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TOWARDS A THEORY-INFORMED PRACTICE OF ENTREPRENEURSHIP EDUCATION FOR UNIVERSITY STUDENTS: THE CASE OF HC.LAB

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Abstract

Amongst the various formal and informal mechanisms through which a university fosters student entrepreneurship, entrepreneurship education (EE) occupies a central role in the academic debate and in university practice. Despite the growing amount of EE studies in the last years, some puzzles persist. More specifically, much remains to be unveiled on how entrepreneurship should actually be taught in the classroom. Scholars lament a knowledge gap between the teaching practices of EE and the theoretical development of both the entrepreneurship and the general education fields. To contribute to this debate, this study describes the characteristics and outcomes of the Healthcare Contamination Lab (HC.LAB), a six-month EE program. In particular, the authors describe a possible way to inform the design of EE with the theoretical foundations of entrepreneurship and with innovative education principles, using HC.LAB as a revelatory single case study. More specifically, for five dimensions of EE design, the authors outline the originality of the HC.LAB journey and offer some very preliminary evidence on the results of the first edition of HC.LAB.

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1. Introduction

The phenomenon of student entrepreneurship, which indicates those entrepreneurial endeavours undertaken by university students and recent graduates (Bergmann et al., 2016; Colombo and Piva, 2020), represents a key mechanism through which knowledge created at the university is exploited by new businesses (Wennberg et al., 2011) and contributes to the economy (Åstebro et al., 2012). As a result, in recent years, student entrepreneurship has attracted increasing attention by policy-makers because it represents an additional channel through which knowledge created within universities can be commercialized, besides the more traditional technology transfer mechanisms such as academic entrepreneurship or licensing (Audretsch et al., 2020; Sansone et al., 2019; Shah and Pahnke, 2014). Therefore, it is not surprising that efforts to create university ecosystems supporting students' entrepreneurial activities have been increasing (Wright et al., 2017). This shift is reflected in the academic debate on university entrepreneurship. The focus on entrepreneurial activities undertaken by researchers and faculty (e.g., Feola et al., 2019; Hahn et al., 2019) now goes hand in hand with increased attention on the processes and outcomes of students' entrepreneurial behaviours and attitudes (Hahn, 2020; Parente et al., 2019; Castellano et al., 2014).

In particular, amongst the various formal and informal mechanisms through which a university fosters student entrepreneurship (e.g., socialization with peers, Kacperczyk, 2013; university climate and culture, Hahn, 2020; Bergmann et al., 2018; and role modelling from mentors, Meoli et al., 2020), entrepreneurship education (EE) occupies a central role in the academic debate and in university practice (Hahn et al., 2020; Nabi et al., 2017). EE offers awareness about the entrepreneurship phenomenon (i.e. education about entrepreneurship) and/or actual entrepreneurial knowledge (i.e. education for entrepreneurship), defined as the knowledge required to identify and exploit new business opportunities (Politis, 2005). Despite the growing amount of EE studies in the last years, some puzzles persist (Nabi et al., 2017). More specifically, it remains to be understood how entrepreneurship can be actually taught in the classroom (Neck and Greene, 2011). Even more importantly, since the EE comes in many different forms, in terms of audience, objectives, content and method pedagogies (Naia et al., 2014), research can help educators and practitioners to identify the most suitable EE practices for a specific target (Hahn et al., 2020; Hahn et al., 2017). To do so, scholars should take advantage of stronger intellectual and conceptual foundations and allow EE to profit more from the development of the entrepreneurship and general education fields (Hägg and Kurczewska, 2019; Fayolle, 2013). Put differently, informing the practice of EE with theoretical foundations of entrepreneurship innovative education

principles represents a valuable opportunity to move a step forward in the design and assessment of entrepreneurship courses.

In order to contribute to such aim, in this paper we adopt a single case study methodology to describe in depth the peculiar characteristics of the Healthcare Contamination Lab (HC.LAB), a six-month EE program offered by the University of Bergamo (Italy). HC.LAB is a specific implementation of the Contamination Labs (CLabs) initiative, which has been recently under investigation in academic journals (e.g., Secundo et al., 2021; Secundo et al., 2020a; Secundo et al., 2020b; Secundo et al., 2020c; Fiore et al., 2019). We focus on HC.LAB because it represents an illustrative case of how conceptual foundations of entrepreneurship and innovative education principles, such as multi-disciplinary, social- and experiential-based learning (OECD, 2017), can be applied to the design of EE. In particular, the theoretical foundation of the program is based on the concept of opportunity. Entrepreneurship is the process of identifying and acting upon entrepreneurial opportunities (Shane and Venkataraman, 2000). Entrepreneurial opportunities are much more than an idea such as an invention or the spotting of an unmet market need. Developing opportunities consists of matching a specific need with those means and resources that offer a marketable solution to that need (Ardichvili et al., 2003). Opportunity development not only requires domain-specific knowledge (Shane, 2000) but also the ability to "connect the dots" and see that knowledge from different angles (Baron, 2006). Reproducing such conditions in the classroom is challenging for traditional curricular EE courses because they often stay too general without focusing on specific industries or classes of businesses (Laukkanen, 2000). Moreover, they are generally attended by homogeneous classes – composed of students of the same age, level, and field of study – or they are taught by a single professor (Fiore et al., 2019). These factors might limit the contamination[1] among different views of the world. The HC.LAB program aims at overcoming some of such limitations. It does so by focusing on a specific industry – the *healthcare* sector – and encouraging the *contamination* between different views.

With this case study, we aim at contributing to the debate on EE by showing how entrepreneurship theoretical foundations and advancements in general education can inform the design and implementation of entrepreneurship programs. To do so, we conceptualize the originality of HC.LAB along different key dimensions and also provide preliminary empirical evidence, through a pre-test and post-test survey, about the actual outcomes reported by students attending the program. Overall, the find-

[1] The word "contamination" should be read here, and in the rest of the paper, in a positive sense and not related to epidemiological contexts; please read contamination as a synonym of "exchange of knowledge and views" or "cross-fertilization"

ings contribute to the understanding of the mechanisms through which universities can foster student entrepreneurship, leveraging on education programs.

