



PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE
ESCUELA DE INGENIERIA

ENTREPRENEURSHIP EDUCATION: “THE CHILEAN EXPERIENCE” – A CASE STUDY ON THE BERKELEY METHOD OF ENTREPRENEURSHIP.

SEBASTIAN ANDRES OPAZO PIPER

Thesis submitted to the Office of Research and Graduate Studies in partial fulfillment of the requirements for the Degree of Master of Science in Engineering

Advisor:

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Santiago de Chile, (May, 2017)

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A mis Padres, hermanos y amigos,
que me apoyaron mucho.

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RESUMEN

Hoy más que nunca el emprendimiento desempeña un papel relevante en las economías abiertas para el crecimiento. Altos niveles de emprendimiento pueden alcanzarse mediante la educación, y especialmente la educación empresarial. A pesar de que existe una amplia variedad de estudios sobre cursos basados en el trabajo grupal para el diseño de productos e innovación, hoy no existe evidencia sustancial de su efecto sobre los resultados de aprendizaje.

Esta tesis estudia el curso “ING2030: Investigación, Innovación y Emprendimiento”, dictado en la Pontificia Universidad Católica de Chile (PUC), considerando la autoeficacia e intención a emprender, asociado a los resultados esperados del curso.

Nuestro principal objetivo es explorar y medir los impactos de nuevos cursos de emprendimiento. Dicho esto, pretendemos ofrecer una intervención probada para fomentar y desarrollar una mentalidad emprendedora en estudiantes de ingeniería. Comenzamos investigando la forma en que los seres humanos guían sus comportamientos para luego poder diseñar metodologías e intervenciones apropiadas para influir en ellos. Luego proporcionamos datos de los efectos del Berkeley Method of Entrepreneurship (BMoE) en los estudiantes de la Universidad de California en el BMoE Bootcamp. A continuación, se realiza el mismo estudio en la PUC, midiendo los impactos de una versión adaptada del curso: ING2030. Consecuentemente, analizamos los efectos generales del BMoE, no sólo como un caso aislado.

Encontramos pruebas concluyentes que la intervención estudiada implementada en Chile fue capaz de mejorar la autoeficacia de los estudiantes de ingeniería de la PUC. En cuanto a la intención a emprender, hubo un incremento positivo en las declaraciones asociadas a este ítem. Sin embargo, no fue estadísticamente significativo y más investigación debe llevarse a cabo. Finalmente, el estudio de este caso provee evidencia que la autoeficacia en el emprendimiento puede aumentar la intención de alguna manera inmediata. Sin embargo, los resultados demuestran que no existe una relación de efecto de causa simple entre ambas variables.

Palabras clave: Emprendimiento, Educación Empresarial, Autoeficacia, Intención Empresarial, Innovación, Berkeley Method of Entrepreneurship

ABSTRACT

Entrepreneurship plays a relevant role in modern open economies for growth, today more than ever. Increased levels of entrepreneurship can be reached throughout education, and especially teaching entrepreneurship education. Even though there exists a broad variety of studies about courses based on teamwork for the design of products and innovation, substantial evidence of their effect over learning results does not yet exist.

This thesis studies the Chilean course “ING2030: Investigation, Innovation and Entrepreneurship” regarding self-efficacy and entrepreneurial intent, associated with the course’s expected outcomes.

Our main objective is to explore and measure the impacts of new courses for entrepreneurship education. By doing this, we aim to offer a proven intervention in order to encourage and develop an entrepreneurial mindset in engineering students. We start by researching the way human beings guide their behaviours in order to design proper methodologies and interventions to influence them. Then we provide data of the effects of the Berkley Method of Entrepreneurship (BMoE) in the students at University of California at the BMoE Bootcamp. Next, the same study is conducted at Pontificia Universidad Catolica de Chile (PUC), measuring the impacts of an adapted version of the course: ING2030. Therefore, we analyse the overall effects of the BMoE, not just as an isolated case.

We found compelling evidence that the studied intervention implemented in Chile was able to improve the self-efficacy of engineering students at PUC. Regarding the entrepreneurial intent, there was a positive increment in the statements associated to this item. Yet, it was not statistically significant and further research has to be conducted. Finally, this case study provides evidence that self-efficacy in entrepreneurship can increase intention in some immediate way. Nevertheless, findings show there is not a simple cause effect relationship between both variables.

Key words: Entrepreneurship, Entrepreneurship Education, Self-Efficacy, Entrepreneurial Intent, Innovation, Berkeley Method of Entrepreneurship.

1. INTRODUCTION

1.1. Motivation

Entrepreneurship plays a relevant role in modern open economies for growth, today more than ever (Sidhu et al., 2014). Policy makers throughout the world believe reaching higher levels of economic growth and innovation requires more entrepreneurship is required (Oosterbeek et al., 2010). Empirical research supports the idea that entrepreneurial activity leads to economic outcomes such as economic growth and innovation (Van Praag and Versloot, 2007). Increased levels of entrepreneurship can be reached through education, and especially entrepreneurship education (Oosterbeek et al., 2010). Universities, colleges, and other schools play a key role in the strategy used to increase the entrepreneurial knowledge, skills, and intentions of undergraduate and postgraduate students to start new ventures (Cooper and Lucas, 2006; Sidhu et al., 2014; Oosterbeek et al., 2010). In designing and conducting entrepreneurship courses, training institutions should not only train students in critical entrepreneurial skills and abilities, but also strengthen their entrepreneurial self-efficacy (Chen et al., 1998). Self-efficacy can be defined as an individual's belief in his or her ability to mobilize motivation, cognitive resources, and courses of action needed to exercise control over events in his or her life (Wood and Bandura, 1989). Self-efficacy beliefs determine how people feel, think, motivate themselves, and behave (Bandura, 1969). Therefore, entrepreneurial self-efficacy represents an individual's belief that he or she is capable of successfully performing the various roles and tasks that arise from a new venture. Best-practice entrepreneurship programs are expected to increase the self-efficacy of participants (Peterman and Kennedy, 2003). Indeed, self-efficacy in one's skills has been associated with behaviors such as innovation, opportunity recognition, and intentions to start new ventures (Boyd and Vozikis, 1994; Chen et al., 1998, Krueger and Brazeal, 1994). If the objective of entrepreneurship education is to influence beliefs, attitudes, and intentions toward entrepreneurship,

consideration of how programs might bring about changes in an individual's level of self-confidence so that he or she will be motivated to try new activities and to persist in the face of difficulty and challenge is important (Cooper & Lucas, 2006).

The Berkeley Method of Entrepreneurship (BMoE) is a holistic/inductive teaching and learning approach that enables engineers to be more entrepreneurial. The Sutardja Center for Entrepreneurship and Technology (SCET) at the University of California Berkeley developed it in 2005. The course "Challenge Lab," taught at UC Berkeley by the SCET, is based on the BMoE. This course has a competition-based format in which students work in cross-discipline lean startup teams vying to create innovative products. The School of Engineering at Pontifical University of Chile (PUC) adapted a version of the course under the name "ING2030: Investigation, Innovation and Entrepreneurship" in the first academic semester of 2015. This thesis studies the impacts of the course regarding self-efficacy and entrepreneurial intent, associated with the expected outcomes of the course. A similar study was conducted at UC Berkeley, at the BMoE Bootcamp in August 2016. The BMoE Bootcamp is a week-long venture workshop, using the BMoE as a teaching methodology. Entrepreneurship courses at engineering schools have focused more on the creation of technologic ventures rather than on broad programs offered by businesses schools (Duval-Couetil et al., 2014). Our main contribution is to provide evidence that an external intervention in engineering entrepreneurial education in Chile actually induces changes in entrepreneurial activity.

Chapter 2 starts with a definition of entrepreneurship, entrepreneurship education, and their impact on society. Next, it describes the concepts of entrepreneurial self-efficacy and entrepreneurial intent in depth, and its importance in behavioural entrepreneurial attitudes. This thesis then presents a description of the BMoE, Berkeley's Challenge Lab, and how they were adapted to a Chilean reality. Chapter 4 proceeds to explain the research setting, and chapter 5 explains the construction of the instrument used to measure the impacts of the course. Chapters

6 and 7 then explain and discuss the results. Finally, chapter 8 presents implications and some ideas for further research.

1.2. Objectives

This thesis studies in Chile the course “ING2030: Investigation, Innovation and Entrepreneurship” regarding self-efficacy and entrepreneurial intent, associated with the expected outcomes of the course. This case study provides evidence that an external intervention in engineering entrepreneurial education actually induces changes in entrepreneurial activity. Therefore, being able to use the BMoE as a framework to improve the self-efficacy and entrepreneurial intentions of engineering students. The work starts by providing data of the effects of the BMoE on the students at the BMoE Bootcamp at UC Berkeley. Next, the same study is conducted at Pontificia Universidad Catolica de Chile (PUC), measuring the impacts of an adapted version of the course: ING2030. Therefore, it analyzes the overall effects of the BMoE, not just as an isolated case.

This study shows the effects of the BMoE independent of the context and analyzes results in two different countries using the same course to teach entrepreneurship. This approach will allow us to determine if the context is an important factor to measure in future investigations regarding entrepreneurial education.

Even though a broad variety of studies have examined courses based on teamwork for the design of products and innovation, these studies have found no substantial evidence of their effect on learning results (Duval-Couetil et al., 2014). More effort is needed to describe which specific competencies students develop in this type of course (Duval-Couetil et al., 2014).

On the other hand, several studies on entrepreneurship education have focused on elective courses or programs in which motivated students participate, and rarely on required courses in which students’ motivations and intentions differ considerably.

ING2030 is a compulsory course at PUC. Therefore, our present study was designed to fill these research gaps by closely examining how engineering students evolve from a methodology imported from Silicon Valley. This approach has not been used extensively in Chile and is ripe for research.

Outside Silicon Valley, the application of the BMoE has been scarce. On the other hand, culture motivates individuals in a society to engage in behaviours that may not be evident in other societies. This thesis presents a qualitative and quantitative study of the effects of the BMoE in the students of engineering at PUC. In this sense, this thesis provides an integrative analysis of entrepreneurial education borrowing some concepts from subjects such as psychology, sociology, and entrepreneurship, as well as from previous empirical research in this field.

Consequently, the objectives of this investigation are to analyze the effects of the entrepreneurship course implemented at Pontifical Catholic University of Chile (based on the BMoE) for students of the School of Engineering throughout a year (two semesters). Look primarily at how the contents and methodology of the course affected the entrepreneurial self-efficacy (ESE) and the entrepreneurial intention of the students. This approach will provide evidence of the validity and effectiveness of the BMoE applied outside UC Berkeley. Secondary objectives include the study of the BMoE outside its original context (UC Berkeley) and as a compulsory course.

2. THEORETICAL BACKGROUND

This chapter constructs the foundations on which this work is based. Section 2.1 starts by explaining the concepts of entrepreneurship, entrepreneurship education, and their importance to economic growth and development. Then section 2.2 describes the concepts of entrepreneurial self-efficacy and entrepreneurial intent in depth, and their importance in behavioural entrepreneurial attitudes. Self-efficacy and entrepreneurial intent will be the variables used to measure the impacts of the entrepreneurship course implemented in Chile (ING2030). Sections 2.3 and 2.4 proceed to describe the methodology developed at UC Berkeley: the BMoE. This methodology is used in the course adapted in Chile as well as in the course measured at UC Berkeley (BMoE Bootcamp). This thesis provides evidence that validates the BMoE as a framework for use in entrepreneurship education. Action-based learning and game-based teaching are two important elements included in the BMoE and are described in section 2.5, detailing its importance in the entrepreneurial pedagogy. This chapter will borrow several concepts from the social sciences and give us a common language for describing the intervention made at the School of Engineering at Universidad Católica de Chile (PUC).

2.1. Entrepreneurship and Entrepreneurship Education

Entrepreneurship has become a popular concept over the last few years. But what is entrepreneurship? Entrepreneurship occurs when entrepreneurs take action to pursue business opportunities (Gielnik et al., 2015). Definitions have emphasized a broad range of activities including the creation of organizations, the carrying out of new combinations, the exploration of opportunities, the bearing of uncertainty, and the bringing together of factors of production, among others (Dutta, 2009). Other definitions, such as Howard Stevenson's, state that entrepreneurship is the pursuit of opportunity beyond controlled resources (Eisenmann, 2013).

The reality is that regardless of its definition, entrepreneurship matters. An important type of entrepreneurship is technology-based entrepreneurship, which is a style of business leadership based on the process of identifying high-potential, technology-intensive business opportunities, gathering resources such as talent and cash, and managing rapid growth using principles and real-time decision-making skills (Byers, 2010).

But what is the actual contribution of entrepreneurs to the economy in comparison to non-entrepreneurs? Recent empirical evidence can collectively and systematically demonstrate technology entrepreneurship has important economic value. Several studies analyzing the “value of entrepreneurship” showed the main benefits relate to employment, innovation, productivity, growth, and the individual’s utility levels (Van Praag and Versloot, 2007). Nevertheless, economics is still constrained by a series of factors caused by social barriers based on geographical distance, lack of trust, differences in language and culture, and inefficient social networks (Hwang and Horowitz, 2012).

Therefore, policy makers throughout the world are motivated to encourage entrepreneurship as a vehicle to reach higher levels of economic growth and innovation. The answer to society’s increasing need for entrepreneurship is for people to be trained to start companies (Sidhu et al., 2014). Higher levels of entrepreneurship can be reached through education, and especially entrepreneurship education (Oosterbeek et al, 2010). Thus, universities, colleges, and other schools play an important role in preparing these new entrepreneurs.

Entrepreneurship has gained attention in the field of engineering education as well. Governments and universities worldwide are pushing for education programs that produce more “entrepreneurial engineers” who are “bilingual”, that is, who possess dual managerial and technical competencies (Sidhu et al, 2014). According to Täks (2014), the new generation of engineers is expected to have a deep knowledge in their field of study, as well as various skills in problem solving,

communication, networking, information technology, and teamwork. They also are expected to show creativity, resilience, determination, and risk taking to achieve goals while being able to spot opportunities (Täks et al., 2014). Consequently, entrepreneurship education seems to be the way to inspire future engineers—even those who are not interested in becoming entrepreneurs—to develop and internalize the mindsets and abilities of an entrepreneur in order to engage in “intrapreneurship” (Antoncic and Hisrich, 2003), that is, to acquire many of the attributes of an entrepreneur without actually becoming one.

In Chile, where the present study was conducted, the engineering instructors at higher-education institutes have essentially followed traditional teaching principles and methods. Even though recent initiatives to promote STEM (Science, Technology, Engineering and Mathematics) education in Chile have been encouraging, changes in teaching practices and efforts to integrate entrepreneurship and real-life issues in engineering studies have remained modest, and much work remains to be done (Echecopar et al., 2011). Sternberg (2003) has argued schooling has traditionally, although in an unbalanced way, emphasized the development of analytical thinking.

This area is where the Engineering 2030 initiative is highly relevant. The Clover 2030 Engineering Strategy—An Engine to Surf the Waves of Chile’s Development, also known as Engineering 2030, is a joint strategy between PUC and Technical Santa Maria University of Chile. Engineering 2030 was recently born as a response to the call from the Chilean Government, through CORFO—Production Development Corporation—to propose strategic plans for a “New Engineering for 2030” (Engineering UC, 2015). This public fund seeks to support national engineering schools to become world-class schools directly influencing Chile’s development.

The Engineering 2030 consortium aims to turn engineering schools into world-class institutions, becoming global, reaching academic excellence, and achieving

international recognition in the realm of the world's top engineering universities. Engineering 2030 aspires to create a true educational, innovation, and entrepreneurial ecosystem within the country that encourages the use of technology as a vehicle to influence global markets.

