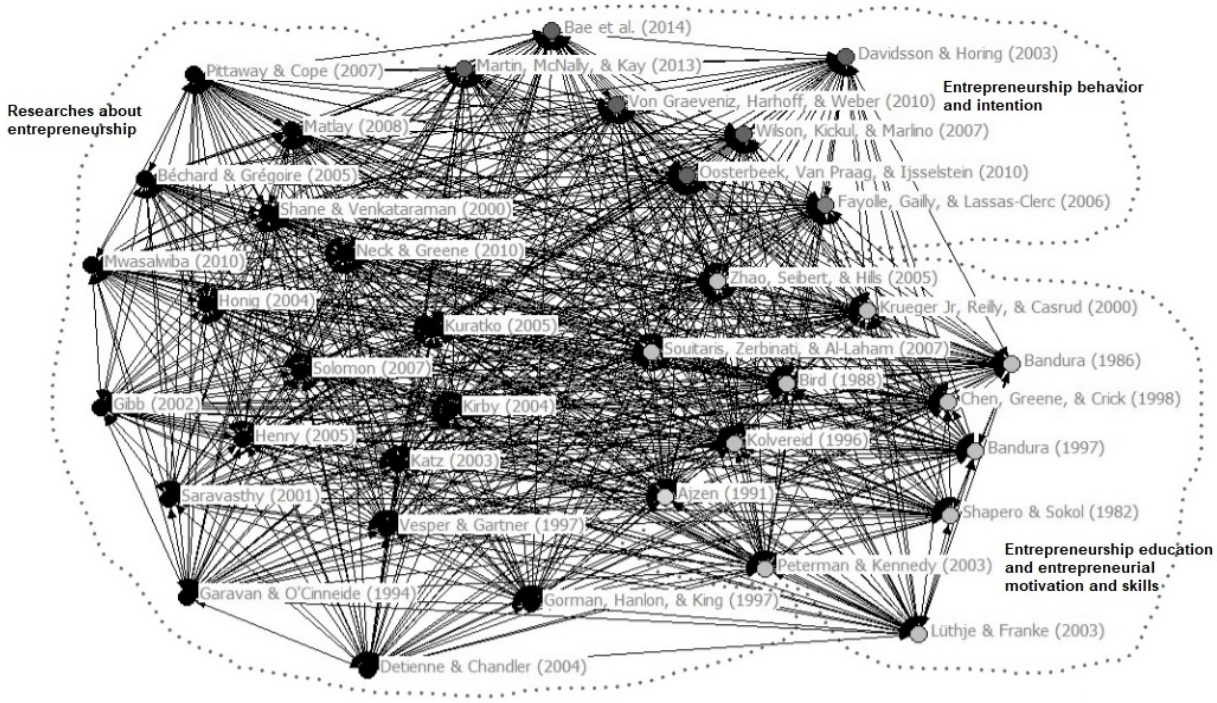
Figure 4 - Co-authorship country of entrepreneurship education



Note: Output from Software VOSviewer 1.6.6 and NetDraw

The sample cited 10,674 references and, aiming to obtain a network with better visualization, this research only considered authors that had at least twenty citations and citing references. The results are presented in Figure 5 and include thirty-seven papers, grouped into three main clusters. The first cluster consists of twelve papers that present outcomes from researches about entrepreneurial behavior and entrepreneurial intention. The second cluster includes seven papers concerning research about entrepreneurship education and relates to other subjects of interest, such as entrepreneurial motivation and entrepreneurial skills. The last cluster is composed of eighteen papers concerning research on entrepreneurship education review, challenges, outcomes, and best practices to conduct entrepreneurship education initiatives. The most important identified connections occurred between Krueger, Reilly and Carsrud (2000), Ajzen (1991), Souitaris, Zerbinati and Al-Lahham (2007), Peterman and Kennedy (2003), Kuratko (2005) and Katz (2003). These connections evidence relationships between authors researching entrepreneurship education regarding other subjects of interest, such as entrepreneurial motivation and entrepreneurial skills, and entrepreneurship education reviews, challenges and outcomes, and how entrepreneurship education is taught.

Figure 5 – Authors' co-citations of entrepreneurship education



Note: Output Software VOSviewer 1.6.6 and NetDraw

Analyzing the co-citation network references (Figure 5) it is possible to visualize three clusters. There is a cluster with a focus on students' intentions to become entrepreneurs (ZHAO; SEIBERT; HILLS, 2005), researches related to the effects of entrepreneurial programs on entrepreneurial attitudes and entrepreneurial intentions (SOUITARIS; ZERBINATI; AL-LAHAM, 2007), and the desirability and feasibility of starting a business (PETERMAN; KENNEDY, 2003); the prediction of entrepreneurial intentions (KRUEGER; REILLY; CARSRUD, 2000; AJZEN, 1991; CHEN; GREENE; CRICK, 1998; KOLVEREID, 1996; LÜTHJE; FRANKE, 2003); and the entrepreneurial motivation and entrepreneurial action (BANDURA, 1986; BIRD, 1988; BANDURA, 1997; SHAPERO; SOKOL, 1982). A second cluster evidences entrepreneurship education and entrepreneurial intention (BAE et al., 2014; VON GRAEVENITZ; HARHOFF; WEBER, 2010), entrepreneurship education and entrepreneurial motivation and entrepreneurial skills (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010); entrepreneurship education developing more and better entrepreneurs (MARTIN; MCNALLY; KAY, 2013); reasons for the increase of entrepreneurs (DAVIDSSON; HONIG, 2003; WILSON; KICKUL; MARLINO, 2007); and, evaluations of entrepreneurship programs (FAYOLLE; GAILLY, 2015). Finally, the last cluster includes papers concerning systematic literature reviews on entrepreneurship

education (PITTAWAY; COPE, 2007; MWASALWIBA, 2010; GORMAN; HANLON; KING, 1997; GARAVAN; O'CINNEIDE, 1994; SOLOMON, 2007); teaching entrepreneurship (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010; GIBB, 2002; HENRY; HILL; LEITCH, 2005; MATLAY, 2008; SHANE; VENKATARAMAN, 2000; BÉCHARD; GRÉGOIRE, 2005; HONIG, 2004); entrepreneurship education, outcomes and important contents (KATZ, 2003; MATLAY, 2008; DETIENNE; CHANDLER, 2004); entrepreneurship education and challenges (KURATKO, 2005; KIRBY, 2004); the rank of entrepreneurship programs (VESPER; GARTNER, 1997); different kinds of entrepreneurship (SARAVASTHY, 2001).

Looking at the content analyzes and the keywords network analyze, it is possible to observe convergences. The three identified clusters in the keywords network (Figure 3) highlight entrepreneurship education, entrepreneurship intention and performance. The keywords network evidences different units of analysis, particularly universities and students. Considering the most frequent keywords, the most relevant interests are entrepreneur behavior (9% of the sample) and entrepreneurial intention (31% of the sample). In the co-authorship country network (Figure 4), it is possible to visualize three clusters, among them the cluster formed for the United States of America (34%) and England (21%).

3.2 Content Analysis

All papers from the initial sample (324 papers) were analyzed considering their titles, abstracts, and keywords, resulting in a publications coding schema that classified these papers and resulted in a first landscape, about the dimensions of the contemporary entrepreneurship education, which helps to answer the RQ1: What are the dimensions of the contemporary entrepreneurship education? (see Figure 6).

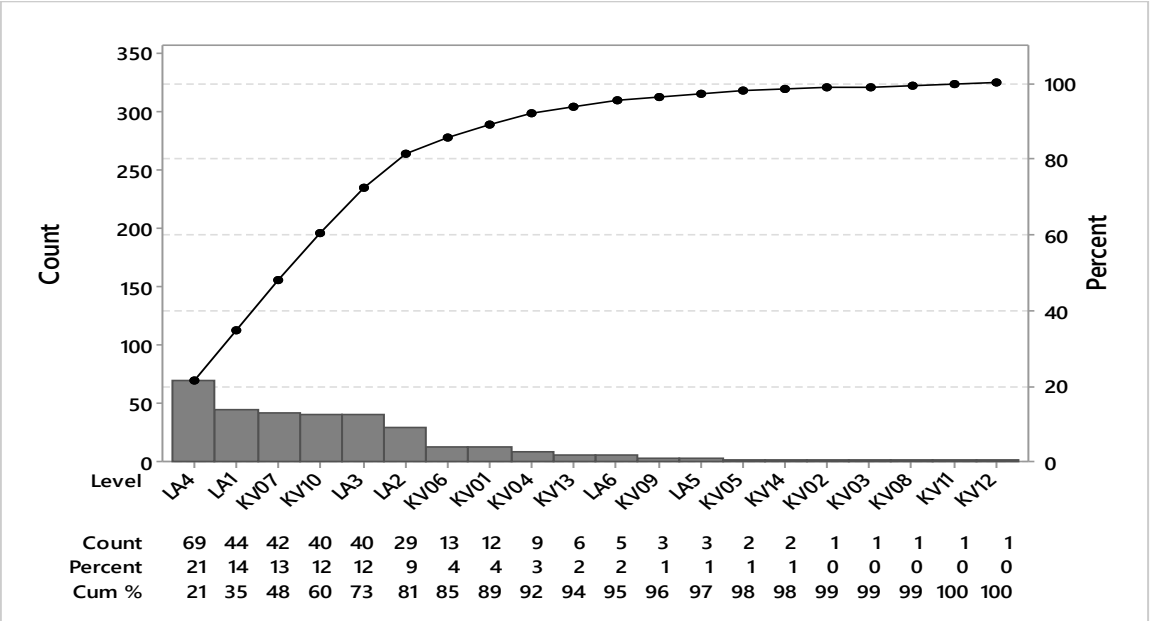
Figure 6 - Coding schema applied in the content analysis

Conceptual research approaches	**Empirical research approaches**
CR1 - Literature review	ER1 - Survey
CR2 - Simulation theoretical-conceptual	ER2 - Case study
CR3 - Website or documental analysis	ER3 - Action research
Research objectives	**Key variables**
LA1 - Evaluation of methodology or education program	KV01 - Entrepreneurial behavior or competencies
LA2 - Evaluation of institution, geographic region or country	KV02 - Design in academic entrepreneurship
LA3 - Scenario of institution, geographic region or country	KV03 - Social responsibility in academic entrepreneurship
LA4 - Development of methodology or education program	KV04 - Innovation and entrepreneurship
LA5 - Comparison between methodology or education program	KV05 - Cultural influence in entrepreneurship
LA6 - Comparison between institution, geographic region or country	KV06 - Influence of entrepreneurship education on students' career choice
	KV07 - Influence of entrepreneurship education on students' entrepreneurship intention
	KV08 - Technology and entrepreneurship
	KV09 - Commercialization and promotion of entrepreneurship
	KV10 - Definition of entrepreneurship education
	KVVON GRAEVENITZ; HARHOFF; WEBER, 2010 - Knowledge and entrepreneurship
	KV12 - Employability and entrepreneurship
	KV13 - Entrepreneurship influencing universities
	KV14 - Sustainability and entrepreneurship

Source: Authors.

Figure 7 and Table 2 presents the codes and frequency of the researches, evidencing that the most popular approach is literature review (CR1) and the most popular empirical field research approach is survey (ER1). Considering the research objectives, most of the identified articles focused on the development of an educational methodology or educational program (LA4) and, as a consequence, on an evaluation of the educational methodology and educational program (LA1). An analyzation of the key variables showed the influence of entrepreneurship education on students' entrepreneurship intention (KV07) and the definition of entrepreneurship education (KV10).

Figure 7 – Codes' frequency of content analysis



Source: Authors.

Table 2 shows the cross-tabulation of the classified articles based on research methods and research objectives, and key variables, such as the influence of entrepreneurship education on students' entrepreneurship intentions (KV07) and the definition of entrepreneurship education (KV10) with the research method of survey (ER1) and literature review (CR1). It is relevant to note that LA4 is more related to CR1, while LA1 is more related to ER1.

With the aim of creating a better understanding of entrepreneurship education and its main related assumptions, the next paragraphs and topics presents an exploration of the definition and evolution of these subjects.

The results of the research evidence the growing importance of entrepreneurship education, including analysis of the growing number of colleges and universities that offers courses in the area of entrepreneurship (KURATKO, 2005; VESPER; GARTNER, 1997) and the growing number of publications since 2015, a period that covers 74% of the identified papers. Concerning the research methods, a significant part of the researches applied empirical field research protocols (67%), most of them survey (42%) and case studies (24%). Just 33% of the identified papers applied conceptual research, particularly literature reviews (27%). Empirical research initiatives can be justified because of the innovativeness of the theme and the need for a better understanding and consolidation of subjects in this field, as suggested by Vesper and Gartner (DUVAL-COUETIL, 2013).

Most of the papers investigate the influence of entrepreneurship education on students' entrepreneurship intention (42 articles – 13%), identify key variables related to the definition of entrepreneurship education (40 articles – 12%), and analyze the influence of entrepreneurship education on students' career choice (29 articles – 9%). Regarding the proposed research objectives, the most prominent identified theme is the development of methodologies and educational programs (69 articles – 21%), followed by the evaluation of the results obtained from the applied methodologies or regarding the educational programs (44 articles – 14%), and by the analysis of the impact of the scenarios that surround the educational initiative, including geographic region and countries (40 articles – 12%).

Table 2 – Cross-tabulation of the coding schema applied in the content analysis

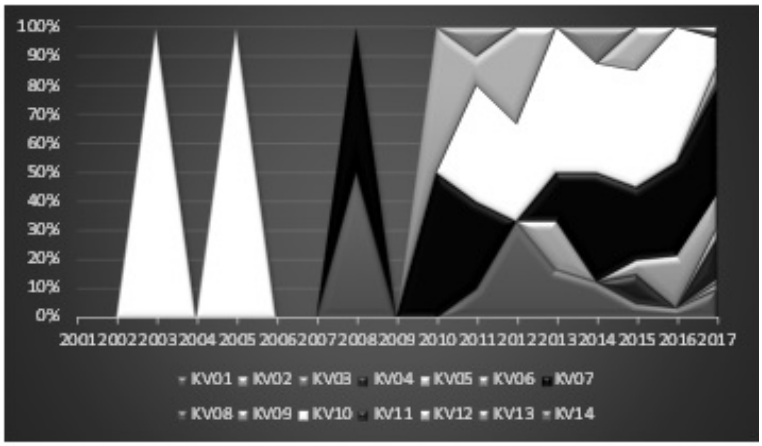
	CR1	CR3	ER1	ER2	ER3	Total
LA1	4		25	14	1	44
LA2	1		16	12		29
LA3	7	5	15	13		40
LA4	27	5	18	18	1	69
LA5	1	1	1			3
LA6	1	2	1	1		5
Total	41	13	76	58	2	190

	CR1	CR3	ER1	ER2	ER3	Total
KV01	3		7	2		12
KV02	1					1
KV03	1					1
KV04	6		2	1		9
KV05			1	1		2
KV06	3	2	6	2		13
KV07	5		28	8	1	42
KV08	1					1
KV09		1	1	1		3
KV10	25	1	10	4		40
KVVON GRAEVENITZ; HARHOFF; WEBER, 2010			1			1
KV12		1				1
KV13	1	2	1	2		
KV14			2			6
Total	46	7	59	21	1	134

Source: Authors.

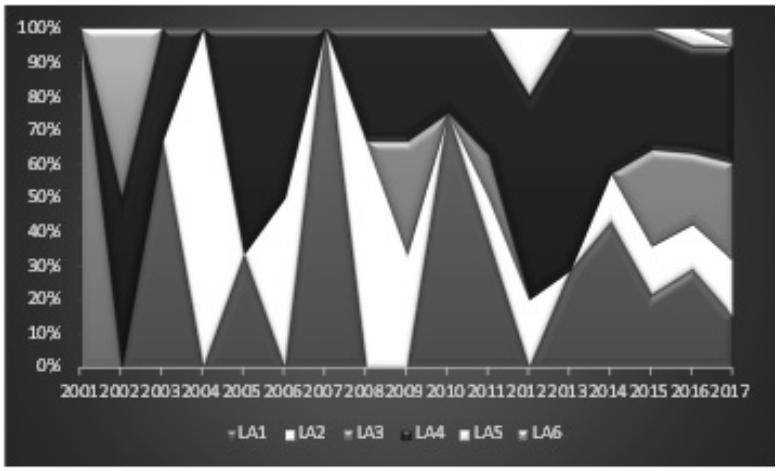
Figures 8 and 9 present the evolution of the relevance of the key variables during the period of analyze. It is possible to observe that, after 2009, different variables have been explored in several contexts, indicating an improved diversity of scope of research concerning entrepreneurship education. It is also important to note that the focus on development of methodology or education program (LA4) and the evaluation of methodology or education program (LA1) are the most significant key variables during the period of analysis.

Figure 8 - Evolution of coding schema over time



Source: Authors.

Figure 9 - Evolution of coding schema over time



Source: Authors.

4 QUALITATIVE RESULTS

This part of the research presents the results of the content analysis of the 37 outliers. This section emerges from the reading and grouping of these articles and helps to understand the thinking of the most relevant authors that research entrepreneurship education until 2017.

4.1 Entrepreneurs and Entrepreneurship

Successful entrepreneurs have the capacity to identify and to exploit emerging opportunities that aim to solve ecological and societal issues, and whose solutions are integrated into viable, profitable and sustainable business models (LANS; BLOK; WESSELINK, 2014). Entrepreneurship focuses on the identification of market inefficiencies and business processes that are not performing well (ACS et al., 2016). It aims to revolutionize market conditions with the introduction of new products and services (DETIENNE; CHANDLER, 2004). The majority of entrepreneurs start businesses in existing markets that are not well served; as a consequence, few new entrepreneurs effectively innovate (ACS et al., 2016). Most individuals become entrepreneurs because of inspiration and not because of financial rewards (ACS et al., 2016).

The entrepreneurship process is chaotic, complex and with no linearity (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010). It performs a crucial part in the creation and diffusion of innovations, leading to productivity growth and technological changes, changing the market structure and the competition basis (KURATKO, 2005). Entrepreneurship cannot be seen only as the creation of a business, it demands opportunity seeking, risk taking and resilience capabilities that permeate the entrepreneur in a permanent manner (KURATKO, 2005). Entrepreneurship is important for all kinds of organizations and, in our contemporary society, people must be able to pursue the new and to innovate (LIMA et al., 2015). Many college and university students go on to create their own business; however, even those without entrepreneurial intentions and entrepreneurial skills can deeply benefit from experimentation with and acquisition of entrepreneurial knowledge and entrepreneurial competencies (LIMA et al., 2015).

The first years of the twenty-first century saw the emergence of the most entrepreneurial generation since the Industrial Revolution. This new revolution spread across the entire world and permanently impacted business practices (KURATKO, 2005). Currently there is an agreement that entrepreneurship knowledge and entrepreneurship skills can be taught and entrepreneurial competencies can be developed (KURATKO, 2005). Entrepreneurship education can be an effective diffuser of the entrepreneurial intention, more than a traditional business education, because entrepreneurship education is aimed at developing entrepreneurial knowledge, entrepreneurial skills, and entrepreneurial competencies (BAE et al., 2014). As a consequence, the educational market has seen a remarkable growth and development of programs in entrepreneurship and new venture creation, developed and run by established or newly created colleges and universities (KURATKO, 2005).

Therefore, authors evidence that entrepreneurship is important for discovering and attending different market needs, and that entrepreneurship education provides knowledge and develop competencies that are useful even for people not pursuing the creation of their own business. As a consequence, it is relevant to explore entrepreneurship education, including entrepreneurial competencies that can be taught and promoted by colleges and universities, resulting in the growing number of programs of entrepreneurship education.

4.2 Entrepreneurial Universities and Entrepreneurship Education

Entrepreneurial universities create the appropriate environment for the university community to conduct entrepreneurial initiatives, contributing to economic and social development, impacting and influencing the economic growth of cities and regions. These universities contribute to the creation of entrepreneurial actions, thinking and institutions, being more influenced by informal factors, such as role models and attitudes towards entrepreneurship, than by formal factors, such as education, training, and support initiatives (GUERRERO; URBANO; FAYOLLE, 2016). Moreover, generating and transferring knowledge from the university to society provides leadership for entrepreneurial thinking and acting, and for the creation of new institutions (GUERRERO; URBANO; FAYOLLE, 2016; KALAR; ANTONCIC, 2015). Entrepreneurship education faces new paradigms and it is necessary to revolutionize the university organizational structure as a whole (GIBB, 2002).

Discussions about the impact of education on entrepreneurial business success is a traditional theme among academics and practitioners (ROBINSON; SEXTON, 1994). On one hand, most small business owner-managers have few educational qualifications and do not have the benefits of education themselves. Their focus is on the business surviving, and not in training – themselves or their employees, especially in the first five years (FULLER-LOVE, 2006). On the other hand, relevant research indicates that education has a positive influence on the success of entrepreneurship (ROBINSON; SEXTON, 1994). Entrepreneurial education aims to improve managerial skills in small firms, as well as the increasing positive characteristics and attitudes of the entrepreneur, which leads to more resilient competitors (FULLER-LOVE, 2006). There is an explicitly correlation between the general level of education and the probability of becoming self-employed and having entrepreneurial success (ROBINSON; SEXTON, 1994).

The first entrepreneurship class was enrolled in 1947, which was led by Myles Mace in the United States (KATZ, 2003). Since then, the growth of entrepreneurship education has been remarkable, even exceptional (KATZ, 2003). The phenomenon spread in the United States, ten years before it reached Europe (KALAR; ANTONCIC, 2015). Today, entrepreneurship education outside North America is growing significantly (KATZ, 2003).

Entrepreneurship education generally has its origins in business schools (LANS; BLOK; WESSELINK, 2014). In response to the phenomenon of people returning from World War II and finding an economy in transition, in 1945, Harvard Business School introduced a precursor entrepreneur course (VESPER; GARTNER, 1997). This movement was not significant in the immediately following decades, but during the 1970s this scenario changed completely. An important factor in the change was the advent of the microcomputer, a tool that exponentially accelerated the capacity of operating complex businesses with reduced production scales and costs (VESPER; GARTNER, 1997). Since the 1990s, books on entrepreneurship have almost doubled in popularity every year and entrepreneurship initiatives have spread into schools of engineering and agriculture (KATZ, 2003). If, in the past, management education focused mainly on large firms, currently there exists a complementary, and also an important, focus on small business (FULLER-LOVE, 2006).

Traditional business and new ventures management education is inadequate for the current societal needs and, with the needs of small business and ventures neglected, there is still little indication of how to attend the needs of this distinguished group (GIBB, 2002). Current research on entrepreneurship must focus on the identification of opportunities (DETIENNE; CHANDLER, 2004), prioritizing new opportunities based on emerging needs (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010). According to Duval-Couetil (2013), the characteristics of entrepreneurship education are singular: (1) as a young discipline, its body of knowledge is still ill-defined; (2) there is no standardization concerning methods and tools; (3) the emphasizes is in practice, involving mainly nonacademic practitioners; (4) economic development and business creation are explicitly expected outcomes.

Therefore, in this century, entrepreneurship education is a worldwide phenomenon, with multiple local, national and international competitors. It is considered a discipline that will certainly grow academically in the next years (KATZ, 2003). As a consequence, the area of entrepreneurship education is increasingly explored academically, being considered a new field because the interest started to increase significantly only in the 1990's, resulting in bodies of knowledge that are still ill-defined. It is an interesting area because of the opportunity to promote self-employment and the capability of re-built country markets after big economic problems. Entrepreneurship education is a positive influence of successful entrepreneurs, because of its capability to develop entrepreneurial behavior and competencies.

4.3 Entrepreneurial Behavioral and Competencies

Entrepreneurship education consists mostly of teaching entrepreneurial skills and entrepreneurial attitudes (BAE et al., 2014). Entrepreneurship education is effective in stimulating entrepreneurial behavior and increasing students' attitudes and perceived behavioral control (RAUCH; HULSINK, 2015). The ability to create sustainable business models in the midst of many adverse situations demands specific skills and competencies that are not completely defined yet. This suggests future research possibilities, with a focus on developing effective entrepreneurial programs based on the identification, definition and measurement of the entrepreneurs' competencies (MORRIS, 2013).

Entrepreneurs' competencies combine knowledge, skills, and resources that differentiate one entrepreneur from another (FIET, 2000). Competencies are outcomes from learning from the interactions between individuals and environments, and its improvement is possible based on studies considering pre-measures and post-measures (MORRIS, 2013). Competencies can be enhanced with good practice, and they decline without practice (MORRIS, 2013).

A strategy to develop entrepreneurship competencies by applying existing theories must be tailored and monitored by lecturers and experimented with, validated, and approved of students (FIET, 2000). Instructors can provide appropriate scripts as a foundation for the practical development of competencies and this process can be measured, with the aim of discovering the most effective teaching approaches (MORRIS, 2013).

Since the identification of business opportunities is central for entrepreneurship education, it is a competency that must be developed in entrepreneurship classrooms, with the aim of improving the number of generated ideas and their innovativeness (DETIENNE; CHANDLER, 2004). Entrepreneurship is a reflective practice; therefore, reflecting about the results obtained in practical initiatives is fundamental and a component of entrepreneurship education (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010).

Entrepreneurship has as a fundamental role in the development of sustainable business models, particularly considering the adverse situations that might be faced by the entrepreneur. In this scenario it is recognized that some competencies, skills, and knowledge, such as the identification of business opportunities, are fundamental for entrepreneurial success, and it can be taught, and even promoted.

4.4 Entrepreneurial Intention

Although the development of entrepreneurship as a knowledge area is evident, entrepreneurial education still receives significant influence from business courses, raising the question of whether students are receiving the right scripts in order to become effective entrepreneurs (MORRIS, 2013). It is relevant to observe that students develop higher entrepreneurial intention after participating on an entrepreneurial course and perceiving the possible behavioral controls (RAUCH; HULSINK, 2015).

One of the biggest myths about entrepreneurship is that entrepreneurs are born with specific innate characteristics, and these are difficult, or even impossible, to develop or learn (LANS; BLOK; WESSELINK, 2014). Nonetheless, aiming to stimulate entrepreneurial activity, many countries have invested in entrepreneurship education, creating a genuine interest in the obtained outcomes of these efforts, initiating researches that later evidenced positive correlations between entrepreneurship education and entrepreneurial intention (WALTER; BLOCK, 2015; FAYOLLE; GAILLY, 2015). Evidences revealed that different circumstances can modify the level of entrepreneurship knowledge and affect entrepreneur intention (LIÑÁN; CHEN, 2009), and that entrepreneurship programs result in higher entrepreneurial intention, inspiration and attitudes, leading students towards self-employment (SOUITARIS; ZERBINATI; AL-LAHAM, 2007).

Since acquiring education demands time and money, a greater level of education results in higher opportunity costs and higher expectations about future returns. A study by Block et al. (PIPEROPOULOS; DIMOV, 2015) demonstrated that people with higher educational levels are more willing to start a new business, and individuals with fewer years of education are more sensitive to scenarios of uncertainty and less willing to initiate a new venture (AUTIO; ACS, 2010).

However, part of the results from these researches showed contradictory results and leads to unclear conclusions, demanding deeper examinations of purpose and nature (PIPEROPOULOS; DIMOV, 2015). Oosterbeek et al. (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010) concluded that entrepreneurship educational programs do not affect students' skills and negatively affect entrepreneurial intention, because students with low levels of entrepreneurship competencies become even less enthusiastic about starting new ventures. Autio and Acs (2010) also verified negative relationships between the individuals' education and entrepreneurial growth aspirations (LIMA et al., 2015). Fayolle and Gailly (2015) highlighted that some recent studies did not find significant impacts after the conclusion of the entrepreneurial programs.

According to Fayolle and Gailly (2015), entrepreneurship education affects individuals' intentions and attitudes towards entrepreneurship. However, students become aware of the effect six months after the participation in an educational program, reinforcing the reflexive character of entrepreneurship education. Therefore, entrepreneurship education presents a positive relationship with entrepreneurial activity, especially at

the end of the educational initiative (WALTER; BLOCK, 2015). The relevance of improving educational methods is remarkable, aiming to guarantee for educators the best concepts, techniques, and tools, capable of evolving students perceived behavioral control (KARIMI et al., 2016). This scenario reinforces the relevance of future researches that look for best educational entrepreneurship programs considering the specific reality of the educational initiative and aiming to stimulate entrepreneurial behavioral (RAUCH; HULSINK, 2015).

Growing investments in entrepreneurship education can be seen, since entrepreneurship education can positively affect entrepreneurial intention. However, as some researchers concluded that the effect is the opposite (negative), it is clear that the research area still demands more in-depth researches.

4.5 Entrepreneurial Programs Categories and Evaluation

Entrepreneurship programs prepare students for an entrepreneurial career. It aims to help students to establish their own businesses (RAUCH; HULSINK, 2015), and provides competencies and knowledge for the creation of jobs and economic value (DUVAL-COUETIL, 2013). However, there is still no agreement about what concepts of entrepreneurship should be explained, no agreement about how new ventures should be initiated, and what complementary tools and techniques should be prioritized, presented, and applied (GIBB, 2002).

Different entrepreneurial programs apply different approaches and different experiences in which students can participate in the “real world”, including developing products and services, competing in creating business plans, taking internship in startups, and being part of technology commercialization activities (DUVAL-COUETIL, 2013). Entrepreneurship programs adopt different approaches, concentrating on familiar topics such as the creation of organizations, the development of innovations, startup growth, intellectual property, value creation, and also new topics such as family businesses, managing high-growth businesses and smaller enterprises (VESPER; GARTNER, 1997). Educational programs include activities that apply virtual reality and real-world simulations, improve decision-making skills and even entrepreneurial self-confidence (KARIMI et al., 2016).

The specifics of educational programs also impact perceived entrepreneurial intentions. Programs orientated towards practical aspects achieve different results

when compared to theory-oriented programs (PIPEROPOULOS; DIMOV, 2015). Programs can be elective or compulsory, and, because elective programs are attended by students with higher entrepreneurship intentions, they usually obtain better results than compulsory programs (KARIMI et al., 2016). Courses usually take one semester and there are relevant intervals between classes for students to understand and incorporate concepts and to develop practical activities (BAE et al., 2014).

Currently it is noticeable that practical outcomes differ significantly in courses where entrepreneurship education focuses on venture creation, with a stronger emphasis on learning-by-doing activities, when compared to courses where the focus is on the hypothetical conception of a business and the development of a traditional business plan (BAE et al., 2014). In active learning and learning-by-doing contexts, students are not passive and they perform activities to promote entrepreneurial action and business creation (GIELNIK et al., 2015). It is also important to recognized that, when action principles connect with concrete behavior and with active learning, students receive feedback based on their real-life results. This helps them to understand the action principles and results in mental frameworks for how to apply them (GIELNIK et al., 2015). The action-based entrepreneurship initiatives have positive effects on acquired knowledge, action planning, and entrepreneurial self-efficacy (GIELNIK et al., 2015).