2. Literature review

2.1 Entrepreneurship education and student entrepreneurship

Student entrepreneurship has increasingly attracted the interest of scholars and policymakers (Wright et al., 2017; Lackéus, 2015) because students' ventures facilitate knowledge spillovers that draw on the entrepreneurial and technological knowledge provided at a university (Minola et al., 2016; Shah and Pahnke, 2014; Åstebro et al., 2012; Wennberg et al., 2011). More in general, students, endowed with an entrepreneurial mindset (Secundo et al., 2020a), who are able "to turn ideas into action" and "to be more creative and self-confident in whatever they undertake", European Commission (2008:7), are better equipped for the current labour market (UNDESA, 2020; Audretsch, 2014; Urbano and Guerrero, 2013). In order to prepare students to perform the variety of tasks required to identify and act upon new business opportunities (Karlsson and Moberg, 2013; McGee et al., 2009), EE has become ubiquitous in universities worldwide, in different disciplinary areas and fields of studies (Fiore et al., 2019; Mustar, 2009; Souitaris et al., 2007). Besides encouraging students to create new ventures (Eesley and Lee, 2021), EE builds on the assumptions that students will take advantage of the acquired entrepreneurial skills even if they eventually decide to work as employees (Davey et al., 2018; Leitch et al., 2012; Mustar, 2009). Moreover, entrepreneurial and interpersonal skills students can acquire through EE belong to the set of competencies that the European Commission considers needed for personal fulfilment and employability (EPC, 2018).

In response to the centrality of EE in the political agenda, in the last decades we have witnessed a growing heterogeneity in EE offerings and in recommendations to design EE curricula (Fayolle, 2013; Pittaway and Cope, 2007). Research on EE has widely recognized that appreciating such heterogeneity is of paramount importance to understand how an EE program should be designed (Hahn et al., 2017; Karimi et al., 2016; Fayolle and Gailly, 2015). In fact, the impact reported by EE studies varies considerably (Naia et al., 2014), with studies showing positive (Karlsson and Moberg 2013; DeTienne and Chandler, 2004), mixed (Volery et al., 2013; von Graevenitz et al., 2010), statistically non-significant (Oosterbeek et al., 2010; Souitaris et al., 2007), or even negative (Chang and Rieple, 2013) effects on EE and students' entrepreneurial skills. The conflicting results of

this research urge scholars to identify the most suitable EE practices for a specific target (Hahn et al., 2020; Lyons and Zhang, 2018; Hahn et al. 2017). To do so, they have started to conceptualize and take into account the main dimensions that describe EE teaching models as key boundary conditions of the EE – impact relationship (Nabi et al., 2017).

2.2 Entrepreneurship education teaching models

In the literature, the teaching model of EE programs is generally described through 5 dimensions (Naia et al., 2014; Fayolle, 2013): (1) For whom? The audience of the program; (2) Why? The objectives of the program; (3) What? The contents of the program; (4) How? The teaching methods of the program; and (5) For which results? The evaluation of the outcomes of the program. Research has shown that these dimensions greatly matter in determining the actual impact of entrepreneurship courses (Nabi et al., 2017).

First, the audience of EE programs varies considerably among different dimensions. These include, for example, their study background. Since EE is becoming diffused throughout campuses, students at any level and of all fields of study are now increasingly exposed to EE (Shinnar et al., 2009). Additionally, an EE course can be offered to multidisciplinary classes (Fiore et al., 2019). EE can also be offered as an elective or compulsory (Hahn et al., 2020). Also, the audience of EE courses can vary based on their prior exposure to entrepreneurship (Peterman and Kennedy, 2003). It is worth mentioning that the target of EE may include actual or even prospective entrepreneurs (Lyons and Zhang, 2018). Overall, research indicates that the audience will affect the impact of EE offerings. For example, students in elective EE courses are usually more motivated to learn entrepreneurship, which makes it easier to observe positive outcomes of EE (Hahn et al., 2020; Karimi et al., 2016; Rauch and Hulsink, 2015). Moreover, pre-existing exposure to entrepreneurship, such as start-up experience or an enterprising family background, helps students to connect EE to the actual practice of entrepreneurship, thereby they learn more effectively (Hahn et al., 2020; Hahn et al., 2017).

Second, EE courses differ in terms of objectives. In general, we can distinguish between 'Education about Entrepreneurship' and 'Education for Entrepreneurship' paradigms (Haase and Lautenschläger, 2011). In the former case, the main goal is to provide students with a fundamental understanding of entrepreneurship as a phenomenon. In the latter case, the aim is to endow students with knowledge, skills, and motivation to identify and act upon opportunities.

Third, the objectives of EE are directly connected with the content taught in entrepreneurship programs. While theoretical approaches towards the study of entrepreneurship (e.g., definitional issues, the conceptualization

of opportunity, effectuation, bricolage) dominate the 'Education about Entrepreneurship' paradigm, courses based on 'Education for Entrepreneurship' concept convey a mix of hard facts about business creation and management (e.g., business planning and financing), soft skills (e.g., creativity, leadership, teamwork), and motivation (e.g., inspiration to undertake entrepreneurship).

Fourth, the methods adopted in EE are numerous and heterogeneous (e.g., conventional lectures, workshops, focus groups, keynote speeches, games, simulations, business planning) and should be connected to the desired educational impact (Nabi et al., 2017). Recently, scholars have suggested that EE should combine teaching methods from both pedagogy and andragogy paradigms, because of the cognitive development phase of its participants: they are emergent adults who are moving away from the typical structured schooling approaches to become gradually more responsible for their learning process (Hägg and Kurczewska, 2019). While pedagogy is based on teachers imparting knowledge and leading the learning environment, andragogy approaches are learner-centric, requiring learners to take full responsibility for their learning processes (McNally et al., 2020). In the EE context, pedagogy is typically characterized by frontal lectures that provide knowledge about theory and hard facts about entrepreneurship concepts and fundamentals. Instead, andragogy embraces practical-oriented methods through which students can get motivation and soft skills by directly experiencing entrepreneurship (Haase and Lautenschläger, 2011; Neck and Greene, 2011) and reflecting on their experiences (Gielnik et al., 2015; Béchard and Grégoire, 2005).