Engineering 2030 was conceptualized as a four-leaf clover (pillars), connected by a STEM (fifth pillar) that delivers nutrients from the fertile soil (our society). The leaves and stem consist of concrete stages and actions, materialized in the form of projects, which are aligned with the strategic goal (Engineering UC, 2015). The pillars are the following:

- Pillar 1: Transforming Engineering Education
- Pillar 2: Facing Societal Grand Challenges
- Pillar 3: Orchestrating Effective, Innovative and Entrepreneurial Networks
- Pillar 4: Building a World Class Organization, Structure and Community
- Pillar 5: Constructing a New Liaison with Society

The motivation for implementing a version of Berkeley's Challenge Lab as a compulsory course in the School of Engineering at PUC is the desire to achieve transversally the objectives proposed in these five pillars.

Therefore, PUC needed to design a completely new and disruptive entrepreneurship course capable of producing these entrepreneurial thinkers, regardless of their career path. Courses often focus on commonly identified management skills but ignore entrepreneurial skills such as mindset, innovation, and risk-taking (Chen et al., 1998).

The goals of entrepreneurship education are related to personal development through helping students become aware of their own abilities and enhancing their entrepreneurial mindset. Research has suggested that methods specifically geared

toward entrepreneurship education or studying entrepreneurship in college could help develop such skills (Täks et al., 2014).

ING2030 is a course full of uncertainty, where the rules change from day to day as a means of educating students about the reality of a start-up. The student should be able to experience the chaos of a venture, which often lacks a daily plan. Students should be able to investigate on their own the information relevant to the development of their projects. This course aims to reveal the student's social behaviors so as to provide the tools necessary to help the student determine whether he or she should become an entrepreneur. Ideally, some real companies will emerge from this experience. The idea is to empower students and give them as little information as possible to enhance their critical thinking.

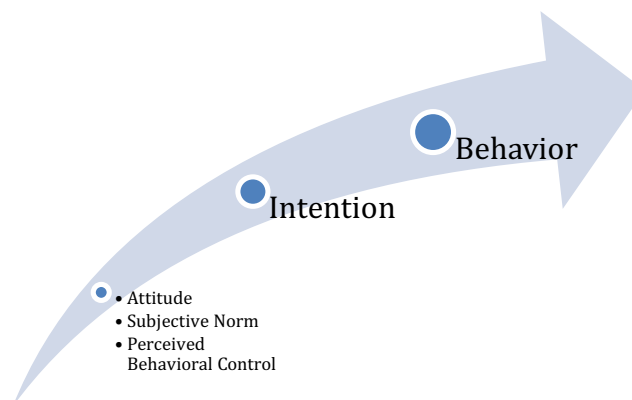
Despite the many efforts to encourage entrepreneurship education within engineering higher education, research on the role and effectiveness of entrepreneurship education as well as changes in attitude towards it is scarce (Täks et al., 2014).

Hereafter, let's refer to the course implemented in Chile as ING2030, and refer to the CORFO initiative as the Engineering 2030 initiative.

2.2. Beliefs, Attitudes and Intention—Entrepreneurial Self-efficacy and Entrepreneurial Intent

The literature regarding the effects of entrepreneurship education on behavior is sparse; therefore, we need to make a big leap and take some concepts developed by the social sciences, such as psychology and sociology. Authors often borrow knowledge from the theory of planned behavior (Ajzen, 1985) and the concept of self-efficacy (Bandura, 1994). By doing so, we can build a logical argument regarding the relationship between entrepreneurship education (specifically, the BMoE) and behavioral intentions to become an entrepreneur.

Human social behavior is extremely complex; nevertheless, it is often surprisingly easy to predict (Ajzen and Flood, 2009). The theory of planned behavior suggests human behavior is guided by three considerations: beliefs about the likely outcomes of the behavior and the assessment of those outcomes (behavioral beliefs), beliefs about the normative expectations of others and motivation to comply with these expectations (normative beliefs), and beliefs about the existence of factors that may enable or impede performance of the behavior and the perceived power of these factors (control beliefs) (Ajzen, 2006). When analyzing their respective aggregates, we find behavioral beliefs lead to a favorable or unfavorable “attitude toward the behavior;” normative beliefs produce a “perceived social pressure” (subjective norm); and control beliefs result in “perceived behavioral control.” These three elements combined give rise to the formation of behavioral intention (Ajzen, 2006; Figure 2.1). People form their intentions before executing them; therefore, intention is considered the immediate antecedent of behavior.



2.1. Elements of the Theory of planned behaviour

In designing and conducting entrepreneurship courses, training institutions should not only train students in critical entrepreneurial skills and capabilities, but should also strengthen their entrepreneurial self-efficacy (Chen et al., 1998). The construct of self-efficacy was introduced by Bandura (1977) and represents one core aspect of his social-cognitive theory. People confident in their abilities approach difficult tasks as challenges to be mastered rather than threats to be avoided. Considerable research has been conducted on the four major psychological processes through which self-beliefs of self-efficacy affect human functioning: cognitive processes, motivational processes, affective processes, and selection processes (Bandura, 1994). Belief is one of the core behavioral patterns in which the BMoE was constructed (Sidhu et al., 2014), which explains the importance of the relationship between self-efficacy and entrepreneurial education. Belief is the foundation of human motivation, performance accomplishments, and emotional well-being (Bandura, 1994). Analyses have been conducted concerning the relationship between self-efficacy and work-related performance, which indicate the existence of a significant weighted correlation (Sidhu et al., 2014).

On the other hand, entrepreneurial self-efficacy (ESE) specifically refers to the strength of a person's belief that he or she is qualified to successfully perform the various roles and tasks of entrepreneurship (Boyd & Vozikis, 1994). Self-efficacy can be applied to a variety of domains as long as the efficacy measure is tailored to the specific tasks being assessed. The predictive power will be sacrificed as the measure becomes more general. That is, regardless of the specificity of the task domain, assessment of efficacy has to occur at the specific task level to maintain its predictive power. Hence, the self-efficacy perspective is highly appropriate to study an entrepreneur. Krueger and Brazeal (1994) included the concept of self-efficacy in their model of entrepreneurial potential and proposed that ESE represents one of the key prerequisites of the potential entrepreneur. Highly efficacious individuals are likely to possess greater confidence in their ability to

embark on challenging courses of action, and also to persist when facing obstacles en route to their goal (Cooper and Lucas, 2006).

The concept of self-efficacy is pivotal to the willingness of individuals to act in an entrepreneurial way, by identifying and seizing opportunities (Cooper and Lucas, 2006). Obstacles and setbacks are all part of the entrepreneurial “package;” therefore, entrepreneurs have to be confident about the world they are getting into, trusting their own capabilities as well determining to see their plan through. The greater an individual’s perceived self-efficacy, the higher the objectives they set for themselves, and greater their persistence to reach those objectives (Leatherbee and Eesley, 2014). In view of the challenges posed, the finding that a high level of confidence is pivotal to starting companies is not surprising. Indeed, confidence in one’s skills has been associated with behaviors such as innovation, opportunity recognition, and intentions to start new ventures (Boyd and Vozikis, 1994; Chen et al., 1998; Krueger and Brazeal, 1994). For instance, research on the effects of self-efficacy found it is the most effective predictor of performance. People with higher self-efficacy have a more intrinsic interest in the tasks, and consequently show greater persistence in facing obstacles and setbacks (Chen et al., 1998). Individuals with the same sub-skills may perform in a completely different way (poorly, adequately, or extraordinarily), depending on their self-efficacy beliefs, which affect how well they use the abilities they possess (Bandura and Wood, 1989). Importantly, the concept of self-efficacy and entrepreneurial self-efficacy refer to the intention to perform a task but not to the outcome. Thus, high self-efficacy can lead to higher entrepreneurial intention, but not necessarily to being a better entrepreneur. Nevertheless, best-practice entrepreneurship programs are expected to increase the self-efficacy of participants (Peterman and Kennedy, 2003).

Self-efficacy is similar to the concept of perceived behavioural control defined in the theory of planned behaviour (previously described in this section). Both concepts refer to one’s sense of being able to successfully create a firm (Liñan and

Chen, 2009). Hereafter, both concepts will be treated as one: self-efficacy.

Interventions intended to alter behavior can be aimed at one or more of its determinants: attitudes, subjective norms, or perceptions of behavioral control/self-efficacy. Changes in these factors should produce changes in behavioral intentions and, given adequate control over the behavior, the new intentions should be carried out under appropriate circumstances (Ajzen, 2006). Ajzen proposes that targeting an intervention at any one of the three major predictors in the theory of planned behaviour is reasonable (if there is room for change), but that targeting predictors that account for significant variance in intention and behavior is safer. He goes further to say the greater the relative weight of a given factor, the more likely the influence on intentions and behaviors. The beliefs provide a “snapshot” of the behavior’s cognitive foundation in a given population at a given point in time (Ajzen, 2006).

The relative contributions of the motivational factors to explaining entrepreneurial intention have not been well established. The exact weighted configuration of the relationship between those constructs would have to be empirically determined case by case for each specific behavior (Liñan & Chen, 2009).

Innovative achievements also require a resilient sense of efficacy (Bandura, 1994). New ventures require immense effort over a long period of time, submerged in an uncertain environment. Thus, in the domain of entrepreneurship, the stronger an individual’s ESE, the greater his or her intentions to start a new business. Further, a higher ESE would also lead to the pursuit of bolder entrepreneurial opportunities and higher expected performance on specific factors such as optimism and environmental dynamism (Leatherbee and Eesley, 2014). That is, higher levels of entrepreneurial self-efficacy are largely considered auspicious for entrepreneurial activity. People must have a strong sense of personal efficacy to maintain the perseverance needed for success (Bandura, 1994).

Chen et al. (1998) emphasize the importance not only of training students in

critical entrepreneurial skills and abilities, but also of strengthening their ESE. Educators should consider the entrepreneurial mindset when designing or assessing their course objectives. Conscious efforts were made in the design and implementation of the course concerning this investigation (ING2030), making sure to involve students in real-life experiences, by inviting successful entrepreneurs to lecture, and by verbal persuasion from the instructor and renowned entrepreneurs. Thus, ESE can be conceptualized as being enhanced by the use of pedagogical approaches that encourage student learning through exposure to role models' experiences, as well as their own experiences (Cooper and Lucas, 2006). That is precisely what the BMoE seeks with an inductive method of education.

For the purposes of this work, only entrepreneurial self-efficacy will be measured as a determinant of behavior and entrepreneurial intention. Nevertheless, all three concepts were included in the design of the BMoE and the adaptation for the School of Engineering at PUC Chile, as well as in the construction of the questionnaire.

The concepts described above will only have an impact if the actual behavior is executed. Therefore, the concept of entrepreneurial intent is important. Given the success of a cognitive approach in fields such as psychology, sociology, and education, the potential for the success of a cognitive approach to the field of entrepreneurship is promising. The level of confidence an individual has in his or her skills and ability to successfully perform all the activities and tasks that are integral to venture creation will be critical in the choice to start a new company (Cooper and Lucas, 2006). According to the theory, for an individual to display entrepreneurial behavior, he or she must have formed a certain intention/desire to do so. Cooper and Lucas (2006) associate intentions with an individual's willingness to pursue a certain type of behavior, considering the external environment, which may impose barriers, and any influence resulting from their previous backgrounds or abilities. If the objective of entrepreneurship education is

to influence beliefs, attitudes, and intentions toward entrepreneurship, one must consider how programs might bring about changes in an individual's level of self-confidence so that he or she will be motivated to try new activities and persist in the face of challenges (Cooper and Lucas, 2006).

In particular, a greater knowledge of a variety of entrepreneurial skills and traits will contribute to a more realistic perception of the entrepreneurial activity, therefore indirectly influencing intentions (Liñan and Chen, 2009). Major models regarding entrepreneurial intentions are largely similar in that they all focus on the pre-entrepreneurial event and integrate Ajzen's Theory of Planned Behavior and the concept of self-efficacy and social learning theory, developed by Bandura (Peterman and Kennedy, 2003).

The entrepreneurial mindset, in this context, represents the orientation toward entrepreneurial activities, learning to deal with ambiguity and adjustment, and pursuing innovation (Täks et al., 2014). The objective of entrepreneurship education is related to personal development through creating students' awareness of their own abilities (self-efficacy) and enhancing the learner's entrepreneurial mindset (Cooper and Lucas, 2006). Thus, the entrepreneurship course described in our study (adapted version of BMoE) does not aim to pressure students to become actual entrepreneurs as such; rather, it aims to encourage individuals to develop an entrepreneurial mindset in addition to skills needed in one's working life. And along the way, such entrepreneurial studies may encourage some students to pursue a career as entrepreneurs (Täks et al., 2014).

2.3. The Berkeley Method of Entrepreneurship (BMoE) and Its Background

The BMoE is a holistic teaching and learning approach that enables engineers to be more entrepreneurial. The Sutardja Center for Entrepreneurship and Technology developed the methodology at UC Berkeley in 2005. The methodology is based on the foundation that the mindset of an entrepreneur can be

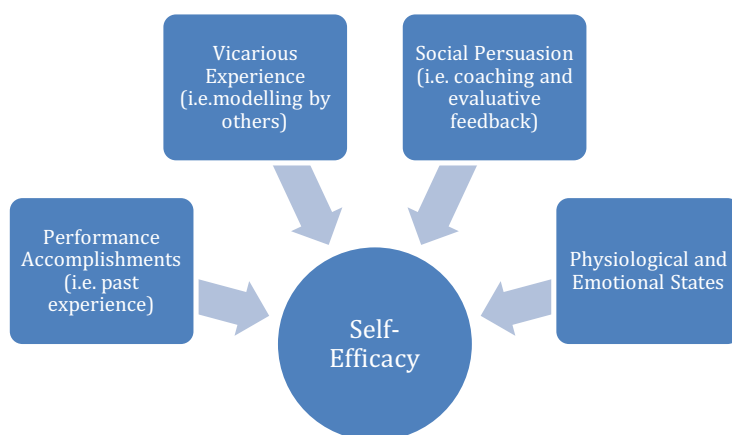
characterized by a set of behavioral patterns and that an inductive game-based teaching approach is a successful vehicle for introducing and re-enforcing contents (Sidhu et al., 2014). The idea is to employ both content and pedagogy to deliver desired outcomes. The development of skills and competencies that are closely related to entrepreneurial behavior are expected, such as positive changes in attitudes toward and confidence in their skills (Cooper and Lucas, 2006).

Going back to the theory of planned behavior described in section 2.2 of this chapter, recall that once you have decided which beliefs you want to change with an external intervention, you must develop an effective method for accomplishing that change, which is where experience and creativity come into play. Given the key role of action in entrepreneurship, an important question discussed in the literature concerns the best method for encouraging entrepreneurial action (Gielnik et al., 2015). The theory can provide general guidelines, but does not tell us what kind of intervention will be most effective. Persuasive communications could be considered, perhaps in the form of newspaper ads, flyers distributed in certain neighbourhoods, or face-to-face discussion, role models, or any other applicable method (Ajzen, 2006).

On the other hand, Bandura (1994) states that people's beliefs about their efficacy derive from four main sources of influence [Figure 2.2]. The most effective way to improve self-efficacy is through mastering experiences (Bandura, 1994). Successes build confidence in one's personal efficacy: "If I have done it well before, I can repeat the process." The idea of improving self-efficacy through repeated success is related to the concept of a "serial entrepreneur": an entrepreneur who continuously comes up with new ideas and starts new businesses. The same dynamic applies to failure; failure undermines self-efficacy (following a similar logic). Nevertheless, pure success is not always good; a resilient sense of efficacy requires experience in overcoming obstacles through perseverance. Entrepreneurs require some setbacks and difficulties in their pursuit to teach them success usually requires a sustained effort. Once people become

convinced of their ability to succeed, they persevere through tough times, and emerge stronger from adversity (Ajzen, 2006).