The evolution of entrepreneurship programs and related business schools demands more debate and dialogue and cannot be considered as something solved and fixed (VESPER; GARTNER, 1997). It is of paramount importance for educational institutions to measure continually the outcomes from programs, including students' satisfaction, performance and the impact on the community (VESPER; GARTNER, 1997; ATHAYDE, 2009). It is also relevant to note that it is inappropriate to evaluate these programs using the same measures traditionally applied to conventional courses (VESPER; GARTNER, 1997). Another relevant issue is related to understanding local, regional, and national conditions to contextualize the outcomes of entrepreneurship education (WALTER; BLOCK, 2015). Research concerning the impact of entrepreneurship education and training can have two focuses: short-term outcomes, including intentions, knowledge, and attitudes; and long-term outcomes, including startup survival (GIELNIK et al., 2015). Few studies analyze both short- and long-term results of entrepreneurship education regarding student attitudes, career goals, behavior and professional competence (DUVAL-COUETIL, 2013).

Therefore, there is no consensus about the best entrepreneurial program and this is a subject that still demands in-depth studies, especially because of the many different available approaches and tools. It is even relevant to research different contexts, analyzing economic development and the impact of entrepreneurs before and after their participation in an educational program.

5 DISCUSSION

Obtained results evidence that entrepreneurs are individuals who pursue business opportunities aiming for sustainable business growth and working to fulfill market inefficiencies. The focus is on the creation of innovations based on the identification of what is not operating well, resulting in the introduction of new products and services to change market conditions (DETIENNE; CHANDLER, 2004; LANS; BLOK; WESSELINK, 2014; ACS et al., 2016). Entrepreneurs also develop sustainable business models in adverse situations, reinforcing the importance of social responsibility in academic entrepreneurship initiatives. Although individuals are inspired to become entrepreneurs, rather than because of the idea of making money, most entrepreneurs start businesses in existing markets that are served by established companies and, as a consequence, only few new entrepreneurs effectively innovate (ACS et al., 2016). However, research results evidenced that currently the adoption of design approaches to identify innovative business opportunities is a trend and, therefore, the application of strategic design to identify emerging opportunities characterizes a new multidisciplinary research field, combining concepts and approaches from design, business and engineering.

In countries with a limited amount of new jobs in the private sector, entrepreneurship education promotes the creation of jobs for the youth and stimulates higher employment and economy growth (RAUCH; HULSINK, 2015; NABI et al., 2017), reinforcing the relevance of research that characterizes the cultural influence on entrepreneurship. Although entrepreneurship education is especially suited for people that want to run their own business, it can benefit all those who want to develop entrepreneurial competencies, entrepreneurial behaviors and entrepreneurial knowledge, which are valuable to have in conditions of uncertainty (LIMA et al., 2015), a trend verified with the development of this research and that can influence students' career choices. The conduction of longitudinal research aiming to verify the relevance of acquiring entrepreneurial competencies among non-entrepreneurs is an opportunity to verify the broad relevance of entrepreneurship education.

The entrepreneurship process is chaotic, complex and with no linearity (NECK; GREENE, 2011; VON GRAEVENITZ; HARHOFF; WEBER, 2010). It performs a crucial role in the creation of innovations and leads to productivity growth and technological development, changing market structure and competition (KURATKO, 2005).

Entrepreneurship is not restricted to the creation of new business and is important for all categories of organizations, since all companies must be able to create innovations (LIMA et al., 2015). Entrepreneurship education can develop competencies, knowledge and skills that are very important for entrepreneurial success, and for promoting and encouraging entrepreneurial intention.

Currently the world is experiencing the most dynamic period of entrepreneurial activity since the industrial revolution, i.e., a new revolution that spreads across the world and has a definite impact on the business landscape (KURATKO, 2005). In this new context, entrepreneurship education can be more effective diffusing entrepreneurial intention than traditional business education, because it is more suitable for the development of entrepreneurial knowledge and skills (BAE et al., 2014). As a consequence, it is possible to verify a remarkable growth and development of entrepreneurship programs at universities and colleges (KURATKO, 2005), in which professionals and business educators consider that entrepreneurs are not “born entrepreneurs” but can be created (KURATKO, 2005).

Answering this study research questions, first was conducted a search to highlight what are the dimensions of the contemporary entrepreneurship education, being discovered two main dimensions, the influence of entrepreneurship education on students’ entrepreneurial intention and the definition of entrepreneurship education. Therefore, the main research objectives identified in the analyzed papers are the development of methodologies and educational programs, and the evaluation of the results obtained with the application of the methodology or with the realization of the educational program. Evidencing the entrepreneurship education as a field already in consolidation, receiving significant researches interest in it better understand and measure their results.

The second main research questions demand the identification of the most important research methods, authors, countries, and relevant journals concerning engineering entrepreneurship education. Parting from the main contemporary dimensions of the engineering entrepreneurship education, was revealing that the researches were moving towards a more confirmatory phase, because a significant part of the papers applied empirical field research, most of them through survey, as method. As authors with more citations in articles about entrepreneurship education they could be grouped in three main groups, studies about, entrepreneurial behavior and entrepreneurial

intention, entrepreneurship education and relates to other subjects of interest, and entrepreneurship education review, challenges, outcomes, and best practices. As countries that most publish in the theme the United States of America highlights. When the subject is the relevant journals concern about engineering entrepreneurship education, an interesting fact is that most of the more relevant publication, parting for the JCR calculation, were not from journals of the engineering education field, evidencing that the interest in the theme are bigger from fields outside the engineering education field.

6 CONCLUSION

This study contributes to the construction of a relevant entrepreneurship literature, evidencing the entrepreneurship as economic catalyst, for be capable of generate jobs and business value, through the development of innovations, that can have as foundation the entrepreneurship education. Emerging a currently grow interest in understand and measure the entrepreneurship education. With the engineering entrepreneurship education being interest even of others fields of knowledge.

Being evidenced that the entrepreneurship education is in its early stages of development and obtained results revealed that the definitions of entrepreneurship education are still consolidating, an evidence that can be explored in future research initiatives. Entrepreneurship is growing, and it is possible to observe little research focused on the identification of the determinants concerning entrepreneurial growth aspirations. Therefore, it is a relatively new field of interest that emerged only after the 90s, and is based on an evolving body of knowledge, still recognized as ill-defined, demanding new and in-depth researches. Being relevant evolve the culture aspects to study the entrepreneurship.

This study final results show a lack of research and motivate the creation of a new research agenda, particularly with studies regarding identifying opportunities, designing courses to teach entrepreneurship, identifying the most interesting approaches to teach entrepreneurship, and comparing entrepreneurship education learning before and after programs. The limitations of this study include: having a focus solely on entrepreneurship education in the engineering field, using only two databases, Web of Science and Scopus, and considering for the content analyze only the most-cited papers.

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8 #P3: Consolidating core entrepreneurial competences: towards a meta-competence framework

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Abstract

Purpose - Emerging digital ventures and related breakthrough innovations result in new challenges for the development of entrepreneurial competences and demand new perspectives for entrepreneurship research. In this context, policy-makers and organizations are increasingly interested in fostering entrepreneurial competences to improve the success of policies and venture capital investments. This paper aims at identifying the core relevant entrepreneurial competences, mapping the current literature and the main clusters, and going beyond, towards a meta-competence framework.
Design/methodology/approach – The research approach is a literature review, combining bibliometric, network, and content analysis. The sampling process was conducted in the Scopus and Web of Science databases. The bibliometric and content analysis were performed with a computer aid approach applying VosViewer 1.6., Ucinet, and NetDraw 2.139. The content analysis approach was performed considering a detailed coding schema developed. Finally, towards the meta-competences framework, the study applied quantitative analysis on the coding schema, particularly cross-tabulation, core-periphery, and network analysis.
Findings - The results show the state of the art concerning entrepreneurial competences. The research identified a list of 98 entrepreneurial competences. Finally, the study prosed a meta-competence framework and clusters the 33 core entrepreneurial competences previously identified.
Originality/value –The proposed conceptual framework exploring meta entrepreneurial competences offers an original contribution with implications for theory and practice. The research contributes to broadening the understanding of the entrepreneurial competences, helping on the creation, design, development, and improvement of entrepreneurship educational initiatives, being important to entrepreneurs' educators. The proposed framework contributes by providing relevant knowledge for policy makers' strategy formulation processes. As implications for the practice, the proposed framework can allow better assessment process for incubators and accelerators, besides more robust ventures, considering learning trails based on meta-competences frameworks.

Keywords: Entrepreneurs; Entrepreneurship; Entrepreneurship education.

1 INTRODUCTION

Entrepreneurs are hardworking professionals (HOFER; SANDBERG, 1987), capable of performing many different tasks (OBSCHONKA et al., 2013) and able to make intense efforts to mitigate the risks of starting new ventures (OBSCHONKA et al., 2013). For universities, entrepreneurship has become a priority since it promotes the generation of successful entrepreneurs and results in brand status and increased revenues (CANTU-ORTIZ et al., 2017). Previous researches revealed that entrepreneurial experiences provided by different universities influenced the development of entrepreneurial competences, improving or inhibiting entrepreneurs' success (GÜMÜSAY; BOHNÉ, 2018; RASMUSSEN; MOSEY; WRIGHT, 2014) reinforcing the relevance of social networks influence (LANS; BLOK; GULIKERS, 2015). Consequently, the importance of entrepreneurship is transcending its traditional academic frontiers and social sciences have started to focus on this research topic (OBSCHONKA et al., 2013; REZAEI-ZADEH et al., 2014).

Academic interest in research concerning entrepreneurship intention started during the 1970s (ESPÍRITU-OLMOS; SASTRE-CASTILLO, 2015) and is currently considered mature in terms of field of enquiry, however continuously demanding new research in emerging themes such as the influence of experiences on the intentions of future entrepreneurs (BIGNOTTI; ROUX, 2020). Entrepreneurship research emerged during the 1980s as a potentially promising field and, considering the impressive success of the startups based in Silicon Valley, by the end of the 1990s this research area was reinforced. At that moment, the lack of substantial theoretical foundation was identified as the main challenge to be tackled by researchers (BYGRAVE; HOFER, 1992; THOMAS; MUELLER, 2000).

It is possible to identify abundant research concerning environmental aspects that stimulate the development of entrepreneurial competences (HERRON; ROBINSON, 1993). Individual circumstances, such as cultural, economic, cognitive, emotional, and physical aspects are powerful drivers in the development of emerging entrepreneurs (MITCHELMORE; ROWLEY, 2010; MILLER; LE BRETON-MILLER, 2017). Initial research results evidenced entrepreneurial competences as innate traits, but then, a growing consensus concluded that entrepreneurial competences could be developed (REZAEI-ZADEH et al., 2014). As a result, research concerning the connections

between entrepreneurship and competences has expanded significantly (OBSCHONKA et al., 2013; REZAEI-ZADEH et al., 2014).

The key for developing successful new ventures is to stimulate entrepreneurial intentions (BIRD, 1988; TAJEDDINI; MUELLER, 2009). Researches have evidenced that higher entrepreneurial intentions can be observed when participants present more diverse and balanced entrepreneurial competences (LAZEAR et al., 2005; MOOG et al., 2015), a combination that results in the creation and development of sustainable business models (BIRD, 1995; MITCHELMORE; ROWLEY, 2010; SÁNCHEZ, 2011; REZAEI-ZADEH et al., 2014). Entrepreneurs' profile evidence a closer connection with business performance (MAN; LAU; CHAN, 2002) and since entrepreneurship tends toward self-employment, it demands more complex skills (CHEN; THOMPSON, 2016). In this context, entrepreneurship education fosters the development of entrepreneurial competences (REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2013; SECUNDO et al., 2020), providing positive environments for entrepreneurs and supplying them with the most relevant resources (MAN; LAU; CHAN 2002; SANSONE et al., 2019).

Tajeddini and Mueller (2009) highlighted the need to identify the meta-competences that facilitate the development of entrepreneurial competences, and the personal characteristics of entrepreneurs that lead to success, a theme also researched by Duffy et al. (2006). The development of entrepreneurial competences is moving towards digital contexts and emerging patterns have to be identified. Monllor and Soto-Simeone (2019) highlighted the need for theorizing the role of digital technologies in shaping entrepreneurial competences and Toniolo et al. (2020) observed that emerging digital technologies demand the development of new sets of entrepreneurial competences, supported by digital platforms, structured and organized in order to promote the development of robust innovation. These new challenges reflect on the ways competences are acquired, developed, maintained and improved, including human aspects (TAN; SMYRNIOS; XIONG, 2014) entrepreneurship methodologies to foster breakthrough innovations (SECUNDO et al., 2017) and the creation of mechanisms to identify innovation ecosystem's actors (BELIAEVA et al., 2019). Entrepreneurial competences are also important assets to fight against and overcome the current situation with the COVID-19.

Consequently, personal sets of entrepreneurial competences should be revisited and combined, in order to promote its effective development. Monticelli, Bernardon, and

Trez (2018) consider that competences must be comprehended individually and Gross and Geiger (2017) highlighted the relevance of improving reflexivity and awareness about organizational core competences, considering the need to mitigate the perceived risks and uncertainty of this career direction (RAE, 2012). Warren and Smith (2015) highlighted the need to reconcile rule-breaking and path-breaking towards the establishment of sets of ethical and behavioral competences of entrepreneurs.

Different initiatives have been identified in the literature aiming to fulfill this gap of knowledge. These include Chandler and Jansen (1992), who investigate the dimensions related to the founding entrepreneurial competences and empirically evidence their results'. Rezaei-Zadeh et al. (2014), who evaluate the importance of a set of entrepreneurial competences. Michelmore and Rowley (2010) which evidenced the wide application of entrepreneurial competences for potentializing the success of already established businesses.

Research initiatives have resulted in a vast number of identified entrepreneurial competences; however, none of the studies provide an analysis of entrepreneurial competences considering a single meta-competence framework. Therefore, although results are useful, they are difficult to tailor to new contexts in order to sustain new research initiatives, such as digital competences in specific development areas (BACIGALUPO et al., 2016). Meta-competences are defined as competences that are generic and overarching (CHEETHAM; CHIVERS, 1996), and as higher-order competences with the ability to understand the current context and to acquire new competences (BHARWANI; TALIB, 2017).

Despite the available literature on entrepreneurial competences, there is a lack of prioritization, clustering and classifying towards a unique framework. The present study aims to narrow the identified gap by answering the following research questions: (RQ#1) What are the entrepreneurial competences (identified by which authors and in which journals)? (RQ#2) How can entrepreneurial competences be clustered and classified?

To answer these questions, a systematic literature review approach was applied (PRET; COGAN, 2019; THOMASSEN et al., 2019), using quantitative (bibliometric, network, cross-tabulation and core-periphery analysis) and qualitative content analysis, with a detailed coding schema. This research contributes to the literature by presenting an extended list of relevant entrepreneurial competences and a coding

scheme, identified from the relevant publications, and analyzed and clustered in accordance with the selected meta-competences framework. In conclusion, this study identified a list of 98 entrepreneurial competences. Then, with the application of the cross-tabulation with core-periphery, this study identified the 33 most relevant core entrepreneurial competences, clustered into nine subgroups based on affinity diagram group dynamics, which were then grouped into the final four meta-competences clusters (Personal and Behavioral - PBMC, Functional - FMC, Knowledge and Cognitive - KCMC and Values and Ethical - VEMC).

This paper has six main sections. This Section One presented the research scenario and highlights its relevance and main objectives. Section Two presents the literature review. Section Three presents the research methodology in detail. Section Four describes the results. Section Five analyzes these results in a discussion, and Section Six concludes this study.

2 LITERATURE REVIEW

The literature covers a number of pertinent concepts regarding entrepreneurship. In this section, definitions of entrepreneurship, competences, entrepreneurial competences, and meta-competences are presented to lay the foundations of this research.

2.1 Entrepreneurship

Schumpeter (1934) defines entrepreneurship as a set of behaviors that raises and manages economic resources to create value. Currently, research on entrepreneurship is evolving significantly and its theoretical foundations are being reformulated (MOOG et al., 2015). According to research, initiatives where participants have balanced, diverse skills and form multidisciplinary teams working in in complementary and motivational environments result in higher entrepreneurial intention, since participants can balance working times and have constant contact with relevant peers (LAZEAR et al., 2005; MOOG et al., 2015). Entrepreneurs are recognized as having the capacity to assume risks (LAZEAR et al., 2005) and, to improve its effectiveness, entrepreneurship is stimulated as a planned and intentional behavior (HERRON; ROBINSON, 1993; MICHELMORE; ROWLEY, 2010; SÁNCHEZ, 2011). Entrepreneurship learning involves experimentation, action, and reflection (EGGERS; LOVELACE; KRAFT, 2017), and students that participate in educational entrepreneurial programs explicitly perceive benefits (SÁNCHEZ, 2011). Economists and policymakers generally defend that higher level of entrepreneurship conduct to better levels of innovation and economic growth (SÁNCHEZ, 2013). This reinforces the importance of improving educational entrepreneurship programs to stimulate the development of the desired entrepreneurial competences (THOMAS; MUELLER, 2000).

2.2 Competence

Competences are high-level abilities that align skills, knowledge, and personal characteristics to allow the entrepreneurs to perform different and complex tasks successfully (MAN; LAU; CHAN, 2002). A new venture demands the entrepreneurs to have a broad combination of different entrepreneurial competences in order to create value, especially in the early stages of development, and requires the combination of

tangible and intangible resources (RASMUSSEN; MOSEY; WRIGHT, 2011). According to Rezaei-Zadeh et al. (2017) and Sánchez (2011), it is possible to conclude that entrepreneurial competences can be classified in three main categories:

- **Personal traits/attributes** – inherent characteristics or qualities of an individual, competences that the individual was born with;
- **Abilities/skills** – the expertise to do something well, the competences that the individual develop by constant practices;
- **Experience/knowledge** – including having the information, ability and capability, acquired through educational initiatives, practical contacts or even from the observation of relevant events.

2.3 Entrepreneurial Competences

Several studies aim to consolidate the definitions of entrepreneurial competences, proposing frameworks and models that identify a great diversity of related entrepreneurial competences considered necessary to become a successful entrepreneur (MICHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014). However, because of their empirical foundations, the biggest challenge concerning these models is how to test their capacity to predict future outcomes (BYGRAVE; HOFER, 1992). Entrepreneurial competences can be defined from different perspectives and, consequently, definitions have different meanings and interpretations (MICHELMORE; ROWLEY, 2010). In common, entrepreneurial competences are defined as characteristics or abilities that enable appropriate entrepreneurial behavior, including opportunity identification and the capability to sustain business development (BOYATZIS, 1982). Scholars differentiate entrepreneurial and managerial competences, suggesting the former results in better evaluations of opportunities, better strategy formulation, and the identification of critical and valuable resources (HOFER; SANDBERG, 1987; TIMMONS et al., 1987; HERRON; ROBINSON, 1993; VENKATARAMAN, 2000; MAN; LAU; CHAN, 2002; MICHELMORE; ROWLEY, 2010).

Many authors evidence the relationships between entrepreneurial competences, skills and behaviors, and venture success. Entrepreneurial competences are recognized as very relevant to business success and growth and as assisting in the development of

sustainable business models (BIRD, 1995; MICHELMORE; ROWLEY, 2010; SÁNCHEZ, 2011; REZAEI-ZADEH et al., 2014). These entrepreneurial competences are also identified as sets of skills that are required for entrepreneurs to transform their ideas into profitable ventures (BYGRAVE; HOFER, 1992; LAZEAR et al., 2005), influencing business performance (HERRON; ROBINSON, 1993; MICHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014). Research initiatives also analyze the importance of personal characteristics for entrepreneurial success (KORUNKA et al. 2003). Consequently, entrepreneurial competence research can be classified into two complementary perspectives: the first analyzes personal entrepreneurial competences that are essential for entrepreneurial success, and the second that aims to identify the entrepreneurial competences needed for the development of sustainable business models (REZAEI-ZADEH et al., 2014).

Regarding the most suitable personal entrepreneurial competences, in particular, research evidences that entrepreneurs with more action-oriented behavior perform better (KORUNKA et al., 2003). In addition, as the creation of a new venture is a complex task, a combination of individual complementary competences leads to better results than having one or more highly specialized competences (LAZEAR et al., 2005; OBSCHONKA et al., 2013). Having an entrepreneurial mindset is a determinant for success (MAN; LAU; CHAN, 2002; OBSCHONKA et al., 2013; ESPÍRITU-OLMOS; SASTRE-CASTILLO, 2015).

However, it should be noted that, although entrepreneurial competences have been researched since the 1990s (HERRON; ROBINSON, 1993; BIRD, 1995), there is, yet, no consensus on which entrepreneurial competences are specifically associated with business success (REZAEI-ZADEH et al., 2014). This is a remarkable gap in knowledge and could be a suitable area for future studies. It would also be relevant to compare the results of entrepreneurial research undertaken in different cultures (THOMAS; MUELLER, 2000). In addition, Moog et al. (2015) highlight the relevance of developing future research initiatives that simultaneously analyze quantitatively and qualitatively different combinations of skills and behaviors.

2.4 Meta-Competences

Meta-competences are all-embracing competences, those that are relevant to a wide range of work settings, and that facilitate adaptation and flexibility on the part of the

organization (OXFORD, 2018). They are generic and overarching (i.e., common to all occupations and spanning all other competences), promote the development of other competences (CHEETHAM; CHIVERS, 1996), include the ability to communicate, to critically engage, reflect and integrate, to conduct research (NURIUS, 2016), and to incorporate different intelligences, such as academic, emotional, analytical, creative, and personal (HARDEN et al., 1999).

Meta-competences are higher-order abilities, which are to do with being able to learn, adapt, anticipate, and create, (BROWN, 1993), recognized as professional qualities performed by specialized professionals (KEARNEY, 2005), including relationships, self-development, analysis, and judgment (TALBOT, 2004).

Meta-competence development can foster career self-management from identifying growth (the way the person views him or herself in the career work role) and increased adaptability (LO PRESTI, 2009). In this scenario, career building in information societies benefit with adaptability and vocational identity, which, together, give individuals a sense of when it is time to change and the capacity to change (PORFELI; SAVICKAS, 2012; BHARWANI; TALIB, 2017).

Different categories of meta-competences have been identified, including learning (KOTZAB et al., 2018), self-awareness and flexibility (approaches to learning), engagement, respect, and empathy (for relationships), being able to self-direct and take risks (for leadership), the ability to conceptualize political and systemic issues (as critical thinking), quick thinking (for communication), and commitment to social justice (for ethics) (REGEHR et al., 2012). Meta-competences are also sets of competences and skills that can be applied effectively and constructively to manage different types of normative conflicts (COLEMAN, 2018).

The search in the literature also revealed a convergent set of entrepreneurial meta-competences, defined similarly by Graham Cheetham and Chivers (1996), Le Deist and Winterton (2005), Uhlenbrook and Jong (2012), Kotzab et al. (2018), Cha and Maytorena-Sanchez (2019), and Yazdani and Yadollahi (2019), including:

5. **Personal and Behavioral Meta-Competence (PBMC)** - the ability to adopt appropriate behaviors during the creation of the new venture, including self-confidence, control of emotions, listening, objectivity, sensitivity to peers, conformity to professional norms, etc.;

6. **Functional Meta-Competence (FMC)** - the ability to perform different business-related tasks to effectively produce context-related outcomes in order to be successful in the creation and deployment of the new venture;
7. **Knowledge and Cognitive Meta-Competence (KCMC)** - mastering appropriate business-related knowledge and the ability to apply this knowledge in practice, including theoretical and technical knowledge of the business field, tacit knowledge about the new venture, procedural knowledge of finance, project management, and contextual knowledge about the environment in which the new venture will be created;
8. **Values and Ethical Meta-Competence (VEMC)** - the possession of appropriate professional values and the ability to make sound judgments, e.g., the adherence to laws, social/moral sensitivity, confidentiality, etc.

3 RESEARCH DESIGN

In order to achieve the research objectives, the study searched to identify the most relevant entrepreneurial competences from the literature, considering the five main phases of a systematic literature review: bibliometric, network, cross-tabulation, core-periphery and content analysis. The study also developed a classification of entrepreneurial competences considering affinity diagram group dynamics and entrepreneurial meta-competences.

To discover the state of the art about entrepreneurial competences and to evidence their most relevant definitions obtained from indexed publications, this research conducted a systematic literature review (KRAUS et al., 2019; SILVA et al., 2019) (HÄGG; GABRIELSSON, 2019; KORBER; MCNAUGHTON, 2018; SILVA; GHEZZI; AGUIAR; CORTIMIGLIA; TEN CATEN, 2019) , including distinct methods that are complementary and applied in combination to improve the relevance of the results (CARVALHO; FLEURY; LOPES, 2013). A systematic literature review synthesizes results gained from high-quality publications and relevant studies of a research area. It also evidences the state of the art and the emerging trends of a particular field, whilst showing research limitations and gaps (SARKA; IPSEN, 2017). For Whetten (1989), a systematic literature review maps a topic landscape that authors should include, evidencing different and validated factors for the essential refinement of the research topic over time, and challenging existing knowledge. Corley and Gioia (2011) corroborate with this, proposing that all theoretical contribution should be original and useful. Developing a systematic literature review and a bibliometric analysis in combination improve the results of a study (CHEN et al., 2017).

A content analysis supports the comparison between groups, allowing the identification of similarities, differences, and frequencies of distinct subjects (PAULSON; O'GUINN, 2012). A Network analysis contributes to the understanding of data obtained from different publications databases (TAKEY; CARVALHO, 2016). A bibliometric analysis initiates the identification of the most cited papers and identifies major research trends, evidencing the specificities and challenges of a research area (CHEN et al., 2017).

3.1 Data Collection

For this research, the considered subjects' sample and procedures are as follows. Research initiatives investigated only publications from two databases: ISI – Web of Science (WoS) and Scopus. The WoS database was selected because it incorporates indexed journals with the relevant impact factor, Journal Citation Report (JCR), and Scopus database was selected because it has the world's largest number of peer-reviewed publications.

Competences are usually defined as individual combinations of knowledge, skills and attitudes, and are also associated with abilities such as acting, mobilizing, integrating, learning, engaging, taking responsibility, and having strategic vision (FLEURY; FLEURY, 2001). For this reason, and, aligned with the considerations from Sánchez (2011) and Rezaei-Zadeh et al. (2017), this paper search included the words "entreprene*" AND "skill*" OR "entreprene*" AND "competence*" OR "entreprene*" AND "abilit*", aiming to identify publications related to entrepreneurial competences. The symbol * allows broadening the search for different related words as entreprene* can search for entrepreneurship and entrepreneur. WoS and Scopus does not have the same filter field options. We searched in the Scopus database using the option "title, abstract, keywords", and in the WoS the option "topic" that is the most similar option in this database. The initial search in the WoS resulted in 8,788 publications. Filtering the results by considering "only articles and reviews", the results were refined to 5,419 publications. The application of the filter "fields of interest" (management OR business OR engineering civil OR engineering industrial OR engineering multidisciplinary OR engineering biomedical OR engineering electrical electronic OR engineering environmental OR engineering manufacturing OR metallurgy metallurgical engineering OR computer science software engineering) resulted in 2,549 relevant papers. The same search process was conducted in the Scopus database, initially resulting in 4,121 publications, which were reduced to 3,013 records after filtering to consider "only articles and reviews". After the application of the filter "only publications from the interest field" (business, management and accounting OR engineering OR chemical engineering), the final sample was reduced to 1,832 papers. The search was conducted to include publication until the end of 2019.

Therefore, the initial database included 4,381 papers from Scopus and WoS and 770 were identified as duplicates, resulting in a final database of 3,611 publications. These

papers had their title, keywords and abstract read and analyzed qualitatively, in order to identify only publications related to the definition and mapping of entrepreneurial competences. Based on this analysis papers related to cultural influences in career, entrepreneurs' access to loans, the role of women as entrepreneurs, and others subjects were withdrawn. This resulted in 109 relevant publications. It is important to highlight that, when the systematic literature review enters the screening phase, despite the explicit inclusion and exclusion criteria, there is always the researcher bias in this process. The researchers performed the screening process individually, then, only excluding the papers that all researchers agreed. Similar bias occurs in the qualitative stage of content analysis when the codification process demands much discussion among researchers on the analysis towards a consensus on the coding schema and classifications.

Thus, despite the sampling process can be replicated, the decision-making performed by the researchers during the whole project cannot be replicated, as acknowledged by the literature (DURIAU et al., 2007; MAYRING, 2008; SEURING; GOLD, 2012).

The publications with more impact were fully analyzed, considering its Impact Factor (IF), calculated with the application of the formula suggested by Carvalho, Fleury and Lopes (2013). Where IF is equal the number of citations multiplied for the impact factor of the journal, considering the Journal Citation Report (JCR), plus one.

3.2 Data Analysis

To answer the research questions (RQs), different methods were applied, see Table 1. To answer RQ#1, first bibliometrics analysis was applied. Initially, in order to map the sample, the number of publications per year and per journal was analyzed. Then, network analysis was applied. The sample was used to construct four networks: co-authorship, co-citations, co-authorship-country, and keywords. To assist in the construction of the network analysis, the software VOSviewer 1.6.6 was used to develop and to visualize the networks, and NetDraw (BORGATTI; EVERETT; FREEMAN, 2002) was used to visualize and to edit the networks.

Then, RQ#2 was answered using the inputs gathered during the analysis of RQ#1, particularly that of the coding scheme. For entrepreneurial competences, a detailed coding scheme for content analysis was defined as suggested by Carvalho, Fleury,

and Lopes (2013), applying a mix of a deductive approach based on the theoretical background and insights of bibliometrics.

Table 1 - Research questions, methods, and softwares

#	Research Question	Method	Software
RQ#1	What are the entrepreneurial competences (identified by which authors and in which journals)?	Bibliometrics and Network Analysis Coding scheme	Minitab, Excel VOSViewer
RQ#2	How can entrepreneurial competences be prioritized, clustered and classified?	Cross-tabulation Core-periphery analysis Network analysis Content analysis Affinity diagram group dynamics	Ucinet, NetDraw, IBM SPSS

Source: Authors.

This analysis results in Appendix A, where is presented the final list of the entrepreneurial competence gathered in the literature, evidencing a code to the entrepreneurial competence, the name of the entrepreneurial competence, the references where the entrepreneurial competence where identified and the subgroup of the entrepreneurial competences, better explained in the next chapters.