In discussing the duality between andragogy and pedagogy models, scholars have recently moved away from an a-critical praising of purely experiential-based methods and have acknowledged the existence of a pedagogy-andragogy continuum which combines elements of both (Hägg and Kurczewska, 2019). Even though 'practice-oriented' rather than 'theoretical-oriented' methods are more suitable to develop students' entrepreneurial skills (Hahn et al., 2017; Piperopoulos and Dimov, 2015), pedagogy can help learners to mature and be more prepared and motivated to profit from the experiential-based method (Hägg and Kurczewska, 2019). For example, theoretical knowledge about entrepreneurship concepts and tools can encourage and help students to reflect and learn from their experiences during business simulations and labs.

Finally, the assessment of EE impact can relate to different dimensions, ranging from satisfaction from the course to entrepreneurial learning, intention, or actual behaviour (Souitaris et al., 2007; Fayolle and Gailly, 2015). In evaluating the effect of entrepreneurship courses, it is important to connect the outcomes under assessment to the course objectives. For example, even though the entrepreneurial intentions construct is widely adopted as

a proxy for EE effectiveness (Bae et al., 2014; Martin et al., 2013), it does not necessarily mean that EE does not work if it does not convince students to become entrepreneurs. In some cases, EE may raise students' awareness about the challenges connected to an entrepreneurial career, thereby discouraging those who do not feel prepared for it (Eesley and Lee, 2021; von Graevenitz et al., 2010). Additionally, learning benefits from EE do not always lead to entrepreneurial intentions (Volery et al., 2013; Souitaris et al., 2007). Therefore, even though students become more confident in their entrepreneurial skills, they do not necessarily want to exploit them in an entrepreneurial career path. This does not represent an undesirable outcome. It also worth mentioning that there are cases in which the diminished perception of entrepreneurial skills could paradoxically represent a desirable outcome of EE because it might be connected to a more critical self-assessment of one's own competences and to the realization that more has to be learned (Eesley and Lee, 2021; Hahn et al., 2017). On the other hand, if we assess entrepreneurship programs specifically designed for enabling aspiring entrepreneurs to implement their business ideas, then looking at the resulting entrepreneurial activities produced by EE is very appropriate (Lyons and Zhang, 2018).

In sum, the design and reciprocal fit of the five dimensions discussed above are crucial in determining the success of entrepreneurship programs. To date, however, scholars lament a knowledge gap between the teaching practices of EE and the scholarly knowledge about entrepreneurship derived from academic research (Fayolle, 2013). EE could also profit more from the development of the general education field. In the following sections, we describe a possible way to inform the design of EE with the theoretical foundations of entrepreneurship, using HC.LAB as a revelatory case study. More specifically, for each of the five dimensions discussed above, we outline the originality of the HC.LAB journey and offer some very preliminary evidence on the results of the first edition of HC.LAB.

3. Methodology

3.1 Research design

This research focuses on the EE program HC.LAB by using a revelatory single case study methodology (Yin, 2009) based on observations, semi-structured in-depth interviews with key informants, and a survey. Recently, case study methodology has been fruitfully adopted to advance the literature on EE by studying the Italian Contamination Labs network (e.g., Secundo et al., 2021). In EE research, single case study methodologies are particularly suited to study in depth the uniqueness of EE programs

(Fiore et al., 2019; Shih and Huang, 2017; Blenker et al., 2014). By focusing on HC.LAB as a revelatory case study, we aim to offer an in-depth understanding of its unique merits and challenges which, although not generalizable, may also have implications transferrable to the design of other programs (Shenton, 2004).

3.2 Research context

The HC.LAB program belongs to the Italian network of Contamination Labs ("CLabs") joined by 23 partner universities. CLabs are financed by the Italian Ministry of Education, University and Research (MIUR) with the aim of equipping students with the skills required for the development of entrepreneurial opportunities (Secundo et al., 2020a). CLabs are virtual and physical spaces that enable the interaction and dialogue among individuals with different disciplinary backgrounds and among university students and other people aiming at becoming more entrepreneurial, thereby fostering the "contamination" between multiple perspectives and disciplinary backgrounds. CLabs take advantage of close links with the local business community and stakeholders, thereby exploiting the strengths of the local ecosystem. For example, HC.LAB, which is the CLab organized by the University of Bergamo, leverages the well-developed healthcare sector in the region. Due to their originality, CLab initiatives have been recently studied in EE research (Secundo et al., 2020a; Secundo et al., 2020b; Secundo et al., 2020c; Fiore et al., 2019).

The present article refers to the 2018-19 edition of HC.LAB; the program was composed of 15 lessons of 4 hours each for a total of 60 hours. The program was divided in two main modules. Before the start of the program, a roadshow promoted the program in university departments and local high schools. During the roadshow, a mix of online channels (e.g., social networks, e-mail invitations, etc.) and in-class presentation of the course served to illustrate the key features of the program and the key benefits that individuals would achieve by joining the program. By doing so, the objective was to attract the interest of highly motivated students from a variety of backgrounds and ages.

The program was attended by 37 students, with 32 participants completing it successfully. The initial class was composed of 22 males and 15 females. Students' ages ranged from 17 to 31 years, with an average of 22 years. In particular, only 5 participants were more than 25 years old, 11 were less than 20 years old, and 22 were aged between 20 and 25 years. Concerning their level of study, 14 were high school students, 11 were bachelor students, 11 were master students, and 1 was a PhD candidate (ongoing). Finally, 7 students came from social sciences, 3 from economics,

7 from management engineering, 5 from computer science or mechanical engineering, and 15 had a natural sciences background.