The second way to create and strengthen self-efficacy is through the examples role models may provide, vicarious experiences (Bandura, 1994). Research has shown that a first step toward a new role or toward developing a new behaviour is to be able to associate yourself with a role model similar to you (Sidhu et al., 2014). Role models are powerful tools for learning a new behavior. Spending time with and listening to someone worthy of emulation is one of the most powerful mechanisms to alter someone's behavior (Hwang & Horowitz, 2012).



2.2. Sources of Self-Efficacy

The more similarities you see between yourself and your role model, the more persuasive his or her successes or failures will be (Bandura, 1994).

Also, people seek to respond to a peer pressure or “perceived social pressure” (Ajzen, 2006), thus producing a tendency to imitate certain behavior of people we see as models/leaders.

According to Bandura, the third way to strengthen self-efficacy is through social persuasion. People who are easily persuaded verbally or even non-verbally are likely to be convinced they possess the abilities to master the activities necessary

to succeed. The fourth and last way to increase self-efficacy is through reducing people's stress reaction (Bandura, 1994). Humans partly rely on their somatic and emotional states when they evaluate their own abilities. The construction of the BmoE considered all of these concepts.

The BMoE seeks to fill the gap between the theories of learning and entrepreneurship education, allowing engineers to be more entrepreneurial. It incorporates three main elements to support its inductive learning and journey-based approach: frameworks (tactics), mindset, and networks (infrastructure) [Figure 2.3].



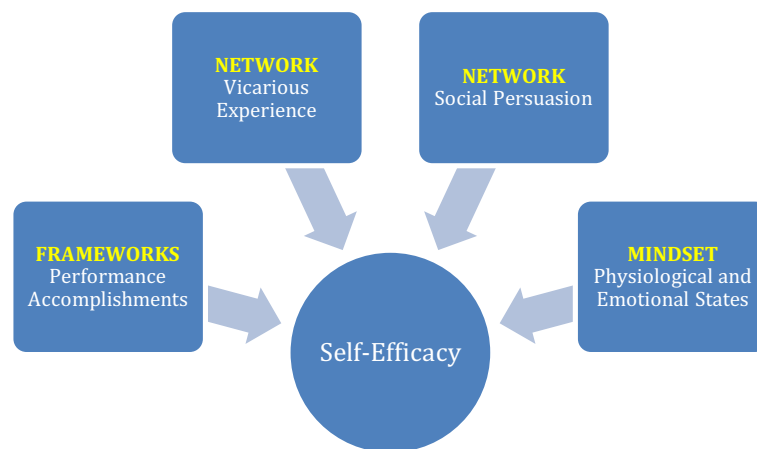
2.3. BMoE three main elements. Copyright 2016 by Sidhu et al

- Frameworks are composed of cases and tactics that may be found in many of the entrepreneurship courses worldwide, which provide the students with the structure and tools associated with entrepreneurship (opportunity recognition, MVP, raising funds, business models, case studies, sales process, etc.).
- Mindset is an element often neglected in traditional courses, and concerns the student's behavior and attitude toward entrepreneurship (SCET, 2017). The methodology exposes students to issues related to culture, social psychology, and

mindset, and therefore to the psychology of being an entrepreneur (trusting, teamwork, self-efficacy, ethics, risk assessment, communication, overcoming social barriers, rejection therapy, fail training, etc.) (Sidhu et al, 2014).

- Networks help students build the proper infrastructure to develop their projects. Networks provide a supportive and safe environment where mentors are assigned to each team to guide them through the journey. This layer of the BMoE covers diverse networks, the ability to connect, facilities, services, ecosystems, mentors, and clarification of the rules of engagement. Role models are a key aspect in this layer, to improve the self-efficacy of students.

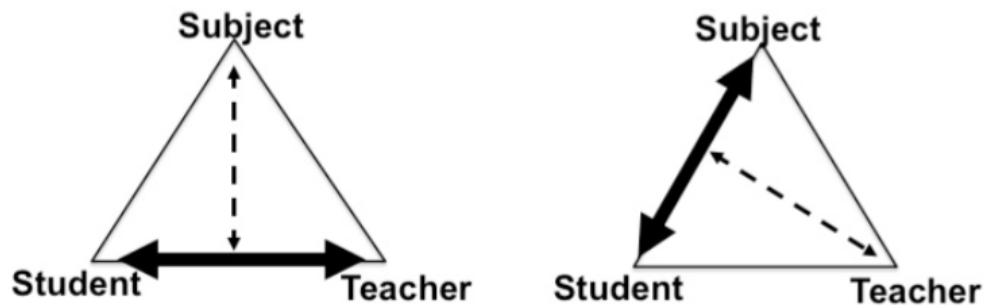
Now let's directly relate the three layers of the BMoE with the four main sources of influence stipulated by Bandura (1994; Figure 2.4). Frameworks provide the tools and methodologies to assist students in their learning process, in such a way to facilitate the accomplishment of their objectives. Therefore, the student is able to generate experiences of success/failure depending on the objectives. On the other hand, an entrepreneurial mindset helps the student regulate his or her physiological



2.4. Relationship among Theory of planned behaviour and BMoE

and emotional states as an entrepreneur. This layer is intended to teach the student what being an entrepreneur requires. The idea is to forge an entrepreneurial form of thinking, resilient to failure and able to overcome setbacks. An entrepreneurial mindset, in this context, represents an orientation toward entrepreneurial activities, learning to deal with uncertainty and change, and pursuing innovation (Fayolle and Gailly, 2008). Finally, the network provides the infrastructure necessary for the student's development as an entrepreneur. The entrepreneurial ecosystem and the mentors as role models play a key part in the methodology, by providing experience, coaching, and guidance throughout the entrepreneur's journey.

The pedagogical approach to teaching entrepreneurial knowledge and skills must be different from traditional teach-and-repeat methods. To create entrepreneurial mindsets in students, the theory suggests the use of innovative models and teaching approaches that may involve changing the content of courses as well as the learning process itself (Sidhu et al., 2014). Thus, self-efficacy for entrepreneurship can be conceptualized as being improved throughout pedagogical approaches that promote student learning through exposure to the experiences of others, as well as their own experience (Cooper and Lucas, 2014). The BMoE pedagogy is focused on learning rather than teaching (Figure 2.5), where the instructor may be seen more as a guide than as a traditional instructor. Students are pushed to proactively develop their own understanding rather than wait for someone to teach them what they need to know (Sidhu et al., 2014).



2.5. Learning approach of BMoE. Copyright 2016 by Sidhu et al

The methodology proposed by the BMoE, on which the course regarding this research is based, deviates radically from the traditional type of lecture-based pedagogy students are accustomed to. The BMoE is therefore inductive rather than deductive, meaning it is organized around the student's learning rather than the instructor's teaching. This change leads to a totally different way of transferring knowledge from teacher to student. Because entrepreneurs' skills and attitudes are as important as facts and raw knowledge, and are "owned" by the students, the relation between the student and the entrepreneurship subject becomes essential. The school and teachers are only a means for the student to reflect upon his or her skills and attitudes (compare Figure 2.5, right side), and an inductive learning approach is therefore most suitable (Sidhu et al., 2014).

This pedagogical approach involves students actively participating and constructing, for example, through semester projects, classroom discussions, writing, role playing, business plan development, problem-based learning, and oral presentations. A variety of mediating tools and processes are required when integrating different forms of knowledge (Täks et al., 2014). All the mediating tools used during the course were integrated with different kinds of assessment

tools in order to contribute to the development of the students and the projects. Each activity had its own reflection time, during which students discussed and analyzed the key points.

2.4. Ten Behavioral Patterns of Entrepreneurs

The nature of complex innovation systems, whether they are in Silicon Valley, a large corporation, university, or anywhere else, can be modeled to encourage their creation and development. Hwang and Horowitz (2012) created a model to explain the workings of innovation ecosystems called The Rainforest. They offer a new and more productive way of thinking about innovation, combining human nature, evolutionary biology, economic cooperation, and social systems. Neoclassical economists handle macroeconomics as the result of their input (labor, land, and capital), but such a theory fails to describe the behavior of real-life innovation systems. Silicon Valley as a rainforest metaphor is characterized as a distinct set of social behaviors. These behaviors intend to maximize the free flow of talent, ideas, and capital in human network, while requiring that individuals rise above short-term selfishness and focus on long-term mutual gain (Hwang and Horowitz, 2012).

Sidhu et al. (2014) studied the mindset of successful entrepreneurs, and describe their most dominant characteristics through 10 behavioral patterns. The BMoE of entrepreneurship is based on these 10 behavioral patterns, and all the courses related to the program aim to, in some way, develop the characteristics they engender. The message is that if everyone in society were to have these characteristics, we would be part of a lively entrepreneurial culture. The 10 behavioral patterns, further explained in Appendix B, are the following: Pay It Forward, Story Telling, Friend or Foe, Seek Fairness, Plan to Fail, Diversify, Role Models, Believe, Good Enough, and Collaboration.

2.5. Action-based Learning and Game-based Teaching

Given the key role of action in entrepreneurship, an important question discussed in the literature concerns the best method for training entrepreneurial action (Gielnik et al., 2015). Specifically, action-based entrepreneurship training has been proven effective in enhancing entrepreneurship (Barr et al., 2009). Several entrepreneurship-training programs emphasize the importance of developing a business plan, but lack a method that involves active engagement by the participants (Gielnik et al., 2015). Starting a new business requires a set of actions necessary to accomplish an objective. Therefore, exposing students to actually “doing” entrepreneurial activities makes them relate more closely to the experience of being an entrepreneur. Actively practicing and repeating actions during the training is fundamental for a deep processing and internalization of the training content (Frese et al., 2016). The point is not just to learn abstract theoretical knowledge, but to also obtain the guidelines for dealing with entrepreneurial tasks. Therefore, action principles can be considered “rules of thumb,” providing at-hand practical knowledge (Gielnik et al., 2015). For example, an activity may show participants how to exhibit personal initiative in goal setting, information and opportunity search, planning, and feedback seeking (Frese et al., 2016). In such a way, learning becomes inductive rather than the direct result of instruction.

The BMoE includes behavioral training and reflections about mindsets, through an inductive game-based teaching approach (Sidhu et al., 2014). Several games have been developed to achieve the desired objectives of this methodology. The games intend to simulate situations in which students have to solve problems or conflicts while engaging with external forces. The games contain rules participants must follow throughout the activity. In the BMoE, four key components of games are included (Sidhu et al., 2014):

- Goals: An objective that is aligned with the teaching desired.
- Rules: Limitations on how to achieve the goals.
- Challenge: Competitions, problems, and use of skills.
- Interaction: A setting where players must interact and communicate with each other and their environment.

The activities are designed to expand students' entrepreneurial mindsets, develop their skills, and increase their understanding of entrepreneurial processes. The design relates to the objective of personal development through collaborative learning, as well as to increasing the participant's self-efficacy (Fayolle and Gailly, 2008).

The purpose of the games is to invoke a certain behavior or attitude in the student—hence the importance of proper reflection following the activity (Sidhu et al., 2014). The training emphasizes feedback, including negative feedback, which provides participants with information about the strengths and deficiencies of their actions. The conclusion of the activity contributes to learning and the ability to deal with gaps in knowledge and experience, thus increasing the participant's self-efficacy (Frese et al., 2016).

The BMoE provides a methodology that can be implemented to enable engineers to become more entrepreneurial. The development of a sense of self-efficacy requires more than simply producing effects by actions. Rather, those actions must be perceived as part of a whole (Bandura, 1994). Consequently, the way in which the BMoE is implemented as a teaching tool is fundamental to allow the students to develop an entrepreneurial mindset.

3. HYPOTHESES

This research measures the effects of the course ING2030: Investigation, Innovation and Entrepreneurship, associated with the expected outcomes of the course. With these measurements, the thesis aims to provide evidence to validate the BMoE as a framework for entrepreneurship education.

However, a means of measuring the impact of the course on students is needed in order to show the validity of the intervention. Based on the literature, two main variables are used: self-efficacy and entrepreneurial intent.

Self-efficacy is an important predictor of human performance (Leatherbee and Eesley, 2014). Previously, this work discussed the importance of the concept of entrepreneurial self-efficacy in entrepreneurship education and economic progress itself. Entrepreneurship education should aim to improve self-efficacy; therefore, this work hypothesizes the following:

Hypothesis 1: Engineering students participating in the ING2030 course at PUC, and therefore immersed in the BMoE, will develop a greater belief in their ability to successfully perform the various roles and tasks of entrepreneurship (entrepreneurial self-efficacy).

Furthermore, educational institutions should play a key role in the strategy they use to increase entrepreneurial knowledge, skills, and students' intentions to pursue a new venture. If the objective of entrepreneurship education is to influence beliefs, attitudes, and intentions toward entrepreneurship, one must consider how programs might bring about changes in an individual's level of self-confidence so that he or she will be motivated to try new activities and to persist in the face of difficulty and challenges (Cooper and Lucas, 2006). Entrepreneurship education should improve the student's desire to start a new business, by means of a higher self-efficacy. Therefore, this study hypothesizes the following:

Hypothesis 2: Engineering students participating in the ING2030 course PUC, and

therefore immersed in the BMoE, will view the desirability of starting a business (entrepreneurial intention) more favorably.

Finally, a greater knowledge of a variety of entrepreneurial skills and traits will contribute to a more realistic perception of the entrepreneurial activity, thereby indirectly influencing intentions (Liñan and Chen, 2009). Also, the factors included in the design of an entrepreneurship course and the influence of the supportive environments contributes to the merging of entrepreneurial attitudes and intentions (Peterman and Kennedy, 2003). Therefore, this thesis hypothesizes the following:

Hypothesis 3: Higher entrepreneurial self-efficacy leads to higher entrepreneurial intention.

These three hypotheses will help us conclude whether the BMoE has positive effects when implemented in Chile, and therefore provide validation of the course as a proven framework for entrepreneurship education.

4. RESEARCH SETTINGS – ING2030: “Investigation, Innovation and Entrepreneurship”

This chapter describes the setting in which this study was developed. The study was conducted in the School of Engineering at PUC, regarding the entrepreneurship course ING2030: “Investigation, Innovation and Entrepreneurship.” This course is an adaptation of the Challenge Lab at UC Berkeley. This chapter explains how the ING2030 course was constructed and implemented at PUC. The chapter starts in section 4.1 with a description of the actual course that was adapted for implementation in Chile—Berkeley’s Challenge Lab—and the changes necessary for that adaptation. Section 4.2 gives an overview of the course, and explains its motivation and general objectives. Sections 4.2.1 to 4.2.6 detail how the course is structured, explaining the stages of the course, the academic team, the games used, the syllabus, and so on. Mentoring and role models are fundamental elements of the BMoE, methodology used in ING2030, and section 4.3 explains how this work leveraged local role models and institutions to teach students. Finally, sections 4.4 to 4.11 describe how the School of Engineering at PUC provided further support to the teams that wanted to continue with their ventures. This chapter allows for an understanding of the course settings in which the measurements were made. Detailed information about the course content, lecturers, syllabus, and so on may be found in Appendix C.

4.1. Berkeley’s Challenge Lab

Challenge Lab is the premier undergraduate course in applied innovation at UC Berkeley. This course was adapted to PUC (Chile) and is based on the BMoE. The course attracts the most talented students not only from engineering, but also from business and humanities. Actual start-up companies have emerged directly from this 15-week course in its eight-year history. Students have worked on projects such as 3D printing, drones, mobile apps, big data, Internet of Things, medical devices, and social impact.

The course is structured as an incubator in which students work organically in cross-discipline lean startup teams. Teams navigate realistic weekly challenges introduced through case studies and games. The idea is for the to understand real-world constraints, be rapid and iterative, and validate development methods.