The first step for answering the RQ#2 towards the meta-competences included a cross-tabulation analysis of entrepreneurial competences codes, aiming to associate objects and attributes (HAIR et al., 2009), applying the IBM SPSS software. In order to prioritize the core entrepreneurial competences, the categorical core-periphery analysis was performed, which uses a genetic algorithm to fit a core/periphery model and identify the core membership codes (BORGATTI; EVERETT, 1999). Then, to understand the relationships between codes, a network based on the cross-tabulation data was performed in Netdraw software (BORGATTI; EVERETT; FREEMAN, 2002). The final step was a qualitative content analysis on the coding scheme, applying a diagram of affinities for clustering the codes in meta-competences, resulting in nine clusters and four categories: personal and behavioral, functional, knowledge and cognitive, and values and ethics, subject better explained in the next topic.

4 RESULTS

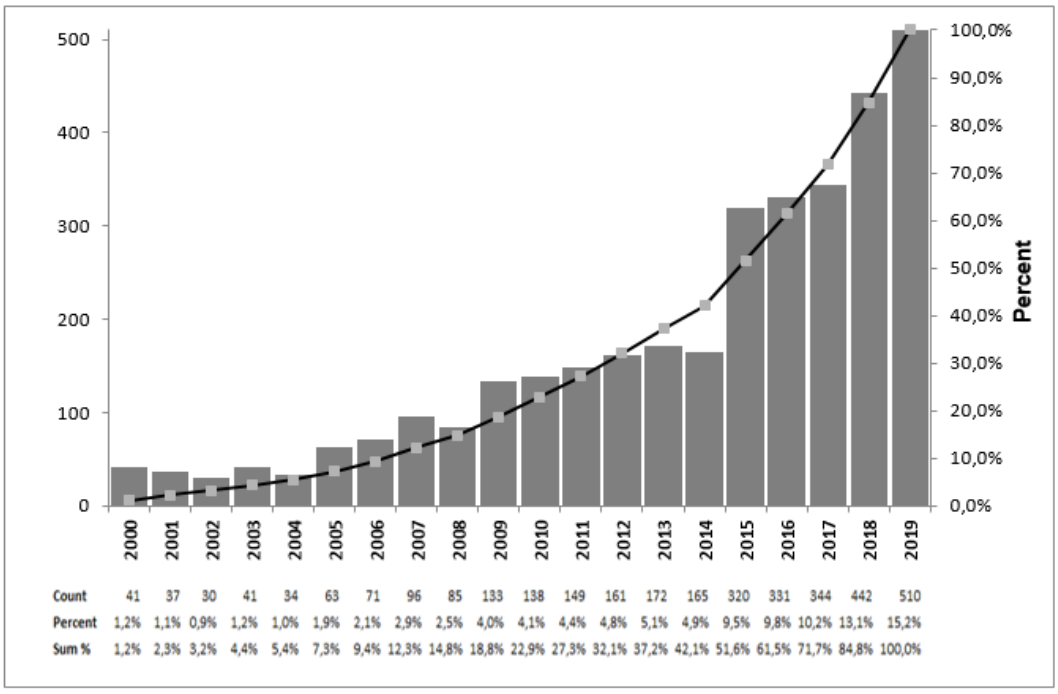
This section presents the results of the research, including a literature, a bibliometric, a network, a content analysis and a proposition of the entrepreneurial competences classification. The application of all methods assists in the better understanding of what has been published on the subject concerning entrepreneurial competences, evidencing the state of the art, and leading to the development of standards and the theoretical foundation of entrepreneurial competences. This results in the entrepreneurial competences final classification.

4.1 Bibliometric Analysis

In the search to identify the state of the art concerning entrepreneurial competences, this study made some relevant discoveries. Research concerning entrepreneurial competences is increasing, especially before 2015. Aligned with this finding, it can be observed that few authors have more than one publication on the subject, evidencing its newness as an area of study.

Figure 1 presents the evolution of the number of publications on the theme per year, and shows increase since 2015, representing more than 50% of the field publications.

Figure 1 - Evolution of publications in entrepreneurial competences (*)



* Based on the final database of 3,611 publications; publications before the year of 2000 totalized 248 publications and were withdraw for better visualization.

Journals with more published articles on entrepreneurial competences are the Journal of Business Venturing (6,1%), Small Business Economics (5,3%), International Entrepreneurship and Management Journal (2%), Entrepreneurship and Regional Development (1,9%) and International Small Business Journal-Researching Entrepreneurship (1,9%) all relevant and very reputable journals.

4.2 Network Analysis

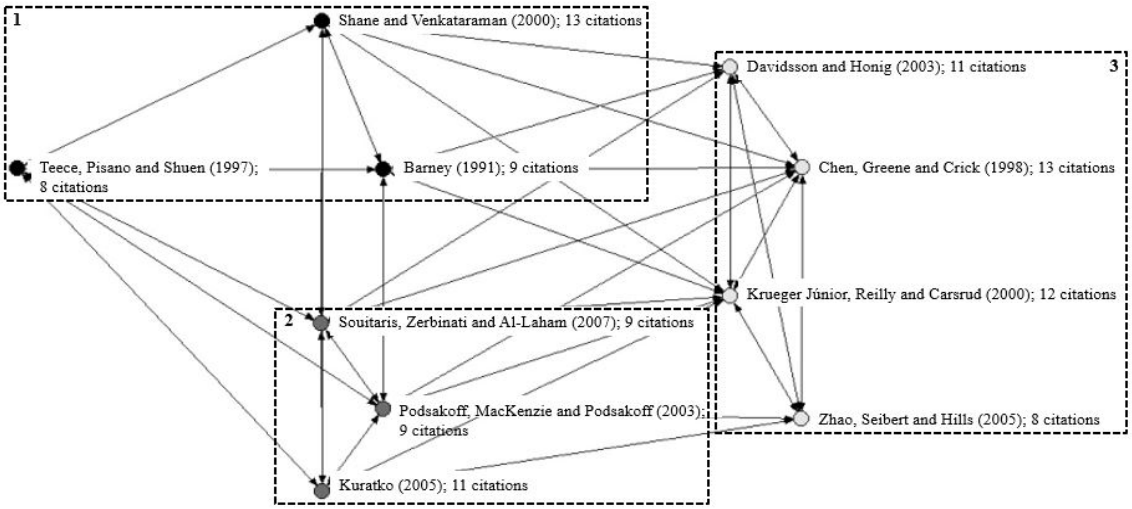
The first phase of the network analysis resulted in the co-authorship network, see Figure 2, including a sample of 243 different authors, but with only four authors having at least two publications, evidencing a lack of consolidation of this research area. The first author, Baron, presents 652 citations in four different publications, establishing the relationship between entrepreneurs' success and: social skills (BARON; MARKMAN, 2000); financial success (BARON; MARKMAN, 2003); behavioral and cognitive factors (BARON, 2007); and cognitive science implications (BARON; HENRY, 2010). The second author, Markman, had 468 citations and four publications: Baron and Markman (2000) and Baron and Markman (2003), both articles previously presented. The third author is Turró, with seven citations and two publications: Turró, López, and Urbano (2013) and Urbano, Alvarez and Turró (2013), both papers about resource-based theories and entrepreneurship. Finally, Kucel had one citation and two publications: Kucel and Vilalta-Bufi (2016) with an analysis of entrepreneurial skills also benefiting self-employment, and Kucel and Teodoro (2017) with a paper on occupation choices based on skills.

Figure 2 - Co-authorship network, for authors with more than two publications

Source: Output from Software VOSviewer 1.6.6 and NetDraw

The co-citation network evidenced 5,152 different citations and, to potentialize its relevance, only articles with at least eight citations were considered, improving the graphical visualization. Figure 3 presents the results of the ten most relevant publications.

Figure 3 - Co-citation network



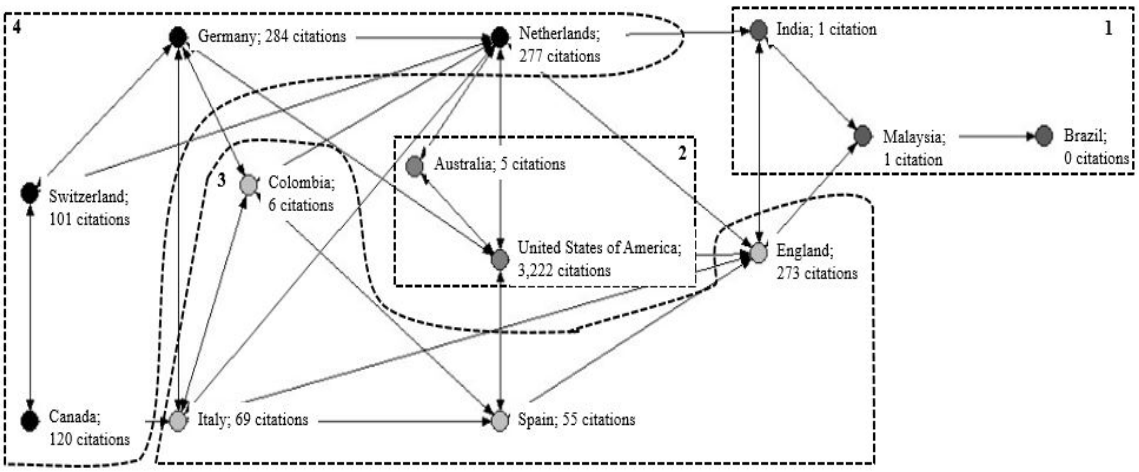
Source: Output from Software VOSviewer 1.6.6 and NetDraw.

The co-citation network presented in Figure 3 shows three different clusters. The cluster one, black cluster, includes Teece, Pisano, and Shuen (1997), Barney (1991), and Shane and Venkataraman (2000), with articles about strategic management for competitive advantage, firm sources for competitive advantage, and entrepreneurship as a field of research, characterizing a sample from the Knowledge and Cognitive Meta-Competence (KCMC) cluster. The cluster two, dark gray cluster, includes Souitaris, Zerbinati and Al-Laham (2007), Podsakoff, MacKenzie, and Podsakoff (2003), and Kuratko (2005), and presents research results on entrepreneurship programs and entrepreneurial intention, method biases in behavioral research, and entrepreneurship education development, trends and challenges, characterizing a specific educational-related cluster. Finally, the cluster three, light gray cluster, includes Davidsson and Honig (2003), Chen, Greene, and Crick (1998), Krueger et al. (2000), and Zhao, Seibert, and Hills (2005). With articles about the role of social and human capital in nascent entrepreneurs, self-efficacy distinguishing managers from entrepreneurs, models for entrepreneur intention, and the role of self-efficacy in entrepreneurial intention, all characterizing a sample from the Personal and Behavioral Meta-Competence (PBMC) cluster. Therefore, the co-citation network analysis evidenced a first cluster related to Knowledge and Cognitive Meta-Competence (KCMC), including entrepreneurship and competitive advantage. A second cluster included articles about entrepreneurship education with a focus on intentions and behaviors. A third cluster had papers related to Personal and Behavioral Meta-

Competence (PBMC), including social and human capital and self-efficacy for the development of entrepreneurs.

The co-authorship-country network, see Figure 4, presents a sample including papers with authors from 41 different countries, of which 13 countries had at least three publications. Four main clusters can be seen. The first is composed of Brazil, India and Malaysia; the second consisting of the United States of America and Australia; the third composed of Spain, Italy, England, and Colombia; and the fourth of Germany, Netherlands, Switzerland, and Canada. The main connections are between the United States of America and England, and between the United States of America and Spain.

Figure 4 - Co-authorship-country network



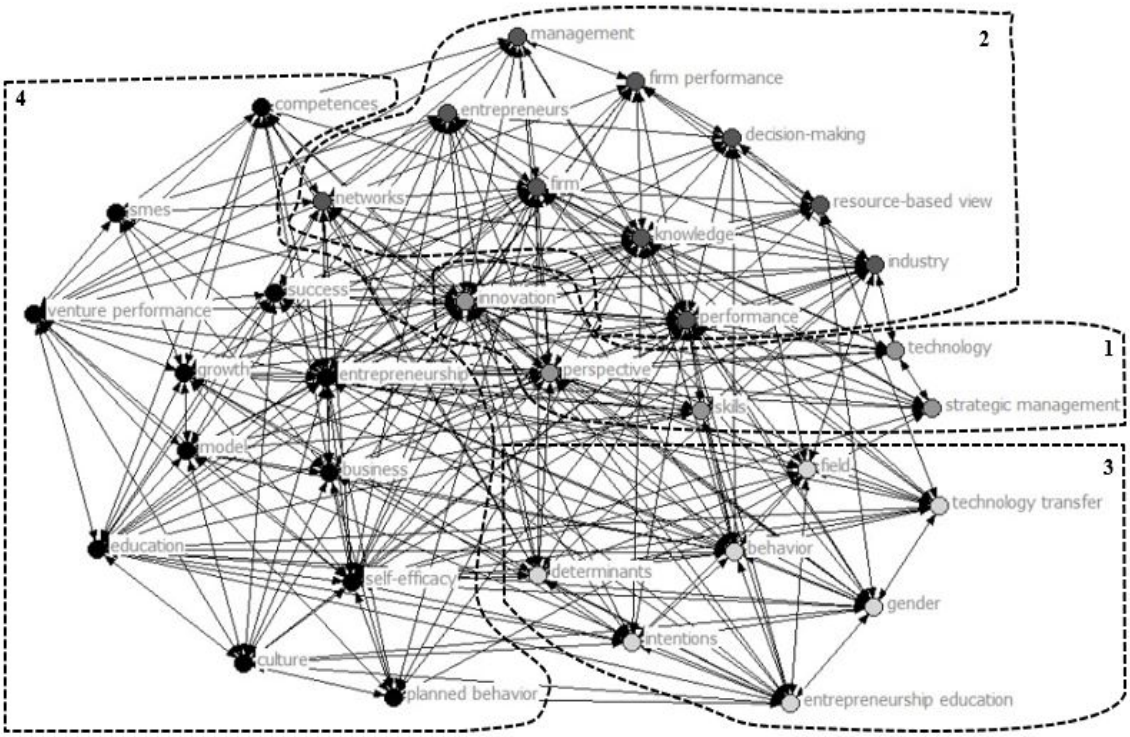
Source: Output from Software VOSviewer 1.6.6 and NetDraw.

The keywords regarding countries perhaps evidenced that the subject of entrepreneurial competences is of interest for developed and underdeveloped countries. However, the main research connections are between developed countries, indicating a lack of relevant research conducted between developed and underdeveloped countries.

Figure 5 presents the keywords network. The initial sample had 566 keywords; however, for a better visualization, only the 34 keywords with at least five mentions were selected. Four main clusters can be seen in the figure. The first cluster includes: skills, perspective, innovation, technology, and strategic management, characterizing Knowledge and Cognitive Meta-Competence (KCMC). The second cluster includes: performance, industry, knowledge, decision-making, resourced-based view, firm, firm performance, management, networks, and entrepreneurs, characterizing Functional Meta-Competences (FMC). The third cluster includes: entrepreneurship education,

intentions, gender, behavior, field, determinants, and technology transfer, characterizing Personal and Behavioral Meta-Competences (PBMC). Finally, the fourth cluster consists of: planned behavior, culture, education, model, self-efficacy, business, success, entrepreneurship, growth, venture performance, SMEs, characterizing Values and Ethical Meta-Competences (VEMC). The main connections are between knowledge and performance, innovation and entrepreneurship, firm and performance, firm and entrepreneurship, and innovation and performance.

Figure 5 - Keywords network



Source: Output from Software VOSviewer 1.6.6 and NetDraw.

4.3 Content Analysis

The content analysis included the development of a coding scheme and a literature review that resulted in the final list of entrepreneurial competences. All the sample, 109 articles, had their title, abstract and keywords analyzed and fully read as required, in the search to develop a coding scheme to illustrate the Conceptual Research approach (CR), the Empirical Research approach (ER) and the Level of Analysis (LA) regarding entrepreneurial competences.

Table 2 present the results obtained with the application of the coding scheme. Almost half of the sample (51, 46,8%) is composed of publications that aimed to investigate

Competence Lists (LA2) and, for this, almost half the researchers conducted Surveys (ER1 – 45, 41,3%), and 33% developed Case Studies (ER2 – 36, 33%).

Table 2 – Cross-tabulation of the coding scheme applied in the content analysis*

	CR1 Literature review	CR2 Simulation theoretical conceptual	ER1 Survey	ER2 Case study	ER3 Experts panel	ER4 Experiments	ER5 Interviews	Total
LA1 Entrepreneurship education evaluation	**1**	**0**	**6**	**11**	**0**	**1**	**1**	**20**
LA2 Competences list	**10**	**1**	**22**	**13**	**0**	**2**	**3**	**51**
LA3 Entrepreneurial intention	**4**	**0**	**9**	**4**	**1**	**0**	**0**	**18**
LA4 Business performance or business success	**4**	**0**	**8**	**8**	**0**	**0**	**0**	**20**
Total	**19**	**1**	**45**	**36**	**1**	**3**	**4**	**109**

(*):
CR: Conceptual Research approach
ER: Empirical Research approach
LA: Level of Analysis

4.4 Entrepreneurial Competences Classification

From the content analysis, reading and qualitatively analyzing the papers in the search of entrepreneurial competences resulted in an initial list of 130 entrepreneurial competences. However, some of these entrepreneurial competences were redundant, because they had the same meaning, but were written in a slightly different way and were discarded. This screening of the competence list led to a consolidated list of 98 entrepreneurial competences that were then coded for further analysis.

The list of the 98 entrepreneurial competences identified, their codes and the traceability to the literature surveyed is presented in Appendix A.

After this, both a quantitative and qualitative analysis was employed towards a competence classification.

4.5 Quantitative Analysis

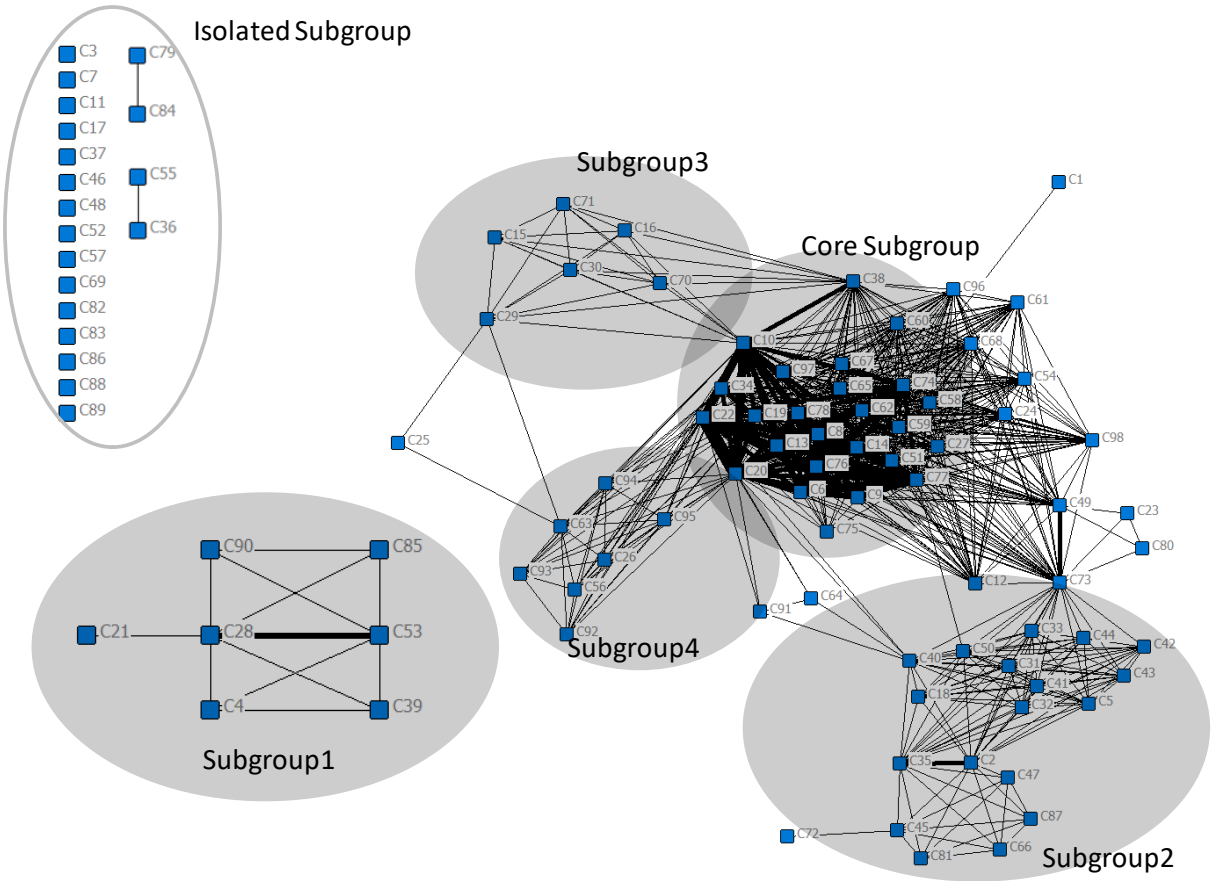
A cross-tabulation of the entrepreneurial competences list was performed to identify the most relevant relationships between them, as shown in Appendix A. This analysis was the input for the core-periphery analysis of the competence coding scheme that led to the identification the 33 most relevant core entrepreneurial competences, see Table 3, based on the 98 entrepreneurial competences identified before, with the output of the core/periphery analysis with a fit of 0.8221. This also resulted in subgroups of competences, see Figure 6.

Table 3 – The most relevant core entrepreneurial competences

Core Entrepreneurial Competence	Code	Core Entrepreneurial Competence	Code
Openness to experience	C6	Goal-driven and goal-setting	C54
Emotional stability	C8	Need for power	C58
Resistance to stress	C9	Need for dominance	C59
Internal locus of control	C10	Self-confidence	C60
Sobriety	C12	Self-esteem	C61
Need for achievement	C13	Self-reliance	C62
Passion	C14	Decision-making	C65
Proactiveness	C19	Integrity	C67
Risk-taking propensity	C20	Norm orientation	C68
Innovativeness	C22	Previous contact with venture capitalists	C73
Creativity	C24	Being autonomous	C75
Originality	C27	Disagreeableness	C76
Look for products that provide real benefit	C34	Conscientiousness	C77
Social abilities	C38	Extraversion	C78
Belief in effect of personal effort on outcomes	C49	Protestant work ethic beliefs	C97
Persistence	C51	Tenacy	C98

Source: Authors.

Figure 6 - Core entrepreneurial competences subgroups



Note: Adapted from the content analysis data using the UCINET software.

In the core entrepreneurial competences subgroup, the entrepreneurial competences codes are well connected. Furthermore, this core subgroup is connected with the subgroup 2, 3 and 4. Nevertheless, subgroup 1 is disconnected from the others.

It is worth noting that various entrepreneurial competences appear isolated (IC) in the network. In addition, some entrepreneurial competences are between the subgroups (IS), helping in the connection, such as C25, which links subgroups 3 and 4.

These analyses are an aid in identifying the topics that have been well addressed in the literature and in exploring the relationships between these entrepreneurial competences. In a complementary way, it shows the entrepreneurial competences that are, as yet, still poorly addressed and their relationships with others that remain under-explored.

4.6 Qualitative Analysis

The quantitative analysis was the start point to the creation of an entrepreneurial competence classification analyzed qualitatively. All the entrepreneurial competences

were analyzed in depth, and a new qualitatively clustering process was applied, based on affinity diagram group dynamics, as detailed in Table 4, resulting in nine competences clusters. The clusters of entrepreneurial competences are also classified in the meta-competences.

Table 4 – The framework of meta competences, aligned with competence clusters and identified single entrepreneurial competences

Meta-Competence	**Competence Cluster**	**Individual Entrepreneurial Competences**
Personal and Behavioral (PBMC)	Learn with feedbacks	C1, C3, C4, C88
	Flexible emotional stability	C6, C7, C8, C9, C10, C11, C12, C77, C97, C98
	Business passion	C14, C15, C16, C17, C18, C19
	Leadership and Communication	C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C79, C89, C90, C91, C71, C72, C5, C46, C81, C68, C78, C82
	Ambition	C57, C58, C83, C13, C2
Functional (FMC)	Strategic foresight	C28, C29, C30, C31, C32, C33, C34, C64, C63
	Facing innovation challenges	C20, C21, C22, C23, C24, C25, C26, C27, C73, C74, C75, C80, C84, C85, C92, C93
Knowledge and Cognitive (KCMC)	Market forecasting	C45, C47, C55, C56, C67, C69, C70, C76, C86, C87, C94, C95
Values and Ethical (VEMC)	Self-confidence with optimism	C48, C49, C50, C51, C52, C53, C54, C59, C60, C61, C62, C65, C66, C96

Source: Authors.

5 DISCUSSION

The lack of substantial theoretical foundation was identified as the main challenge to be tackled by researchers focused in entrepreneurial competences (BYGRAVE; HOFER, 1992; THOMAS; MUELLER, 2000), specially because more diverse and balanced entrepreneurial competences contribute to the creation and development of more sustainable business models (BIRD, 1995; MITCHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2011).

In this scenario, the first effort of this paper was to answer (RQ#1) What are the entrepreneurial competences (identified by which authors and in which journals)? And for that a systematic literature review, with qualitative and quantitative analysis were performed, allowing the identification of 130 competences, that were clustered withdrawing the similarities into 98 competences, see Appendix A, being also possible to identify the existence of 33 most relevant core entrepreneurial competences, presented in the quantitative results topic.

Evolving in the discussion about entrepreneurial competences, and considering that meta-competences facilitate the development of entrepreneurial competences (TAJEDDINI; MUELLER, 2009) the paper aims to answer the (RQ#2) How can entrepreneurial competences be clustered and classified? A cross-tabulation of the entrepreneurial competences was performed, and from the above results, it can be observed that the entrepreneurial competences clustered into subgroups “core”, “3”, and “7”, see Appendix A, evidence proactive behaviors, which facilitate the acquisition of an open mind and a curious nature, lead to the identification of relevant business opportunities and their initial exploration, resiliently drive new ventures to desired futures, and manage any failures. These are aligned with the proposed definition for the Personal and Behavioral Meta-Competence (PBMC).

The second cohort of entrepreneurial competences, clustered subgroups “2” and “6”, see Appendix A, include customer orientation, creativity for the creation and development of innovations, facilitating communication, mastering finances, and competence management. This subset is clearly aligned with the proposed definition for the Functional Meta-Competence (FMC) as it covers abilities to perform different business-related tasks to effectively produce context-related outcomes in order to be successful in the creation and deployment of the new venture.

The third cohort of entrepreneurial competences were from subgroups “4” and “8”, see Appendix A. This cluster evidences thinking models, including critical and strategic thinking, analytical capabilities, and “intuitive”. These are closely related to the proposed definition for the Knowledge and Cognitive Meta-Competence (KCMC) because they focus on mastering relevant business knowledge and its application.

Finally, the fourth cohort includes entrepreneurial competences from subgroup “1”, see Appendix A, and evidence relevant values for an entrepreneur to succeed in the creation of his/her business. These include a long-term vision, a capability for dealing with big challenges, and learning from any failures. These entrepreneurial competences are aligned with the proposed definition for the Values and Ethical Meta-Competence (VEMC).

The results also show other entrepreneurial competences classified as Personal and Behavioral Meta-Competence (PBMC) (43%) and Functional Meta-Competence (FMC) (22%). These indicate entrepreneurial competences that are also attributed to entrepreneurial success, as the founder of a new business. Other existing entrepreneurial competences are important for entrepreneurs more generally, potentially being those acquired by partners or other leaders in the business. See Table 5.

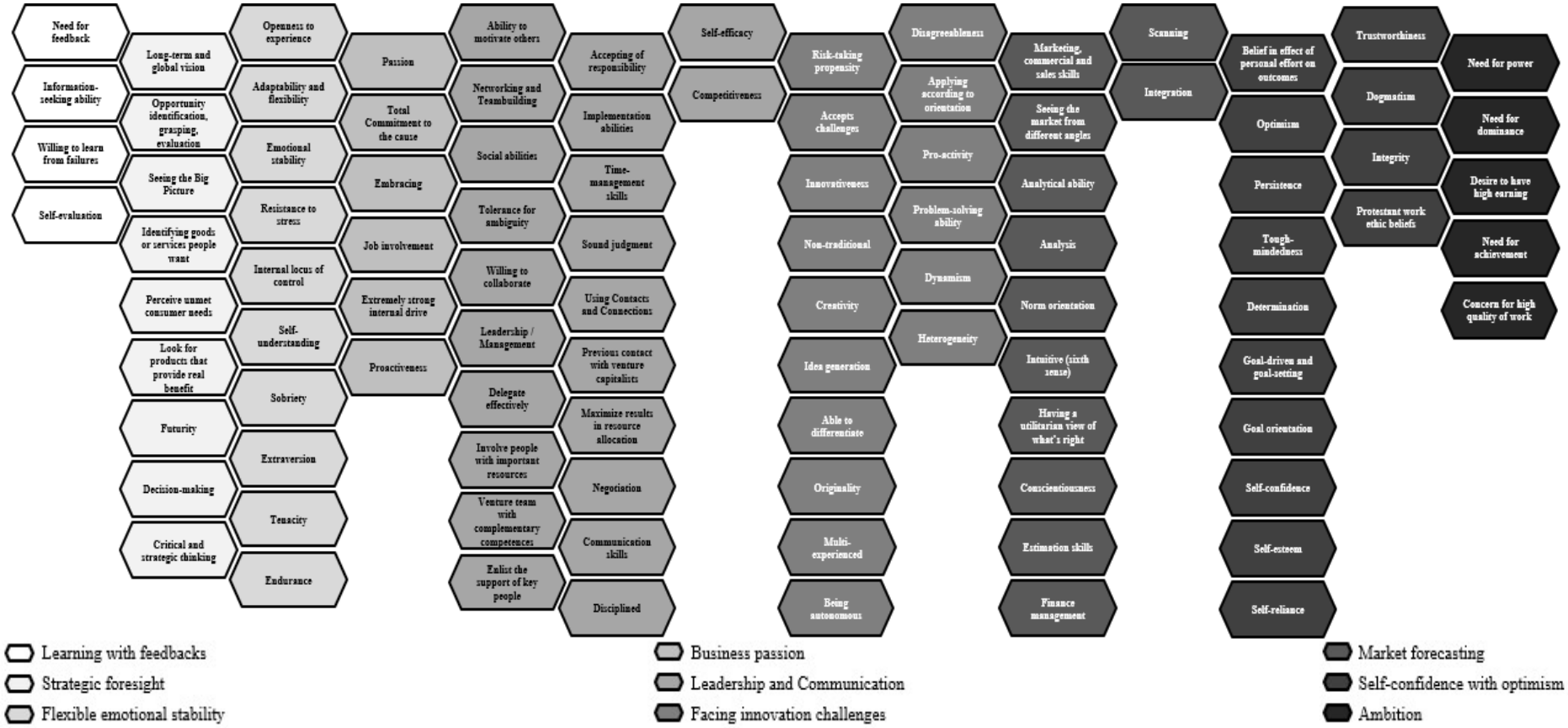
Table 5 – Entrepreneurial competences list classified according to the proposed meta-competences

Meta-Competence	**Count Meta-Competence**	**%**	**Entrepreneurial Competence Cluster**	**Count Competence**	**%**
Personal and Behavioral Meta-Competence (PBMC)	42	42,9%	Learn with feedbacks	4	4,2%
			Flexible emotional stability	10	10,2%
			Business passion	6	6,1%
			Leadership and Communication	22	22,4%
Functional Meta-Competence (FMC)	25	25,5%	Strategic foresight	9	9,2%
			Facing innovation challenges	16	16,3%
Knowledge and Cognitive Meta-Competence (KCMC)	26	26,5%	Market forecasting	12	12,2%
Values and Ethical Meta-Competence (VEMC)			Self-confidence with optimism	14	14,3%
Personal and Behavioral Meta-Competence (PBMC)	5	5,1%	Ambition	5	5,1%

Source: Authors.