In the first module – lasting from December 2018 to February 2019 – students were taught about the fundamentals of entrepreneurship by the main professor and other lecturers. In addition, invited speakers occupying different roles in the healthcare sector offered to students some knowledge about this industry. This mix of lectures and keynote speeches helped participants to understand the actual needs of the healthcare industry, which represents the first step for the development of entrepreneurial ideas. Only at later stages of the program students had to come up with potential solutions for those needs. Finally, students were given some opportunities for contamination and cross-fertilization. They had the possibility to work on small tasks in provisional teams to get to know each other better. At end of the first module, each student was individually asked to formulate at least three needs in the healthcare industry. The assignment pushed students to apply and reflect on what they had learned about the identification of needs in a specific industry. To sum up, the first module was built on the main pillars of HC.LAB: (i) contamination (through teamwork and the exposure to a multidisciplinary faculty); (ii) healthcare sector (by inviting experts of the sector); and (iii) the goal of generating entrepreneurial opportunities (by teaching the fundamentals of entrepreneurship and asking students to come up with ideas). More details about the Module can be found in Table 1.

Tab. 1: Structure of HC.LAB

Lesson	Content	Speakers
Module 1		
1: 1st part	**Lecture:** Introduction to the course. Entrepreneurship and Healthcare	**Tommaso Minola:** professor of entrepreneurship and strategy at the University of Bergamo and director of the entrepreneurship and family business research Center CYFE (Center for Young and Family Enterprise) **Mario Salerno:** CYFE fellow and Project Manager of HC.LAB; experience in supporting start-ups.
1: 2nd part	**Lecture:** Entrepreneurship as career opportunity	**Silvia Ivaldi:** scholar and professor in the Department of Human and Social Sciences at the University of Bergamo; specialized in work and organizational psychology; consultant for profit and non-profit organizations
2: 1st part	**Lecture:** Health, habits and social impact	**Stefano Tomelleri:** professor and scholar in the Department of Human and Social Sciences at the University of Bergamo; specialized in social dynamics of collective phenomena
2: 2nd part	**Lecture:** Business models and management of health	**Luca Foresti:** CEO of a Medical Center since 2010; previous experience as employee and founder in the fintech sector.

3: 1st part	**Lecture:** Idea generation	**Daniele Radici:** lecturer of entrepreneurship at the University of Bergamo and founder of Innovation Lab; consultant on creativity and innovation processes.
3: 2nd part	**Lab:** Idea generation - exercise in provisional teams	**Francesco Magni:** researcher at the University of Bergamo on pedagogies, formation of teachers, school systems and entrepreneurship education
4: 1st part	**Keynote:** Founder of "Quickly Pro" **Lecture:** Healthcare and digitalization **Keynote:** Healthcare initiatives at the University of Bergamo	**Niccolò Sala:** medical doctor and co-founder of the healthcare start-up Quickly Pro. **Roberto Ascione:** CEO of Healthware, a leading consulting company for digital health. **Caterina Rizzi:** scholar, professor and director of the department of Management, Information and Production Engineering at the University of Bergamo; she leads the research group V&K (Virtualisation & Knowledge) which develops ICT technologies supporting industrial applications.
4: 2nd part	**Keynote:** Technologies for improving well-being of individuals	**Franco Molteni:** medical doctor specialized in rehabilitation; he works as Division Director in the hospital, as consultant and as research coordinator for non-profit organization
5: 1st part	**Keynote:** From a prototype to a marketable product. The experiences from incubators (e-Novia) and start-ups (Holey)	**Cristiano Spelta:** co-founder of e-Novia, a consulting company which helps entrepreneurs to turn ideas borne in university research labs into businesses. **Gabriel Scozzarro:** entrepreneur and inventor at Holey, a start-up which uses 3D printing to produce medical devices.
5 2nd part	**Keynote:** Investing in the healthcare sector	**Alessio Beverina:** co-founder and Managing Partner at Panakes Partners, venture capital specializing in the healthcare sector.
6: 1st part	**Lecture:** Business Model Canvas	**Daniele Radici**; **Fabio Donadoni:** innovation consultant at Innovation Lab; specialized in strategic and project management, teamwork, and business planning.
6: 2nd part	**Lab:** Business Model Canvas - exercise in provisional teams	**Fabio Donadoni; Silvia Ivaldi**
7: 1st part	**Lab:** Team formation and wrap-up	**Mario Salerno; Andrea Potestio:** scholar and professor in the Department of Human and Social Sciences at the University of Bergamo; specialized in the study of pedagogies and teaching; coordinates students' job internships for his department
7: 2nd part	**Lab:** Preparation to the outdoor trip	**Stefano Tomelleri**
9: 1st part	**Lecture:** Analysis of the market need; data sources	**Daniele Radici**
9: 2nd part	**Lab:** Teamwork with tutors	
10: 1st part	**Lecture:** Opportunity evaluation	**Roberto Lusardi:** scholar and professor in the Department of Human and Social Sciences at the University of Bergamo
10: 2nd part	**Lab:** Teamwork with tutors	

11: 1st part	**Lecture:** Market analysis	**Marco Daz:** lecturer of entrepreneurship and marketing at the Engineering Department at the University of Bergamo
11: 2nd part	**Lab:** Teamwork with tutors	
12: 1st part	**Lecture:** Revising the Business Model Canvas	**Daniele Radici**
12: 2nd part	**Lab:** Teamwork with tutors	
13: 1st part	**Lecture:** How to present a business project	**Mario Salerno; Silvia Ivaldi**
13: 2nd part	**Lab:** Teamwork with tutors	
14	**Final event 1:** Presentation and evaluation of the projects to the class and the faculty	
15	**Final event 2:** Presentation and evaluation of the projects to a mixed audience of students, faculty and industry experts	

Source: Authors' elaboration

The second module started after the team formation, and it was aimed at enabling students to develop further the entrepreneurial opportunity from their idea of needs. The module ended with the pitch of students' business models to an audience composed of faculty and industry experts. During the module, students worked in teams built around a specific need, and they collaborated in order to come up with a possible solution for it. To simulate a real team-building process, teams were formed through a process of negotiation among participants. First, the professor formed 6 clusters based on the similarity of the needs identified by students on an individual basis. Second, the professor shared with students all of these clusters and allowed everybody to see the ideas generated by their colleagues (often with different backgrounds). At this point, based on the socialization with other participants and the personal preferences concerning the ideas to develop, participants formed the teams. Just as it happens when real entrepreneurial teams are formed (Preller et al., 2020), the ideas generated by the individuals can precede and influence the selection of partners. In contrast to other EE initiatives, where teams are formed ex-ante before the idea generation, the program is built in a way to ensure that ideas are generated on an individual basis and that the team formation follows this process. By doing so, the faculty also facilitate the spontaneous formation

of heterogeneous teams. In fact, participants have the opportunity to see and appreciate ideas generated by individuals with different backgrounds, which stimulated curiosity to collaborate with them. To further encourage the formation of multidisciplinary teams, participants were informed by the advantages enjoyed by teams with a broad range of competences, especially in healthcare (Garbuio et al., 2019). As shown in Table 2, the 8 teams formed benefited from a broad range of competences.