Although many universities provide entrepreneurship and innovation courses, UC Berkeley's Challenge Lab is unique in its design and scope. Industry sponsors propose pressing industry and social challenges for student teams to solve with innovative technology and revenue models. Several companies have participated in the course, such as Facebook, Nokia, Qualcomm, SoftwareAG, and non-profits such as Ashoka. The industry partners are expected to participate in the development of the student's projects by assisting them and mentoring the teams. Through frequent interactions with the sponsors and mentors, student teams should have a working prototype and a business pitch for a final competition. The final competition is judged by a panel of experts (from the sponsoring partner) and venture capitalists. The sponsor is required to fund the prizes, which range from startup capital to trips to Europe or Asia in order to showcase the winning pitch at a conference.

Each semester, the Sutardja Center for Entrepreneurship and Technology (SCET) opens a call for proposed topics from students and faculty. The SCET staff selects the most interesting topics based on the current technology trends and social impact based on the SCET Watchlist (SCET, 2017). Finally, the Center reaches out to the most innovative and relevant companies in those fields to offer them the opportunity to sponsor a challenge.

The inclusion of industry partners in the design of the course is important to strengthen and create new collaborations between key industry players and the innovation engine at UC Berkeley: the students. The idea is that both sides of the equation, industry and students, can learn from each other and develop new solutions to today's pressing challenges.

4.1.1 Adaptation to Chile – Cultural Differences

The mission of the School of Engineering at PUC includes the following goals: “To integrally educate and form students, allowing them to perform as applied scientists, innovators and technological/social entrepreneurs” and to “Translate that knowledge into innovations and ventures that are technology/socially based and that increase the relevance and prestige of this community and at the same time accelerate the development of Chile in relation to the rest of the world.” Thus, the need exists to design a new and disruptive entrepreneurship course capable of producing these entrepreneurial thinkers, regardless of their career paths.

However, this study cannot simply copy Berkeley’s Challenge Lab and implement it in Chile. Certain adaptations are required, mainly based on cultural differences between Berkeley students and Chilean students, but also due to the maturity of the entrepreneurial ecosystems themselves.

The application of the BMoE has been scarce, outside Silicon Valley. Beyond UC Berkeley, entrepreneurship courses based on the BMoE have only been applied in Mexico. On the other hand, culture motivates individuals in a society to engage in behaviors that may not be evident in other societies. Sociocultural knowledge is immersed in social practices of local contexts and cultural elements such as rules, unwritten laws, technology, and workplace norms (Täks et al., 2014). Hence, some of the elements constituting the syllabus of the Challenge Lab were maintained, but several aspects were changed to comply with different cultural factors.

The main elements that were intervened are related to four main concepts: Belief/Trust, Failure, Collaboration/Networks, and Rules of the Game. These elements will further be discussed in the research setting of this study, when the actual implementation of the course in Chile is presented. Detailed information

about the adaptations made can be found in the Appendix describing the elements of the course.

Humans are designed to trust people closer to them and also distrust those further from them (Hwang and Horowitz, 2012). Chilean society characterizes itself as having extremely low levels of social confidence, which translate into the lack of relationships and bonding with strangers (Valenzuela and Cousiño, 2000). Only 13.4% of Chilean people express a high trust of their fellow citizens, a percentage that is considerably lower than the average of 59% in OECD countries (OECD, 2011). We can also compare these results with the 48.7% trust level in the United States or near 80% in the Scandinavian countries. The high degree of social confidence we find in the United States can be expressed in three dimensions: the strength of neighbor relationships, the extension of friendship bonds, and the strength of associative capacities (Valenzuela and Cousiño, 2000). Hence, the predisposition of Americans to trust and establish bonds with strangers is translated, at the same time, into a greater ability to form friendships than in Chile. Valenzuela and Cousiño (2000) show an average of 1.7 associations per person for Americans versus 0.7 for Chileans. These numbers clearly show a lack of collaboration and networks that are needed to form a proper entrepreneurial ecosystem. Therefore, unsurprisingly, bankruptcy and failure are stigmatized in Chile, even though several studies show failure catalyzes the future success of serial entrepreneurs (Hwang and Horowitz, 2012).

Solving these issues involves designing an ecosystem, with a proper set of rules, that incites the behaviors that lead to interpersonal trust, generating an organizational culture based on trust that clears the way to innovation (San Martín, 2014). A leader who is able to ignite the associations between the members of a certain community is vital.

4.2. ING2030 - Overview

The ING2030 curriculum is built around the foundations of the BMoE and the Engineering 2030 initiative, seeking to become a world-class school of engineering. Specifically, the course was designed under the first pillar of the 2030 initiative: Transforming Engineering Education; aiming to accelerate innovation and entrepreneurship in students.

This 15-week course immerses the participants in the reality of a technology- and scientific-based venture. The idea is to expose students to state-of-the-art techniques and strategies related to the discovery, design, and implementation of entrepreneurship opportunities.

The course is structured as an incubator in which students organically form start-up teams. During the semester, students are expected to collaborate, build and launch a working prototype, and develop and present a strong business pitch. At the conclusion of the course, each team pitches its company to a panel of venture capitalists and angel investors. The top teams have the opportunity to transition their companies into the Start-up Chile acceleration program, funded by the course sponsor.

The objective is for students to get involved in an experience as close as possible to the reality of being an entrepreneur. They will live with the complexity, uncertainty, and challenge inherent in bringing a product to market based on their engineering knowledge. Alumni companies from Challenge Lab courses in the United States and Mexico have successfully generated revenue, raised investment, and sold products during the course.

ING2030 is deeply focused on the central themes of a technology entrepreneurship mindset: self-learning and teamwork.

The first month of class is intensive in team formation, with activities that facilitate team dynamics and the opportunity for students to get to know each

other. At around the five-week mark, the teams should be finalized and comprise no more than five students.

Teams must deliver a functional prototype of their solution at the end of the semester, with a business pitch coherent with their final product. Projects must be framed within certain challenges proposed by the teaching team. Relevant local problems are prioritized, the solutions for which could come from a technological point of view. As opposed to Berkeley's Challenge Lab, which focuses a lot on mobile development, at ING2030, solutions completely based on information technologies (IT) are not allowed. IT can be used as a resource within the solution but not as the core of it, which forces students to come up with technological solutions beyond just mobile/web apps.

At UC Berkeley, an industry sponsor proposes challenges within a certain theme relevant for the teaching team. At PUC, challenges are framed based on real problems within Chile that could contribute to the country's economic and social development. The idea is to raise students' awareness regarding the opportunities and problems existing in Chile at an industry and social level. Thus, they can see opportunities at the intersection of problems and technology. To achieve this, five challenges were proposed based on the Engineering 2030 initiative:

1. Laboratory and Natural Resources
2. Health
3. Sustainability
4. Information and Big Data
5. Social Entrepreneurship (included in the second version of the course)

Nevertheless, those students that have a business idea that is relevant for the course can submit their idea for revision and are allowed to pursue their venture. Students must aim to solve problems with a high technological impact with scalable solutions.

4.2.1. Lecturers and Team

To implement an external intervention in Chile, based on the BMoE, the course employs a hybrid model of teaching. The actual content is taught weekly in a single online plenary lecture directly from UC Berkeley, whereas local instructors guide the activities, presentations, and evaluations in four separate sections. Also, guest speakers either from Silicon Valley or the Chilean entrepreneurial ecosystem deliver some of the plenary lectures.

4.2.2. Stages and Contents of the Course

The contents of the course are intended to provide the basic tools for students to develop their projects. The word “basic” is important, because the BMoE proposes an inductive learning pedagogy, where learning is not exclusively based on what the instructors teach. The instructors may be seen more as guides, rather than traditional professors, willing to motivate students to find their own answers. Students are expected to learn from each other. Because entrepreneurship is at its roots a social activity, an emphasis on learning in teams, communicating with each other, generating and sharing ideas, interacting with clients, and so on is important. The contents included in ING2030 intend to develop an entrepreneurial mindset and to boost the self-efficacy and entrepreneurial intent of the students. Appendix C contains the list of contents and stages of the course.

4.2.3. Syllabus and Schedule

The course program is meant to provide the students with a broad outline of the course material and structure. However, it is not set in stone; the program is constantly revised and modified as the semester unfolds, depending on the progress each team makes in developing the prototypes and business proposals.

Announcements, homework, and lecture slides are regularly uploaded via PUC's School of Engineering digital platform: Siding. Siding is the final location for details on assignments and deliverables made during the course of the semester. All assignment and project work are submitted via Siding as well.

The information provided to the students is intentionally minimal. The course is designed to mimic the chaotic nature of starting a technology company. Therefore, students are expected to be creative, clever, and strategic in order to succeed. ING2030 is full of surprises, turnovers, and failures along the students' path. If students do not have the answers, they are expected to ask their teammates or classmates before asking the instructors.

Chilean local instructors receive a detailed weekly schedule with the contents, activities, and outcomes of the entire course. To maintain a chaotic setting, students do not receive this material.

4.2.4. Games

The inductive methodology proposed by Berkeley makes use of games as activities to facilitate learning. In Chile, a similar approach is implemented mainly in the first stage of the course (team and idea formation). These different activities invoke certain behaviors or attitudes in the students (Sidhu et al., 2014). More important than the actual games is the reflection afterward, or "post-mortem." After the activity, students should reflect on their own behavior and compare it with that of successful entrepreneurs. The results of the reflection may vary for

each participant: it can either be an ignition (confirming one wants to be an entrepreneur), an extinguisher (confirming one does not want to be an entrepreneur), or a wake-up call (wants to learn more about this attitude) (Sidhu et al., 2014). All mediating tools used during the course are integrated with different kinds of assessment tools, such as peer evaluations or oral and written feedback from the instructor. Using this approach, encourages students to really learn the outcomes expected for each game or activity. Games are intensive in the first part of the course because they also promote interaction between participants. For each game, the teams had to comprise different participants, allowing students to get to know as many classmates as possible. The games that were implemented in ING2030 may be found in Appendix C.

4.2.5. Final Competitions and Prizes

Human behavior is governed by incentives. Therefore, the design of the incentives is important for the development of the course. At the beginning of the semester, the faculty explains the course is competition based and that prizes will be awarded. Only three or four teams per section have the opportunity to go to the final competition. Finalist teams are selected by each section in their final graded presentations. These 12-16 finalist teams are expected to present to a panel of judges, in the School of Engineering's main auditorium.

All participants are expected to assist in the final competition. Several people from the entrepreneurial ecosystem and industry are invited, as well as a number of venture capitalists and members of the Chilean national press.

For the period of study, the judges' panel consisted of a representative from PUC's School of Engineering (the Dean), Sutardja Center for Entrepreneurship and Technology Berkeley (Ken Singer), Endeavour Chile (a director), Start-Up Chile (Executive Director Rocio Fonseca), CORFO (a high executive), and a guest

alumnus. In the second semester of the course, the panel included representatives from the course's sponsor.

Several prizes are offered in this competition [Figure 4.1]. When designing the course, Start-Up Chile was contacted to see if it could help with the prizes. Start-Up Chile is a governmental program that seeks to attract early-stage, high-potential entrepreneurs to bootstrap their startups in Chile. The program aims to position Chile as the innovation and entrepreneurship hub of Latin America. It provides seed-stage funding and an acceleration program of six months. Start-up Chile offered four slots or wild cards to the winners of the course ING2030 during the first year. These wild cards came without funding, due to legal issues. Funding of 5M CLP (per winning team) was provided by the School of Engineering the first semester and by the course sponsor (Engie) the second semester.

Engie is a global energy company expert in the businesses of electricity, natural gas, and energy services. It is committed to innovation, and provided a total of 20M CLP in prizes, as well as mentoring and the possibility to continue some of the projects under the company's portfolio.



4.1. ING2030 Competition based Dynamics

Finally, a co-working place for a month was also offered to the winning teams. This prize allowed them the space to continue developing their projects if they wanted to.

The final competition provides the perfect platform to showcase the outcomes of the ING2030 course to the Chilean entrepreneurial ecosystem.

4.3. Mentoring and Role Models

Role models are an important element of the BMoE and Berkeley's Challenge Lab; therefore, including them as a main element in ING2030 is important. Through frequent interactions with the sponsors and mentors, students should improve the development of their projects and entrepreneurial mindset.

To provide a close contact with mentors, the School of Engineering at PUC reached an agreement with Endeavour Chile (Endeavor Chile, 2017). Endeavour Chile supports entrepreneurs with the potential of generating high impact and growth, by providing their network of experts—people and organizations—in different business areas. This network provides the necessary tools, mentoring, networking, strategic support, inspiration, and possibilities to access smart capital and attract talent. These elements are key to starting a venture and having an impact on the world.

Endeavour Chile entrepreneurs are outstanding business people, executives, and local entrepreneurs, living in Chile or not, eager to share their experiences with the ING2030 students. Endeavour Chile provided a pool of local entrepreneurs that were matched to each team according to the industry of their project. Thus, each team had its own mentor the members could use for business discussions. Mentoring is supposed to be a great learning tool. Students were expected to be proactive and set meetings with their mentors. Each mentor was available at least three times per team during the semester, but this number could increase

depending on the mentor. After each meeting, students wrote up summaries of those meetings and their main learnings.

Endeavour Chile also provided a number of the guest speakers for the plenary lectures, where they could share their experiences with the students. The use of guest entrepreneurs in the classroom provided students with the opportunity to learn from those with first-hand experience of the venture-creation process. In selecting guest speakers, similarities between the speaker and the target audience should also be considered.

SCET provided some guidelines for mentoring based on the Socratic method: the key to being a great mentor is to ask great questions (Reich, 2003). A document was given to Endeavour Chile which includes guidelines such as talking to your mentor as a peer, asking good questions, and admitting what you do not know.

4.4. School of Engineering Infrastructure and Further Support

The School of Engineering at PUC offered its entire infrastructure to support the success of this course. A communication letter was sent at the beginning of the academic year to all faculty at the School of Engineering, informing them of this new course and asking for their collaboration if students looked for help in different engineering fields. On the other hand, all laboratories and physical infrastructure were available for students' use regarding their projects.

The purpose of the course is to promote an entrepreneurial mindset among engineering students, but good teams and students are expected to continue their ventures if they wish to. To encourage this, the School of Engineering at PUC offers several opportunities to help its teams and students, such as further mentoring, fast-tracking to entrepreneurship competitions, and so on. Note the school offers this further support not only to the winning teams, but also to any teams that have the potential and willingness to continue.

5. DATA AND MEASUREMENTS

In designing the research setting and methods of measurement for the study, emphasis was given to establishing whether the contents and methodology implemented in Chile had a positive impact in several forms of entrepreneurial self-efficacy, as well as entrepreneurial intent. Establishing internal validity of the methodology is important, regardless of whether the treatment is experimental or, more generally as in this case, an entrepreneurship course.

This chapter begins showing the measurements conducted at UC Berkeley (within this research), at the BMoE Bootcamp in August 2016. The BMoE Bootcamp is a week-long venture workshop, using the BMoE as the teaching methodology. The purpose of this questionnaire is to show the effects of the BMoE independent of the context and to show the effects of the intervention outside PUC. Section 5.1 explains the study conducted at UC Berkeley, which will allow us to determine if the context is an important factor to measure in future investigations regarding entrepreneurial education.