It can be concluded, therefore, that the quantitative results are aligned with the proposed entrepreneurial meta-competences definitions. As a consequence, these meta-competences can be applied in future practical and theoretical initiatives. Practical initiatives include the design of entrepreneurial educational courses, balancing the development of the meta-competences while taking into account the needs of different students. In terms of theory, the framework can be used as the basis for consolidating systemic literature reviews with the aim of adding to applied research and using qualitative and quantitative approaches. Figure 7 synthesize the identified main entrepreneurial competences and details about each entrepreneurial competence are described in the Appendix A.

Figure 7 - Illustration of the main entrepreneurial competences



The clear identification of clusters of competences, realized in the form of meta-competences, evidences relevant foundations for supporting new actions to improve the process of forming entrepreneurs.

Entrepreneurship education is increasingly based on digital experiences (TONIOLO et al., 2020), so the creation of clusters of meta-competences circumscribes domains that can be used by natural and artificial intelligence algorithms in order to recognize potential entrepreneurs, considering their trajectories in the digital innovation ecosystems (BELIAEVA et al., 2019).

Meta-competences also generate new designs for entrepreneurship training initiatives considering their four main areas. The first area, Knowledge and Cognitive Meta-Competence (KCMC), includes the comprehension of the environment and the development of analytical and critical strategic visions of the future considering possible and profitable opportunities (RAE, 2012). The second area, Functional Meta-Competence (FMC), provides directions for the development of innovations considering technological trends and changing markets (MONLLOR; SOTO-SIMEONE, 2019). The third area, Personal and Behavioral Meta-Competence (PBMC), promotes the formation of entrepreneurs considering aspects such as curiosity and resilience throughout their trajectory (GROSS; GEIGER, 2017; MONTICELLI; BERNARDON; TREZ, 2018). Finally, in the fourth area, Values and Ethical Meta-Competences (VEMC), the identification, prioritization, and communication of values and principles, previously aligned with the different involved stakeholders, promote entrepreneurial behaviors that are sustainable considering the ethics of entrepreneurship (WARREN; SMITH, 2015). Therefore, their balanced combination can result in instructional designs that are capable of guiding future entrepreneurs towards their successful initiatives.

Learning processes formulated with a view to the gradual development of the different competences that consolidate meta-competence clusters strengthen leadership roles, as well as practices focused on improving the entrepreneurial climate (TAN; SMYRNIOS; XIONG, 2014). Considering the new educational contexts, these learning trails can benefit from the new possibilities of digital education and expand traditional classroom contexts (SECUNDO et al., 2017). Finally, learning trails based on meta-competences strengthen the design of pre-incubation programs, with focus on the

continuous improvement of entrepreneurs considering the results obtained by their ventures (MUNGILA HILLEMANE; SATYANARAYANA; CHANDRASHEKAR, 2019).

The search to identify a list of the entrepreneurial competences started with the read of the papers, allows identifying 130 entrepreneurial competences, withdrawing the synonyms, only 98 different competences remained. Then, with the application of the cross-tabulation with core-periphery was possible to identify the 33 most relevant core entrepreneurial competences, clustered into nine clusters, which could be grouped into the four different meta-competences.

6 CONCLUSIONS

This article contributed to the literature in two folds. First, the research identified with an in-depth literature review 98 entrepreneurial competences, and among these entrepreneurial competences, 33 are considered core and achieved more consensus in the literature. These entrepreneurial competences list considered the most relevant publications, in the field, and can subsidize future studies, considering different time perspectives and cultures, allowing the development of comparisons, involving different realities considering the same framework.

Second, a framework of meta-competences is presented that highlights four main meta-competences. Personal and Behavioral Meta-Competence (PBMC) related to the ability to adopt appropriate behaviors during the creation of new ventures. Functional Meta-Competence (FMC), associated to the ability to perform different business tasks to produce effective outcomes. Knowledge and Cognitive Meta-Competence (KCMC), related to having the appropriate business knowledge and the ability to apply it. Values and Ethical Meta-Competence (VEMC), associated to the possessing professional values and the ability to make sound judgments. This framework is built on 98 identified entrepreneurial competences grouped in nine clustered linked with the meta-competences, by the software UCINET, as follows: learn with feedbacks, strategic foresight, flexible emotional stability, business passion, leadership, and communication, facing innovation challenges, market forecasting, self-confidence with optimism, and ambition.

In this scenario, the outcomes of this study contribute for the understanding of the state of the art about entrepreneurial competences, and considering that entrepreneurial competences can be learned, obtained results can promote better educational initiatives, improve business performance, and conducts to the new venture's success. This study has implications for practice once the identification of entrepreneurial meta-competences contributed to the assessment of entrepreneurial competences and help to design the evolutionary pathway for developing meta-competences. The framework also assists entrepreneurs, policy makers and corporations that are interested in the development of entrepreneurial competences since it creates the initial foundations of what need to be developed, being of relevance for organizations that consider economic growth, because of entrepreneurial success. Moreover, incubators, accelerators (SANSONE et al., 2020) and other actors of the entrepreneurial

ecosystem (e.g., corporations, Business Angels, etc) can use this framework to foster the entrepreneurial competences of their employees to assist the entrepreneurs supported by them, also being useful to assist in the entrepreneurs' evolution.

As a limitation, this study focused only in entrepreneurial competences that influence entrepreneurial intentions. Factors such as culture, which can also influence entrepreneurial intentions, should be explored in future research initiatives. Another limitation is that only two databases were used in the construction of the final list of entrepreneurial competences, meta-competences and clusters of entrepreneurial competences. The categorization of the entrepreneurial competences into the cluster entrepreneurial competences framework since this is an interpretative process, is also a limitation. Future research initiatives include the application of the framework of meta-competences in practice and the observation of these results, with a pre-test and a post-test in academic courses, besides the need of more in deep studies related to entrepreneurial intention. It would also be, of interest to analyze the evolution of entrepreneurial competences against a successful business venture.

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APPENDICES

Appendix A: The list of entrepreneurial competences gathered in the literature.

Code	Entrepreneurial Competences	References	Subgroup
C1	Need for feedback	Rezaei-Zadeh et al. (2017).	IS
C2	Concern for high-quality of work	Chandler and Jansen (1992); Izquierdo and Deschoolmeester (2010); Rezaei-Zadeh et al. (2017).	2
C3	Information-seeking ability	Rezaei-Zadeh et al. (2017).	IC
C4	Willing to learn from failures	Rezaei-Zadeh et al. (2017); Timmons (1979).	1
C5	Maximize results in resource allocation	Chandler and Jansen (1992).	2
C6	Openness to experience	Bacigalupo et al. (2016); Obschonka et al. (2013); Rauch and Frese (2007); Staniewski et al. (2016).	Core
C7	Adaptability and flexibility	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Tajeddini and Mueller (2009).	IS
C8	Emotional stability	Rauch and Frese (2007); Staniewski et al. (2016).	Core
C9	Resistance to stress	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Staniewski et al. (2016).	Core
C10	Internal locus of control	Miller (1983); Rauch and Frese (2007); Staniewski et al. (2016); Rezaei-Zadeh et al. (2017).	Core
C11	Self-understanding	Rezaei-Zadeh et al. (2017).	IS
C12	Sobriety	Rauch and Frese (2007).	2
C13	Need for achievement	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Staniewski et al. (2016).	Core
C14	Passion	Rauch and Frese (2007); Staniewski et al. (2016).	Core
C15	Total Commitment to the cause	Rezaei-Zadeh et al. (2017).	3
C16	Embracing	Rezaei-Zadeh et al. (2017).	3
C17	Job involvement	Rezaei-Zadeh et al. (2017).	IC
C18	Extremely strong internal drive	Chandler and Jansen (1992).	2
C19	Proactiveness	Miller (1983); Rauch and Frese (2007).	Core
C20	Risk-taking propensity	Bacigalupo et al. (2016); Hébert and Link (1988); Herron and Robinson Júnior (1993); Mill (1848); Miller (1983); Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Sánchez (2013); Staniewski et al. (2016).	Core
C21	Accepts challenges	Rezaei-Zadeh et al. (2017).	1
C22	Innovativeness	Hébert and Link (1988); Herron and Robinson Júnior (1993); Miller (1983); Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Schumpeter (1934); Staniewski et al. (2016).	Core
C23	Non-traditional	Rezaei-Zadeh et al. (2017).	IS
C24	Creativity	Bacigalupo et al. (2016); Rauch and Frese (2007); Rezaei-Zadeh et al. (2017).	Core

C25	Idea generation	Mitchelmore and Rowley (2010); Rezaei-Zadeh et al. (2017).	IS
C26	Able to differentiate	Rezaei-Zadeh et al. (2017).	4
C27	Originality	Rauch and Frese (2007).	Core
C28	Long-term and global vision	Bacigalupo et al. (2016); Rezaei-Zadeh et al. (2017); Timmons (1979).	1
C29	Opportunity identification, grasping, evaluation	Bacigalupo et al. (2016); Mitchelmore and Rowley (2010); Rezaei-Zadeh et al. (2017).	3
C30	Seeing the Big Picture	Rezaei-Zadeh et al. (2017).	3
C31	Has perspective	Chandler and Jansen (1992).	2
C32	Identifying goods or services people want	Chandler and Jansen (1992).	2
C33	Perceive unmet consumer needs	Chandler and Jansen (1992).	2
C34	Look for products that provide real benefit	Miller (1983); Rauch and Frese (2007).	Core
C35	Futurity	Bacigalupo et al. (2016); Chandler and Jansen (1992); Izquierdo and Deschoolmeester (2010); Rezaei-Zadeh et al. (2017).	2
C36	Ability to motivate others	Bacigalupo et al. (2016); Rezaei-Zadeh et al. (2017).	IC
C37	Networking and teambuilding	Rezaei-Zadeh et al. (2017).	IS
C38	Social abilities	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017).	Core
C39	Tolerance for ambiguity	Rezaei-Zadeh et al. (2017); Timmons (1979).	1
C40	Willing to collaborate	Chandler and Jansen (1992); Collins and Moore (1964); Hébert and Link (1988); Herron and Robinson Júnior (1993); Rezaei-Zadeh et al. (2017).	2
C41	Leadership/management	Chandler and Jansen (1992).	2
C42	Delegate effectively	Chandler and Jansen (1992).	2
C43	Involve people with important resources	Chandler and Jansen (1992).	2
C44	Venture team with complementary competences	Chandler and Jansen (1992).	2
C45	Enlist the support of key people	Izquierdo and Deschoolmeester (2010); Rezaei-Zadeh et al. (2017).	2
C46	Marketing, commercial and sales skills	Rezaei-Zadeh et al. (2017).	IC
C47	Negotiation	Izquierdo and Deschoolmeester (2010); Rezaei-Zadeh et al. (2017).	2
C48	Seeing the market from different angles	Rezaei-Zadeh et al. (2017).	IS

C49	Belief in effect of personal effort on outcomes	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017).	Core
C50	Optimism	Chandler and Jansen (1992); Rezaei-Zadeh et al. (2017).	2
C51	Persistence	Rauch and Frese (2007).	Core
C52	Tough-mindedness	Rezaei-Zadeh et al. (2017); Thomas and Mueller (2000).	IS
C53	Determination	Rezaei-Zadeh et al. (2017); Timmons (1979).	1
C54	Goal-driven and goal-setting	Rauch and Frese (2007).	Core
C55	Goal orientation	Rezaei-Zadeh et al. (2017).	IC
C56	Analytical ability	Rezaei-Zadeh et al. (2017).	4
C57	Analysis	Rezaei-Zadeh et al. (2017).	IC
C58	Need for power	Rauch and Frese (2007).	Core
C59	Need for dominance	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017).	Core
C60	Self-confidence	Bacigalupo et al. (2016); Rauch and Frese (2007).	Core
C61	Self-esteem	Rauch and Frese (2007).	Core
C62	Self-reliance	Bacigalupo et al. (2016); Rauch and Frese (2007).	Core
C63	Trustworthiness	Miller (1983); Mitchelmore and Rowley (2010); Rezaei-Zadeh et al. (2017).	4
C64	Critical and strategic thinking	Hébert and Link (1988); Herron and Robinson Júnior (1993); Rezaei-Zadeh et al. (2017).	IS
C65	Decision-making	Rauch and Frese (2007).	Core
C66	Dogmatism	Izquierdo and Deschoolmeester (2010); Rezaei-Zadeh et al. (2017).	2
C67	Integrity	Rauch and Frese (2007).	Core
C68	Norm orientation	Rauch and Frese (2007).	Core
C69	Disciplined	Rezaei-Zadeh et al. (2017).	IC
C70	Intuitive (sixth sense)	Rezaei-Zadeh et al. (2017).	3
C71	Having a utilitarian view of what's right	Rezaei-Zadeh et al. (2017).	3
C72	Using contacts and connections	Rezaei-Zadeh et al. (2017).	IS
C73	Previous contact with venture capitalists	Chandler and Jansen (1992); Rauch and Frese (2007).	2
C74	Multi-experienced	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Staniewski, Janowski and Awruk (2016).	Core
C75	Being autonomous	Staniewski, Janowski and Awruk (2016).	Core

C76	Disagreeableness	Rauch and Frese (2007); Staniewski, Janowski and Awruk (2016).	Core
C77	Conscientiousness	Rauch and Frese (2007); Rezaei-Zadeh et al. (2017); Staniewski, Janowski and Awruk (2016).	Core
C78	Extraversion	Rauch and Frese (2007); Staniewski, Janowski and Awruk (2016).	Core
C79	Self-efficacy	Bacigalupo et al. (2016); Rezaei-Zadeh et al. (2017); Sánchez (2013).	IS
C80	Accepting of responsibility	Rezaei-Zadeh et al. (2017).	IS
C81	Applying according to orientation	Izquierdo and Deschoolmeester (2010).	2
C82	Communication skills	Man et al. (2002); Rezaei-Zadeh et al. (2017).	IC
C83	Competitiveness	Rezaei-Zadeh et al. (2017).	IC
C84	Desire to have high earnings	Rezaei-Zadeh et al. (2017).	IS
C85	Pro-activity	Bacigalupo et al. (2016); Rezaei-Zadeh et al. (2017); Sánchez (2013).	1
C86	Problem-solving ability	Nekka and Fayolle (2010); Rezaei-Zadeh et al. (2017).	IC
C87	Estimation skills	Izquierdo and Deschoolmeester (2010).	2
C88	Finance management	Bacigalupo et al. (2016); Rezaei-Zadeh et al. (2017); Wong, Cheung and Venuvinod (2005).	IC
C89	Self-evaluation	Bacigalupo et al. (2016); Rezaei-Zadeh et al. (2017).	IC
C90	Implementation abilities	Rezaei-Zadeh et al. (2017).	1
C91	Time-management skills	Hébert and Link (1988); Herron and Robinson Júnior (1993).	IS
C92	Sound judgment	Miller (1983); Rezaei-Zadeh et al. (2017).	4
C93	Dynamism	Miller (1983); Rezaei-Zadeh et al. (2017).	4
C94	Heterogeneity	Miller (1983); Rezaei-Zadeh et al. (2017).	4
C95	Scanning	Miller (1983); Rezaei-Zadeh et al. (2017).	4
C96	Integration	Rauch and Frese (2007).	Core
C97	Protestant work ethic beliefs	Bacigalupo et al. (2016); Rauch and Frese (2007).	Core
C98	Tenacity	Rauch and Frese (2007).	Core

9 #P4: Application of New Agile Approaches at University of São Paulo Innovation Agency's Entrepreneurship and Innovation Course

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Abstract

Organizations continually look for new ways to generate ideas and to convert them into innovative products and services, a movement that strengthens entrepreneurship. Considering the context of entrepreneurship education, this paper presents and analyzes the main results obtained with the realization of the "7600001 Innovation and Entrepreneurship" course, offered by the University of São Paulo Innovation Agency (AUSPIN), with support of the platform "*Bota Pra Fazer*", an Endeavor and SEBRAE initiative. The paper promotes the discussion concerning best practices for the academic diffusion of entrepreneurship education considering the diffusion of the agile approaches (Design Thinking, Lean Startup and Business Model Canvas). It was possible to conclude that the experience with the 7600001 course, with a blended format and project-oriented learning, was adequate to improve the learning of entrepreneurship at the Brazilian academic environment according to the vision of the students involved.

Keywords: Business model canvas; Design thinking; Entrepreneurial education; Entrepreneurship; Lean startup; Universities.

1 INTRODUCTION

Organizations continually look for new ways to generate ideas and to bring them into the market. If in the past the Research and Development department (R&D) conducted this process and presented itself as a formidable barrier against the entry of new competitors (CHESBROUGH, 2003), currently new ventures have been successfully implementing new ideas for restructuring existing business processes (RIES, 2011). Entrepreneurship has proven its ability to transform ideas into innovative products and services, resulting in a large number of new businesses, increasing their relevance to individuals, organizations and for the societies (NECK; GREENE; BRUSH, 2014). However, despite great encouragement, there is still an expressive volume of new ventures that still fail in their initial structuration (NIRWAN; DHEWANTO, 2015). Entrepreneurial activity is recognized and valued internationally, and its practice is stimulated by governments and corporations (STARTUP GENOME, 2017), demanding new research with focus on the proper development of this process, capable of stimulating the entrepreneurial behavior (RAUCH; HULSINK, 2015).

Entrepreneurship education changed during the last decade (NECK; GREENE; BRUSH, 2014) and has no longer as its main focus the elaboration of an extensive business plan, capable of detailing the possible future functioning of a new corporation (SEBRAE, 2013). Due to its complexity, the construction of a business plan demands high dedication to research and to formulate future scenarios, keeping the entrepreneur far from the reality experienced by its potential customers. Considering that this distance was the main cause of failure of many startups, Blank (2005) proposed an approach in which the entrepreneur considers that in an initial moment his business is based only in hypotheses, which must be tested in practice with real customers in order to be validated or not, a concept baptized by the author as GOOB (Get Out Of the Building). This approach, in which field validation becomes more valuable than the elaboration of the complete business plan, has established the main foundations of the Hypothesis-Driven Entrepreneurship (EISENMANN; RIES; DILLARD, 2011), popularized since 2012 and today the main driver of the new approaches for the entrepreneurship education.

Considering this context of transition, this paper contributes with the identification and promotion of the discussion about best practices for the entrepreneurship education in the Brazilian academic environment. The objective is to improve entrepreneurship

education, strengthening and disseminating best practices that enable its popularization in different educational institutions, promoting the creation of new disruptive business, capable of bringing more and better innovations to organizations and for the society.

Entrepreneurship at the University of São Paulo (USP) is promoted, among other actors, by the University of São Paulo Innovation Agency (AUSPIN), Technological Innovation Center of the University and diffuser of academic innovations. The scope of AUSPIN includes activities related to the protection of intellectual property, the promotion of technology transfer, the stimulation of entrepreneurship and the signing of agreements with other universities. In terms of entrepreneurship, AUSPIN supports the structuring of business between professors, students and employees, participates in the governance of innovation habitats, supports the university's entrepreneurial ecosystem and aligns results with the business sector.

For the dissemination of entrepreneurship, AUSPIN has created and offers every semester for all undergraduate students of the University the course "7600001 - Innovation and Entrepreneurship", which aims to enable students to fully experiment the initial cycle of creating a new business. This cycle includes two main phases: the first phase, with focus on discovering and learning about possible business customers and their most relevant problems, and the second phase, with focus on the development of a Minimum Viable Product (MVP), the initial version of the product and/or service that is being developed and that is presented for evaluation among potential customers, allowing decisions concerning to the continuity of the project (BLANK, 2013).

The course is conducted in a blended format and in 2016 it included two hundred and thirteen students from two campuses, São Paulo and São Carlos. In each campus five presential classes were conducted, when professors and speakers presented the programmatic content, with main focus on the agile approaches for new business development, including Design Thinking, Lean Startup and Business Model Canvas. The course applies the Project-Based Learning approach (BOSS; KRAUSS, 2014), with the main focus on experiencing the first steps of developing a new startup. The “Bota Pra Fazer” platform, developed and operated by Endeavor - a global reference in supporting high-impact entrepreneurs (ENDEAVOR, 2017) in partnership with

SEBRAE, complemented the educational process providing video lessons and tasks related with new business development.

This paper presents the main results and learnings obtained with the realization of this course and analyzes the relevance of this new approach to teach entrepreneurship considering students' responses to a reaction questionnaire and also the relevance of the projects developed during the semester. The structure of the paper includes a literature review concerning the scenario of entrepreneurship education and the subjects of interest addressed in the course (Design Thinking, Lean Startup and Business Model Canvas). The method of the research is presented below. Considering the projects elaborated in the course, the paper presents the students' results and the reaction questionnaire, applied at the end of the course. Finally, from the alignment of the different conceptual and practical aspects explored throughout the paper, answers are offered for the motivating questions of the study.

2 LITERATURE REVIEW

In order to analyze the results of the "7600001 - Innovation and Entrepreneurship" course, it is necessary a better understanding of entrepreneurship education and its typologies, allowing to contextualize the course in relation to the state of the art, a theme presented in the first part of this literature review. In order to make possible the establishment of frameworks of best practices for entrepreneurship education, the second part of the literature review presents the construction and conceptualization of the content that directed the development of the projects, based mainly on the agile approaches (Design Thinking, Lean Startup and Business Model Canvas).

2.1 Entrepreneurship Education

Many countries invest in entrepreneurship education as a way of encouraging entrepreneurial activity, and there are evidences of the positive relationship between entrepreneurship education and entrepreneurial intent (SOUITARIS; ZERBINATI; AL-LAHAM, 2007; WALTER; BLOCK, 2011; SÁNCHEZ, 2013). If, in the 1970s, the diffusion of microcomputers accelerated the ability to operate businesses and reduced critical points such as scale and costs, facilitating the creation of new varied business (VESPER; GARTNER, 1997), currently entrepreneurship is associated with high levels of economic growth and generation of innovations (SÁNCHEZ, 2013; RAUCH; HULSINK, 2015).

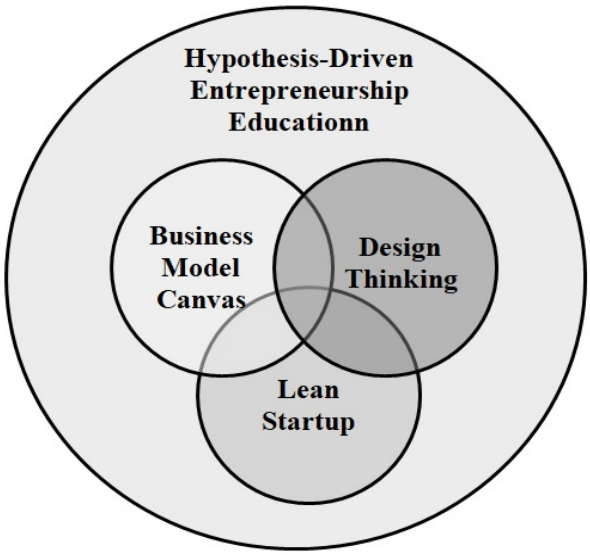
In general, entrepreneurship education has focus on the development of the skills and competences required for entrepreneurs (SÁNCHEZ, 2013; RAUCH; HULSINK, 2015; OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010), influencing their success (ROBINSON; SEXTON 1994). The results obtained with these initiatives are usually evaluated by measuring the degree of entrepreneurial intention after contact with the educational programs (LOI; DI GUARDO, 2015; OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SOUITARIS; ZERBINATI; AL-LAHAM, 2007). Therefore, entrepreneurship can be taught as a method, a certain way of acting and thinking, based on certain techniques to create assumptions, supposing that students will exercise it in practice, and it can also be taught as a process, characterized as a predictable process (NECK; GREENE, 2011).

Neck, Greene and Brush (2014) propose five practices that should be observed in entrepreneurship education: the practice of play, the practice of empathy, the practice of creation, the practice of experimentation, and the practice of reflection. The different schools of entrepreneurship present different views on topics such as innovation, growth, management and business creation, highlighting the relevance that the different initiatives have their results measured, especially their impact with students, organizations and society, since the entrepreneurship education is not fixed, requiring constant debate and dialogue (VESPER; GARTNER, 1997). Entrepreneurship courses can begin with a deeper understanding of their nature and purpose (PIPEROPOULOS; DIMOV, 2015), in order to predict the results that can be achieved (NECK; GREENE, 2011).

2.2 Agile Approaches to Entrepreneurship Education

Hypothesis-Driven Entrepreneurship helps in the reduction of the great risk that a entrepreneur may offer products and/or services that are not aligned with the needs and desires of customers, bringing the entrepreneur's vision to identify the hypotheses on which the new business is rooted, which must then be tested with potential customers for evaluating and acquiring knowledge capable of confirming or changing the initial idea, carrying forward only products and/or services that have been proven to be aligned with market demands (EISENMANN; RIES; DILLARD, 2011). The Hypothesis-Driven Entrepreneurship approach considers that practical validation is more valuable than the elaboration of a complete business plan and is currently the main driver for the new approaches for entrepreneurship education. Figure 1 presents the main concepts covered throughout the course "7600001 - Innovation and Entrepreneurship".

Figure 1 - Main concepts addressed in the course



Source: Authors.

In this context, entrepreneurship education at the "7600001 - Innovation and Entrepreneurship" course is composed by the combination of the following approaches: Design Thinking, with focus on the detailed understanding of the reality experienced by the end customer in order to generate innovative ideas, capable of resulting in differentiated projects; Lean Startup, which promotes the development of products and/or services that are validated considering the needs and desires of potential customers, contributing mainly with the development of the initial prototypes; and Business Model Canvas, which contributes to the development of projects with the design of business models in a simple, complete and structured way. This course approach is aligned with the “Startup Garage” approach, promoted at the Stanford University Business School, which includes the steps of exploration, immersion, formulation of customer needs, ideation, prototyping, testing, design and testing.

Therefore, the approach practiced in the course "7600001 - Innovation and Entrepreneurship", starts with the identification of the public of interest, followed by a detailed process of immersion, aiming to identify the main difficulties experienced by this public. These difficulties are then summarized in a sentence that articulates the main needs identified and that will guide the process of ideation and creation. The selected ideas are then prototyped and tested with the audience of interest. If the tests result in evidences that suggest the development of the business, the entrepreneur advances to complete the startup structuration.

2.2.1 Design Thinking

Design is a fundamental human activity, combining intuition, rationality and creativity, possessing the essence of a multifaceted nature (LAWSON; DORST, 2013). Design acts as a humanizing activity for technological innovations and plays an important role in cultural and economic exchanges (INTERNATIONAL CONCIL OF SOCIETIES OF INDUSTRIAL DESIGN, 2017). Therefore, the designers' activity is considered different from other professional activities, incorporating different and particular methods for solving complex problems, whose solution is usually based on the tacit knowledge of the designer (CROSS, 2006). Therefore, the main focus of the design activity is to solve complex problems based on the deep understanding of the individual's experience (BUCHANAN, 1992). It is characterized as a creative process, difficult to study because it does not occur according to a previously determined and understood process (DORST; CROSS, 2001).

Design Thinking (DT) is defined by Brown (2008) as an approach that applies the methods and the sensitivity of the designer to obtain solutions that correspond to what is desired by the customers, technologically feasible and that can result in interesting business models. The DT is an approach that promotes the generation of innovation by identifying the most relevant difficulties faced by a particular segment of customers (BROWN, 2008). Solving these difficulties is the objective of the resulting products, services and processes, enabling strategies with superior value. Therefore, in the context of contemporary entrepreneurship, DT becomes valuable because it allows for the new venture to be originated from the identification of relevant needs of a particular public of interest for the entrepreneur (NECK; GREENE; BRUSH, 2014). According to Brown (2008), a designer applies the DT observing reality in detail, searching for interesting problems to solve, elaborating creative solutions, constructing prototypes that enable their validation with potential customers, collecting relevant opinions and exposing the generated innovation at the potential market.

Brown (2008) states that the DT process consists of three main phases, which must be executed several times, during different iterations, in order to refine the solutions under development and to allow the identification of other possible directions for the project: inspiration, that is, the identification of the circumstances that motivate the search for new solutions; ideation, that is, the development and prototyping of ideas of

potential solutions; and implementation, that is, the search for ways to take the solutions to the market.

It is observed that DT is not a linear process of steps to be strictly followed (FLEURY; STABILE; CARVALHO, 2016) and, according to Grotti, Fleury, and Zancul (2016), during the development of the project the designer can apply techniques such as observations, with the purpose of observing users in their natural environment, capturing details and wide perspectives of this universe; interviews, which search to understand the motivations, desires and needs of the users through conversations; personas, that express the main archetypes identified in the information gathering; affinity diagram, organizer of large amounts of information obtained from the field work; and prototyping, in order to materialize the solutions.

2.2.2 Lean Startup

A startup is an organization created to establish a replicable and scalable business model (BLANK; DORF, 2012), adopting a strategy focused on developing new products and/or services under conditions of extreme uncertainty (RIES, 2011). When success happens in the search for the new business model, it is possible to create a relevant organization, that could not be created by the traditional market players (THIEL, 2014). However, according to Arruda et al. (2013), 25% of the startups fail in less than a year; therefore in order to reduce this high mortality rate, a new approach emerged and popularized because of it ability to optimize the process of starting a new business: the Lean Startup (LS), whose essence is the search for a successful business model with less focus on planning and greater focus on the formulation of hypotheses to be tested with potential customers (BLANK, 2013).