Tab. 2: Teams and Projects

Business Project	**Need and Solution**	**Team**
Apparecchio	IT platform that improves the efficiency of school canteens and encourages healthy food choices	University students in tourism, clinical psychology, engineering, humanities
BGenome	An integrated database that facilitates the collection, integration and management of genetic data	High school and university students in computer science engineering, bioinformatics
Ecate	A device that helps individuals to orient themselves in hospitals	High school and university students in healthcare engineering, foreign languages, and literature
HealthVox	Podcast platform for healthcare professionals	High school, university and doctoral students in computer science engineering, psychology, and economics
HigeyAPP	Digital platform for home health care	High school and university students in healthcare engineering
Remi	Smart pill organizer to remind patients or care givers when pills should be taken	High school and university students in management engineering, mechanical engineering, and philosophy
Superich	Smartphone application that offers a set of services to take care of Alzheimer patients	High school and university students in healthcare engineering and clinical psychology
Vicino a te	Online platform that collects, integrates and elaborates data by facilitating communication and sharing of experiences among cancer patients and care givers	High school and university students in healthcare engineering and mechanical engineering

Source: Authors' elaboration

In order to give students an opportunity to build up a strong cohesion within the multidisciplinary teams in the program, at the start of the second module an outdoor trip was organized to a wine-maker in the region. The teams spent an intense day together by working on an unexpected entrepreneurial task which is unrelated to their ideas and to the sectorial focus of the course. After receiving a set of different types of wine bottles, the teams were asked to combine them creatively to create their own type

of wine, to find a name for their wine, and to build a value proposition in order to commercialize the wine. During this task, they familiarized themselves with some key challenges including, among others: Who are the target customers? What price would be charged for the wine? What is the uniqueness of the wine? The goal of this exercise was to strengthen the collaboration between team members and prepare them to face unexpected challenges.

After the team-building day, in the course of the second module, participants were offered a set of lessons providing them with the tools to develop the business models. Each lesson consisted of a frontal lecture followed by a lab in which teams, with the support of the instructor, applied the tools learned in the lecture to their ideas. This combination of frontal lectures and practice allowed students to reflect and practically experiment with what they learned on their real case. The module concluded with a pitch of the business models developed by the teams. Teams presented the results of their work first in front of the faculty and subsequently in a special closing event in front of the representatives of the local healthcare sector as well as potential investors, university students, and faculty. Before this event, students received some tips from the faculty to help them develop their presentation skills. The program represents a first step in the journey that leads to student entrepreneurship for those attendants wishing to further develop their business opportunity, turn it into a business plan, and eventually into a venture. The faculty encourages HC.LAB attendants to participate to the StartCup Summer School. This is a subsequent EE intensive program that helps nascent entrepreneurs to develop a business plan for a business plan competition. Details of the second module can be found in Table 1.

3.3 Data collection and analysis

The data collection was based on multiple methods: archival research, observation of participants, interviews with key informants, and a survey (cf. Secundo et al., 2021). By collecting information from both primary and secondary sources and triangulating qualitative and quantitative data, we were able to reduce the risks of biased interpretations and improve the construct validity of the case (Yin, 2009). Moreover, the accessibility to the researchers of the data archived in shared folders contributes to the reliability of case data (Yin, 2009).

First, we analysed the official documents describing the programs as well as the material used by the instructor during the course. These included, among others, the CVs of the participants and of the instructors, the syllabus, the supporting material for the lectures, the final presentations made by the teams, the results of the intermediate assignments, and the

final report written by the managers of the course. Second, we interviewed the teaching coordinator of HC.LAB who described in depth the structure of the program and the rationales behind its design. Third, the direct involvement of two of we in the program facilitated the analysis of the program and allowed us to obtain further insights about students' learning experiences. Finally, we collected data about students' learning outcomes, perceptions, and changes in their entrepreneurial intentions and attitudes through pre- and post-surveys. More specifically, we administrated a questionnaire at the start of the program and at the end. In the first one, we asked students about their prior exposure towards entrepreneurship and about their self-assessed predisposition towards entrepreneurship in terms of skills, motivation and career aspirations. In the final questionnaire, we asked the students to re-assess their predisposition towards entrepreneurship in order to verify the effects of the course. We also asked the students to evaluate their satisfaction with the course and their perceived learning outcomes. The questions of the survey were based on a validated in scale in EE literature (e.g., Zellweger et al., 2011; Liñán and Chen, 2009; Souitaris et al., 2007). Open questions about their overall experience and the challenges faced during the program allowed us to gain further insights about the students' entrepreneurial learning journey.

To analyse the collected data, we grounded the preliminary empirical analysis on existing scholarly work through a series of iterations between the literature and the information obtained from the various sources described above (Eisenhardt, 1989). By doing so, we were able to take advantage of the theory and conceptual advancements of extant research and ensure the internal validity (Yin, 2009) of this research, as described in the findings and discussion sections. Generalization of this research is limited because we adopted a single-case methodology and to address concerns about external validity, the authors will thus proceed with caution in proposing how lessons learned from the case study could be applied to other contexts (Shih and Huang, 2017).

4. Findings

4.1 Audience of HC.LAB

We know from entrepreneurship literature that in dynamic environments (e.g., such the healthcare sector) heterogeneous teams typically offer a competitive advantage to start-ups, provided that team members are able to manage conflicts and effectively share different perspectives with each other (Klotz et al., 2014). Teams having access to diversified knowledge are also facilitated in the development of potential opportunities into marketable solutions (Hahn et al., 2019; Knockaert et al., 2011). Finally, teams work better if they are kept close by the sharing of common goals and visions (Preller et al., 2020; Aldrich and Ruef, 2006).