The chapter follows in section 5.2 with a characterization of the population participating in the ING2030 course at PUC (Chile). To measure the impacts of entrepreneurship education on these students, a pre- and post-survey methodology was used. A questionnaire was designed according to the existing literature in entrepreneurship education, with the help of the “Dirección de Educación en Ingeniería” (DEI) and Isabel Hilliger. Section 5.3 explains in detail the construction of this questionnaire. The questionnaire measures entrepreneurial self-efficacy (ESE) in terms of the level of confidence students have regarding the different outcomes they expect from the course (on a scale from 0 to 10). Additionally, the questionnaire measures entrepreneurial intent on a Likert scale from 1 to 5. We use a Cronbach alpha to see the reliability of the samples and measures, and a T-statistic to analyze the distribution of the information gathered and statistical significance. Additionally, the questionnaire included questions to

characterize the population. Qualitative data from the participants was gathered to know their opinions of the course as a whole.

5.1. Measurements at UC Berkeley's BMoE Bootcamp

This research tries to prove the BMoE as a valid framework for entrepreneurship education. We also need to show the BMoE has provided results in its original context: UC Berkeley. Therefore, the students at UC Berkeley's the BMoE Bootcamp in August 2016 received a similar questionnaire. The purpose of this survey is to show the effects of the BMoE independent of the context, and to analyze the comparative results between two countries using the same intervention to teach entrepreneurship.

The BMoE Bootcamp is a week-long venture workshop. The Bootcamp facilitates immersive learning for new-venture creation based on the BMoE. During the course, participants attend sessions that weave together lectures and game-based learning. Mentoring is also an important part of the course, as teams receive one-on-one mentoring from Berkeley's SCET faculty and industry experts. Students enrolled in an entrepreneurship program at Berkeley are expected to take this course.

At the beginning and end of the course, 38 participants answered a mandatory questionnaire. In contrast to the study in Chile, participants of the Bootcamp are not only from engineering studies, but also from diverse backgrounds including business, sociology, and media [Table 5.1]. The sample age range is 19-24 years old, with an age average of 20 years old, meaning they are in their third or junior year.

Table 5.1: Distribution of participants' majors studies of Berkeley Sample

Major	Students (N)	% (of 38)
Computer Sciences	5	13.16%
Biomedical Engineering	1	2.63%
Civil Engineering	3	7.89%
Mechanical Engineering	4	10.53%
Chemical Engineering	2	5.26%
Operations Research	1	2.63%
Business and Economics	19	50.00%
Sociology	1	2.63%
Media	1	2.63%
Material Science	1	2.63%

In this case, to manage self-selection bias, the questionnaire was presented as a mandatory activity within the BMoE Bootcamp.

The statistical approach to analyzing the data was identical to the one employed in Chile, which will be described in section 5.3, along with an explanation of the construction of the questionnaire.

5.2.Characterization of the Population at PUC

Most of the studies on entrepreneurship education have focused on elective courses or programs in which highly motivated students participate. This study presents measurements taken from a compulsory course and considers only engineering students. The fact that ING2030 is a core course in the curriculum

allows us to measure a population in which students' motivations and intentions vary considerably. The objective of the course is to influence engineering students' mindset and beliefs regarding technology-based entrepreneurship, regardless of the engineering major they were pursuing.

Table 5.2: Characterization of the ING2030 Sample		
	1_2015	2_2015
N° of sections of the course	4	4
N° of slots offered by section	100	70
N° of students that were enrolled during the course	318	195
N° of students that answered pre-post questionnaire	234	94
Rate of response	74%	48%
Demographic statistics of surveyed students		
% of female students	21%	28%
% of students whose age is between 20 and 21	86%	79%
% of students with entrepreneur relatives	61%	69%
% of students participating actively in extracurricular activities	54%	53%
Engineering Major Choice		
% of students in the operations research major	29%	43%
% of students in the mechanical engineering major	13%	6%
% of students in the electrical engineering major	6%	3%
% of students in the computer engineering major	7%	5%
% of students in the engineering design major	1%	10%
% of students in other majors	44%	33%

The course was taught for the first time during the first semester of 2015; a second version was taught the second semester of 2015. Four sections were offered in each of the semesters, varying from 70 to 100 slots per section. In total, 318 students enrolled in the course the first semester, and 195 students enrolled the

second semester. Of the total universe of students enrolled in the course, we only considered the students who actually answered the pre- and post-questionnaire designed to measure the variables in study translating to a response rate of 74% (234 respondents) for the first semester and 48% (94 respondents) for the second semester. The first sample responded to a paper-based questionnaire, whereas the second sample migrated to an online format, which may explain the differences in the response rates. In summary, the results presented in this thesis were obtained from these 328 usable questionnaires covering the whole 2015 year [Table 5.2].

The School of Engineering at PUC offers several majors in engineering studies. The lack of diversity in the sample in study may be compensated for by the distribution of majors among students in the ING2030 course. Table 5.3 shows the distribution of the number of participants according to their major of preference. Operations Research is the most popular major among students.

Table 5.3: Distribution of Engineering Major Studies of PUC Sample

Major	Students (N)	% (of 328)
Operations Research	108	32.93%
Mechanical Engineering	36	10.98%
Computer Sciences	22	6.71%
Transportation Systems	19	5.79%
Electrical Engineering	18	5.49%
Hydraulic Engineering	13	3.96%
Mining Engineering	13	3.96%
Design and Innovation	12	3.66%
Autonomous and Robotic Systems	12	3.66%
Construction	11	3.35%
Biological Engineering	9	2.74%
Civil Engineering	8	2.44%
Structural Engineering	8	2.44%
Mathematical Engineering	8	2.44%

Engineering and Architecture	8	2.44%
Environmental Engineering	7	2.13%
Chemical Engineering	6	1.83%
Biomedical Engineering	3	0.91%
Environmental Sciences	2	0.61%
Geotechnical Engineering	2	0.61%
Geoscience	1	0.30%

5.3. Construction of the Questionnaire

Publications on educational outcome assessment recommend balancing different assessment approaches (Duval-Couetil, 2013). So far, self-reported surveys have been the primary tool for measuring psychosocial outcomes of entrepreneurial training (Duval-Couetil, 2013; Purzer et al., 2016). Although these instruments are reliable and remarkably predictive in many cases, they have serious limitations for evaluating educational programs (Duckworth and Yeager, 2015). Besides reference biases, the size of the sample might prevent the attainment of statistical significance in self-reported measurements *ex ante* and *ex post* (Duckworth and Yeager, 2015). Thus, assessment efforts for evaluating entrepreneurship education have to include direct measurements of student learning outcomes. By integrating direct measurements, more information will be available about students' competency and mastery of knowledge and skills (Duval-Couetil, 2013). Likewise, quantifiable behaviors do not suffer from reference bias over time and across sites (Duckworth and Yeager, 2015). A system of instruments would benefit the understanding of engineering entrepreneurship education as a particular phenomenon (Purzer et al., 2016).

Therefore, after adapting the course taught at UC Berkeley to PUC in Chile, an approach was needed to measure the impact of the course on students and show the validity of the BMoE course. A questionnaire was designed according to the existing literature in entrepreneurship education (Cooper and Lucas, 2006; Liñan

and Chen, 2009; Chen et al., 1998; Täks et al., 2014; Mohd Noor and Mohammad, 2009; Terenzini et al., 1991). The instrument was designed with the help of the “Dirección de Educación en Ingeniería” at PUC (DEI), specifically by Isabel Hilliger, Subdirector of Evaluation, Measurement and Quality. To measure the effects of the course on students, two main variables were used: self-efficacy and entrepreneurial intent. The methodology aims to measure considerable changes in these two variables to show positive impacts on the entrepreneurial mindset of participants of ING2030.

Once it is decided which beliefs the course will attempt to change, an effective intervention method must be developed (Ajzen, 1985). Therefore, the questionnaire needs to be specifically oriented toward entrepreneurial activity and the outcomes expected in the course taught in Chile. So the challenge was to construct a questionnaire specifically oriented toward engineers in technology entrepreneurship programs. The methodology involved a two-step questionnaire, at the beginning and end of the program.

The first step was to determine the items to include in the questionnaire and each of the variables to measure. Therefore, the outcomes of the ING2030 course were translated into a list of possible items to consider, such as teamwork, communication, prototyping, recognizing opportunities, and so on. At the same time, instructors were asked for a list of outcomes they thought to be fundamental in an entrepreneurship course like this. With this information, this study could cross check which items were actually important to measure. Then the study compared the final list of items with the existing literature and returned to the course instructors for their approval.

This work tested the instrument before actually using it with the participants of ING2030. About 200 students answered the survey as part of the survey piloting. Two initial samples to pre-test the instrument were used: first-year students

(N=199) and students from the Design and Innovation Major (N=34). Cronbach-alpha coefficients showed the reliability of the instrument in the pilot.

5.3.1. Self-efficacy & Entrepreneurial Intent

Bandura (1994) states that self-efficacy can be applied to a variety of domains as long as the efficacy measure is tailored to the specific tasks being assessed. As the measure becomes more general, the predictive power will be sacrificed (Chen et al., 1998). To define and describe the set of specific tasks within a domain, a useful source for ideas was the CDIO Syllabus 2.0 (Lucas, 2010) in order to orient the construction of the categories.

As stated in the theoretical background of this work, four main factors determine self-efficacy: mastery of experience, vicarious experience, social persuasion, and emotions (Bandura, 1994). These elements would self-efficacy, ultimately leading to a certain behavior or performance. Other elements that are important to consider are the actual desire to follow an entrepreneurial career and resilience to failure (Cooper and Lucas, 2006; Oosterbeek et al., 2010). These elements must be matched to the actual outcomes expected in an entrepreneurship course in engineering, such as working with high-potential technology, design in engineering, and opportunity recognition.

When studying self-efficacy in an engineering school, one should take into account the diverse options for majors. Different academic specializations in engineering usually mean distinctive personality traits from the subjects (Terenzini et al., 1991, 2010). Therefore, individuals are asked whether they are capable of performing a certain role of a given occupation, without specifying the skills that might be required (Cooper and Lucas, 2006).

The questionnaire uses a set of eight different items to measure entrepreneurial self-efficacy in terms of the level of confidence that students have regarding the

different outcomes they expect from the course. Participants were asked to indicate their effectiveness in these eight different skills on a scale from 0 to 10 (0=totally ineffective, 10= fully effective). In this sense, multi-item scales are more reliable than single-item ones (Liñan and Chen, 2009).

The questionnaire measures entrepreneurial intention on a Likert scale from 1 to 7. This was measured with four statements in an attempt to quantify a student's intention to start a venture in the near future. Cooper and Lucas (2006), Chen et al. (1998), and Zhao et al. (2005) used a similar methodology.

The actual questionnaires used may be found in Appendix A and B.

5.3.2. Important elements to consider in the instrument

This research uses self-reported assessment as an instrument to measure the effects of ING2030 on the students participating in the course. This thesis needs to be careful with certain elements that may affect the results of the research, such as social desirability bias and self-selection bias.

Socially desirable responding (SDR) is the tendency to give an overly positive answer in order to be viewed favorably by others. To reduce the social desirability in the questionnaire, similarly to Chen et al. (1998), survey instructions emphasized the promise of confidentiality and the importance of honesty for self-assessment. At the same time, the experiment itself does not have a strong influence on social desirability. Therefore, we could reasonably conclude the subject over-represented both the pre- and post-test, and thus the change would be the same (Leatherbee and Eesley, 2014).

On the other hand, self-selection bias would result in a wrong choosing of the sample. To prevent this possibility, every participant in the course received the survey, and only the students who did not answer both questionnaires were discarded.

5.3.3. Measuring the Significance of Results

To determine the statistical significance of the variables measured, two different methods were used: Student's T-test and Welch's T-test. This way, we can determine the likelihood that random chance did not cause the relationships before and after the experiment. Student's T-test was used in all the items in the questionnaire except for those that had unequal variances, where Welch's t-test was used. Even though Welch's is an adaptation of Student's, Welch's t-test appears to be a more reliable test when two samples have unequal variances and unequal sample sizes.

This work identified the psychosocial outcomes of the ING2030 course by estimating significant changes in self-efficacy in course-performance indicators. The significance of changes in entrepreneurial intent was also estimated. To perform both analyses, we previously matched the responses obtained in the [Pre-Questionnaire] and the [Post-Questionnaire] for each period by the student's id number. Then we conducted t-tests to analyze the statistical significance of the pre and post differences of the averages in both periods, considering that t-tests are generally more powerful than the nonparametric Wilcoxon rank test (Murnane and Willet 2011).

5.3.4. Reliability of the Methodology

Liñan and Chen (2009) consider reliability and validity as the essential psychometrics to be reported. Reliability refers to the consistency and stability of a score from a measurement scale, whereas validity considers the evidence that the measurement is actually measuring the intended construct.

To evaluate the reliability and validity of the pre- and post-questionnaires, the study adopts a quasi-experimental pretest and posttest design in two different educational settings. The first setting was the ING2030 core-engineering course.

The second was a BMoE boot camp taught during the third week of August 2016. Students were not only from engineering majors, but also from diverse backgrounds such as business, sociology, and media.

Cronbach's alpha was measured in these two cases. Cronbach's alpha is a measure of internal consistency that shows how closely related a set of items are in a group, in this, case self-efficacy and entrepreneurial intent. We use Cronbach's alpha to see the reliability of the instrument.

The instrument applied at UC Berkeley and PUC is based on the existing literature (Cooper and Lucas, 2006; Liñan & Chen, 2009; Chen et al., 1998; Täks et al., 2014; Mohd Noor and Mohammad, 2009; Terenzini et al., 1991). Therefore, it provides a robust external validation of its effectiveness.

6. RESULTS

This chapter presents the results of the measurements conducted both at PUC and UC Berkeley. Section 6.1 shows the measurements of reliability and construct validity of the scales of self-efficacy and entrepreneurial intent in both educational settings. Section 6.2 shows data from the BMoE BootCamp at UC Berkeley. Finally, section 6.3 shows the results obtained at PUC. It starts by showing results regarding the population in the study, including the level of exposure to entrepreneurial family and the age group of the participants. Section 6.3 then provides tables showing the changes in levels of self-efficacy and entrepreneurial intent. Section 6.3 concludes by providing qualitative data gathered from the students, showing their appreciation of the course classified by subject.

6.1. Cronbach's Alpha Reliability Scales

Table 6.1 presents Cronbach's alpha coefficients for four samples of students both in the pilot questionnaire and the questionnaire used in this study. This index measures the cohesion of the items measured in order to provide validity of the questionnaire. The first two samples for the pilot questionnaire were used, and the other two in the actual research (ING2030 and UC Berkeley). About 230 students, who were either first-year students or were from the Design and Innovation major, answered the survey as part of the pilot. As Table 6.1 shows, Cronbach's alpha coefficients for self-efficacy are over 0.80 for all samples, which means the self-efficacy scale is reliable. Regarding entrepreneurial intent, three of four samples have a Cronbach's alpha near 0.80, showing good reliability for the instrument. The Design and Innovation major sample has a Cronbach's alpha of 0.53, but it is expected to have lower coefficients with smaller samples. Still, it is an aspect that could be further revised.

Table 6.1. Scale reliability according to Cronbach's alpha coefficients

Sample	Cronbach-alpha	
	Self-efficacy (k=7)	Entrepreneurial Intent (k=4)
First year students	0.81	0.78
Design and Innovation Major (2016)	0.81	0.53
ING2030	0.8	0.81
SCET Berkeley	0.81	0.79

Note: K= Number of Questions

6.2. BMoE BootCamp

Results at UC Berkeley show similar behaviors in the samples. Table 6.2 presents the average levels of self-efficacy for participants at the boot camp at UC Berkeley, pre and post course. Five of the seven indicators are statistically significant, and all of them show a positive increase. One of the indicators with a higher increase is the ability to solve an unstructured problem. Also, we see a significant increase in participants' belief in their ability to start a business if they choose to, with a 0.87 increase on a scale from 0 to 10.