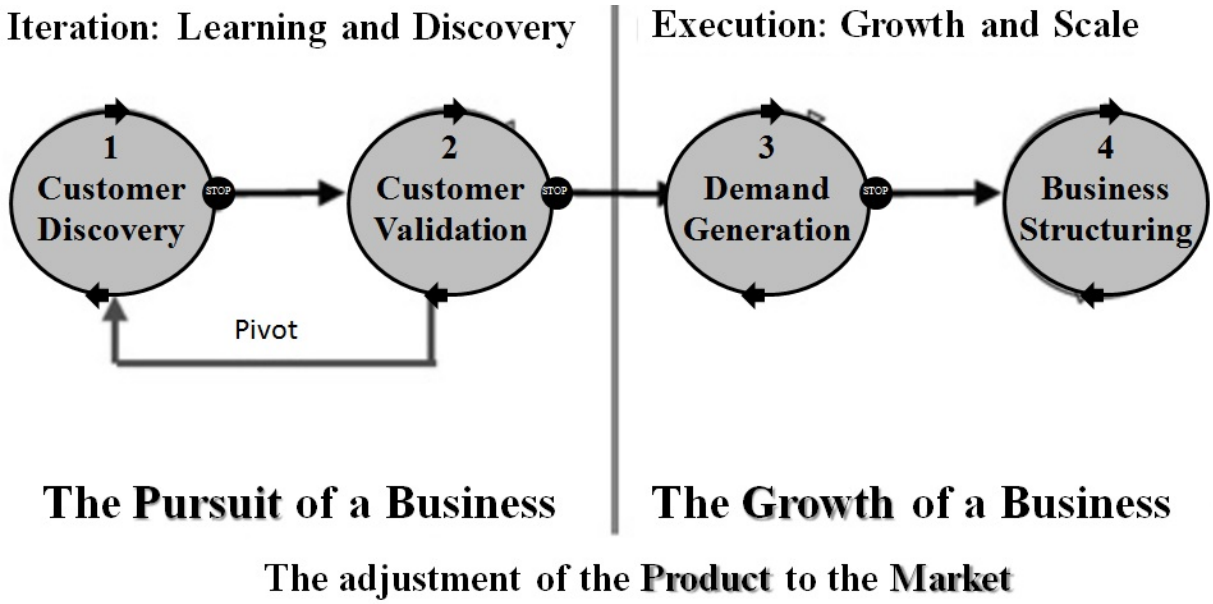
According to Järvi, Taajamaa and Hyrynsalmi (2015) and Ries (2011), LS methodology has emerged at software development organizations and has spread rapidly because of its ability in eliminating waste throughout the creation, acceleration and evolution of startups. Its application was diffused at Eric Ries's blog, "The Lean Startup", since 2008, and its application is already on the curriculum of renowned educational institutions such as Harward, Stanford and Columbia, and companies such as Qualcomm, Intuit and GE (ANDERSON, 2012). Lean Startup's methodology is based on Hypothesis-Driven Entrepreneurship, in which the opinions of potential customers

are collected in the search for the development of only products and/or services with market demand (EISENMANN; RIES; DILLARD, 2011).

LS, according to Ries (2011) and Karlsson and Nordström (2012), is a new approach, based on agile management models and product development frameworks, that continually foster the creation of innovations. It has as its main focus minimizing the risk of the new business failure after a high consumption of resources such as time and money. For that, it performs short learning cycles and applies agile tests that validate the project's guiding ideas (RIES, 2011), working for the entrepreneurs' success (NIRWAN; DHEWANTO, 2015) and turning the new business vision into prototypes that can be tested and validated with customers (RASMUSSEN; TANEV, 2015). Learning from the validation and prioritization obtained with the customers become the great drivers for the development of the innovations, based on their opinions, allowing the structuration and validation of adjustments, creating value for customers and eliminating waste during the creation phase, assisting in the refinement of the products and/or services that should be created (EDISON, 2015).

For Blank and Dorf (2012), the initial structuration of a startup mainly includes the development of its first products and/or services and the establishment of the initial business relationships. According to the authors, the evolution of a startup includes four main phases, summarized in Figure 2.

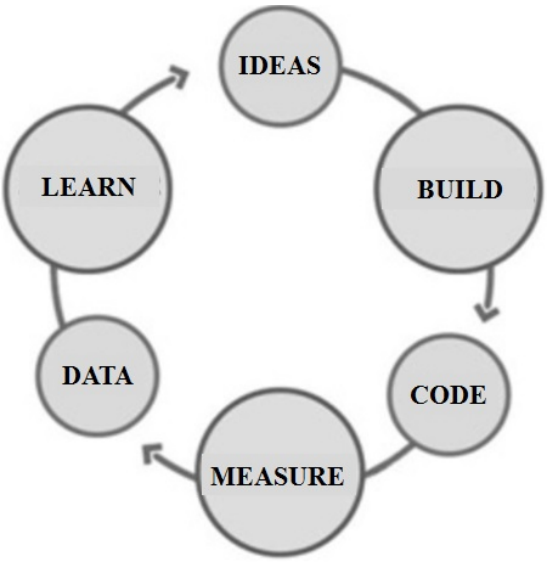
Figure 2 - The four phases of startup development



Source: Blank e Dorf, 2012.

The realization of each phase is based on the validated learning process, proposed by Ries (2011) and presented in Figure 3, in which the creation of the startup happens in an iterative way and, in each cycle, hypotheses are created and tested with customers. If the hypotheses are considered true, then the entrepreneur must proceed; on the other hand, if the hypotheses are not confirmed, the entrepreneur must search a new path and develop new hypotheses, which will be tested again in the next iteration.

Figure 3 - Process of validated learning



Source: Ries, 2011.

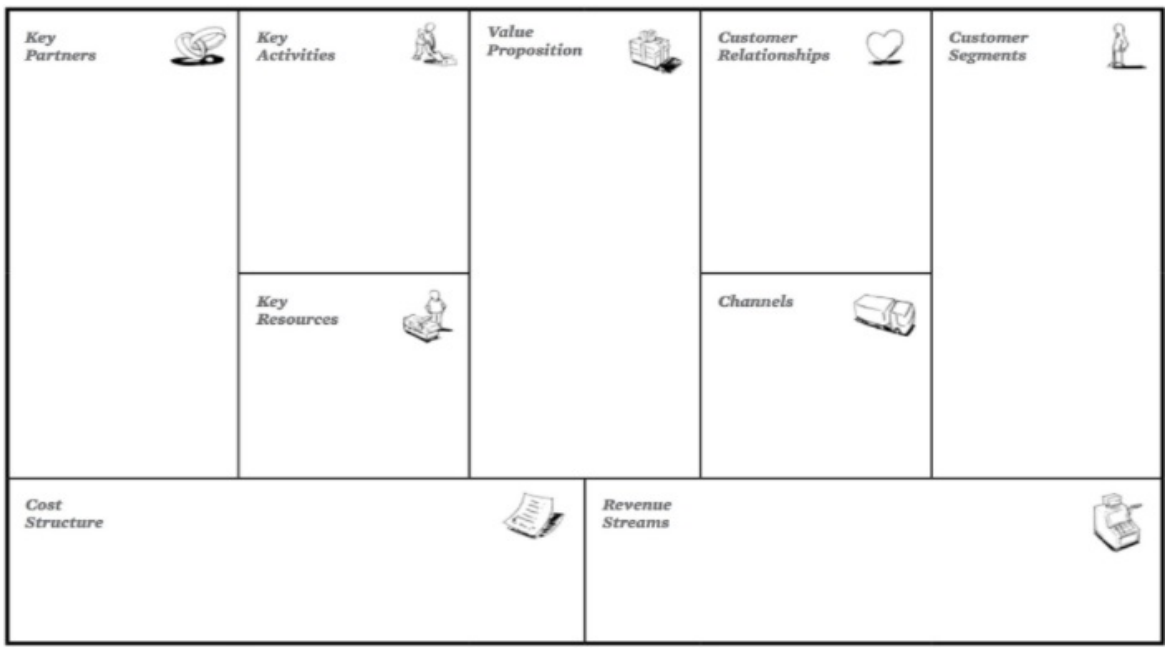
One of the ways for the startup to test the identified hypotheses is creating a Minimum Viable Product (PMV), which enables the tests to be performed and acts as a tool for deciding about the construction or not of the new products and/or services (RIES, 2011; CROLL; YOSKOVITZ, 2013). According to Ries (2011), Anderson (2012), and Blank (2013), the PMV is a product or service version that allows the validation of learning.

2.2.3 Business Model Canvas

The beginning of a new business is complex, specially in its early stages, when the product and/or service to be offered is under development and the best value proposition is still being searched (TRIMI; BERBEGAL-MIRABENT, 2012). According to the authors, the development of business models assist entrepreneurs in making decisions, providing information, validation tools and the identification of new opportunities, increasing the chances of new business success.

According to Osterwalder and Pigneur (2011), business models describe the logic of how an organization creates, delivers, and captures value, and the Business Model Canvas (BMC) graphically represents an organization's business model with simplicity and flexibility, having big applicability in startups. BMC most traditional framework is presented in Figure 4.

Figure 4 - Business Model Canvas



Source: Osterwalder e Pigneur, 2011.

For Farina (2017), the BMC is a useful approach to perform different analysis, graphically schematizing the logic of how a business creates value for its customers, evidencing relationships and the business logic, allowing the identification of the most relevant points for the delivery of superior value to customers and establishing organizational competitive advantages. According to Osterwalder and Pigneur (2011), Banchieri, Blasco and Campa-Planas (2013) and Martikainen, Niemi and Pekkanen (2013), BMC makes it easy to describe the business model, graphically summarizing its logic, presenting only relevant content for the initial steps of the venture, whose design enhances the constant reflection on the most important decisions related with the environment, evidencing the relationships between its elements and their articulations in different fields, such as a manual that facilitates even the organizational search for strategic alternatives.

3 METHODOLOGY

In order to contribute with the identification and promotion of the discussion about best practices for entrepreneurship education, a case study was conducted with the objective of registering, measuring and analyzing the results obtained by the students in the course "7600001 - Innovation and Entrepreneurship", promoted by AUSPIN, with a blended character, taught in the campuses of São Paulo and São Carlos, in the second semester of 2016, making possible the comparison of the effectiveness of the entrepreneurship learning in the scenario of analysis.

Case study is a strategy of research that focus on understanding the dynamics of the present, with a unique configuration and combination of methods for data collection such as interviews, questionnaires, observations, and secondary research, obtaining quantitative evidences and/or qualitative evidences (EISENHARDT, 1989). Case study provides an understanding of the real world, in which the analyzed events cannot be manipulated by the researcher (MCCUTCHEON; MEREDITH, 1993). Case studies allow the construction of generic models (MARTIKAINEN; NIEMI; PEKKANEN, 2013), investigating decisions (CHOUDHARI; ADIL; ANANTHAKUMAR, 2012) and allowing a better understanding of the present in the real context, thus presenting an appropriate format for the understanding and analysis of entrepreneurship education initiatives.

For the development of the case study a reaction questionnaire was applied with the students, whose participation was optional. The questionnaire had an initial section for sample characterization and a second section for course evaluation; this section consisted of twelve structured questions and five questions related with the presential meetings, incorporating closed options to evaluate each meeting (totaling five questions) and open questions to incorporate student comments (totaling another five questions). All the data were analyzed quantitatively and qualitatively.

In order to conduct the analyzes related to the case study, the developed projects were classified according to their level of technological uncertainty, relevance to the customer considering the identified needs and the capital required to start the venture operation (without considering advertising). The analysis of the quality of the final delivery considered the results obtained at the two initial phases of the project, conducted according to the model proposed by Blank and Dorf (2012): "Customer Discovery" and "Customer Validation". Each of these phases was divided into two

stages, resulting in a total of four stages that were evaluated according to the results obtained in relation to the predicted scope, as can be observed in the Table 1.

Table 1 – Analyze steps for the course final delivery

Projec Phase	Stage	Objective
Customer Discovery	Stage 1	Understand the context of the problem performing interviews and observations with the target audience and applying the synthesis tools.
	Stage 2	Elaboration of the first proposal of the business model, using the Business Model Canvas approach.
Customer Validation	Stage 3	Creation of the first Minimum Viable Product (MPV).
	Stage 4	Test of the MPV with the target audience and analysis of the obtained results.

Source: Authors.

For each stage being evaluated a certain group of criteria was considered, directing the evolution of the projects in order to reinforce its final results and generating a comparative base (partial evaluations and final evaluations).

Customer Discovery: in the **first stage** the groups of students search for relevant problems, identifying the challenge they wish to address. Aiming to obtain the first ideas of the business models, groups identify their potential customers and their most relevant problems, applying observation and interviews techniques. In this step, the deliveries are evaluated with grades from 0 to 10: a) description of the context and the opportunity of interest, justifying its originality and relevance; b) realization of interviews with potential customers; c) observation of the context of the problem, highlighting main activities, spaces, interactions, objects and users; and d) the group's considerations regarding the results of interviews and observations, which may or may not lead to the first project pivotal. In the **second stage** the groups structure the business model proposal using the Business Model Canvas (BMC). Thus, the business model should be proposed and the assumptions of its functioning and viability analyzed. Using the validated learning cycle (Figure 2) proposed by Ries (2011), the hypotheses must be tested and obtained learning must be applied for planning the next steps. The points evaluated with grades from 0 to 10 are: a) graphical representation of the business model, including description, analysis and justification; b) hypotheses and tests suggested for each of the nine BMC blocks; c) test results - qualitative or quantitative - performed and d) analyzes and considerations based on the tests performed.

Customer Validation: in the **third stage** the focus is on the development of the first Minimum Viable Product (MVP), that is, the first testable sketch of the imagined project

result, applying the main Design Thinking synthesis tools: affinity diagram, personas, empathy map and user journey. A MVP can be structured as a physical or as a digital artifact, as long as it incorporates some of the key features imagined as interesting for the potential customers. The objective is to develop a MVP that incorporates the functionalities that will be tested with customers. Evaluation considering a scale from 0 to 10 included: a) main MVP concepts/functionalities; b) presence and clarity of the value proposition; c) development plan of the MVP and d) MVP itself (content and form). Finally, in the **fourth stage** the focus is to conduct the tests of the MVP with potential customers aiming to validate (or not) the hypotheses and to measure the formal interest of the customers in relation to the product and/or service. Evaluation from 0 to 10 include: a) main hypotheses and tests that will be conducted; b) achievement of test plan and c) tests themselves and obtained results.

4 RESULTS

This section presents the results of the reaction questionnaire and the evaluation of the quality of the projects developed during the course, considering the students' learning in relation to the entrepreneurship education initiative. The focus is to evidence most relevant results considering the replication and comparison of possible results in future contexts.

4.1 Course reaction questionnaire

At the end of the semester a course reaction questionnaire was sent to the 213 students who participated, being 122 enrolled in São Carlos and 91 in São Paulo. From the 213 invited students 72 returned and, therefore, the rate of return was 33.8%. Most respondents (62.5%) attended the course in São Carlos and more than half of the respondents (54.2%) affirmed that they did not know about other courses with similar focus on entrepreneurship conducted at their schools of origin. Due to the format of the course being oriented to the development of projects, with class credits and work credits, 65.3% of the respondents considered that they dedicated themselves more to this course than to other electives courses that they had already attended. The majority of the respondents (89.7%) considered the course proposal to be appropriate or very appropriate, with a greater emphasis on the generation and validation of business models.

According to the students the positive aspects of the course were: introduction to concepts and methodologies applied in the projects and used for entrepreneurship; strengthening or creation of a knowledge base in entrepreneurship; possibility and incentive to test proposals quickly and to verify their adherence to potential customers; face-to-face feedback with teachers or monitors; network with students from other courses; contact with entrepreneurs and their experiences; greater sense of security for future business. The negative points were: scarce time, mainly due to the small number of presential classes (5 classes); lack of deepening in some specific contents; impossibility of access to the platform "*Bota Pra Fazer*" after the end of the semester; few support material beyond the platform content; difficulties with the groups - group formation and maintenance, dropout of students during the semester, students who did not know each other previously; difficulty in managing the course's activities. Although several points of improvement have been identified, the final result of the

experience was considered positive, since for 77.8% of the respondents the willingness to create a startup increased after the experience with the course and 93.1% affirmed that they would recommend the course for other students.

4.2 Projects presentation

The ten best projects presented at the end of the course were selected by an examining board, constituted by evaluators from USP, SEBRAE and also market experts. These 10 projects are presented below.

4.2.1 Shared security app

Table 2 - Shared security app

	Shared security app
Class	**São Carlos**
Objective and target audience	App that aims to make public spaces more secure. A map records events and generates statistics of hazardous locations and dangerous hours; users can ask for help (police and security) and alert facts happening in real time; the cameras installed in the locations can be accessed by the app.
Value proposal	A) Increase the population security at an affordable price; B) Alerting for hazards and allowing rapid response; C) Allowing intelligent monitoring and tracking, integrated and in real-time.
MVP	App screens, simulating its operation.
Validations made	There was no validation.

Source: Authors.

This is a business that aims to minimize the serious security problem by creating an app. The benefits provided with the system include the sharing of camera images, owned by participating users, which can be accessed by any user.

4.2.2 Phone charger

Table 3 - Phone charger

Phone charger	
Class	**São Carlos**
Objective and target audience	Produce portable cellular chargers with a life cycle 100 times superior to the conventional batteries, starting from the transformation of waste into nanomaterials. It deals with the problem of the mobile phone lack battery users and reduces the amount of toxic solid waste produced by society.
Value proposal	A) Sustainable (absence of heavy metals in the composition of chargers, reducing toxic waste and pollution by incineration; B) Heal the problem of users lack battery; C) Rapid charging (40% charge in seven minutes); D) Light and compact design.
MVP	Product landing page about the product that the group want to develop.
Validations made	105 page access and 84 (80%) clicks on the "Buy" button.

Source: Authors.

It is a business with high potential impact, combining nanotechnology and sustainability. A suggestion to the project was the elaboration of an estimation of cost, since, besides the expenses with the product development, the technology used already exists in the market, being able to be used in systems of cars departure and exit emergency doors of airplanes.

4.2.3 College choice

Table 4 - College choice

College choice	
Class	**São Paulo**
Objective and target audience	Electronic platform for sharing information about educational institutions, providing information such as location, costs and course characteristics. Assists the students in choosing the educational institution that they will attend.
Value proposal	A) Provide systematized information on higher education for college students; B) Provide greater security when choosing the university career; C) Establish a communication channel between universities and students.
MVP	Webpage creation for the preliminary registration of potential users.
Validations made	Two pages were created: one on the internet, with some information about the services that the platform would provide, and another on Facebook to publicize the previous one. Despite the efforts of the group, there were few accesses.

Source: Authors.

The proposal is to create a channel of communication between college entrance and universities, being able to offer information and career opportunities to college entrance and propaganda to universities. It is believed that the website has not been well developed (low number of access and a page with little information to the users at

the time of first access), suggesting to the entrepreneurs that they first provide relevant information to the users and then request their e-mail address.

4.2.4 Digital Manufacturing Machine

Table 5 - Digital Manufacturing Machine

Digital Manufacturing Machine	
Class	**São Carlos**
Objective and target audience	Assembly and sale of a digital manufacturing machine, based on the traceability and control of the displacement of the material. The equipment will act by repeating what is sent to it. Currently the technology is used in the manufacturing of drills, milling cutters and three-dimensional printers.
Value proposal	A) Customization options; B) Process speed and precision.
MVP	A computer system with three drive shafts, control and communication systems, motor controller hardware, software, displacement motors and guides for motion transmission.
Validations made	The project entrepreneurs contacted two companies and both were interested in acquiring the machine.

Source: Authors.

It was suggested to entrepreneurs not only to cite but to detail the business focus (fine milling) in order to present more information as well as their differential in relation to the competition: for example, to justify how the machine would be more accurate and faster in the process or even produce a product (such as making a sheet metal hole) so that the quality of the machine could be analyzed by potential customers.

4.2.5 Alcoholic beverages

Table 6 - Alcoholic beverages

Alcoholic beverages	
Class	**São Carlos**
Objective and target audience	Offer high quality and affordable microdistillates made with Brazilian botanists.
Value proposal	A) National product of high quality; B) Affordable price; C) Attractive design.
MVP	Landing page creation.
Validations made	The numbers obtained with the page spread were: 58 visits, 53 likes on Facebook and 9 subscribed to receive information of the drinks.

Source: Authors.

It was pointed out to the entrepreneurs that, in addition to the landing page creating, it is important that they also prototype the beverage machine, in order to test their acceptance with potential customers, allowing the quality evaluation of the product offered.

4.2.6 Tours app

Table 7 - Tours app

Class	Tours app São Carlos
Objective and target audience	Kind of Tinder (app) for non-romantic purposes. The target audience is people who search companionship for recreation.
Value proposal	Provide company for fun quickly and safely.
MVP	Screens that simulate the app, where the compatibility between the individuals is considered in the tours scheduling.
Validations made	The screens were printed and exposed to potential users, searching interactions and suggestions, allowing the improvements development.

Source: Author.

A favorable aspect to the business is the existence of a large target audience: lonely people. The entrepreneurs were suggested to focus on validation, trying to understand if people would use the application, because only were collected opinions related to the screens characteristics application.

4.2.7 Travel bag

Table 8 - Travel bag

Class	Travel bag São Paulo
Objective and target audience	Optimize a light backpack that fits in the airplane cabin for the purpose of dispensing large suitcases. The target audience includes travelers who do not need to carry a lot of luggage, such as young people traveling for short periods and executives or speakers who usually travel with only one handbag.
Value proposal	A versatile backpack with multiple dividers to make traveler life easier.
MVP	A web page was created to promote the product and was built the first backpack physical prototype.
Validations made	The page was shared on blogs and got good acceptance.

Source: Authors.

This product avoids lost luggage and makes travelers life easier for those who do not need to carry a lot of luggage. Its functional prototype was created and presented at the end of the course and was very well evaluated.

4.2.8 Education evaluation app

Table 9 - Education evaluation app

Class	Education evaluation app São Carlos
Objective and target audience	Real-time classroom evaluation app. The target audience includes professors and students, with professors getting real time feedback about their classes and being able to improve them.
Value proposal	A) Provide the managerial view of education to the course coordinators; B) Promote class improvement through rapid feedback from students.
MVP	Application screen where the teacher receives student feedback.
Validations made	There was no validation.

Source: Authors.

The group proposes that students should constantly evaluate professors at educational institutions. Evaluations similar to the proposal of this project already exist in preparatory entrance exam courses and, although the objective to evaluate the class can improve its quality, the environment can become stressful to the professors, disrupting the education quality.

4.2.9 Recycling of electronic devices

Table 10 - Recycling of electronic devices

Class	Recycling of electronic devices São Carlos
Objective and target audience	It has the purpose of separating materials that are still useful, such as raw material for the industries.
Value proposal	A) Collect electronic devices offering benefits in return; B) Recycle electronic devices and sell the metals extracted from them; C) Reduce environmental impact.
MVP	Offer service of collecting boards, printed circuits and components separation for companies.
Validations made	There was no validation.

Source: Authors.

The project is innovative for the Brazilian reality since the service of materials collection and separation is already conducted abroad. However, due to the difficulty of sending solid waste to other countries and receiving back the extracted raw material or sell it, it can be said that there is market potential to this business.

4.2.10 Water treatment

Table 11 - Water treatment

Water treatment	
Class	**São Paulo**
Objective and target audience	The microenterprise will conduct water treatment, developing and implementing treatment systems in commercial and residential condominiums, and small and medium-sized industries. The entrepreneurial idea is to redesign processes and deploy technologies.
Value proposal	A) Advantages to the customers towards the local concessionaire; B) Greater independence; C) Improved water quality; D) Financial economy; E) Capacity to monitor the process.
MVP	The main product offered is a mini WTS (Water Treatment Station) installed at the obtaining and using place of water. The purpose is to provide clean and quality drinking water as an alternative source, independent of the local utility.
Validations made	Research was conducted with potential customers that suggested improvements, with the process monitoring implementation, allowing the real-time data monitoring about the water quality.

Source: Authors.

The project has been developed for a company that is starting its operation at the market and, for this reason, it was suggested for the entrepreneurs the setting of goals, such as the number of customers desired for the next year and plans on how to reach them.

4.3 Projects taxonomy

In order to make possible a better analysis of each project status and its need for future developments considering its effective implementation, a project taxonomy and its variables is proposed in Table 12 and the results obtained with the classification of the projects are presented in Table 13. This taxonomy is based on the concepts proposed by IDEO (2012), according to which a solution presents itself as promising when it is desirable, that is, presents clear value to its potential customers, when it is technically feasible, that is, possible to be developed and when it is financially feasible, that is, when the solution is able to bring financial return to the developer organization.

Table 12 - Taxonomy variables

Taxonomy variable	Description
Level of technological uncertainty	It is related with the risk of concretely obtaining the technology required to execute the project.
Customer relevance considering their unattended needs	It addresses the project relevance in terms of attending the identified customers latent needs.
Capital need to start operation (no advertising)	Identifies the capital need degree to start the project operation, without considering advertising revenues.

Source: Authors.

Table 13 - Projects classification

Projects	Level of technological uncertainty	Customer relevance considering their unattended needs	Capital need to start operation (no advertising)
Shared security app	Medium	High	High
Phone charger	High	Medium	High
College choice	Low	Medium	Low
Digital Manufacturing Machine	High	Medium	Medium
Alcoholic beverages	Medium	Low	Medium
Tours app	Medium	Low	Low
Travel bag	Low	Medium	Low
Education evaluation app	Medium	Low	Low
Recycling of electronic devices	Medium	High	High
Water treatment	Medium	Medium	High

Source: Authors.

Observing Table 13 it is possible to conclude that most of the resulting projects present low technological uncertainty and, in this way, it they are possible to be executed considering existing technologies. Only the Phone Charger and Digital Manufacturing Machine projects require technological maturation and, in this way, its evolution must consider this development period. About the relevance of unknowing customer needs, the vast majority of projects address non-priority needs. Regarding the startups capital requirement for start operations, about half of the projects do not require high capital and the other half needs bigger investments.

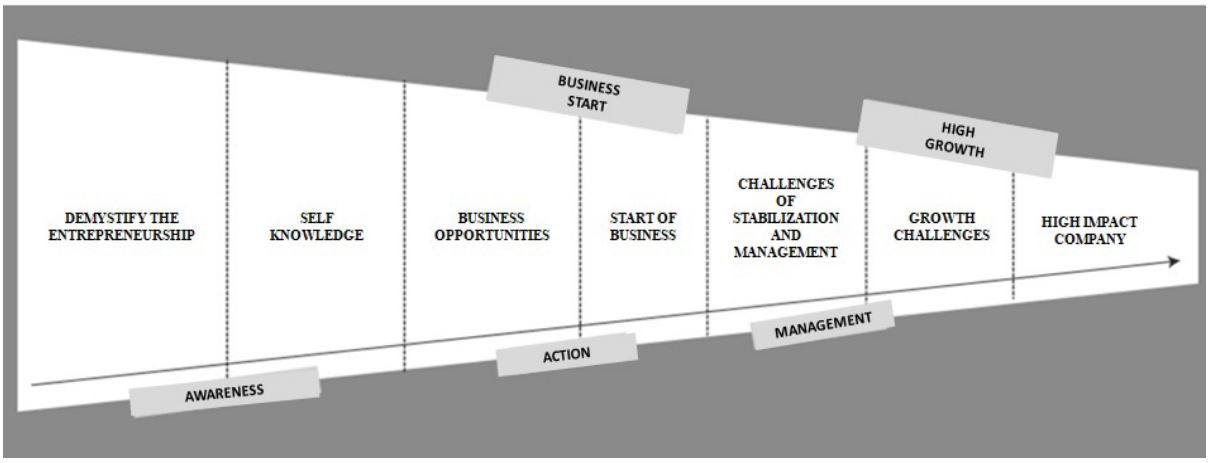
4.4 Results discussion

The initiative to conduct a course combining students from different schools of the University of São Paulo (USP), applying and analyzing the effectiveness of the Hypothesis Directed Entrepreneurship approach and promoting the discussion about the best practices for its diffusion generated very positive results. As previously mentioned, when asked about the course's proposal to have a less theoretical focus

and a greater emphasis on the generation and validation of business models, 90.3% of the respondents considered the approach appropriate or very appropriate.

Among the main positive points highlighted by the students are the possibility of putting ideas into practice and verifying in the field their applicability, as proposed by Blank and Dorf (2012) through the GOOB (Get Out of the Building) concept; to have a first contact with the entrepreneurship universe, defended by Blank and Dorf (2012); to have contact with students from different USP courses, aligned with the multidisciplinary proposed by IDEO (2012); and promoting a deeper understanding of the steps for creating new products and/or services and diffusing them into the market (BLANK, 2013). Some students also expressed interest in evolving the projects created at the course. Concerning the interest in the entrepreneurial activity, 77% of the students showed a greater willingness to start new ventures after attending the course. It is worth noting that this number is common in the entrepreneurial journey, which can be understood as a funnel, which begins with a larger number of students in the sensitization phase and decreases throughout the journey, decreasing even more in the beginning phases of the enterprise and growth, as is illustrated in Figure 5 (ENDEAVOR, 2017).

Figure 5 - Entrepreneur journey



Source: Adapted from Endeavor, 2017.

The blended format, with only five presential meetings, was considered the course weakest point. In relation to the number of meetings, 48.6% of the students considered that a greater number of presential meetings would be more appropriate, evidencing the demand for the groups attendance, enabling the incorporation of reflexive practice

based on practical experimentation in the course context (Neck, Greene & Brush, 2014).

Another aspect mentioned by the students was the process of formation of the groups, since not all the members presented the same motivation and involvement with the project, aspect that remains very challenging for this course. In addition, the optional and blended character of the course is credited with a significant dropout rate, evidenced by the non-delivery of 22.2% of the final projects of the São Paulo class and 9.5% of the São Carlos class.

Still, for 77% of the respondents willingness to entrepreneur increased after the course and 93.1% affirmed that they would recommend the course to other students, a very significant proportion considering the course elective characteristics, with presential meetings on Saturdays and with a considerable volume of activities and deliveries. Based on the evaluation of the entrepreneurship education by the entrepreneurial intention increase of the participants of programs and course related to the field, such as it is presented in the literature review, it is possible to conclude that the course helps in the identification of the best practices for the promotion of entrepreneurship education in the Brazilian academic environment and contributes with the proposed taxonomy to classify the projects presented at the end of the course, since no similar taxonomy was found in the literature, taking into account questions of technological uncertainty, needs of unknowing customers and capital needs for operation.