In the specific context of EE, teams with heterogeneous cognitive skills perform better in the development of new venture ideas (Huber et al., 2020). In general, recommendations for innovative learning environments (OECD, 2017) endorse the connection across different areas of knowledge through socialization and interaction.

Based on such theoretical premises, the contamination among different perspectives within close and heterogeneous teams is one of the central elements of the originality of HC.LAB. In this respect, a proper selection of the audience of the program plays a fundamental role. In particular, three main actions were undertaken to achieve such an objective.

First, the program is promoted in different disciplinary areas of the university and in high schools. By doing so, heterogeneous participants get interested in the program. In fact, the final class was composed of university students and high school students and the ages ranged from 17 years to 31 years. Among university students, there were bachelor and master students as well as researchers or ex-alumni. Participants had backgrounds in engineering, social sciences, business, and law study areas. Such a class composition allows contamination among different perspectives to take place.

Second, the organizers of the program made sure to have highly motivated participants who were willing to socialize, collaborate, and connect with other subjects. The commitment to the program and the intrinsic motivation to learn and challenge oneself are key prerequisites for the sharing of ideas and perspectives. Therefore, the program is elective and not compulsory. Moreover, of all the applicants (more than 50), only 37 participants were accepted based on their motivation letters and interviews with the faculty. Despite their different backgrounds, study levels, and ages, the attendants shared the motivation to grow their personal soft skills in terms of creativity and teamwork.

Finally, the outdoor trip strengthens the cohesion and the effective col-

laboration within teams, while the team formation process based on negotiation builds up teams kept close by the sharing of common goals (i.e. the needs to be addressed).

4.2 Objectives of HC.LAB

The conceptualization of opportunity development (Ardichvili et al., 2003) and its antecedents (McMullen and Shepherd, 2006) inform the objectives of the program.

First, the program is focused on idea generation and opportunity development, which is the starting phase of the entrepreneurial process. In contrast to other programs that provide general knowledge for the entire entrepreneurial process – from spotting an opportunity until creating a venture – HC.LAB has a narrower scope. The course has traded the breadth of the objective for more depth in learning about how to identify and develop an entrepreneurial opportunity. Without good opportunities, no successful business can be created and managed. It is the identification and development of opportunities which makes EE unique with respect to management and business education (DeTienne and Chandler, 2004). Because of the course objective, as final output and deliverable, the faculty asked students to present a business model describing the entrepreneurial opportunity (e.g., market need, solution, customers, revenue model) rather than a business plan for a potential new venture (Honig, 2004).

Second, to strengthen the quality of the opportunities developed by students, the faculty adopted a sectorial focus which enables students to obtain in-depth knowledge of a specific industry and its needs. In contrast to programs with a general focus that provides non-specific knowledge about business and opportunities, the faculty employed a more contextualized approach, which allows students to take advantage of the so-called "knowledge corridors" that permit entrepreneurs to come up with unique opportunities (McMullen and Shepherd, 2006). This approach is in line with recent developments in the education field which encourage the connection between learners and the external world (OECD, 2017).

At the individual level, while students work in the laboratory to generate new ideas, they have the opportunity to empower their soft skills. For example, interpersonal skills and creativity were greatly tested and trained in the course of the program. The program is not meant to necessarily create new entrepreneurs, but it is aimed at forming more entrepreneurial individuals. The skills students learn during the journey can be used not only to develop the entrepreneurial opportunity into an actual business but also for whatever career students eventually decide to undertake: creativity, proactivity, and interpersonal skills are also crucial for employees and consultants of all sectors.

4.3 Contents of HC.LAB

The knowledge spillover theory of entrepreneurship conceptualizes student entrepreneurship as a mechanism to commercialize knowledge generated at a university (Audretsch, 2014; Wennberg et al., 2011). More specifically, the knowledge required to do so is of two types (Shah and Pahnke, 2014), technological and entrepreneurial knowledge. The former relates to knowledge about technological opportunities, while the latter is associated with understanding the processes through which those opportunities can be exploited.

Both dimensions of knowledge are present in the contents taught during the 15 lessons (see Table 1). More specifically, the content of the course combines specific knowledge about the healthcare sector with the tools for idea generation and opportunity development. By knowing a specific sector in depth, students have the possibility of practically applying the tools taught in class to a focused and well-defined area of expertise. This differs with respect to many venture creation programs in which students are taught these tools but lack the in-depth knowledge of a specific market or industry on which these tools can be applied. To further support students in the achievement of the course objectives, the program also teaches some fundamentals of the entrepreneurship phenomenon as a preparatory phase (Lesson 1). In fact, most students had never received a course in entrepreneurship before attending HC.LAB. Therefore, they needed to be introduced to the phenomenon before undertaking the core course activities. The program had also some space dedicated to skills such as presentation (Lesson 13) or teamwork (Lessons 7 and 8).

By imparting fundamental knowledge about entrepreneurship and healthcare, the program prepares students to reflect and learn from the practice-oriented activities of HC.LAB, which require them to develop a business idea in the healthcare sectors. Combining tools of idea generation, testing, and evaluation with in-depth knowledge about the healthcare sectors motivate and enable students to fully take advantage of the experiences made during the business project. The program thus embraces elements of pedagogy (i.e. imparting knowledge) in order to promote the maturation of the participants into learners capable to govern their learning process, as required by andragogy (i.e. implemented through practice-oriented approaches) (Hägg and Kurczewska, 2019).

4.4 Methods of HC.LAB

Entrepreneurship research emphasizes the importance of experience and socialization in entrepreneurs' learning processes (Cope, 2005), consistent with developments in general education (OECD, 2017). Experien-

ce allows potential entrepreneurs to test and revise their assumptions and beliefs in the actual business context. Also, it allows them to gain actual knowledge about the needs of the society. Socialization with co-founders or stakeholders is crucial to challenge and revise ideas, and it might also represent a source of support and motivation during the entrepreneurial journey. These elements are reflected in the variety of teaching methods employed during the program.