Table 6.2. Entrepreneurial self-efficacy levels BMoE Boot Camp

Course Outcomes	Average self-efficacy level (scale from 0 to 10)			
Performance Indicators	Pre-course	After Course	Difference	P-value (T>t)
Solve an unstructured problem	7.58	8.45	0.87	0.00***
Clearly describe a problem orally	7.82	8.34	0.53	0.05***
Clearly describe a problem in writing	8.13	8.47	0.34	NS
Ask probing questions that clarify facts	8.16	8.58	0.42	0.09***
Motivate a group of people to work as a team	7.84	8.21	0.37	0.07***
Recognize a good opportunity	8.26	8.53	0.26	NS
Start a successful business if you want	6.82	7.68	0.87	0.00***

Note: NS = Not Significant - NI = No Information

Significance Levels: *90% - **95% - ***99%

When observing the results related to entrepreneurial intent (Table 6.3), we find a modest positive increase in three of four statements in the instrument. The biggest increase is in the statement related to the appeal of high-risk/payoff ventures (pre-test 52.63%, post-test 60.53%). The table also indicates a significant decrease in the statement related to ideating technology-based ventures, which was the highest one at the beginning of the course (pre-test 68.42%, post-test 57.89%). Even though a positive increase occurs in three of four statements, a Student's t-test shows these results are not statistically significant.

Table 6.3. Entrepreneurial Intent BMoE Boot Camp

Entrepreneurial Intent	Number of students that Agree or Strongly Agree			
Statements	Pre-Course	After Course	Difference	P-value (T>t)

If I see the opportunity to work in a start up the upcoming years, I would take it	60.53%	63.16%	2.63%	0.2434**
The idea of a high risk/high payoff ventures appeals to me	52.63%	60.53%	7.89%	0.3218*
I think often about ideas for starting a technology-based entrepreneurship	68.42%	57.89%	-10.53%	NS
At least once I will have to take a chance and start my own company	65.79%	71.05%	5.26%	0.3240*

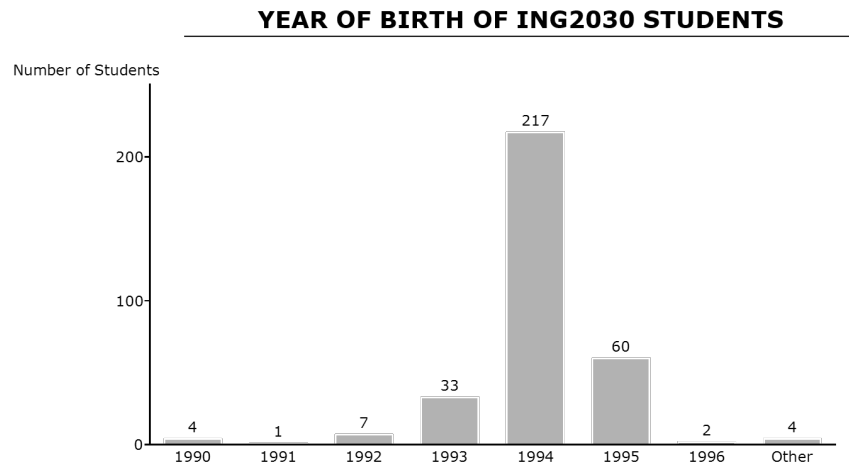
Note: NS = Not Significant - NI = No Information

Significance Levels: *90% - **95% - ***99%

6.3. ING2030

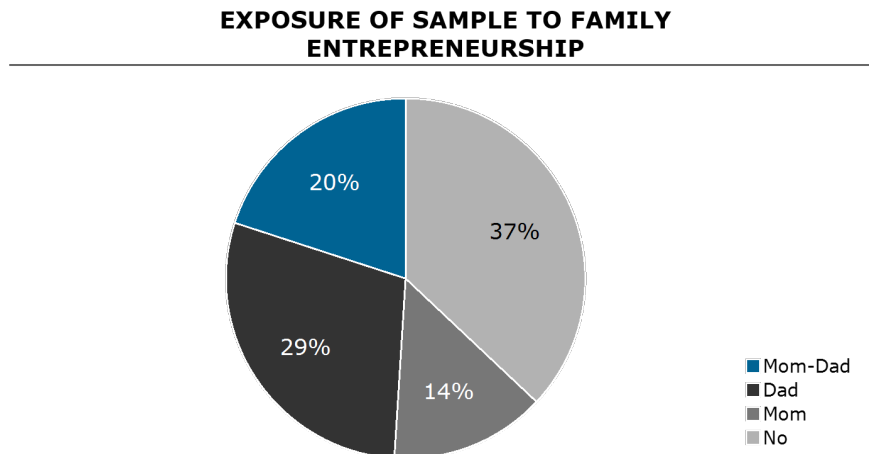
The results of this thesis suggest ING2030 has had an impact on self-efficacy to start a technology-based entrepreneurship. The percentage of students that agreed with entrepreneurial-intent statements increased, but the impact observed in this aspect of the research was lower than self-efficacy levels. At the same time, the research conducted at Berkeley showed participants' self-efficacy and entrepreneurial intent increased after the intervention.

Of the 328 engineering students in this study, 23% were female. Figure 6.1 shows the distribution of students in the study according to year of birth. Most of the students are 21 years old, which means they are part of the 2013 admitted cohort and are taking the course because their curriculum requires it. The chart also shows older students who might have taken the course as an elective.



6.1. Year of Birth of ING2030 students

The previous level of relationship with entrepreneurship activities of the sample is also important to consider. Mohd Noor and Mohammad (2009) show that environmental, social, and personality factors (e.g., individual character and the



6.2. Exposure of Sample to Family Entrepreneurship

background of the respondents) influenced the drive to establish self-owned businesses. Figure 6.2 shows the students' exposure to entrepreneurship within their families: 63% of the sample has been exposed to entrepreneurship through a relative. Also note that 177 students declared actively participating in extracurricular activities.

Table 6.4 shows the average levels of self-efficacy for each performance indicator measured in the questionnaire. According to the scale used, self-efficacy levels vary between 0 and 10. This table indicates an increase in almost all performance indicators at the end of the course. In addition, the difference turns out to be statistically significant for five of the seven performance indicators the first semester, and for four of the five indicators in the second semester. In both semesters, the increase in "solving an unstructured problem" and "recognize a good opportunity" had one of the biggest differences. A considerable increase occurs in the self-efficacy levels of participants on the item related to starting a successful business, increasing 1.23 on average both semesters.

Table 6.4. Entrepreneurial self-efficacy levels

Course Outcomes		Average self-efficacy level (scale from 0 to 10)		
		1st Semester 2015		
Performance Indicators	Pre-course	After Course	Difference	P-value (T>t)
Solve an unstructured problem	6.64	7.34	0.7	0***
Clearly describe a problem orally	7.23	7.73	0.5	0.0002***
Clearly describe a problem in writing	7.77	7.77	0	NS
Ask probing questions that clarify facts	6.7	7.06	0.36	0.0049***
Motivate a group of people to work as a team	7.23	7.36	0.13	NS
Recognize a good opportunity	6.08	7.01	0.93	0***
Start a successful business if you want	5.88	7.11	1.23	0***

Performance Indicators	2nd Semester 2015			
	Pre-course	After Course	Difference	P-value (T>t)
Solve an unstructured problem	5.97	NI		
Clearly describe a problem orally	6.8	7.39	0.59	0.029**
Clearly describe a problem in writing	7.29	NI		
Ask probing questions that clarify facts	6.2	6.94	0.74	0.008***
Motivate a group of people to work as a team	6.91	7	0.09	NS
Recognize a good opportunity	5.75	6.55	0.8	0.016**
Start a successful business if you	5.22	6.47	1.25	0.001***
Note: NS = Not Significant - NI = No Information				
Significance Levels: *90% - **95% - ***99%				

Table 6.5 shows the results of the questionnaire regarding entrepreneurial intent. The table indicates the percentage of students that agreed or completely agreed with each of the statements about entrepreneurial intent. Results show that in both semesters, three of four statements had a positive increase. Nevertheless, the results in the second semester are not statistically significant. The largest gains occur regarding the statement that one would take advantage of an opportunity to work in a startup in the upcoming years if such an opportunity were to arise (pre-test 70.51/69%, post-test 80.77/76%).

Table 6.5. Entrepreneurial Intent

Entrepreneurial Intent	Percentage of students that agree or strongly agree			
	1st Semester 2015			
Statements	Pre-Course	After Course	Difference	P-value (T>t) (***)
If I see the opportunity to work in a start up the upcoming years, I would take it	70.51%	80.77%	10.26%	0.0001
The idea of a high risk/high payoff ventures appeals to me	62.82%	70.94%	8.12%	0.0053
I think often about ideas for starting a technology-based entrepreneurship	49.57%	57.26%	7.69%	0.0001
At least once I will have to take a chance and start my own company	93.59%	88.03%	-5.56%	NS
2nd Semester 2015				
Statements	Pre-Course	After Course	Difference	P-value (T>t)
If I see the opportunity to work in a start up the upcoming years, I would take it	69.00%	76.00%	7.00%	0.145*
The idea of a high risk/high payoff ventures appeals to me	59.00%	65.00%	6.00%	0.202*
I think often about ideas for starting a technology-based entrepreneurship	44.00%	51.00%	7.00%	0.181**
At least once I will have to take a chance and start my own company	84.00%	84.00%	0.00%	NS

Note: NS = Not Significant - NI = No Information

Significance Levels: *90% - **95% - ***99%

Together, these results show the ING2030 course has had a statistically significant impact on self-efficacy and lead to some increase in entrepreneurial intentions of the participating students.

Results at PUC show similar behaviors to the UC Berkeley sample results. Even though participants at PUC start at a lower level of self-efficacy, the levels of increase after the course are same as or higher than the ones observed at Berkeley. Meanwhile, entrepreneurial intent shows a higher increase at PUC, even though students do not start at a considerably higher or lower level than the participants at Berkeley.

The ING2030 course had a great impact on the continuity and projection of many of the teams participating. Several of the alumni teams took part in numerous innovation and entrepreneurship competitions, obtaining first-place prizes and even funding. Teams featured in competitions such as European Innovation Academy, Start-Up Chile, Jump Chile, Brain UC, Aplica tu Idea, and PUC's Demo Day.

Qualitative data were gathered from the participants of ING2030 in order to form a big picture of their opinion of the experience. The results were divided in five categories: Content, Continuity, Contradictions, Mindset, and Tools for Life. Table 6.6 contains some of the selected feedback.

Table 6.6. Qualitative Data Regarding ING2030 Course

Categories	Participant's Comments
Methodology	<ul style="list-style-type: none"> • “Promote graduate students or from other careers to take the course in order to diversify the teams.” • “We need to go into the ‘mud’ in order to see the real problematics, interviews are not enough, the course needs another approach.” • “Little collaboration from the different engineering departments to help and facilitate the labs and tools to develop our projects.”
Content	<ul style="list-style-type: none"> • “Disruptive course, very good to think differently, nevertheless is important not to impose a vision of entrepreneurship that not everybody has. You need too many connections for entrepreneurship. I really like the opportunity of working with mentors.”
Continuity	<ul style="list-style-type: none"> • “Course should be longer to give continuity to the ideas.” • “Great course that promotes quality. It is great that this course is mandatory.” • “Generate a second course as a continuation of this one. Second course should help us more with the technic knowledge necessary for our projects. The course should be interdisciplinary.”
Mindset	<ul style="list-style-type: none"> • “It made me change my mentality, it nurtured my curiosity, learn a whole new world, giving sense to things. The course opens an unknown world. Throw yourself into the river.” • “The course takes us out of our comfort zone, you have to go and knock doors, move, that is what I most liked of the course.” • “It was good to hear the experiences from successful entrepreneurs that motivate you and tell you this is not a game and that you can really do it.” • “The truth is that the course changed my life, I thought entrepreneurship and innovation was not my thing, I hated it, when ING2030 started I thought the same. Throughout the course, little by little, I started liking it, now this is what I want to do as a career.” • “Is the first course that has a transcendental background in our future professional life. It shows us a path that not many of us consider in Engineering School.” • “It contributed to my motivations, I want to change the world and engineering will provide me the tools for it.” • “I believe I passed throughout all stages of the course, from frustration, hatred, and finally a lot of motivation.”
Tools	<ul style="list-style-type: none"> • “Is the course where I have most learned in university and I know the knowledge acquired will be really useful in my professional life. “ • “I think the course is a great opportunity to grow, as a person and as an entrepreneur.” • “The course helps to generate contact networks and gain experience in the fields of innovation and entrepreneurship.”

7. DISCUSSION

The main objective of this research was to provide evidence that the BMoE is a valid framework for entrepreneurship education in Chile. We adapted and implemented UC Berkeley course into PUC, based on the local needs of development for the participants and the local entrepreneurial ecosystem. To measure the effects of the intervention, we measured two main variables in different dimensions: entrepreneurial self-efficacy and entrepreneurial intent.

ING2030 was constructed with the objective of strengthening the chance that its participants would pursue an entrepreneurial journey or would consider entrepreneurship as a valid career path. We treated the design and implementation of the course as a quasi-experiment, helping to establish a deeper understanding of entrepreneurial development. We achieved success from one perspective: levels of self-efficacy in performance indicators associated with technology-based entrepreneurship increased significantly. Claiming that entrepreneurship programs cause a desirable effect is often open to challenge (Cooper and Lucas, 2006), but the evidence here clearly confirms the first hypothesis of this research: engineering students participating in the ING2030 course at PUC, and therefore immersed in the BMoE, will develop a greater belief in their ability to successfully perform the various roles and tasks of entrepreneurship (entrepreneurial self-efficacy).

Cooper and Lucas (2006) suggest the surge of self-confidence might result from the fact that participants in entrepreneurship courses are usually self-selected and both eager and ready to be influenced to believe they have leadership and entrepreneurial potential. This scenario is not the case in Chile, however, where ING2030 appears as a compulsory course that every engineer student from PUC has to take to graduate.

The increase in self-efficacy, therefore, is not determined by the self-selection of the participants in the intervention. This outcome is contrary to studies conducted in elective courses (Cooper and Lucas, 2006).

This entrepreneurship course drastically deviated from the traditional type of lecture-based pedagogy to which the students were accustomed. The activities and games were designed to expand students' entrepreneurial mindset, develop their skills, and deepen their understanding of the entrepreneurial process. These were all oriented toward raise the participants' self-awareness levels (Fayolle and Gailly, 2008). Also, as in Täks et al. (2014), participants recognized having developed totally new perspectives, either in relation to their future career paths or regarding their engineering studies. New knowledge and increased self-efficacy translated into students' ability to see new aspects of their own capacities, inspiring them to continue further with entrepreneurship studies in order to be better prepared for self-employment possibilities (Täks et al., 2014).

Against our predictions, the intervention did little to build participants' entrepreneurial intentions. Although we observed some positive increases, two out of three of the samples showed non-statistically significant changes. Other research has used the entrepreneurial intention scale employed here, and has found it captures an immediate intention estimate to start a company (Cooper and Lucas, 2006). Three of the items show an increase in both semesters (statistically significant in the first measurement), which may suggest a latent desire to start a company or work in a startup sometime in the participant's career. We can neither accept nor reject our second hypothesis—that engineering students participating in the ING2030 will positively increase their entrepreneurial intention. Nevertheless, the study conducted is insufficient to reach a proper conclusion. Further evaluations have to explore social desirability biases in the entrepreneurial intent declared in the questionnaire.