5 CONCLUSION

Morin (2000), one of the main contemporary philosophers, highlights that knowledge cannot longer be considered a ready tool and that it is always threatened by error and illusion. For twenty years, entrepreneurship was taught as a ready tool, which search to follow abstract conceptual models to implement new concrete business models (NECK; GREENE; BRUSH, 2014) and, as a consequence, the results usually did not meet expectations. However, the application of agile methodologies (Design Thinking, Lean Startup and Business Model Canvas) for the creation of new products, services and structuring of new business transformed the entrepreneurship education approach, allowing the practical application of its concepts and, for the students, the possibility to experience in the real world the viability of their ideas and projects. Thus, the student can, at the beginning of their project, find errors in their assumptions and try new ways to pursued in the search for the desired business model.

The entrepreneurship education with the application of agile approaches, as seen in the case studied, enables the student to experience and to appropriate knowledge, since it has to be situated in a context for the development of new products and services from the identified opportunities along with the costumers, connecting different answers in order to establish the business model overall logic. It also requires students to work in multidisciplinary teams from different University units and, finally, to face the high complexity involved in structuring a new business.

In this way, it has been verified that this new form of entrepreneurship education, in which the learning is guided by the project and by the developed hypotheses, leads the students to experience a new set of educational experiences. In this way, students were presented to new ways of creating new startups and, moreover, made possible the decision to continue or not to evolve with the project. This initiative strengthens the capacity to generate innovation in the context of the university and facilitates its market incorporation in the form of startups, or in the companies, that come to have access to professionals who effectively understand how to establish new business starting from the development of new products and services, as suggested by Bagnato (2012).

It has been also observed that the course is aligned with different practices of entrepreneurship education, such as empathy, creation, experimentation, play, and reflection, defended by Neck, Greene and Brush (2014) and not aligned with the

traditional detailed development practice defended by SEBRAE (2013). Based on the evaluation of the students and the quality of the final projects delivered, the blended format, with project-oriented learning focused on agile approaches to the course, was adequate to promote entrepreneurship education, fulfilling its role of discuss and identify best practices for the entrepreneurship promotion in the Brazilian academic environment and helping to understand the entrepreneurship education, generating ideas that can be implemented with potential market.

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10 #P5: A comparison between hypothesis-driven entrepreneurship education approaches

Journal: RAE – Revista de Administração de Empresas
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Status: Submitted

Abstract

Entrepreneurship is an economic growth catalyst and a powerful job creator. Interest in entrepreneurship education has grown significantly. Based on the effectuation concept, the hypothesis-driven entrepreneurship approach has been adopted for the creation of successful startups and currently it can be teach based on two main approaches: the “Startup Owner’s Manual”, combining minimum viable product, business model canvas and lean startup methods, and the “Startup Garage Innovation Process”, combining design thinking, value proposition canvas and lean startup methods. Both approaches have been applied in different initiatives at University of São Paulo. This paper analyzes similarities and differences between these approaches, considering concepts explained in class, project instructions template, project-based learning dynamics and final projects outcomes. Obtained results evidence that, although intrinsically different in their initiatives, both approaches produce similar results because entrepreneurship is an abductive process, a valuable outcome for improving discussions concerning best practices to promote entrepreneurship education.

Keywords: Entrepreneurship; Entrepreneurship education; Lean startup; Startup owner’s manual; Startup garage innovation process.

1 INTRODUCTION

Innovation is a critical priority and entrepreneurship is currently its major driver (BROWN; KURATKO, 2015). Entrepreneurship is usually associated with innovation, technological progress, employment generation and economic growth (ACS et al. 2016; AL-ATABI; DEBOER, 2014; GUEDES, 2015) and, consequently, entrepreneurs are considered as representatives for the future of every country (JUNOVEN; OVASKA, 2012). However, entrepreneurs face complex, difficult and problematic environments (BISSOLA; IMPERATORI; BIFFI, 2017). In this challenging context, entrepreneurship education applies problem-solving approaches (YOCK; BRINTON; ZENIOS, 2011) to develop competences that results in the generation of jobs and economic value (AL-ATABI; DEBOER, 2014; COOPER; BOTTOMLEY; GORDON, 2004; DUVAL-COUETIL, 2013). As a result, entrepreneurship education creates more and better entrepreneurs, becoming a phenomenon of concern for governments and spreading fast around the world (CARAYANNIS; EVANS; HANSON, 2003; COOPER et al., 2004; FAYOLLE; GAILLY, 2015; MARTIN; MCNALLY; KAY, 2013; NABI et al., 2017; NECK; GREENE, 2011).

Considering that entrepreneur's creativity and skills can be developed (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013), academics are avid to understand which the best practices to promote entrepreneurship education are and how to obtain more relevant results (MARTIN et al., 2013). Entrepreneurship teaching techniques develop creativity (BROWN; KURATKO, 2015; CARAYANNIS et al., 2003) and assist entrepreneurs in their educational processes (NECK; GREENE, 2011). Based on the effectuation principle proposed by Sarasvathy (2001), the diffusion of the hypothesis-driven approach restructured the process of developing new businesses initiatives and promoted fast prototyping and iterative learning, resulting in different teaching techniques, creating bridges between practical experiences and theoretical knowledge, increasingly aligned with "real and active learning" objectives (COOPER et al., 2004), combining innovation, design and entrepreneurship in preparing students for the ever-changing and dynamic world (BROWN; KURATKO, 2015).

Entrepreneurship education outcomes are analyzed considering how the process was conducted in order to obtain relevant experiences and what are the appropriate metrics to measure these outcomes, subjects that are still relevant as research themes

(DUVAL-COUETIL, 2013; MARTIN et al., 2013). Currently researches attempt to characterize approaches to teach entrepreneurship, but this literature is still in its early stages, with no consensus and few validated protocols, demanding more research based on the evidences obtained with the application of distinct teaching methods (DUVAL-COUETIL, 2013; MARTIN et al., 2013). A research agenda concerning entrepreneurship education include the development and validation of educational innovate methods and robust and deep research considering the learner active participation and his/her experience in a deep and real context, highly-involving and experiential environment offered in a multifaceted learning experience (COOPER et al., 2004).

This study aims to contribute with entrepreneurship educational bodies of knowledge, with the identification of techniques that positively affect entrepreneurial intention, based in a robust and deep research that applied pre and post-test (CARAYANNIS et al., 2003; MARTIN et al., 2013) in two distinct educational initiatives, analyzing both differences and similarities for future improvements. Assisting in discussing the entrepreneurship, fundamental to improve the entrepreneurship politics and maximization of the results from the new startups (ALVES et al., 2019).

The paper starts with a literature review (PALMARINI et al., 2018) to present the hypothesis-driven entrepreneurship concepts and techniques (EISENMANN, 2013) and analyses the results obtained with two researches conducted at the University of São Paulo (USP), a leading Latin America university, with relevant initiatives in education, research and extension. Currently at USP entrepreneurship courses applies by two main approaches for entrepreneurial education, both aligned with Yock, Brinton and Zenios (2011) framework. The first approach has as its main focus the customer validation phase, starting with an idea of a product or service and finishing with the analysis of its market viability. The second approach focus in the customer discovery phase, starting with the identification of a relevant customer need and finishing with a prototype of a product or service. To compare these initiatives, questionnaires were sent to the students that attended the courses, in order to gather their experiences perceptions.

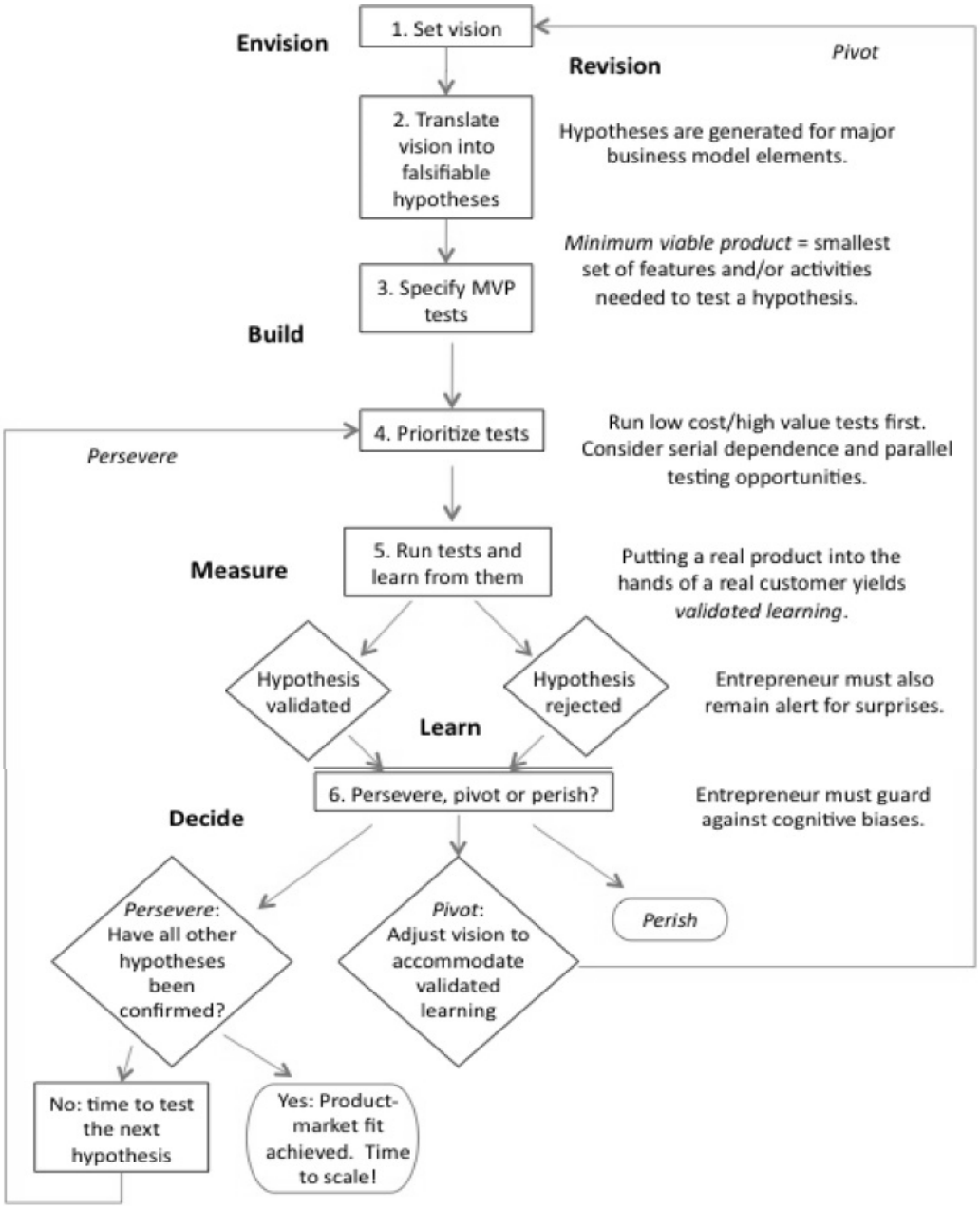
This article is composed by six main sections: section one describes the research context and its importance; section two presents the literature review; section three describes each applied approach; section four describes the case studies; section five

discusses the results and, finally, section six concludes the research, reinforcing obtained results, limitations and future researches perspectives.

2 LITERATURE REVIEW

This literature review presents the hypothesis-driven entrepreneurship approach (see Figure 1), based on Sarasvathy effectuation concept (2001) and popularized because of its effectiveness in assisting entrepreneurs in the development of new products and/or services, aligned with the customers desires and needs, based on the identification of different hypotheses that will be tested with potential customers (EISENMANN; RIES; DILLARD, 2011). Two variations of this approach have been applied as teaching methods at USP.

Figure 1 - Hypothesis-Driven Entrepreneurship approach steps



Source: Eisenmann, Ries and Dillard (2011).

The first variation is inspired in the “Startup Owner’s Manual” book (BLANK; DORF, 2012; RIES, 2011) and includes the customer participation for the development of the value proposition and consolidation of the business architecture (PRÉ; LECOCQ; ANGOT, 2010). In this context, Business Model Canvas hypothesis and Minimum Viable Products value propositions are validated with potential customers in order to gather feedbacks. The second variation is inspired by the “Startup Garage Innovation Process” (ZENIOS, 2016), beginning the comprehension of the reality of potential customers, applying Design Thinking techniques (BROWN, 2008) to understand customers’ needs and wants, followed by an ideation process, development of the Value Proposition Canvas, and creation of a strong and well-tailored value proposition (OSTERWALDER et al., 2014). Finally, the Lean Startup approach is applied with special focus on prototyping, testing, and iterating (RIES, 2011).

2.1 “Startup Owner’s Manual” Approach

The “Startup Owner’s Manual” approach is mainly based on the concepts of the Lean Startup, whose interpretation should consider the concepts of “Lean” and “Startup” isolated. On one hand, the term “Lean” comes from “Lean Manufacturing”, characterized as the search for waste elimination, with superior effectiveness in the use of resources and achieving company performance improvements, by boosting the process of learning from customers (MAURYA, 2012; RASMUSSEN; TANEV, 2015; YANG; HONG; MODI, 2011). On the other hand, “Startups” are emerging companies looking for the development of replicable, rentable and scalable business models, operating under conditions of extreme uncertainties and looking for the highest number of people that can be convinced to work in the direction of constructing a better future (BLANK, 2012; BLOMBERG, 2012; HARTMANN, 2013; KARLSSON; NORDSTRÖM, 2012; RIES, 2011; THIEL; MASTERS, 2014). The “Startup Owner’s Manual” most relevant techniques and methods include “Lean Startup”, “Business Model Canvas” and “Minimal Viable Products”.

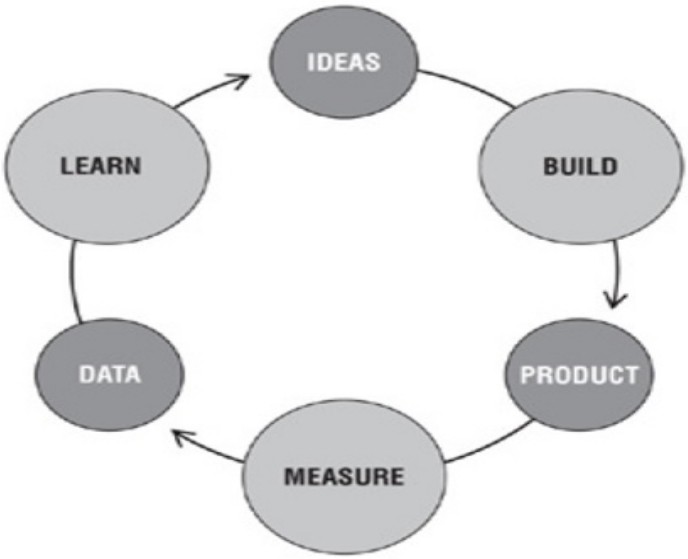
2.2 Lean Startup (LS)

Lean Startup (LS) emerged as a new approach to look for constant innovation (RIES, 2011), guided by potential customers validations (BALDASSARRE et al., 2017), based on real life experiments (WEISSBROD; BOCKEN, 2017), advocating waste elimination

(BAJWA et al., 2017; JÄRVI; TAAJAMAA; HYRYNSALMI, 2015), and reducing the risk of developing something that customers do not need or do not want (BAJWA et al., 2017; BJÖRK; LJUNGBLAD; BOSCH, 2013; BLANK, 2012; EDISON, 2015; LINDGREN; MÜNCH, 2016; NIRWAN; DHEWANTO, 2015; RIES, 2011). Initially developed for software companies, but currently the approach is widely applied in several other business areas (JÄRVI et al., 2015; RIES, 2011). Lean Startup is recognized as a scientific method applied to develop startups (WEISSBROD; BOCKEN, 2017), reducing the product time-to-market (DINGSØYR; LASSENIUS, 2016) and iteratively refining business concepts (WEISSBROD; BOCKEN, 2017).

The validated learning process of the LS allows the conduction of experiments based on the specification of problems, test of the hypothesis, and results in learning obtained from these validated or not validated hypothesis. This process is illustrated in the LS Learning Looping, also named as Build-Measure-Learn Loop (see Figure 2) (BAJWA et al., 2017; FITZGERALD; STOL, 2017; RASMUSSEN; TANEV, 2015; RIES, 2011). Validated learning is based on the “fail fast in order to succeed sooner” principle (BAJWA et al., 2017; YAMAN et al., 2017). It is important to note that the phases presented in Figure 2 do not have value separately and the objective is to conclude the looping in the fastest and least expensive way, considering constant optimizations (RIES, 2011), and searching for product and customer matches (FREDERIKSEN; BREM, 2017).

Figure 2 - Lean Startup Learning Looping



Source: Ries (2011, p. 81).

The application of the Build-Measure-Learn Loop is possible with the development of Minimum Viable Products (MVP's) (BAJWA et al., 2017), when entrepreneurs convert an idea into a product, measure customers' feedback about the product and learn in order to decide between persevere or pivot considering the obtained results (BAJWA et al., 2017; FREDERIKSEN; BREM, 2017; LINDGREN; MÜNCH, 2016). A pivot is a change of direction of the business model, of the business concept, or of the value proposition of the product (BAJWA et al., 2017; WEISSBROD; BOCKEN, 2017).

The LS is based on the premise of developing a Business Model Canvas (BMC) (BLANK, 2011) instead of a detailed business model plan, evidencing the creation of value (BAJWA et al., 2017; BLANK, 2011; FREDERIKSEN; BREM, 2017). BMC offers an agile and resumed format for representing the business model, facilitating the prioritization and identification of the essential (MAURYA, 2012).

2.3 Business Model Canvas (BMC)

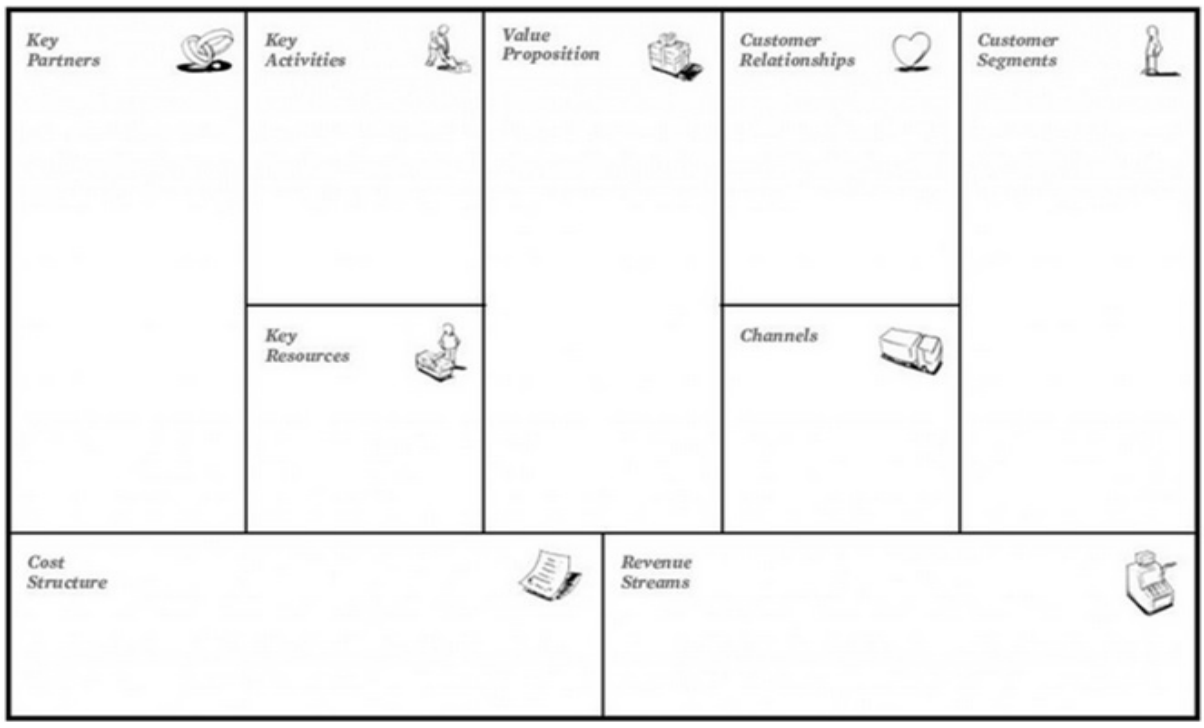
For a business to succeed, it is essential the development of a business model with superior value propositions, capable of assisting in experimentations and tests (TRIMI; BERBEGAL-MIRABENT, 2012). The BMC assists in the processes of business understanding and decision-making, delivering value (ABRAHAM, 2013; BOCKEN et al., 2013; TRIMI; BERBEGAL-MIRABENT, 2012). As a management tool that characterizes and describes the business strategically, it provides an overview of value capture and creation of the business relationships and related success factors (PÖLLING et al., 2017). According to Casadesus-Masanell and Ricart (2010), the BMC represents the company's value creation process, reflecting their strategy and providing tools to add value for co-creation (BEH et al., 2016). Considering the development of a company's business model as complex, the BMC is a traditional business plan simplification to describe the way the company creates, captures and delivers value (OSTERWALDER; PIGNEUR, 2010).

Because of its schematic representation, BMC is powerful in evidencing relationships and establishing business logics, evidencing the essential points for the creation of value and its strategic alternatives (BANCHIERI; BLASCO; CAMPA-PLANAS, 2013; BOCKEN et al., 2013; GELBMANN; HAMMERL, 2014; IACOB et al., 2014; MARTIKAINEN; NIEMI; PEKKANEN, 2014; NIELSEN; MONTEMARI, 2012; OSTERWALDER; PIGNEUR, 2010; SLEUWAEGEN, 2013; TRIMI; BERBEGAL-

MIRABENT, 2012). BMC also assists in the business model documentation, measuring progress and communicating the learning process (BANCHIERI et al., 2013; MAURYA, 2012).

According to Iacob et al. (2014), BMC is also suitable for the implementation of new innovation projects because of its popular template that facilitates the creation of radical innovations. It can also be used in already established companies, ensuring that their businesses are analyzed considering different perspectives (AXELSSON; PAPATHEOCHAROUS; ANDERSSON, 2014; MARTIKAINEN et al., 2014). According to Osterwalder and Pigneur (2010) and Cherif and Grant (2013), the BMC includes nine blocks, evidencing how the company generates financial return, working as a strategic blueprint of the company's structure, processes and systems implementation (see Figure 3). To Yen, Drinka and Kanamori (2013) and Blank (2012) each block can be translated as hypothesis for customer discovery.

Figure 3 - Business Model Canvas



Source: Osterwalder and Pigneur (2010, p. 44).

2.4 Minimum Viable Product (MVP)

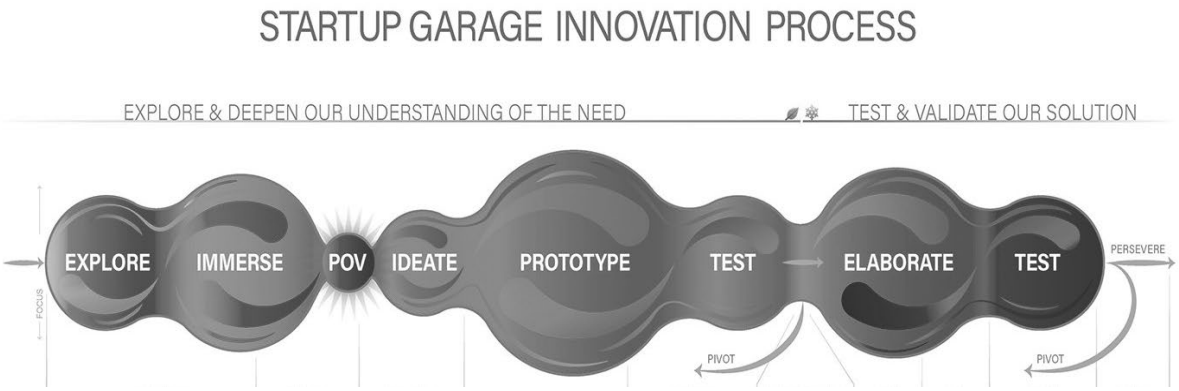
Minimum Viable Products (MVP's) incorporate the most relevant aspects of the value proposition, summarizing the smallest group of features that are necessary for the initial product, in order to solve the core problem and to demonstrate value for potential

users. It is a tool that minimizes efforts, saving time in product development, with focus on customers and learning objectives (ANDERSON, 2012; BLANK, 2012; CROLL; YOSKOVITZ, 2013; RIES, 2011). A MVP is a project outcome that demonstrates a technical solution, bringing together business and technical implementation teams (CONTAN; MICLEA; DEHELEAN, 2017). For startups, MVP assists in the critical development for the market considering a proposed performance, overcoming innovation risk challenges (NAYEBI et al., 2017), because the process needs to be fast, based on quick decision and pivoting, ensuring agility and fast decision implementation (BLANK, 2012; RIES, 2011). MVP assists in the development of a sustainable business for testing the hypothesis identified during the BMC construction (RIES, 2011).

2.5 "Startup Garage Innovation Process"

According to Zenios (2016), the "Startup Garage Innovation Process" can be applied in all business sectors and is considered a better innovation approach than the development of a traditional business plan. "Startup Garage Innovation Process" activities are presented in the Figure 4 and include Design Thinking concepts and tools, complemented with LS methods and with the consolidation of MVPs validations in the search for providing the expected value for the target customers. For this, Zenios (2016) propose the validation of the developed innovation considering three main criteria: usability, viability and feasibility.

Figure 4 - Startup Garage Innovation Process



Source: Adapted from ZENIOS (2016, p. 57).

2.6 Design Thinking (DT)

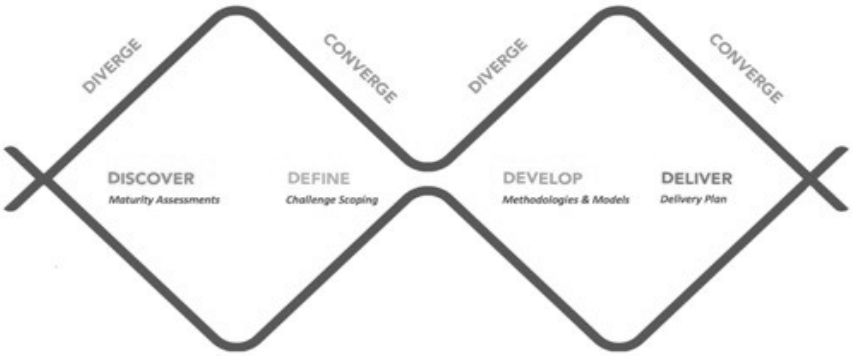
Historically design has been considered a least important phase in product and service development, and designers' only role was to create beautiful packages into the project final output (BROWN, 2008). However, design has a multifaceted nature and combines the creativity required throughout the design process (LAWSON; DORST, 2013). Designers are problem solvers, open to new approaches, acting as masters of problem exploration and discovery, developing links between actions, signs and ideas (BUCHANAN, 1992; CHRISTIAANS; VENSELAAR, 2005; CROSS, 2006; VIANNA et al., 2011).

Design Thinking (DT) is a theoretically advanced approach, but still in its infancy when considering field research (BICEN; JOHNSON, 2015), without a consensual definition (LIEDTKA, 2015). When performing DT activities, designers iteratively define and redefine the problem, using a holistic thinking for sketching possible ideas (GOLDSCHMIDT; RODGERS, 2013), including the participation of non-designers in the design process (RISKU; ABRAHAMSSON, 2015). It is characterized for applying designers' sensibility and methods for discovering and deeply understanding customers' needs and behaviors and, based on that comprehension, developing products and services that results in benefits for customers and value for companies, transforming challenges into opportunities (BICEN; JOHNSON, 2015; BROWN, 2008, 2010; DORST; CROSS, 2001; IDEO, 2012; SCHULENKORF, 2017; VIANNA et al., 2011).

DT is specifically tailored to deal with wicked problems, i.e., complex problems with no clear boundaries and specifications (BUCHANAN, 1992), that requires the development of creative solutions, resulting in an effective approach to generate and to evolve with unconventional ideas (DORST; CROSS, 2001; IDEO, 2012; RISKU; ABRAHAMSSON, 2015). It is recognized as an essential approach to develop and to improve innovations (LIEDTKA, 2015; WELLS, 2013), generating new products creatively (Verganti, 2008) and improving existent alternatives (ERZURUMLU; ERZURUMLU, 2015). It is also an excellent way to be innovative and creative (JOHANSSON-SKÖLDBERG; WOODILLA; ÇETINKAYA, 2013), using experimentation and imagination (SCHULENKORF, 2017).

DT promotes innovation and growth and, because of the systematic successes obtained with its application, it is receiving significant academic attention as a new business problem-solving methodology, assisting decision-makers in reducing their cognitive biases (LIEDTKA, 2015). Its diffusion among academics and practitioners grew during the 90's (MUELLER; THORING, 2012), especially because of its capability for including new perspectives about the problem context (IDEO, 2012), influencing the academic knowledge concerning new product development processes (SEIDEL; FIXSON, 2013). Figure 5 presents the DT approach and evidences its abductive logic, working with “convergence-divergence” cycles to develop the innovations, assisting in the prioritization of relevant and effective learning (BOCKEN et al., 2013; MAURYA, 2012).

Figure 5 - Design Thinking Phases

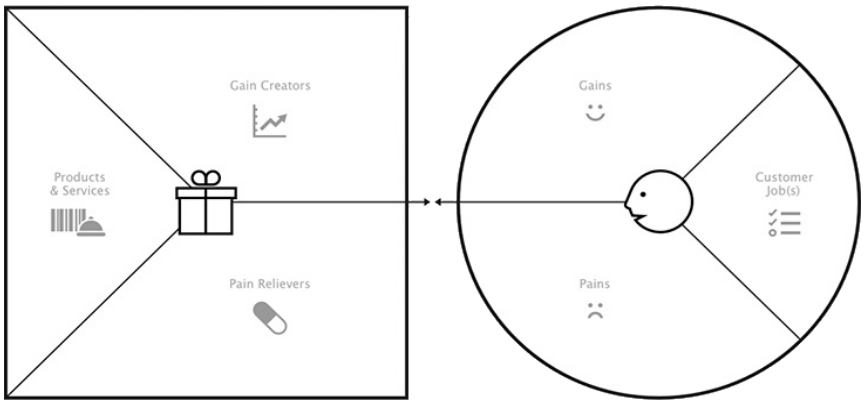


Source: Adapted from Tenshi (2018).