First, exposure to the healthcare sector is achieved by inviting keynote speakers from the healthcare sector who share their experience as entrepreneurs, professionals, or investors. By doing so, students not only gain knowledge about the industry, its functioning, and needs, but they also get a sort of inspiration which further motivates them to contribute to the sector and to learn appropriate skills for this promising industry.

Second, socialization among participants is encouraged through a combination of different methods. Besides the teamwork inside and outside the classroom, the creation of a Facebook group further encourages the dialogue among students and between students and faculty. A method of great novelty, which prompts contamination and cross-fertilization, is the sharing of the three needs identified by each individual participant with all the class. By having an overview of all the needs identified by the class members, each participant has the opportunity to share his/her ideas and at the same time obtain insights about other perspectives. The contamination is further encouraged by taking advantage of a multidisciplinary faculty complemented with keynotes with different career experiences and roles in the healthcare sectors (Table 1).

Finally, the modules have several labs in which students could experiment with the tools learned in the lectures with the assistance and support of a tutor.

Overall, the variety of methods employed in the program reflect a positioning in the pedagogy-andragogy continuum (Hägg and Kurczewska, 2019), which is consistent with audience and objectives of the program. By combining methods borrowed from both pedagogy (e.g., frontal lectures) and andragogy (e.g., labs), HC.LAB ensures a gradual maturation of the learners. At the beginning of the course, they need to become aware of entrepreneurship and then build on this awareness towards the end of the course; they gradually develop skills to actually engage in the entrepreneurial process of opportunity development.[2]

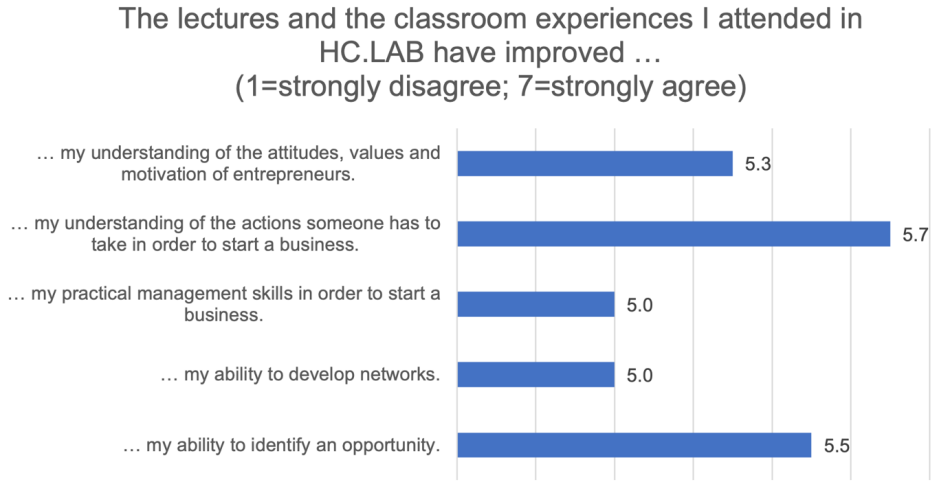
[2] We are grateful to an anonymous reviewer for this valuable suggestion.

5. Findings

The survey administered at the end and at the start of the program offers some qualitative evidence about the impact caused by the course design.

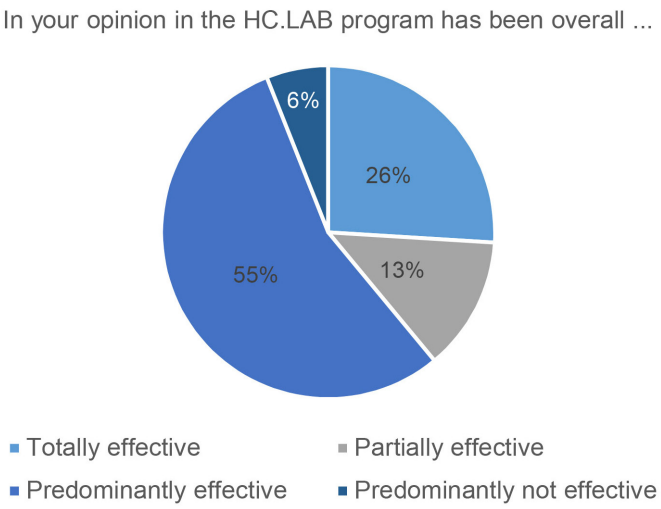
First, the authors discuss the questions related to students' satisfaction with the program (Figures 1-3). On average, students were satisfied with the course in terms of entrepreneurial learning (Figure 1), as evaluated on the scale used by Souitaris et al. (2007) and Hahn et al. (2017). The entrepreneurial learning scale covers the main elements taught the "education for entrepreneurship" paradigm: not only hard facts about business creation but also soft skills and motivations. Most of them perceived the program as totally or predominantly effective (Figure 2). Moreover, about more than half of the respondents considered the course as an investment in the medium-long term, while almost one fifth perceived HC.LAB as an opportunity to empower their competencies (Figure 3).