ING2030 was intended to create a positive change in entrepreneurial intent. Results in the literature (Chen et al., 1998; Cooper and Lucas, 2006) indicate participants in entrepreneurship education experience a significant immediate positive effect of entrepreneurial self-efficacy on the likelihood of becoming an entrepreneur. Studies on the persistence of this intention come to varying conclusions, contradicting the view in the literature that increasing self-efficacy predicts heightened entrepreneurial intention. The relationship between the variables could be used to attribute causality to either of them; for instance, one could view self-efficacy as the cause of entrepreneurial intent, or one could view the founding experience as the cause, reasoning that people who get involved in setting up a business will develop higher self-efficacy (Chen et al., 1998). Alternatively, self-efficacy might be a prerequisite, as in a necessary but not sufficient condition, for intent, or some other complex relationship may be at play (Cooper and Lucas, 2006). Our research provides evidence that self-efficacy in entrepreneurship can increase intention in some immediate way, but findings show no simple cause-and-effect relationship between them. The problem could be caused by the isolation of self-efficacy as the only predictor for entrepreneurial intention. Therefore, we cannot accept or reject our third hypothesis— that higher entrepreneurial self-efficacy will lead to higher entrepreneurial intention. Nevertheless, the methodology used in this case study does not allow us to determine causality between the variables.

The effects of the intervention are similar at the BMoE Boot Camp at UC Berkeley. Initial levels of self-efficacy are higher in Berkeley's students than in Chile's. This difference could be explained by the fact that the Berkeley students are immersed in a developed entrepreneurial ecosystem such as Silicon Valley or that the course is not compulsory, so students are expected to have higher self-efficacy levels. Nevertheless, increases in similar performance indicators are analogous, showing a positive effect of the BMoE in the samples studied.

The data are also similar when we analyze the effects of the BMoE Boot Camp. Even though, the measurements are not statistically significant, a positive increase occurs in three out of four of the statements in the questionnaire. Interestingly, the students at Berkeley start with a considerable lower entrepreneurial intent than the students in Chile. The social desirability of the samples could explain this difference. The tendency to give an overly positive answer in order to be viewed favorably by others could vary depending on the context. Berkeley students are immersed in a different entrepreneurial ecosystem than students at PUC. The expectations of the contexts could be different regarding the willingness of the participants to appear favorably to their counterparts.

Note the effects observed in the intervention cannot be associated either with the contents or methodology of the course alone. The experiment was not designed to abstract these two elements of the course, but to evaluate the overall effect of an imported intervention on the engineering students at PUC.

Finally, when we analyze the qualitative results obtained by interviewing the students, we find positive results regarding the ING2030 course. Several participants describe the experience as disruptive and game changing. The course opened their minds and offered entrepreneurship as a valid professional option for their development. The action-based component of the curriculum was one of activities that received the most positive feedback from the participants, confirming the Action-Based-Learning approach proposed by Gielnik et al. (2015).

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this thesis project was to explore and measure the impacts of new courses for entrepreneurship education. We aim to offer a proven intervention in order to encourage and develop an entrepreneurial mindset in engineering students. To design proper methodologies and interventions, we start by researching the way human beings guide their behaviors. Next, we took an external methodology used at the University of California Berkeley (BMoE) and adapted a Berkeley course (Challenge Lab) into a Chilean context. We took several factors into consideration, such as cultural differences, maturity of the entrepreneurial ecosystem, Chilean universities' infrastructure, and so on. The ING2030 course implemented in Chile included both content and pedagogy to deliver desired outcomes.

To measure the effectiveness of the intervention, we measured two variables: self-efficacy and entrepreneurial intent. We formed hypotheses regarding the increment and relationship between these two variables.

We found compelling evidence that the course implemented in Chile was able to improve the self-efficacy of engineering students at Pontificia Universidad Catolica de Chile. Regarding entrepreneurial intent, we found a positive, though statistically insignificant, increment in the statements associated with this item, so further research is necessary. Finally, this case study provides evidence that self-efficacy in entrepreneurship can increase intention in some immediate way. However, findings show no simple cause-and-effect relationship between the variables. Additionally, the methodology used in this case study does not allow us to determine causality between the variables.

From a practical perspective, the research instrument design for this investigation provides systematic data as to whether an entrepreneurship course is effective. Nevertheless, we cannot argue persistence in the behaviors studied in this thesis.

Therefore, we propose a follow-up survey to the participants of ING2030 so we can debate the established foundation of ING2030 and BMoE as enhancers of self-efficacy.

Engineering students are accustomed to traditional teaching, so a transformation to self-directed learning causes considerable difficulties and even frustration. Therefore, one must take into account the differences between students when planning and implementing entrepreneurship education. Because the course was compulsory, from the very beginning, the students' expectations of entrepreneurship studies and the purpose of learning differed. Thus, extreme detail in a self-discovery form of education where participants learn by doing is necessary.

Individuals must possess an accurate sense of their abilities if they are to avoid putting themselves into positions where they are likely to fail, which may have the negative effect of decreasing their levels of self-efficacy. An informed decision is a better decision, and if we are self-aware about what we are capable of (self-efficacy), our intentions should follow these desires.

Future research regarding data collected could explore a deeper understanding of the differences between individuals in the program. Is the exposure to family entrepreneurship a relevant factor in the increase in self-efficacy and entrepreneurial intent? Is the cultural and socio-economic context relevant also? Do any differences exist in the levels of self-efficacy regarding gender and exposure to extracurricular activities? What majors favor higher self-efficacy levels and entrepreneurial intent? Such findings will aid in developing and refining the methodology.

The DEI continues to standardize the measurement instruments used to assess the effects of entrepreneurship education. Further research using the instrument and methodology adopted here is being undertaken to explore the impact of ING2030 and other entrepreneurship programs.

We propose as a continuation of this research the inclusion of more explanatory factors for entrepreneurial intention rather than only self-efficacy. For example, locus of control measures not only behavioral but also outcome control, whereas self-efficacy concerns only behavioral control (Chen et al., 1998). These findings could help us better understand what really triggers the act of starting a company, and therefore enable us to incorporate it in entrepreneurship education methodologies.

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APPENDIX

A. Questionnaires

a. PUC Questionnaire



Encuesta Final Curso ING2030

La Dirección de Educación de Ingeniería (DEI) ha diseñado esta encuesta sobre conocimientos y habilidades relacionados con el curso ING2030.

Por favor lee detenidamente, y contesta con total sinceridad. Este cuestionario será utilizado con fines de investigación, y no para la aprobación del curso.

Agradecemos tu participación en este estudio.

Por favor indica tu número de alumno/alumna: _____

Instrucciones

A continuación, vas a encontrar tres secciones, las cuales te preguntan:

1. Cuán eficaz serías en la realización de una serie de tareas
2. Cuán de acuerdo estás con algunas afirmaciones
3. Cuán beneficioso son para ti diferentes elementos del curso

En las tres secciones, marca con una cruz la opción que mejor expresa tu grado de respuesta. Por favor prestar atención a la escala de respuesta cada pregunta, la cual varía según sección.

Tener en cuenta que cada hoja está impresa por ambas caras.

¿Cuán capaz serías de realizar eficazmente las siguientes tareas?

Indica tu grado de eficacia del 0 al 10 (0=Totalmente ineficaz; 10=Totalmente eficaz).

1. Diseñar un prototipo que permita entender cómo funciona un nuevo producto o servicio

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

2. Resolver un problema cuyo enunciado no contiene toda la información necesaria

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

3. Describir un problema oralmente de forma clara

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

4. Describir un problema por escrito de forma clara

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

5. Hacer preguntas que estimulen a otros a pensar y explorar ideas

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

6. Motivar a un grupo de personas a que trabajen en equipo

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

7. Reconocer una buena oportunidad para generar un producto o servicio con proyección internacional

	0	1	2	3	4	5	6	7	8	9	10	
Totalmente ineficaz	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Totalmente eficaz

8. Estudiar una tecnología y descubrir una nueva forma de uso que sea práctica

	0	1	2	3	4	5	6	7	8	9	10	
--	---	---	---	---	---	---	---	---	---	---	----	--

Totalmente ineficaz ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente eficaz

9. Iniciar un emprendimiento con base tecnológica

0 1 2 3 4 5 6 7 8 9 10

Totalmente ineficaz ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Totalmente eficaz

¿Cuán de acuerdo estás con las siguientes afirmaciones?

Marca una opción por fila.

	Muy en desacuerdo	En desacuerdo	Ni de acuerdo ni en desacuerdo	De acuerdo	Muy de acuerdo
a. Si tuviese la oportunidad de trabajar en un start-up tecnológica en los próximos años, la tomaría.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Me atrae la idea de un proyecto de alto riesgo con alto retorno de inversión.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Pienso a menudo en ideas y maneras para iniciar un emprendimiento con base tecnológica.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Me gustaría vivir la experiencia de emprender en tecnología al menos una vez.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indica hasta qué grado has pensado en emprender en los últimos 15 días.

Lee las opciones enumeradas a continuación y encierra la opción que mejor describa tu intención de emprender.

1. No he pensado en emprender últimamente
2. He pensado en emprender ocasionalmente
3. He pensado en emprender frecuentemente
4. He pensado de forma concreta en cómo emprender
5. He decidido emprender en 3 años más
6. Tengo planes de emprender en un plazo de 1 año

Elaborada por Isabel Hilliger para Escuela de Ingeniería UC

7. Inicié un emprendimiento
8. Estoy auto empleado en el emprendimiento que inicié
9. He iniciado emprendimientos anteriormente, y estoy participando activamente de uno de ellos

BORRADOR

¿Cuán beneficioso fueron para ti los siguientes elementos del curso?

Marca una opción por fila.

	Para nada beneficioso	Algo beneficioso	Beneficioso	Muy beneficioso	Totalmente beneficioso
a. Trabajar en equipo en un emprendimiento tecnológico.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Vivir la experiencia de idear y emprender.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Contar con mentorías de emprendedores.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Crear un blog de reflexión individual.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Defender una idea ante un panel de inversionistas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Rendir controles individuales con nota.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Ser evaluado por tus pares.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Indica cuán beneficioso fue para ti contar con cátedras sobre:

	Para nada beneficioso	Algo beneficioso	Beneficioso	Muy beneficioso	Totalmente beneficioso
a. Emprendimiento y fracaso	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Trabajo en equipo	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Comunicación persuasiva	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Generación de ideas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Descubrimiento de mercados y clientes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Modelo de negocios	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Financiamiento	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

¿Cuán beneficioso fueron para ti los siguientes aspectos administrativos del curso?

Marca una opción por fila.

	Para nada beneficioso	Algo beneficioso	Beneficioso	Muy beneficioso	Totalmente beneficioso
a. Orientación entregada por el programa del curso	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Horarios de cátedras y talleres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Estructura del curso (cátedra y talleres)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Uso de idioma inglés en cátedra	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Clima de interacción en la cátedra	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Uso de medios en la cátedra	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Clima de interacción en los talleres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Experiencias de aprendizaje en los talleres	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Criterios de evaluación	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Carácter mínimo del curso	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Identifique 1 aspecto concreto que contribuyó a su aprendizaje	Señale 1 sugerencia que apoyen a un mejor desarrollo del curso

Indica qué pasos planeas dar para avanzar en el desarrollo de la propuesta de emprendimiento tecnológico que presentaste en el curso.

Encierra una o más opciones de las enumeradas a continuación.

- ☐ No planeo seguir avanzando en la propuesta por ahora
- ☐ Tomaré otros cursos en materias de emprendimiento e innovación
- ☐ Hare una investigación tecnológica
- ☐ Participaré en concursos para conseguir fondos
- ☐ Buscaré la asesoría de algún mentor
- ☐ Participaré en redes de emprendimiento
- ☐ Buscaré más socios para el proyecto
- ☐ Conversaré con potenciales clientes
- ☐ Pediré financiamiento a inversionistas o instituciones bancarias

Indica cuáles serían las barreras que podrían dificultar tu avance en el desarrollo de tu propuesta tecnológica.

Encierra una o más opciones de las enumeradas a continuación.

- ☐ Acceso a medios de financiamiento
- ☐ Conocimiento de la normativa y regulaciones que aplican
- ☐ Falta de habilidades y competencias asociadas a innovación y emprendimiento
- ☐ Falta de habilidades y competencias técnicas
- ☐ Falta de tiempo para asumir un emprendimiento
- ☐ Poco contacto con potenciales clientes
- ☐ Poco contacto con potenciales inversionistas
- ☐ Poco contacto con otros emprendedores y falta de redes

b. Berkeley Questionnaire

Student ID* _

Major/Background* _

Gender* _

Age* _

1. Self-Efficacy

How effective would you be to do the following ?

Indicate your effectiveness from 0 to 10 (0 = totally ineffective; 10 = Fully effective).

Design something novel and innovative* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Solve an unstructured problem* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Clearly describe a problem orally* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Clearly describe a problem in writing* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Ask probing questions that clarify facts* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Motivate a group of people to work as a team* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Recognize a good opportunity* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Put a detailed plan to action* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Understand what it takes to start your own business* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

Start a successful business if you want* _

1 2 3 4 5 6 7 8 9 10

Totally Ineffective

Fully Effective

2. Entrepreneurial Intention

2.1 Have you started a venture before?

The questionnaire makes reference to the detection of a problem and the subsequent development of a product idea or service with a scientific and technological focus. It should be noted that we consider social enterprises to also classify as ventures.

* _

- Yes
- No

2.2 How are you agree with the following statements ?

Please select one option per row

*

	Strongly Disagree	Disagree	Somewhat Disagree	Indifferent	Somewhat Agree	Agree	Strongly Agree
[a. If I see the opportunity to work in a start up the upcoming years, I would take it]							
[b. The idea of a high risk/high payoff ventures appeals to me]							
[c. I think often about ideas for starting a technology-based entrepreneurship]							
[d. At least once I will have to take a chance and start my own company]							

Benefits of the BMoE Bootcamp and Next Steps

After finishing the BMoE Bootcamp, What would be your next steps?*

You can check more than one option.

- I don't plan to continue with my idea/project at the moment
- Take more courses regarding Innovation and Entrepreneurship
- Start a technology-academic research
- Try to get funded
- Seek help of a mentor
- Actively participate in the entrepreneurial ecosystem
- Look for partners for my idea/project
- Talk to potential customers
- Other:

If you think we missed promoting some competition, tool or skill in the bootcamp for the development of your project, you can submit it in the field below.Optional

B. 10 Behaviors of Entrepreneurs

1. *Pay it Forward:*

One of the fundamental rules of an innovation ecosystem is the concept of “paying it forward”, in other words, doing a favor for someone without expecting something in exchange (Hwang and Horowitz, 2012). Entrepreneurs in areas strong in entrepreneurship, such as Silicon Valley, build support networks outside existing companies. These networks can be around any area of interest, and are mutually beneficial (Sidhu et al, 2014). The beauty of an environment of paying-it-forward is that eventually it comes back around. It is not expected that the person you help will help you back directly, but ultimately someone else will repay you back. A Pay It Forward culture makes an entrepreneurship ecosystem smarter (Blank, 2011).

2. *Story Telling*

How do we describe a completely new technology, when not even enough words exist to do it? How do we inspire and convince people to believe in our new venture? Entrepreneurs need to find a way to cross communication barriers in order to express what they have conceived in their minds. They should be able to convince investors, and customers of the value they are creating. Especially in high-tech markets, where an entrepreneur’s product idea or business model can be radically new, or disruptive (Sidhu et al, 2014). Entrepreneurs need to be able to communicate their ideas in a completely different way, storytelling is a useful tool. The power of storytelling allows people to learn from stories. Stories spark emotions and engage people to make sense of things.

3. *Friend or Foe*

The entrepreneur is concerned that his idea will be stolen, but if he is not willing to trust the person in front of him, the conversation will be a no starter; therefore: trust fast or die (Hwang and Horowitz, 2012). How do expect to get the proper feedback or investment, if you are not willing to share the basic information about your startup? Someone has to take the first step. Innovation ecosystems cannot

function without trust. This may mean being willing to suffer the occasional treason, but overall, trusting others will boost your ideas and projects. Trusting and sharing is not common in many parts of the world, and this was a point of action in the adaptation of the innovation course taught in Chile, which will be further discussed in the next chapter.