2.7 Value Proposition Canvas (VPC)

The Value Proposition Canvas (VPC) represents how the company creates and captures customer value (ÄYVÄRI; JYRÄMÄ, 2017), considering the customer practices in an attempt to develop a product or service, searching for “gain creators” and “pain relievers” for customers, based on the identification of customers’ needs and “pains” (BURGI; BLUMER; MAKHLOUF-SHABOU, 2017). For this, VPC details how the company creates value for its customers and reinforces its value propositions (OSTERWALDER et al., 2014; POKORNÁ et al., 2015). The propositions are tested and validated with real customers, using relevant prototypes, and obtaining useful feedbacks, which are fundamental for developing what the customer wants and promoting the creation of attractive business models based on deep customer’s knowledge (see Figure 6).

Figure 6 - Value Proposition Canvas



Source: Osterwalder et al. (2014, p. 3 e 4).

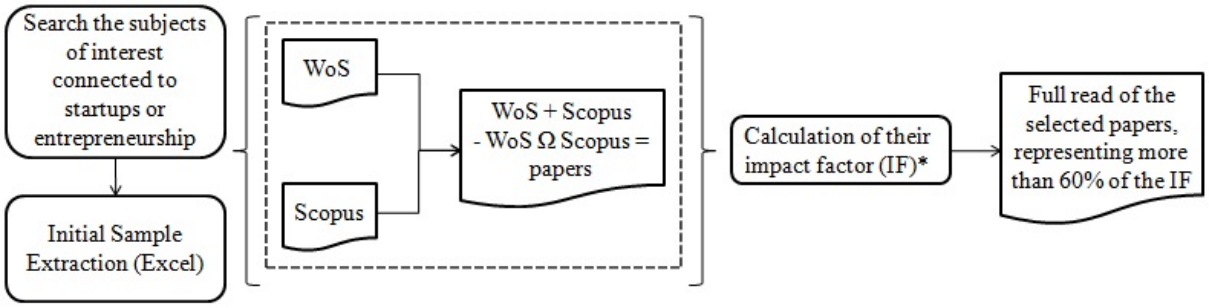
3 METHOD

This topic presents the fundamentals of the research techniques applied during the development of this research, including systematic literature review and case studies.

3.1 Systematic Literature Review

For this research an extensive literature concerning the subjects previously presented in chapter two was conducted, considering classical and recently published studies. Searches were conducted at the Web of Science and Scopus databases, following the steps presented in Figure 7. The systematic literature review was conducted because of its potential for identifying and synthetizing the most relevant studies in a research area (IRSHAD; PETERSEN; POULDING, 2018), evidencing the current state of the art and its limitations (PALMARINI et al., 2018), and assisting in the built of an area map that evidences the research gaps and directs the development of necessary future researches (DIKICI; TURETKEN; DEMIRORS, 2018; MAIER; MEYER; STEINBEREITHNER, 2016). The method also emphasizes the identification of research trends, allowing its classification and mapping specific subjects (LIMA-JUNIOR; CARPINETTI, 2017; SARKA; IPSEN, 2017). According to Weissbrodt and Giauque (2017) the systematic literature review also synthesizes available high-quality materials.

Figure 7 - Literature Review Workflow



*The IF search to evidence the more relevant papers, using the Equation IF = C *(JCR+1) proposed for Carvalho et al. (2013), where C is the number of citations and the JCR is the impact factor of the journal that published the paper.

Source: Authors.

3.2 Case Study

Case studies enable the understanding of the real world, analyzing events that can hardly be manipulated or that cannot be manipulated, characterized as the

photography of a phenomenon (MCCUTCHEON; MEREDITH, 1993). Case studies allow the understanding of the present dynamics in the real context, resulting in a research strategy that applies a unique combination of methods for data collection, including observations, interviews, questionnaires, and secondary research, obtaining quantitative and/or qualitative evidences (CHOUDHARI; ADIL; ANANTHAKUMAR, 2012; EISENHARDT, 1989). The method also enables the construction of generic models and investigates decisions previously made (CHOUDHARI et al., 2012; MARTIKAINEN et al., 2014). It can be conducted considering only one case or with multiple cases (MCCUTCHEON; MEREDITH, 1993).

This research presents and analyze two cases, both of them concerning the application of distinct entrepreneurship teaching approaches at undergraduate courses at the University of São Paulo (USP). The “Startup Owner’s Manual” teaching objectives follow the basic principles of “entrepreneurship in practice” for constructing a startup. It begins with the definition of the business mission, vision and values, followed by the development of the value propositions and MVPs to be validated with real customers and to analyze its financial viability. The final decision of the project is to start or not the business. The course aims to promote the startup creation experimentation with the students, demanding decision-making and demanding students to act as real business administrators. It is inspired by the entrepreneurship focus advocated for Yock, Brinton and Zenios (2011). The course dynamics include:

- **Team formation** - students should structure teams based on the similarity of interests, resulting in teams with the maximum of five members, composed by students that have the same area of concern;
- **Project** - during the course, teams work to develop a business based on a solution-idea for a problem. The initial problem can change during the course and, therefore, the proposed solution can change. The final delivery of the project includes a viable proposal of the solution for the identified problem, validated with potential customers. During the course students have four deliveries, all deliveries are evaluated by professors and tutors, and teams receive feedback about what has been developed and what are expected for the next steps;
- **Classes** – face-to-face classes are divided in two parts: a) explanatory part, with professors explaining concepts and providing examples of practical

applications concerning the theoretical concepts, and b) team work at the second part of the class, when students have time and support to apply the theoretical concepts in their projects;

- **Online content** - the course has a virtual learning environment where students have access to the theoretical concepts presented including texts and videos, and areas to deliver the project outcomes;
- **Tutoring** - students receive four feedbacks about their project deliveries and have the opportunity to discuss the project evolution and results, always receiving the feedback for the next steps from the teachers and from the tutors, with face-to-face and online meetings.

The second analyzed case is offered for undergraduate students, of all courses of USP, as a chance to have a complete entrepreneurship experience before leaving the university. The course applies the “Startup Garage Innovation Process” and combines DT, VPC and LS, focusing in business development based mainly on customer discovery and validation (BLANK, 2012). It is inspired by the design focus advocated for Yock, Brinton and Zenios (2011) and designed with the following characteristics:

- **Team formation** – team members must be from different courses of USP (multidisciplinary) and teams should have the maximum of five members;
- **Project** - based on the identification of unattended needs from potential customers of interest, the project evolves with the creation and validation of prototypes to supply the customer’s demand of interest and ends with MVP tests, aiming to validate or not the new business value, considering its potential market relevance. The course includes: a) customer discovery and validation, based on the DT approach, b) Get Out Of the Building (GOOB), emphasizing the necessity of potential customers interaction, c) Prototyping, enabling hypothesis tests and in-depth customer interactions and d) Pitch, allowing to the entrepreneur present his business in an objective and concise way;
- **Classes** – there are six face-to-face classes, usually divided in: a) explanatory class, explaining concepts, methodologies and tools, b) guest speaker, usually with the participation of a young entrepreneur from the university, and

c) team work, when teams have the opportunity to apply tools for their project with the professor's and tutor's support;

- **Online classes** – complementary materials are offered online in partnership with a global organization that focus on promoting entrepreneurship, especially high-impact startups;
- **Tutoring** - teams have the opportunity to personally discuss their project development with the teacher and/or tutors during tutoring meetings;

To analyze the presented cases, research questionnaires were applied with students from both courses. Questionnaires were constructed with questions to obtain information concerning specific contexts and included the use of scales (FORZA, 2002). All questions were essential to the validity and reliability of this research (ALRECK; SETTLE, 1995) and proposed questions could be closed, including only a set of possible answers, or opened, without a specific set of answers suggest (RASINSKI, 2005). The research questionnaires were designed to measure students' perceptions of knowledge and skills before and after their participation in the courses, making possible comparisons. Both questionnaires included questions concerning the student's perception gain of knowledge about the approaches studied during the courses, evolving for the "Startup Owner's Manual" course LS, MVP and BMC approaches and for the "Startup Garage Innovation Process" course DT, VPC and LS practices.

The questionnaires were applied using Google Forms to facilitate its application and visualization, in April of 2018, and invitations were sent by e-mail to the students that had attended the courses in the year of 2017. Questionnaires' forms were open for answers for a month, with weekly reminder sent for the students that had not answered it. The results were analyzed applying different technics that allows a comparison between the courses, with the detainment of the techniques and results presents in the next section.

4 RESULTS

As part of this research results Table 1 presents a summary theoretical comparison between the courses considering their most relevant aspects:

Table 1 - Comparative of courses

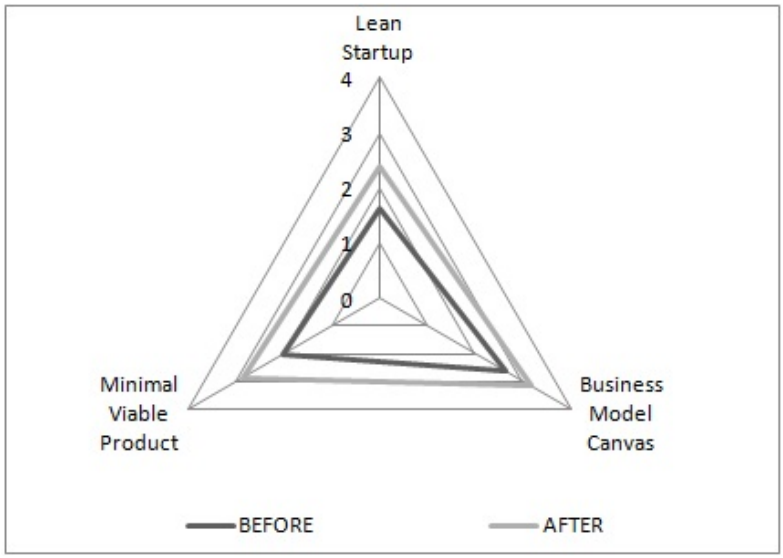
#	Startup Owner's Manual	Startup Garage Innovation Process
Course objective	Develop and evolve new ideas considering customers' feedback, resulting in attractive proposals for potential customers, with technical viability and financial potential.	Promote student's entrepreneurial capacity, focusing on new products, services and business creation, aligned with customer needs.
Characteristics	Required course, offered in face-to-face format with traditional classes, tutoring meetings and online materials.	Elective course, offered some Saturdays, with face-to-face classes, tutoring meetings and complementary online materials.
Student profile	Undergraduate students from engineering courses at USP.	Undergraduate students from all different courses across USP.
Expected outcomes	Development of prototypes and MVPs to be validated with potential customers.	Projects with a validated value proposition, prototype and MVP tests.
Course duration	Four months.	Four months.
Project dynamic	Groups with an average of five students that develops a project in four main activities: 1. Idea presentation; 2. Structuration of BMC, strategy, development of hypothesis and tests; 3. A first MVP, with the results of quantitative and qualitative researches; 4. Results of the tests with customer and final idea validation.	Groups of up to five students that present a project in five steps: 1. Context immersion; 2. Problem identification and creation of personas; 3. Development of Ideation (DT), VPD and Prototype test; 4. MVP test; 5. Pitch presentation.
Final project outcomes	Projects that are qualitatively and quantitatively validated with customers, evolving the customer feedback, having a validated MVP.	Projects in which value proposition was identified and qualitatively validated and tested in the form of a MVP.

Source: Authors.

Considering students' participation, 11% of the students of the "Startup Owner's Manual" course (24 answers from 226 students) and 12% of the students of the "Startup Garage Innovation Process" course (47 answers from 400 students) provided validated answers for the questionnaire. Figure 8 and Figure 9 illustrates a comparison

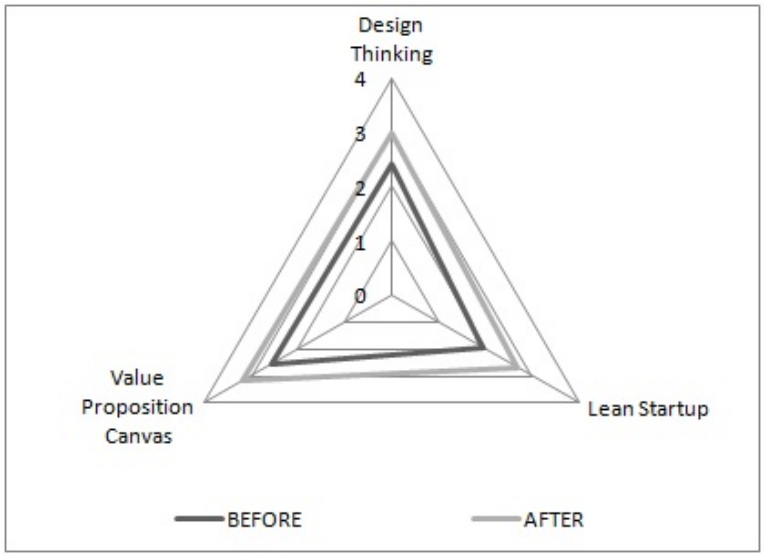
between the perception of acquired knowledge before and after the courses, representing respectively "Startup Owner's Manual" and "Startup Garage Innovation Process" results. The dark gray triangles represent the students' perception of knowledge about the topics before taking the course, with scale ranging from 1 to 5, where: 1 - I had never heard of it, 2 - I had heard of it, but knew just a little, 3 - I had already know of it, but with no depth, 4 - I already had deep knowledge about it and 5 - I had a deep knowledge about it and I was confident about how to apply it. The light gray triangles represent the students' perception knowledge about the topics after taking the course, with scale ranging from 1 to 4 meaning: 1 - I have gained some knowledge, but it was superficial, 2 - I have gained knowledge, but I think it was not enough, 3 – I have gained a lot of knowledge, but I do not have the security to apply it and 4 - I have gained a lot of knowledge and the confidence to apply it. For the "Startup Owner's Manual" course, the perceived evolution was respectively 46% for the LS, 21% for BMC and 44% for MVP, and for the "Startup Garage Innovation Process" it was 23% for DT, 38% for LS and 23% for VPC.

Figure 8 - Students' perception of knowledge "Startup Owner's Manual" course



Source: Authors.

Figure 9 - Students perception of knowledge “Startup Garage Innovation Process” course



Source: Authors.

Table 2 presents the descriptive statistics considering the students’ perceptions before and after the courses. It is relevant to note that students perceived the acquirement of knowledge and skills in both initiatives and considered as relevant all the different techniques practiced during the courses, a fact that can be explained by the “project-based” format of both initiatives, an educational approach that provides relevant experiences for the students.

Table 2 - Descriptive statistics

#	Sum Before	Sum After	Average Before	Average After	Standard Deviation Before	Standard Deviation After
Startup Owner’s Manual course						
Lean Startup	39	57	1.63	2.38	0.82	1.01
Business Model Canvas	63	76	2.63	3.17	1.31	0.92
Minimal Viable Product	48	69	2.00	2.88	1.14	1.03
Startup Garage Innovation Process course						
Design Thinking	114	140	2.43	2.98	1.10	0.87
Lean Startup	91	126	1.94	2.68	1.15	1.00
Value Proposition Canvas	121	149	2.57	3.17	1.28	1.05

Source: Authors.

Students were asked if the obtained knowledge about methods and tools was applied in other academic contexts, including projects, classes, work, new business or other activities. 40% of the “Startup Owner’s Manual” students affirmed they had applied knowledge at least once, with 60% applying in academic projects and 33% applying in a new business project. From the “Startup Garage Innovation Process”, 59% of the students applied their knowledge one or more times, with 42% applying in academic projects and 16% applying in the companies where they work.

Concerning the continuity of the developed course projects, most of the “Startup Owner’s Manual” students (92%) did not continued, because they had others priorities (63%) or because they did not think that the project could be viable (29%). A significant number of students of the “Startup Garage Innovation Process” also did not continued the project (72%), because they had others priorities (39%).

Considering the analysis of the entrepreneurial intentions of the participants, most of the “Startup Owner’s Manual” students (43%) increased their entrepreneurial intentions, but it is also relevant to note that for a significant number of students (40%) their entrepreneurial intention remained the same; similar results were evidenced at the “Startup Garage Innovation Process” initiative, since most of the students (48%) considered the improvement of their entrepreneurial intentions and for a significant number of students (47%) the entrepreneurial intention remained the same. Both approaches resulted in expressive number of students recommending the courses, with “Startup Owner’s Manual” course with 88% of referencing and the “Startup Garage Innovation Process” course with 94% of referencing.

5 DISCUSSION

Obtained results evidenced that in both courses the evolution of students' perception of knowledge acquisition was relevant. The topics with less improvement of students' perception of knowledge acquisition were BMC and VPC, both related to business model representation, a fact that can be justified because these are consolidated approaches from the literature and are applied in many other courses as a way to simplify the business model schematization. In a comparison between the two approaches, the “Startup Owner’s Manual” students' global perception of knowledge acquisition was 37% and the “Startup Garage Innovation Process” was 28%.

Another relevant fact is that students from the “Startup Garage Innovation Process” course obtained higher results concerning both “average before” and “average after” when compared with the results obtained by students from the “Startup Owner’s Manual” course, a fact that can be explained because the first is an elective course and the second is a required course, so students of the first course usually already have knowledge about the proposed methods and techniques.

Table 3 illustrates a comparison between the two approaches concerning the adopted methodology.

Table 3 - Comparison of methodologies

#	Startup Owner’s Manual	Startup Garage Innovation Process
Project template	Includes LS, BMC and MVP, starting from the development of a BMC, with the entrepreneurs assuming that they know a problem and will try to solve.	Includes DT, VPC and LS, starting with the Immersion of DT, to discover a problem that the entrepreneurs will try to solve.
Concepts explained in class	BMC, LS, Strategic approaches (5 Forces of Porter, SWOT, Blue Ocean), Competences (organizational and individual), Organizational culture, Marketing, Classic School (Taylor, Fayol, Ford), Organizational process, Activity Based Costing, Economic Engineering (Future Value, Uniformed Value).	DT and tools (immersion, personas, customer journey, ideation), Customer Development (customer discovery and customer validation), GOOB, VPC, BMC, LS, Prototype, MVP and Pitch.

Source: Authors.

A comparison between the practical aspects of the two dynamics evidenced that the “Startup Owner’s Manual” started with the drawing of a BMC to propose a solution for a problem that the entrepreneurs believed that exists, evolved to the LS with the development of the idea in the form of a MVP, tested the proposed solution and ended

with the validation of the BMC for the effective and detailed solution design, so the main focus is “engineering the solution”. On the other hand, the “Startup Garage Innovation Process” provided strong interactions with potential customers in the search to identify and to validate the existence of a relevant problem and to develop possible solutions, with DT assisting in the problem formulation and solution validation, using the VPC to develop the first solution based on the potential customers’ needs and LS assisting in the development and test of solution, so the main focus is “designing the solution”.

After the courses ending, a significant amount of the students did not apply the approaches at other contexts or situations (“Startup Owner’s Manual” 60% and “Startup Garage Innovation Process” 41%), and this difference can be justified because the “Startup Owner’s Manual” course is mandatory and all the students are from the same graduate course. The same reasons can justify the discontinuity of the final projects, with 92% for “Startup Owner’s Manual” and 72% for “Startup Garage Innovation Process”. After the courses, a relevant part of the students revealed an expressive increase in their entrepreneurial intention, confirming the results revealed by Walter and Block (2015).

One interesting observation from the classes is that greater engagement was observed among the students of the “Startup Garage Innovation Process” and resulted in more innovative projects, once they were in elective courses and working with people from different undergraduate courses, forming multidisciplinary groups, including members with different abilities and views of the world. It is also important to highlight the interest of the students in learning more about entrepreneurship after ending the course.

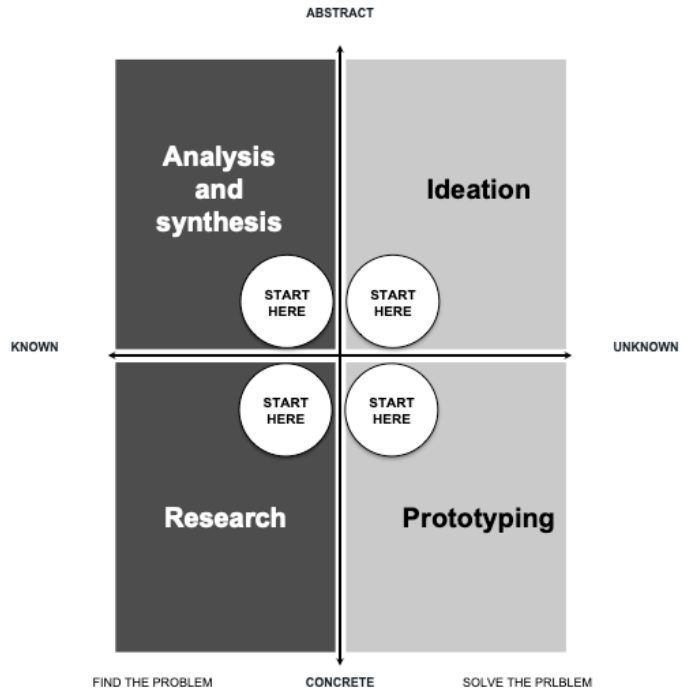
6 CONCLUSION

In the search for identifying differences and similarities between two approaches for teaching entrepreneurship, the “Startup Owner’s Manual” and “Startup Garage Innovation Process”, this research compared both methods and applied questionnaires among students to evaluate their perception of knowledge acquisition, before and after the courses and the evolution of their entrepreneurial intentions considering the concepts and techniques explained and practiced during the courses.

Results evidence an overall perception of knowledge acquisition, with a greater perception about new approaches such as Lean Startup, and smaller perception for approaches that are generally applied in other courses, such as the Business Model Canvas. Is also possible to conclude that, independently of the course, most of the students did not continued with the project development, however their improved entrepreneurial intention can still lead them towards the construction of new businesses, demanding continued accompaniment in longitudinal studies. Another relevant result is that both courses affect positively or maintain the entrepreneurial intention, not affecting it negatively, confirming the positive effect advocated by Walter and Block (2015).

Considering the previously presented results, it is possible to conclude that both courses obtained similar results, evidence that contributes for answering the demands of Duval-Couetil (2013) and Martin, Mcnally and Kay (2013) about how to get started and how to use the appropriate metrics to teach entrepreneurship. This fact can be justified because entrepreneurship is an abductive process and it can be started in any phase of the design process – research, synthesis, ideation or prototyping, as presented in Figure 10.

Figure 10 - Entrepreneurship abductive process and its phases



Source: Adapt from Zenios (2016).

This study contributes with discussions concerning best practices to teach entrepreneurship and assists in the construction of research frameworks to make viable comparisons for future development and theoretical formulations of entrepreneurial education. As limitations of this initiative, it is necessary to highlight the fact that the research was conducted in only one University (USP) and that student selection varied between the courses. Future research initiatives include the development of more techniques and tools to promote the comparison among the results obtained in different initiatives, the evaluation of the students' entrepreneurial intention over the time, and a comparison between more methods to teach entrepreneurship.

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11 #P6: Student's entrepreneurial intention, confidence and competences: a before and after course survey

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Abstract

In the current scenario, organizations need to be competitive, and a way towards it is by innovations. With innovations being the development of the new, facing a great increase of achievement in the startups, new small organizations raised by entrepreneurs, evidence a strong relationship between innovations and entrepreneurship, as the latter being the main driver of innovations. Being believed that the entrepreneurs can be developed with the improvement of some entrepreneurial competences. Competences that when together also incentive the entrepreneurial intention and confidence, something possible with the entrepreneurship education. Emerging this study, that research to evaluate courses that search to teach entrepreneurship, understanding how these courses affect the development of entrepreneurial competences, intention and confidence, trying to evaluate courses by comparing pre and post-course questionnaires. This evidences that most of the students took the courses to improve their competences and not necessarily develop new ones, the courses also assisted in increasing the students' entrepreneurial intention and confidence.

Keywords: Entrepreneurial intention; Entrepreneurial competences; Entrepreneurship education; Entrepreneurs; Survey.

1 INTRODUCTION

Since the earliest times, the development of products and services has been a central concern for humanity and, in the early twentieth century, the relevance of developing approaches and techniques to improve this process has gained prominence (CUNHA, 2008; FREDERIKSEN; BREM, 2017). When globalization became inevitable and kept increasing, organizations faced a scenario that demanded diversified products, produced at lower costs, incorporating a broad spectrum of technological innovations, considering expanding and changing customers' demands, resulting in much lower products lifecycle (ROZENFELD et al., 2006).

In this context, products and services development became a decisive competitive advantage and innovating emerged as a survival element, evidencing a strong need to expand possibilities of creating innovations (EDISON et al., 2018). Innovation is the successful implementation of a new or significantly improved product, service, marketing or organizational method, capable of transforming organizational practices (BIANCOLINO; MACCARI; PEREIRA, 2013; BONAZZI; ZILBER, 2014; MANUAL DE OSLO, 1997), resulting in an important driver for organizational development and growth (BONAZZI; ZILBER, 2014). Innovations result in the development of something new, marketable and aligned with the productive processes, arising from the identification of new opportunities, successfully entering the market when delivering value equal or superior to the initial expectation of the customers (CARVALHO, 2009; DRUCKER, 1980; KOTLER, 2006).

Innovations are increasingly considered central to organizations, and the success obtained by startups attracted the attention of large companies (TAMAMAR; JAKITAS, 2015). A startup is an organization built to find a repeatable and scalable business model, designed to create and to deliver new products and services under conditions of extreme uncertainty, conducted by the largest group of people convinced of a plan to build a different future (BLANK, 2003; LEUNG et al., 2006; RIES, 2011; THIEL; MASTERS, 2014). Startups are recognized because of their ability to create radical innovations, usually emerging from the combination of disruptive technologies and new markets (O'CONNOR, 2013; SALERNO et al., 2015). Startups are important drivers in the current economy (RISKU; ABRAHAMSSON, 2015), since they are more agile in developing innovations (WEIBLEN; CHESBROUGH, 2015), a significant competitive advantage when compared to large organizations (REIS; FLEURY, 2017). Due to their

exponential success, especially in emerging markets, large companies have created programs to identify, select and support startups, offering financial incentives and opportunities for partnership (TAMAMAR; JAKITAS, 2015), evidencing the existing strong ties between innovation and entrepreneurship (FREDERIKSEN; BREM, 2017).

In a scenario where promoting economic growth is boosted by innovations, entrepreneurship becomes especially relevant (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010) acting as an economic catalyst and a powerful tool for innovation development, job creation and technological progress (ACS et al., 2016; AL-ATABI; DEBOER, 2014; OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013; VON GRAEVENITZ; HARHOFF; WEBER, 2010). Its importance is widely recognized, by academics and practitioners, attracting the attention of social sciences researchers (OBSCHONKA et al., 2013; REZAEI-ZADEH et al., 2014).

In this context, entrepreneurship education is an essential area, which fosters the development of innovative entrepreneurs, integrating qualitative and quantitative initiatives, comprehending theory, approaches, tools and techniques, aiming to improve entrepreneurial capabilities, attitudes and skills (BAE et al., 2014; NECK; GREENE, 2011). Becoming a subject of great interest about results (MARTIN; MCNALLY; KAY, 2013) and academic improvements (LIÑÁN; CHEN, 2009). Entrepreneurship education is positively associated with entrepreneurial intention (WALTER; BLOCK, 2015) and behavior (KARIMI et al., 2016). Literature evidenced that entrepreneurship education increases entrepreneurial intention by promoting entrepreneurial knowledge and skills (BAE et al., 2014; SÁNCHEZ, 2013), and influencing entrepreneurial intention (FIET, 2000). Entrepreneurial creativity and skills are not inborn abilities, but can be developed (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2013), attracting attention because of their capability in predicting the entrepreneurial behavior (FAYOLLE; GAILLY, 2015).

These considerations evidence knowledge gaps. Entrepreneurship is still an evolving field of knowledge and demands extensive research (KISS; DANIS; CAVUSGIL, 2012), remaining as a challenge for academics and practitioners (LIMA et al., 2015). Entrepreneurship education fosters the development of entrepreneurial competences (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; SÁNCHEZ, 2013) and the improvement of entrepreneurial intention and confidence (BAE et al., 2014). In this

context, the most relevant success factor in the development of prosperous new business is by stimulating entrepreneurial intention (BIRD, 1988; TAJEDDINI; MUELLER, 2009).

Researches evidence that improved entrepreneurial intention was verified when entrepreneurs had diversified and balanced competences (LAZEAR et al., 2005; MOOG et al., 2015), resulting in the creation of more sustainable business models (BIRD, 1995; MITCHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2013). In this context, research concerning entrepreneurship education aims to structure effective educational programs, identifying and measuring the improvement of entrepreneurial competences, usually applying pre and post capabilities verifications (CANTU-ORTIZ et al., 2017; DZISI; ODOOM, 2017). This study presents the outcomes a research that measured the evolution of entrepreneurs' competences, intention and confidence, before and after their participation as students in entrepreneurship courses, aiming to measure its effectiveness, in alignment with Morris et al. (2013), contributing to the practice and to the literature with the consolidation of the measures related to entrepreneurial education. For this, two main questions guided our research:

- What are the most relevant aspects that have to be measured to analyze the effectiveness of entrepreneurship courses?
- What is the evolution of the entrepreneur's competences, intention and confidence in entrepreneurship courses, considering the previously identified relevant aspects?

To answer these questions, this study first presents a systematic literature review evidencing the most relevant aspects to be measured. It resulted in the construction of a questionnaire to be applied to entrepreneurship students. This questionnaire is further explained in Section three.

This paper is structured as follows. The first section contextualizes and justifies this study, presenting its objectives and questions. Section two presents a literature review concerning entrepreneurship, entrepreneurship education, entrepreneurial intention, confidence and competences. Section three presents the method applied to this

research. Section four details the studied courses and highlights the main results. Section five discusses the main points discovered and section six concludes the study.

2 LITERATURE REVIEW

The literature review of this research analyzes the most relevant subjects related with this study objectives and research questions, aiming to highlight the relevant literature about these subjects, establishing the theoretical foundations of this study. The most relevant concepts are aligned with the themes of Entrepreneurship, Entrepreneurship Education and Entrepreneurial Competences, Intention and Confidence.

2.1 Entrepreneurship

Schumpeter (1934) defined entrepreneurship as a set of behaviors to raise and to manage economic resources aiming to create value. Entrepreneurship is currently defined as a way of thinking to identify new businesses opportunities (TEECE, 2007), searching for innovations and creating new businesses that provides value to customers by meeting needs and requirements, which are sometimes known but other times unknown, offering new value propositions (ALDRICH; FIOL, 1994; GANDHI; DEARDORFF; RODRIGUES, 2014). These are associated with positive outcomes (MARTIN et al., 2013), for transforming innovative ideas into products and services that can be considered innovative, resulting in new businesses (NECK; GREENE; BRUSH, 2014).