4. *Seek Fairness*

Another behavior that has been related to successful entrepreneurs is the search for fairness in relationships, transactions and businesses. The idea is to capture the synergies and aim that 1+1 is greater than 2. One does not negotiate looking for the counterpart to earn less. That does not help to establish a long term relationship, that allows to continue to do business together. Entrepreneurs should make deals that seek fairness, not advantage (Sidhu et al, 2014). This does not only apply to businesses, but to the relationships among people that work with us. Startup teams must consider this in their internal relationships. In an innovative organization you may find collaborators, not just employees, who must feel they are acquiring more than just an economic compensation. An ecosystem where people feel they are being treated fairly lowers the barriers to transactions, generates trust, and keeps people motivated to pursue aspirations together (Hwang and Horowitz, 2012).

5. *Plan to Fail*

When you talk to entrepreneurs or people related to an entrepreneurial ecosystem, the concept of failure has a totally different meaning. Failure is not necessarily related with distrust, disappointment or shame; but with gained experience in the process. Everybody wants to talk about success and nobody about failure. Failure is no fun and even can be devastating. Nevertheless, managed correctly, it can be a key learning resource for resiliency in your career and company (Danner and Coopersmith, 2015). The crucial part is to get up again. Eric Ries (2011) summarizes it in the following sentence: “if you cannot fail, you cannot learn”. In developed ecosystems, error and failure are still unpleasant, but they are not seen as the end of the world. If we can learn from the experience and use this to improve the

odds of success next time, failure and error are actually positive indicators in a system (Hwang and Horowitz, 2012).

6. *Diversify*

Once we have our idea in mind, how do we execute? How do we connect the scientist with the customers and the CEO with the marketer? In order to generate this social encounter, we must increase diverse interactions. The diversity of an entrepreneur's connections is crucial to the extent of opportunities open to them. The information needed to execute an idea is likely to be spread widely among individuals (Sidhu et al, 2014). This is how you manage to gather information that is key to the development and success of your business, such as potential market for goods, investments or even people that may provide feedback to your idea. No one can possibly have enough information by themselves to achieve a venture. And if people are not interacting, the value of their potential relationship remains buried, and the system as a whole loses (Hwang and Horowitz, 2012). Today, more than ever we should take advantage to diversification due to the lack of communication barriers permitted by technology.

7. *Role Model*

Human brains are flexible, and we are wired to learn by emulating (Hwang and Horowitz, 2012). Therefore, role models are a powerful tool for learning new behaviors and allowing students to spend time and listen to someone else they admire is a key component in suggesting a conduct (Hwang and Horowitz, 2012). The BMoE uses mentors as role models that may inspire through words and actions. Usually it is an entrepreneur or someone related with the ecosystem. Entrepreneurs are role models for how new entrepreneurs should be, regarding interactions with others, hustling in your business and ethics in entrepreneurship (Sidhu et al, 2014).

8. *Believe*

Belief and its relation to self-efficacy has been a concept long discussed in this thesis. Without going deep again into this subject, encouraging students to increase

their belief in their capabilities to success in the creation of a new venture is related to an actual higher achievement. The BMoE incites students to believe in themselves and that they can be world changers (Sidhu et al, 2014).

9. *Good Enough*

It is often counterproductive to be a perfectionist when you are an entrepreneur (Roth, 2015). We frequently want things to go perfectly and deliver 100% of the capabilities we can, but this is not always possible. Entrepreneurs must understand that perfection may be an enemy to your product or service, not because of the perfect result but because of the time needed to comply, and timing can be more important than a perfect result (Sidhu et al, 2014). The point is to align our efforts with a business and product that are working to create value and drive growth, not just adding as much features as we can (Ries, 2011). It is vital to find the proper point in the development of a new product where the features and functionality of it are “good enough” for the customer to find value with the product; from that point you just need to iterate, iterate and iterate.

10. *Collaboration*

Entrepreneurial ecosystems should create environments that encourage collaboration and interaction between people. Leaders frequently promote institutional collaborations, such as between universities and business entities, because it is impossible for a central agent to do everything (Hwang and Horowitz, 2012). There can even be a collaboration between competitors in the same industry, so called co-opetition which is defined as a strategy embodying simultaneous cooperation and competition among firms (Sidhu et al, 2014). The point is that creating value and pursuing a business opportunity is not a solo adventure.

C. ING2030

a. Lecturers and Team

- On-line lectures: The content of the course was taught via video conference by the Managing Director of the Sutardja Center for Entrepreneurship and Technology at UC Berkeley: Ken Singer. Once a week, all students enrolled in the class would gather in the main auditorium of the PUC School of Engineering and listen to a 1-hour lecture taught directly from UC Berkeley in English.
- Weekly Sections: Students were divided in four different sections in order to guide them with their projects and develop the activities and games proposed for the week. Sections met twice a week and were guided by local instructors properly trained at UC Berkeley. In the second version of the course (second semester), an actual entrepreneur or someone related to the ecosystem was incorporated as a co-instructor in each of the sections. The co-instructor provided a different point of view to the academic side of the teaching. At the middle of the course, students were expected to present the improvements to their projects to the teaching team on a weekly basis, in order to receive the proper feedback regarding their companies.
- Guest Lecturers: Some of the content taught at ING2030 was imparted by guest speakers. The idea was to provide the knowledge to the students coming from experts in the subjects or entrepreneurs that could actually inspire students in the different themes regarding the course. For example, John Danner and Mark Coopersmith, authors of the book “The other F Word”, taught the class about failure in entrepreneurship the first semester the course was offered.

Logistics were conducted jointly by teams in Berkeley and Chile. Weekly meetings were set in order to maintain the communication of the teaching teams and assess the execution of the course. This process meant constantly analysing and calibrating many elements and contents of the course, according to student’s and instructor’s feedback. Plenty of the activities and material provided to the students were designed throughout the way, in order to fulfil the objectives of the course. For example, when

we realized students were coming up with shallow problems that did not solve real issues or were not novel enough, we assigned them an investigation homework where they had to research deep in academic sources regarding their challenges.

Finally, a Teaching Assistant team was assembled. Two or three teaching assistants (TAs) were required per section. The job of the TAs was to make sure all the material was ready either for the plenary lectures or section meetings. TAs were also in charge of grading the different homework assigned to the students and to guide the different teams in their main projects. The TAs were selected according to their motivation and involvement with entrepreneurial education methodologies, most of them were actual entrepreneurs.

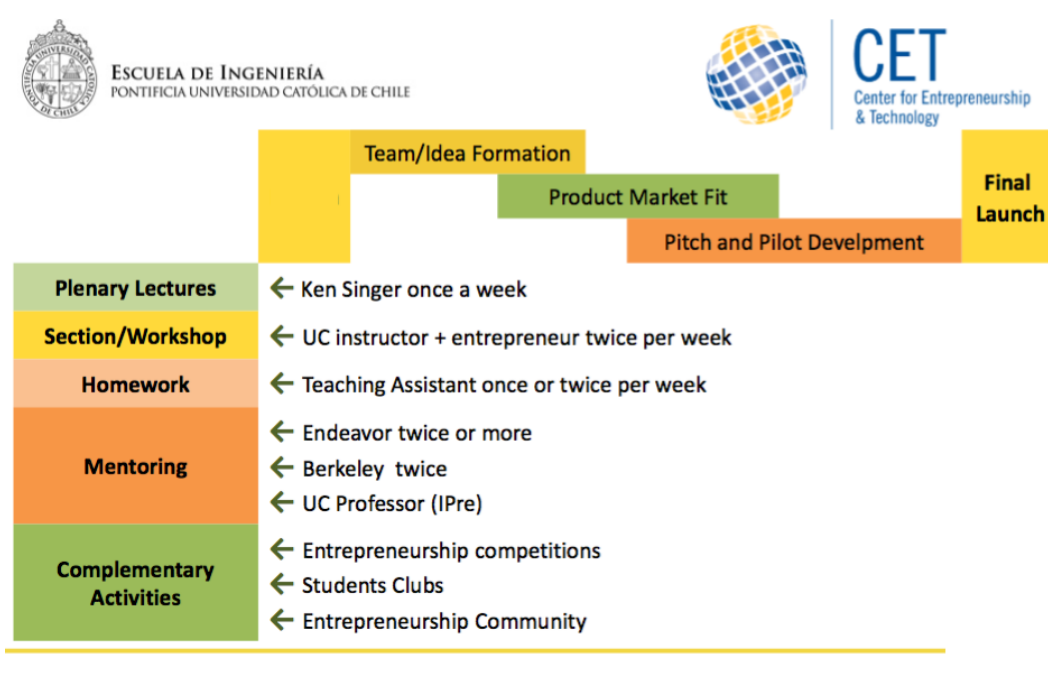
b. Stages of the Course

The course is designed by stages (Figure 4.1), so that the development of the student's projects may be guided throughout the semester. Plenary lectures, workshops and mentoring are provided to the different teams participating.

1. Team/Idea formation: The first five weeks of the course are intensive on introducing the course and encouraging participants to get to know each other. Several activities, game-based, compose this first part of the course that pretends to reveal certain social behaviours on students that will help them decide what or who is better for their teams. At the same time, students are expected to go deep into the four challenges proposed. They start researching, observing and interviewing people in order to come up with relevant necessities of society within the challenges.
2. Product Market Fit: Once teams are already formed, students must get deep into finding the proper product-market fit for the problematic they chose. From week six to thirteen, teams are expected to ideate, get out of their comfort zone and iterate, iterate and iterate. One of the main tools students have to come out with a

solution and keep improving it, is to actually talk to people, especially potential customers. In order to encourage teams to actually do this, from week six teams are expected to deliver ten interviews relevant for their projects. TAs collected in weekly manner their notes and findings. Interviews should be designed with open questions pushing for an actual conversation with the interviewee. Yes/No questions are not the ideal, as well as questions that guide for an answer.

3. Pitch and Pilot Development: At the same time that teams are searching for a proper product-market fit, from week seven to 14, they are expected to start actually building their prototypes as well as a convincing business pitch. Teams must present the developments in their projects (in a pitch format), incorporating the contents that were taught in the plenary lecture that week. By this, they are able to receive feedback from the instructors and TAs in order to improve their products and iterate.



4. Launch: At the end of this 15-week course, students are expected to present a demo of their solutions. A functional prototype must be incorporated in their business

pitch. The best teams per section classify to the final competition of the course, where the selected teams pitch their companies and solutions to a judge panel composed by people coming from the academia and industry, as well as real investors.

c. Contents (Syllabus)

1. Introduction:

- 1.1. Introducing the Berkeley Method of Entrepreneurship
- 1.2. Being an Entrepreneur
- 1.3. Team Dynamics
- 1.4. Entrepreneurship & Failure
- 1.5. Structure of a Startup

2. Team and Communication

- 2.1. Managing Teams and People
- 2.2. The Science and The Art of the Pitch
- 2.3. Communicating via Visual Diagrams

3. Discovery

- 3.1. Ideation and Opportunity Recognition
- 3.2. How to ask Questions and Psychology of the customer
- 3.3. “Lean Startup”: Market and Customer Discovery

4. Design and Implementation of the Product

- 4.1. Value Proposition
- 4.2. Product Market Fit
- 4.3. Marketing and Distribution
- 4.4. Revenue Models

5. Finance

- 5.1. Investors Due Dilligence
- 5.2. Pay it Forward: Your responsibilities of being an ethical entrepreneur

d. Games

1. Self Portraits: Students write their names on a name tag provided and draw a self-portrait of “how they see themselves”. After all the students have put their name tags on, they were told the following: “Take a look at everyone’s portraits. It says a lot about them. If they just drew stick figures, it may mean they are not that creative or that they don’t take their work seriously. Every action you take is an indicator of your work ethic and pride of work. Understand that people will judge everything you do. Do you want to partner with someone who will rely on you to do all the work? Now go and talk to your class-mates, and form teams of 5.”
2. Rejection Therapy: It is important that participants appreciate that project development and its implementation is not easy. As entrepreneurs they will constantly experience failure and rejection. Entrepreneurs have to learn to handle and leverage when potential customers and/or potential investors reject them. This is a critical part of finding the right product to sell. So, in teams of 3, students have to videotape each person making an unrealistic request from a stranger. They need to capture at least 1 rejection and 1 acceptance.
3. Trading Up Game: The goal of this game is to get participants to think strategically about customer targeting and sales/negotiations. Students must form teams of no more than 5 members, and they are provided with an orange. Teams have a whole day to trade this product as many times as they can for an item of greater value. No money can be exchanged. The teams that bring the item with greater value or made the greater number of trades, win the activity. This activity is meant to teach students to learn to step out of their comfort zone and engage with strangers. Not all targets want the same thing, so teams must think several steps ahead so they do not get stuck with an item they cannot trade.
4. Lego Game: Students make teams of 5 people and select two members to be an “architect” and the rest to be “engineers”. Architects have to roles, one person will

see a Lego model (airplane or boat) and describe it to the other. The second architect never sees the model, but will write the instructions on how to build it based on the spoken description of the first architect. Written instructions may not include pictures or drawings, only words. Then, engineers enter to action, they are handed a bag of incomplete Lego pieces (they do not know that part) and must follow the instructions to build the model. Architects should not communicate with engineers. Architects learn the challenge of describing and writing instructions. Many times, entrepreneurs have to describe things that they have not seen before, because maybe they do not exist. In the other hand, engineers learn that instructions are often unclear and how to build things when they do not have all the right pieces.

e. Evaluation and Grading

Berkeley's Challenge lab is a project team-based course and because of this the majority of the grade is based on the team's final output: final presentation and prototype. In Chile, as an adaptation to the course in Berkeley, mid-term evaluations were included as well. This change was made to measure the constant work of students along the semester and not just grade their projects at the end of the course. It is important to set clear rules at the beginning of the course; students should know what is expected from them. At ING2030 the grade of the participants is made up of the following:

- Team Grade: Corresponds to the work realized by the team and is composed by:
 - 30% Mid-term presentation
 - 20% Final prototype
 - 50% Final presentation

- **Individual Grade:** Corresponds to the work realized individually by the participant, mainly video blogs documenting your team's progress and learnings. This evaluation could increase or decrease the Team grade by 1.5 points maximum, in a 1 to 7 scale. Also, the individual grade of students could vary according to a final peer evaluation that each team member must deliver.

In order to approve the course, both, team and individual grade must be higher or equal than 4.0 (in a 1-7 scale). Also the student is expected to assist to all (100%) of the plenary lectures, and 80% of the team must always be present in the sections.

Homework is meant to keep students learning and progressing in their projects along the semester. Points were given to the students for the participation in each exercise. Exercises covered subjects as: team dynamics/conformation, investigation of the challenges, ideation, competition, market, value proposition, interviewing, prototyping, pitch, revenue model, finance, among others.

Video Blogs are an important part of the evaluation of students. Participants are expected to post a video blog each week documenting their team's progress, their personal progress and the decisions they and their team are making. They are not meant to document everything, but to explain why they are doing what they are doing. It is important to know the "why" participants are making certain decisions (i.e. why are they pivoting, why did they chose that particular revenue model). The constant use of assessment and the provision of feedback have been shown to influence positively the development of self-efficacy; assessment and feedback on a regular and timely basis provides tangible evidence of changes in performance which can influence the enhancement of self-efficacy (Cooper y Lucas, 2006)

Homework, activities, interviews and blogs, were qualified in a point scale going from 0-2. Zero points meant the student did not deliver, one point that he delivered and two points that he delivered his work in an outstanding way.

It is important, in entrepreneurship courses, that techniques as self-evaluation, peer evaluation, analysing one's own failures and reactions to these failures, problem-solving tasks, and studying real-world stories of entrepreneurs overcoming crises (Täks et al, 2014).