Entrepreneurship is considered a complex, non-linear and chaotic process (NECK; GREENE, 2011). In a scenario where organizations are searching for innovations, entrepreneurship becomes important for all the organizations, since it provides a way to innovate and to create the new (LIMA et al., 2015). Entrepreneurship is an essential part in the development and diffusion of innovations, having the power to impact competition basis and to redesign market structures (KURATKO, 2005).

Entrepreneurship aims to change market conditions, revolutionizing with the development and implementation of new services and products (DETIENNE; CHANDLER, 2004), originated from the identification of inefficiencies of business processes and of market opportunities (ACS et al., 2016). Entrepreneurship includes creating new businesses and also the search for opportunities, resilience capability and risk-taking (KURATKO, 2005). Entrepreneurs usually start from inspirations and not from the search of financial rewards (ACS et al., 2016), and only a small part of the

entrepreneurs effectively innovate, since most of them just explore markets that are not properly served when beginning their new businesses (ACS et al., 2016).

The main role in the entrepreneurship scenario is the entrepreneur. An entrepreneur tackles different challenges with the ability of performing many different tasks (OBSCHONKA et al., 2013), is a hard-working professional (HOFER; SANDBERG, 1987), and has the ability of mitigating the risks of starting a new business (LAZEAR et al., 2005; MACMILLAN; SIEGEL; NARASIMHA, 1985; OBSCHONKA et al., 2013). Entrepreneurs are considered successful when they identify and exploit opportunities, solving issues in a profitable and viable way, developing sustainable business models (LANS; BLOK; WESSELINK, 2014). Yet being an entrepreneur is an uncertain process, which cannot be predicted (NECK; GREENE, 2011), which was initially neglected in the specialized literature (BYLUND; MCCAFFREY, 2017) but is currently recognized as a crucial research area that demands in-depth studies (KISS et al., 2012; SALERNO et al., 2015). This study hence aims to understand how entrepreneurship education assists the development of entrepreneurial competences and intention.

2.2 Entrepreneurship Education

To be an entrepreneur is a behavior that can be intentionally planned and stimulated (HERRON; ROBINSON, 1993; MITCHELMORE; ROWLEY, 2010; SÁNCHEZ, 2011), and its learning process comprehends action, experimentation, and reflection (EGGERS; LOVELACE; KRAFT, 2017). There is growing number of programs that teach entrepreneurship, in new and also in traditional institutions (KURATKO, 2005). Once entrepreneurial competences can be developed and entrepreneurial skills and knowledge can be taught (KURATKO, 2005), entrepreneurship education is an effective disseminator of entrepreneurship (BAE et al., 2014), by teaching entrepreneurial attitudes and skills (BAE et al., 2014; RAUCH; HULSINK, 2015). Education influences the business success positively (REIS; FLEURY; CARVALHO, 2019; ROBINSON; SEXTON, 1994), with the development of more resilient competitors (FULLER-LOVE, 2006), and with the development of knowledge, skills and competences that are essential to the success of the business (REIS; FLEURY; CARVALHO, 2019).

Entrepreneurship education is a worldwide phenomenon (REIS; FLEURY; CARVALHO, 2019) that assists students in the development of their new business (RAUCH; HULSINK, 2015), providing knowledge and stimulating attitudes (DUVAL-COUETIL, 2013), assisting in the development of entrepreneurs' competences (REZAEI-ZADEH et al., 2014). One important aspect in entrepreneurship education is the ability to construct an environment that provides the relevant resources for entrepreneurs, an environment perceived and experienced as positive (MAN; LAU; CHAN, 2002) in developing the competences and skills necessary for entrepreneurs (OOSTERBEEK; VAN PRAAG; IJSSELSTEIN, 2010; RAUCH; HULSINK, 2015; SÁNCHEZ, 2013).

One big myth about entrepreneurship is that an entrepreneur is born with specific innate characteristics, ones that cannot be developed or learned (LANS et al., 2014; REZAEI-ZADEH et al., 2014). However, many emerging studies investigated the relationship between entrepreneurship education and entrepreneurial intention (FAYOLLE; GAILLY, 2015; WALTER; BLOCK, 2015) and evidenced that entrepreneurship education positively affects the students' entrepreneurial intention and attitudes (FAYOLLE; GAILLY, 2015; SÁNCHEZ, 2013; SOUITARIS; ZERBINATI; AL-LAHAM, 2007; WALTER; BLOCK, 2015).

2.3 Entrepreneurial Competences, Intention and Confidence

Entrepreneurial competences are different among entrepreneurs, and result from the combination of knowledge, resources and skills (FIET, 2000). This set of competences allows entrepreneurs to successfully perform complex and different tasks (MAN; CHAN, 2002), enabling the appropriate entrepreneurial behavior (BOYATZIS, 1982). Entrepreneurial competences improve with good practice and declines without practice, resulting from the learnings experienced in interactions among environments and among individuals (MORRIS et al., 2013). Environment conditions affect the development of entrepreneurial competences (BLENKER; CHRISTENSEN, 2010; HERRON; ROBINSON, 1993; IZQUIERDO; DESCHOOLMEESTER, 2010; NEKKA; FAYOLLE, 2010), and there is a set of competences that are recognized as important for entrepreneurs (REZAEI-ZADEH et al., 2014).

Research evidenced the connection between entrepreneurial competences and intention, revealing that when entrepreneurs have more balanced and diverse

competences, they have higher entrepreneurial intention (LAZEAR et al., 2005; MOOG et al., 2015), resulting in more sustainable businesses models (BIRD, 1995; MICHELMORE; ROWLEY, 2010; REZAEI-ZADEH et al., 2014; SÁNCHEZ, 2011), with good business performance (HERRON; ROBINSON, 1993; MAN; CHAN, 2002; MICHELMORE; ROWLEY, 2010; OBSCHONKA et al., 2013; REZAEI-ZADEH et al., 2014) and more confidence in being an entrepreneur.

The interest in the study of entrepreneurial intention began in the 1970s (ESPÍRITU-OLMOS; SASTRE-CASTILLO, 2015) and is affected by particular circumstances including economic and cultural aspects (MICHELMORE; ROWLEY, 2010; MILLER; LE BRETON-MILLER, 2017). Entrepreneurial intention is central to creating successful new businesses (BIRD, 1988; TAJEDDINI; MUELLER, 2009). Students increase their entrepreneurial intention after realizing the possible control of behavior during the participation in courses on entrepreneurship (RAUCH; HULSINK, 2015). Entrepreneurial intention can be affected by the modification of entrepreneurial knowledge (LIÑÁN; CHEN, 2009) and by entrepreneurship programs (SOUITARIS et al., 2007).

3 METHOD

This study applied two distinct research methods. A systematic literature review was conducted to draw the foundations of this research and to develop the research tool, the questionnaire. Case studies were performed to apply, to test and to measure students' performance aiming to validate what was discovered in the literature, highlighting how the literature works in practice, and if theory and practice are aligned or not.

3.1 Systematic Literature Review (SLR)

A systematic literature review shows the relevant publications of a specific area of knowledge, synthesizing the relevant researches (IRSHAD; PETERSEN; POULDING, 2018), and the results from high-quality publications (WEISSBRODT; GIAUQUE, 2017). A SLR allows constructing databases with the state of the art. It also points out limitations of previous researches, knowledge gaps and emerging trends and themes. Since structured data allow performing different analyses, as the cause and effect of what was published, leading to relevant new researches (DIKICI; TURETKEN; DEMIRORS, 2018; LIMA-JUNIOR; CARPINETTI, 2017; MAIER; MEYER; STEINBEREITHNER, 2016; PALMARINI et al., 2018; SARKA; IPSEN, 2017), that tend to be original and useful (CORLEY; GIOIA, 2011).

To develop the systematic literature review, searches were made in the Web of Science (WoS) and Scopus databases. The WoS was consulted because it provides access to all indexed journals with impact factor in the Journal Citation Report (JCR) (TAKEY; CARVALHO, 2016). The Scopus database was also consulted because it includes papers approved in a peer-review evaluation process (CARVALHO; FLEURY; LOPES, 2013). To conduct the searches, we used strings related with entrepreneurship, entrepreneurship education and entrepreneurial intentions and competences. Later initial filters were applied for prioritizing the most relevant papers in English, Portuguese or Spanish, published as articles, articles in press, reviews or reviews in press. To select only the more relevant papers, we also applied the snowballing process, to identify the most relevant publications cited in the initial sample (WOHLIN, 2014), resulting in the incorporation of more articles and books. The final database was analyzed and synthetized to prepare the pre and post-questionnaire.

3.2 Case Studies

Case studies results in a photo of a determined context (MCCUTCHEON; MEREDITH, 1993) and allows the comprehension and analysis of a specific context and its current reality. It is an unique method that aims to understand the dynamic of the present by applying a combination of other methods of research to collect data in different ways, including interviews, questionnaires, observations and secondary research, resulting in evidences that can be quantitative or qualitative (CHOUDHARI; ADIL; ANANTHAKUMAR, 2012; EISENHARDT, 1989). Case studies assist in the development of generic models (MARTIKAINEN; NIEMI; PEKKANEN, 2014) when investigating a phenomenon in its real-life routines (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002; YAN; YIN, 2006), resulting in realistic outcomes (BOLTON; MOLINARO; HOUSER, 2019).

We conducted multiple exploratory case studies to describe the teaching of entrepreneurship in different scenarios, inspired in the studies of Eisenhardt (1989) and Yan & Yin (2006). To analyze the obtained results from the case studies we applied multiple techniques, including analysis of variances (ANOVA), aiming to classify students' demographic characteristics and to compare students' entrepreneurial intentions and competences considering a pre and post-test, in alignment with the study of Amorim Neto et al. (2018).

The multiple case studies were conducted in two different entrepreneurship courses with focus on developing students' entrepreneurial competences and intentions. All the courses have in common the same dynamics, in a semester of weekly face-to-face classes, divided into two halves. In the first half, students have theoretical class and presentation of real cases. The second half of the class is dedicated for applying the presented concepts considering the specific reality of their projects. In these projects, students turn business ideas into prototypes of service or a product, developing the foundations of possible new businesses. Groups include three to five students. The project template includes four distinct deliveries: refinement and justification of the business idea; project design, including the development of the Business Model Canvas and its business strategy; the development of a Minimum Viable Product (MVP) and quantitative and qualitative data collection with potential customers; the development of a high fidelity MVP and a final presentation to the class, pitching the project and highlighting what the team learned with the project development.

To evaluate the students' entrepreneurial competences, intention and confidence, we applied a pre-course and a post-course questionnaire. The model of pre and post-course questionnaires was developed in alignment with the research initiatives of Carayannis, Evans, and Hanson (2003) and Martin et al. (2013). Questionnaires have three groups of questions. The demographic group, with questions about the general profile of the students. The entrepreneurial competence group, which included questions to understand the competences that the students initially believed to have and intended to develop by taking the course. After the course finished, they were asked if they considered they had developed the competence or not. Finally, the entrepreneurial intention and confidence group asked students about their entrepreneurial intentions and confidence before and after the course, also considering aspects they believed that could increase or decrease them.

4 RESULTS

As results, Table 1 presents the demographic data. As return rate, Course A, with 57 students, had 65% in the pre-test and 49% in the post-test. Course B, with 63 students, had 79% in the pre-test and 63% in the post-test.

Table 1 - Demographic Data

Demographic	*Course A*	*Course B*	*Total*	*Total (%)*
Age				
17-18	0	3	8	*8%*
19-20	11	20	43	*42%*
21-22	6	8	24	*24%*
23-24	10	7	23	*23%*
25-26	1	2	4	*4%*
High school profile				
Only public school	1	10	22	*22%*
Only private school	3	28	53	*52%*
More in public school	6	0	6	*6%*
More in private school	18	2	21	*21%*
Course				
Production Engineering	12	0	15	15%
Mechanical Engineering	2	0	2	2%
Environmental Engineering	1	0	2	2%
Electrical Engineering	9	0	14	14%
Naval Engineering	3	0	4	4%
Civil Engineering	1	32	52	51%
Computer Engineering	0	0	1	1%
Architecture and Urbanism	0	8	11	11%
Geology	0	0	1	1%
First year in the college				
2012-2013	0	9	10	10%
2014-2015	15	0	23	23%
2016-2017	11	19	36	35%
2018-2019	2	12	33	32%
Knows some entrepreneurs				
Yes	23	32	84	82%
No	5	8	18	18%

Source: Authors.

To understand if the courses affect the evolution of the students' entrepreneurial intention and confidence, students were asked to point from 0 to 10 their entrepreneurial intention and confidence in the first week of the courses and in the last week of the courses. We then applied a Two-Way ANOVA: One between ANOVA to evaluate the results, elected for its capability in work with one dependent variable (in this study the different courses) and two independent variables; in this study, students'

entrepreneurial intention and confidence, before and after the courses (pre and post-test).

In the descriptive statistics, see Table 2, we pointed out the evolution of the means before and after both courses, considering entrepreneurial intention.

Table 2 - Descriptive Statistics, entrepreneurial intention

	Course	Mean	Std. Deviation	N
Intention_Before	Course_A	6,33	2,904	21
	Course_B	6,12	2,129	34
	Total	6,20	2,430	55
Intention_After	Course_A	6,5238	2,80391	21
	Course_B	6,2647	1,98950	34
	Total	6,3636	2,31232	55

Source: Extracted from IBM SPSS Statistics 20.

In the Test of Man Effect (within subjects factor) for the entrepreneurial intention, the results, see Table 3, $F(1, 53) = 0.498$, $p = 0.484$ evidenced that the students' entrepreneurial intention changed over time, when comparing the pre and post-test, although with low significance, close to 0.5. Another result, $F(1, 53) = 0.008$, $p = 0.928$ highlights that there was not a significant time and courses interaction effect on the students' entrepreneurial intention, with a high level of no significance.

Table 3 - Test of Man Effect, entrepreneurial intention

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	,740	1	,740	,498	,484	,009
	Greenhouse-Geisser	,740	1,000	,740	,498	,484	,009
	Huynh-Feldt	,740	1,000	,740	,498	,484	,009
	Lower-bound	,740	1,000	,740	,498	,484	,009
time * Course	Sphericity Assumed	,012	1	,012	,008	,928	,000
	Greenhouse-Geisser	,012	1,000	,012	,008	,928	,000
	Huynh-Feldt	,012	1,000	,012	,008	,928	,000
	Lower-bound	,012	1,000	,012	,008	,928	,000
Error(time)	Sphericity Assumed	78,751	53	1,486			
	Greenhouse-Geisser	78,751	53,000	1,486			
	Huynh-Feldt	78,751	53,000	1,486			
	Lower-bound	78,751	53,000	1,486			

Source: Extracted from IBM SPSS Statistics 20.

The courses had a significant effect on the students' entrepreneurial intention, see Table 4 evidencing the increase between the means in a before and after test.

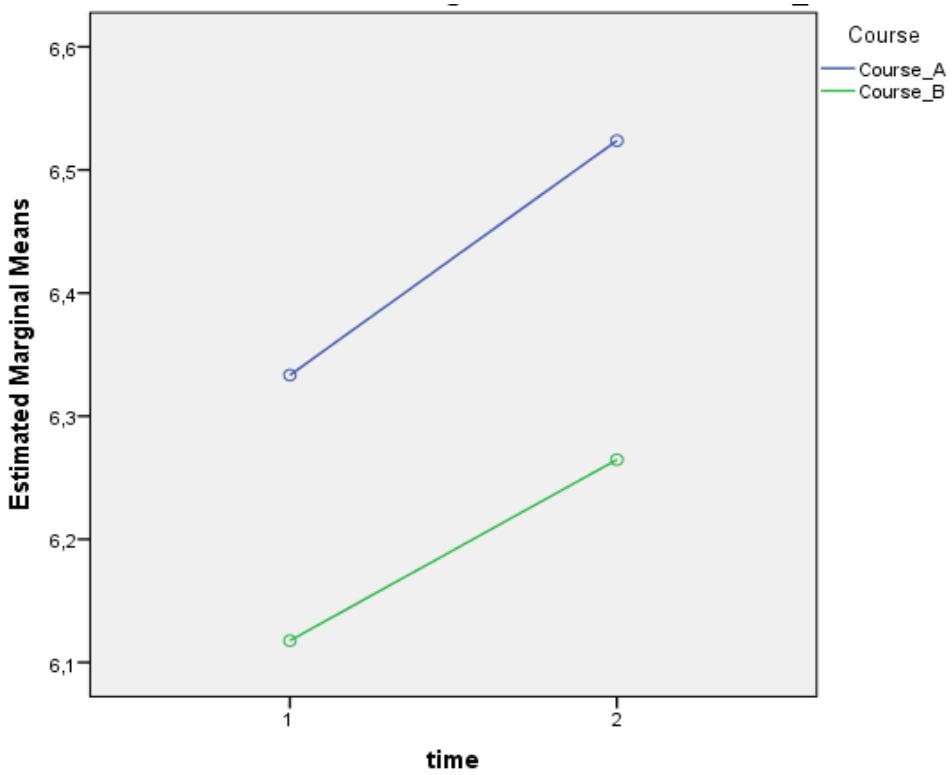
Table 4 - Test of Between Effect, entrepreneurial intention

time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	6,225	,340	5,543	6,907
2	6,394	,323	5,746	7,043

Source: Extracted from IBM SPSS Statistics 20.

Graph 1 evidences that in both courses (A and B) the students' entrepreneurial intention increased, with a greater increase in Course A, greater inclination.

Graphic 1 - Estimated Marginal Means, entrepreneurial intention



Source: Extracted from IBM SPSS Statistics 20.

Before the courses, the students believed that their intention in becoming an entrepreneur could increase or decrease with the acquisition of knowledge about what it is like to be an entrepreneur and how to launch a more financially consistent business. Another point revealed from the questionnaires was the worries about the global financial crises, including the Brazilian market, influencing the belief in the possible success of a new business idea, sometimes directing students to traditional jobs and occupations reducing financial risks associated with entrepreneurship. After the course ending, the same issues were revealed but new subjects, related with the

construction of networks, creating good groups to work together, and having a mentor for new business ideas were also evidenced in the questionnaires.

Table 5 evidences the descriptive statistics about entrepreneurial confidence, revealing the evolution of the means before and after both courses.

Table 5 - Descriptive Statistics, entrepreneurial confidence

	Course	Mean	Std. Deviation	N
Confidence_Before	Course_A	4,14	2,372	21
	Course_B	4,68	2,070	34
	Total	4,47	2,185	55
Confidence_After	Course_A	4,90	2,119	21
	Course_B	5,21	1,903	34
	Total	5,09	1,975	55

Source: Extracted from IBM SPSS Statistics 20.

In the Test of Man Effect (within subjects factor) for the entrepreneurial intention, the results, see Table 6, $F(1, 53) = 3.582$, $p = 0.064$ evidenced that the students' entrepreneurial confidence changed over time, when comparing the pre and post-test (conducted before and after the courses), being a great significance, since it is much lower than 0.5. Another result, $F(1, 53) = 0.116$, $p = 0.735$ highlights that there was not a significant time and the courses interaction effect on the students' entrepreneurial confidence, with a high level of no significance.

Table 6 - Test of Man Effect, entrepreneurial intention

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
time	Sphericity Assumed	10,824	1	10,824	3,582	,064	,063
	Greenhouse-Geisser	10,824	1,000	10,824	3,582	,064	,063
	Huynh-Feldt	10,824	1,000	10,824	3,582	,064	,063
	Lower-bound	10,824	1,000	10,824	3,582	,064	,063
time * Course	Sphericity Assumed	,351	1	,351	,116	,735	,002
	Greenhouse-Geisser	,351	1,000	,351	,116	,735	,002
	Huynh-Feldt	,351	1,000	,351	,116	,735	,002
	Lower-bound	,351	1,000	,351	,116	,735	,002
Error(time)	Sphericity Assumed	160,140	53	3,022			
	Greenhouse-Geisser	160,140	53,000	3,022			
	Huynh-Feldt	160,140	53,000	3,022			
	Lower-bound	160,140	53,000	3,022			

Source: Extracted from IBM SPSS Statistics 20.

The courses had a significant effect on the students' entrepreneurial confidence, see Table 7, evidencing the increase between the before and after tests.

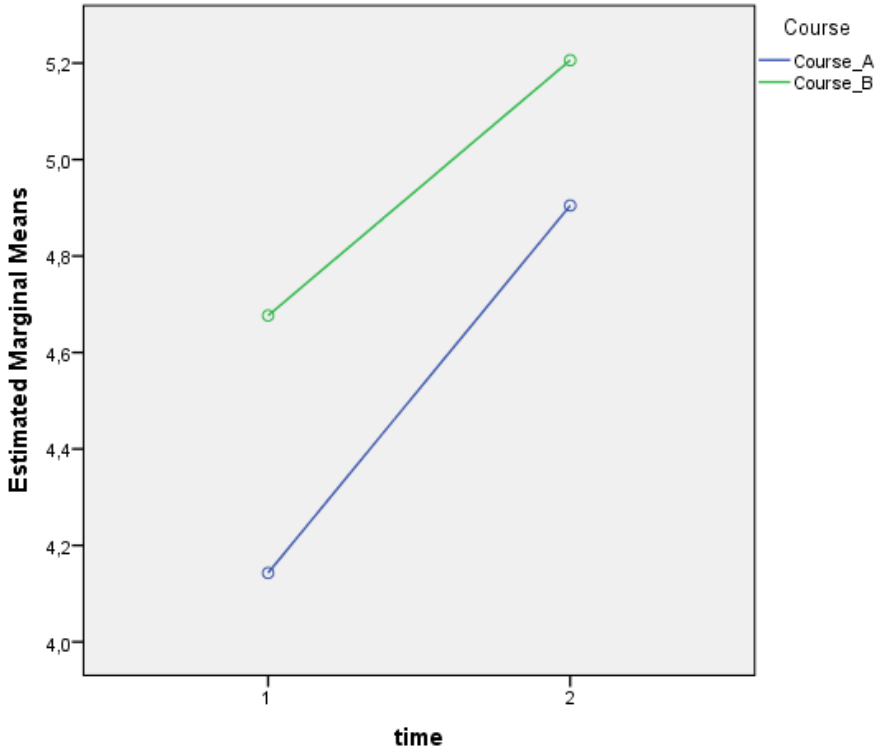
Table 7 - Test of Between Effect, entrepreneurial intention

time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	4,410	,304	3,800	5,019
2	5,055	,276	4,502	5,609

Source: Extracted from IBM SPSS Statistics 20.

Graph 2 evidences that in both courses (A and B) the students' entrepreneurial confidence increased, with a bigger increase in the Course A, bigger inclination.

Graph 2 - Estimated Marginal Means, entrepreneurial intention



Source: Extracted from IBM SPSS Statistics 20.

Before the courses, students believed that their confidence in being an entrepreneur could increase or decrease with knowing more about entrepreneurship, about the market of interest and having confidence in reducing the risks of starting a new business; after the courses, the same issues were verified. The evolution of competences was analyzed considering three distinct perspectives: competences that the students had at the beginning of the course and intended to improve with the participation in the course (HBII); competences that the students had at the beginning of the course and maintained at the end of the course (HBHE); and competences that

students intended to improve with the participation in the course and had acquired at the end of the course (IIHE).

In Course A and in Course B, all the competences that students had were also intended to be improved with the participation in the course, except for competence “Have applied guidance”, in both courses. Competences that students most wanted to improve in Course A were “Having critical and strategic thinking” (6%), “Having common sense” (6%) and “Possessing awareness” (5%); in Course B, the revealed competences were “Dealing with challenges” (6%), “Having critical and strategic thinking” (6%) and “Having the ability to solve problems” (6%).

In Course A and in Course B, all the competences that students considered to have in the beginning of the course were also considered at the end of the course, with the exception of the competence “Needing power and dominance”, and in the case of Course A, also the competences “Having integrity” and “Possessing discipline”. Competences that students improved more in Course A were “Having critical and strategic thinking” (6%), “Having a global and long-term view of the opportunities” (5%), and in Course B were “Learning from feedbacks” (6%), “Dealing with challenges” (6%), “Being innovative and creative” (5%) and “Understanding marketing and commercial” (5%).

In Course A, all the competences that the students intended to improve with the participation in the course were eventually obtained, except for the competence “Needing power and dominance”. In Course B, the exceptions were the competences “Understanding marketing and commercial”, “Knowing how to use contacts and connections”, “Having applied guidance” and “Possessing the ability to predict”. The competences that the students improved more in Course A were “Having critical and strategic thinking” (6%), “Having analytical skills” (5%) and “Having the ability to solve problems” (5%). In Course B, the competences were “Learning from feedbacks” (8%), “Dealing with challenges” (7%), “Knowing how to accept responsibilities” (6%), “Having common sense” (6%), “Having analytical skills” (5%) and “Knowing how to adapt and to be flexible” (5%).

5 DISCUSSION

The study identified that part of the objectives of an entrepreneurship course were verified since students' entrepreneurial intention and confidence changed over time, in a comparison between before and after the course (pre and post-test). The results also evidenced that the evolution of students' entrepreneurial intention and confidence did not change significantly between the courses, evidencing that the courses positively increase students' entrepreneurial intention and confidence, considering the same context of two distinct courses, highlighting the value of the content and of the classes. After the courses, students started to associate their increased or decreased intention in being an entrepreneur associated with more people, evidencing the importance of guidance provided by mentors, work teams and even network opportunities with already established entrepreneurs.

Regarding competences, the only competence the students considered developed after taking the courses and that was not previously mentioned is "Having applied guidance", being a competence that they did not believe to have before the courses. Students initially considered to have and wanted to improve all the other competences by taking the courses. The competences that most of the students wanted to improve by taking the courses were "having critical and strategical thinking", and "ability to solve problems". The research also evidenced issues that affected their increase or decrease of entrepreneurial intention.

The Courses had difficulty in developing the competence of "Needing power and dominance", evidenced in the comparison of the students' competences in the pre and post-test questionnaires. In the case of Course B, some competences related to improving the use of networks with other people and predicting the market emerged. Therefore, the courses were observed to assist more in the development of competences related with learning from feedbacks, being innovative and creative, and having a long-term view of opportunities, aligning the courses with the issues that can affect the students' increase or decrease of entrepreneurial intention.

6 CONCLUSIONS

In the current scenario of reduction of product lifecycle and expansion of customers' demands, innovating emerges as a solution many times associated with entrepreneurship. Our research thus evidenced that entrepreneurship education is effective in developing entrepreneurs with a balanced set of entrepreneurial competences and high entrepreneurial intentions.

Nevertheless, answering this study first research question, a viable proposal to measure the effectiveness of courses that teach entrepreneurship is by measuring the students' evolution of entrepreneurial competences, intentions and confidence and the proposed questionnaire could effectively handle this task. The questionnaire was applied before and after the course end, measuring the course effectiveness by qualitatively and quantitatively analyzing the responses and considering a scenario of multiple case studies. This study allowed evidencing that the courses effectively contributed to the development of the students' entrepreneurial competences and intentions.

This research contributes to improving theories that aim to evaluate the effectiveness of entrepreneurship courses, promoting the evolution of entrepreneurship education. As limitations, this study was carried out in a single university, evaluating only the evolution of entrepreneurial intention and competences, which asks for similar studies being conducted in different scenarios to allow comparing others variables, such as environmental aspects.

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APPENDICES A – PRE-QUESTIONARY PROPOSAL

Question	Questionnaire	Scale	Authors
01. Name	pre and post-questionnaire	open question	control variable
02. Age	pre-questionnaire	open question	control variable
03. In what kind of school did you attend high school:	pre-questionnaire	no scale	ANDIFES (2011)
04. Name of undergraduate course:	pre-questionnaire	open question	result from pilot tests
05. Year of start in the undergraduate course:	pre-questionnaire	open question	result from pilot tests
06. Who is financially responsible for your family:	pre-questionnaire	no scale	result from pilot tests
07. Household income:	pre-questionnaire	no scale	ANDIFES (2011)
08. Currently working:	pre and post-questionnaire	yes, no	result from pilot tests
09. If you work, what do you work with?	pre and post-questionnaire	open question	ANDIFES (2011)
10. Do you see yourself as an entrepreneur:	pre and post-questionnaire	no scale	Chen, Yao, and Kotha (2009) *apud* Coviello and Yli-Renko (2017)
11. Imagining yourself as an entrepreneur, ranging for 1 to 5:	pre and post-questionnaire	five-point Likert scale ranging from 1 = ‘not at all’ to 5 = ‘always’	ANDIFES (2011)
12. Whose do you know with experience in starting their own business, in be an entrepreneur:	pre and post-questionnaire	no scale	result from pilot tests
13. On a scale from 0 to 10, what is your level of intention in be an entrepreneur:	pre and post-questionnaire	ten-point Likert scale ranging from 0 to 10	ANDIFES (2011)
14. Why do you intend to be an entrepreneur or not? Do you believe your intention to be an entrepreneur could increase or decrease by what?	pre and post-questionnaire	open question	result from pilot tests

15. What is your confidence in be an entrepreneur:	pre and post-questionnaire	five-point Likert scale ranging from 1 = 'completely unsure' to 5 = 'completely sure'	result from pilot tests
16. Why do you feel confident or not about be an entrepreneur? Do you think your confidence in be an entrepreneur could increase or decrease by what?	pre and post-questionnaire	open question	Chen, Greene, and Crick (1998), Kazanjian (1988), Long (1983), Miner (1990) *apud* Coviello and Yli-Renko (2017)
17. Check your competences below (tick as many options as you like): *List of competences from #P3	pre and post-questionnaire	five-point Likert scale ranging from 1 = 'very slightly or not at all' to 5 = 'extremely'	result from pilot tests
18. Check below the competences you want to develop with the course (tick as many options as you like): *List of competences from #P3	pre-questionnaire	five-point Likert scale ranging from 1 = 'very slightly or not at all' to 5 = 'extremely'	result from pilot tests
19. Check below the competences you believe to had developed with the course (tick as many options as you like): *List of competences from #P3	post-questionnaire	five-point Likert scale ranging from 1 = 'very slightly or not at all' to 5 = 'extremely'	result from pilot tests
20. Would recommend the course:	post-questionnaire	five-point Likert scale ranging from 1 = 'very slightly or not at all' to 5 = 'extremely'	result from pilot tests
21. Any suggestions for the course?	post-questionnaire	open question	Chen, Greene, and Crick (1998), Kazanjian (1988), Long (1983), Miner (1990) *apud* Coviello and Yli-Renko (2017)

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