Fig. 1: Perceived entrepreneurial learning from HC.LAB



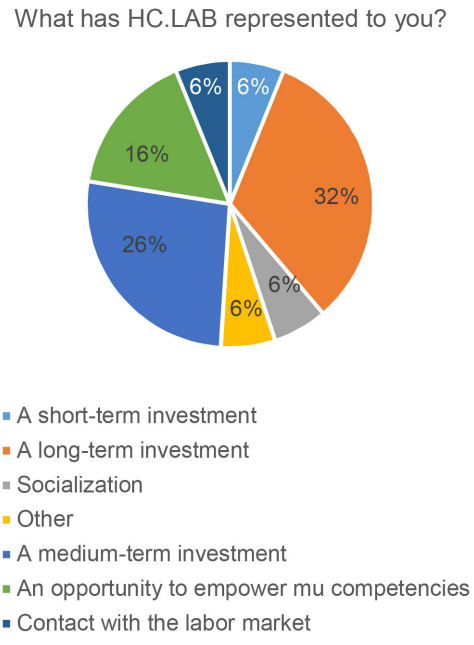
Source: Authors' elaboration

Fig. 2: Overall students' assessment of HC.LAB



Source: Authors' elaboration

Fig. 3: Meaning of HC.LAB to participants



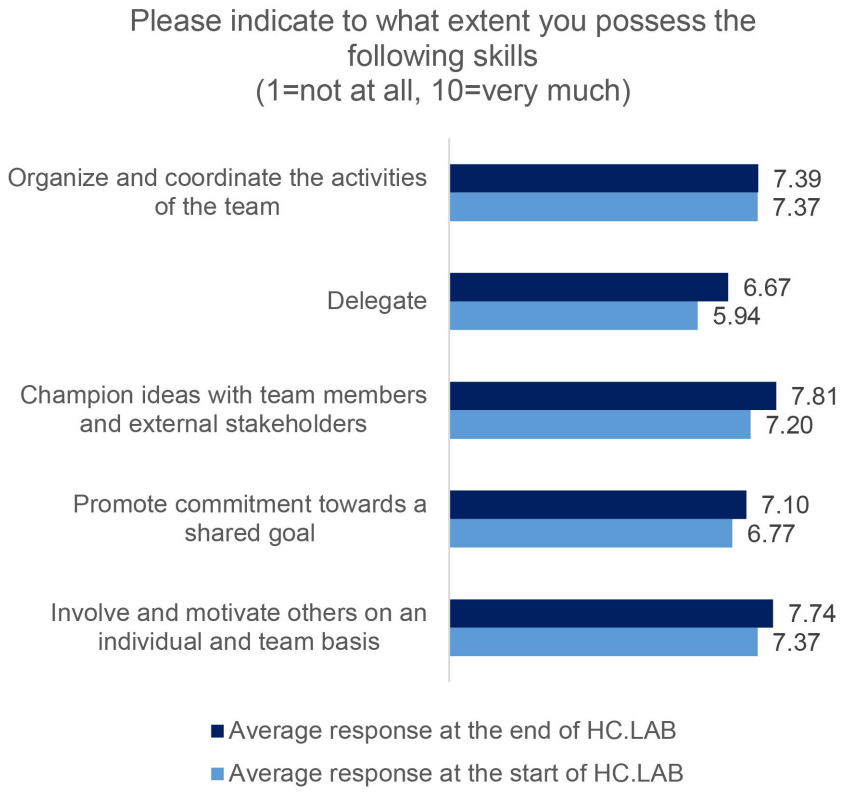
Source: Authors' elaboration

Second, in line with the course objectives focused on empowering students' opportunity development and teamwork skills, the authors checked the change of these abilities during the course (Figures 4-5). Figure 4 shows that students on average exit the course with higher perceived skills in those tasks required to develop entrepreneurial opportunities: identify needs and target market, plan the business, marshal resources, implement the opportunity (Kickul et al., 2009). After the course, students were also more confident about their leadership and collaboration skills (Figure 5).

Fig. 4: Change entrepreneurial skills of HC.LAB to participants

Source: Authors' elaboration

Fig. 5: Change in collaboration and leadership skills of HC.LAB to participants

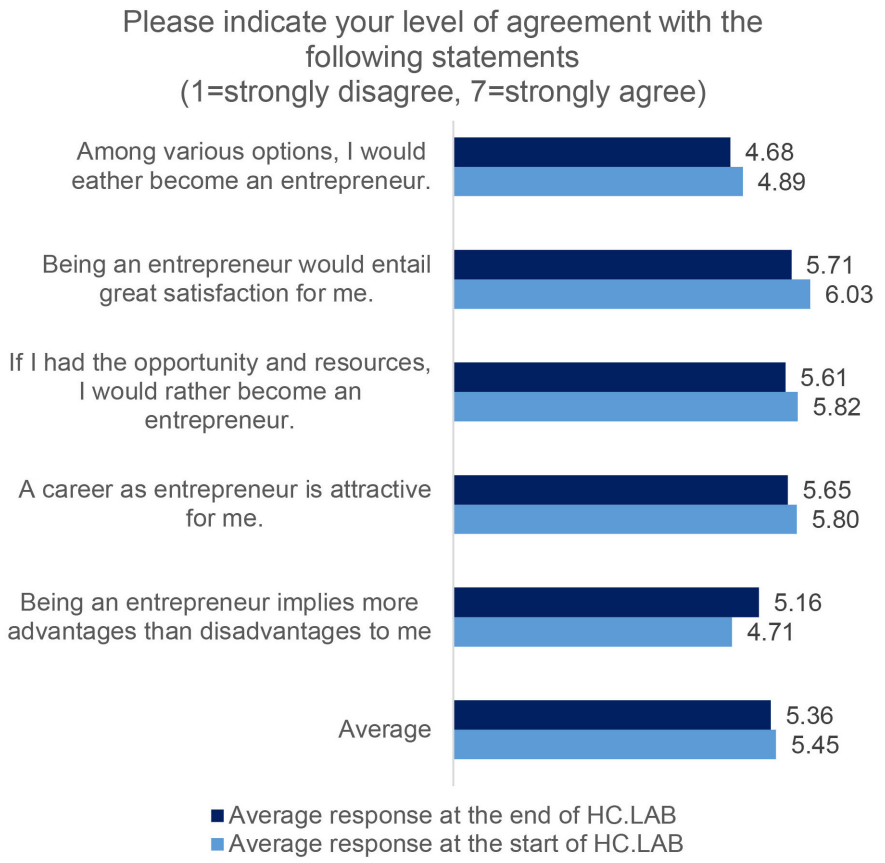


Source: Authors' elaboration

However, looking at the change in entrepreneurial attitudes (Liñán and Chen, 2009), a decline is observable after the course (Figure 6), suggesting that increased skills do not necessarily translate into the propensity towards founding a business (Souitaris et al., 2007). This is confirmed by students' preferred career choice before and after the course. At the start of the course, there were six students who wanted to become founders right after their studies, two of these changed their idea, and only one student developed this career aspiration during the course. Looking at career aspirations for 5 years after finishing studies (Zellweger et al., 2011), we had 13 aspiring founders at the start of the course. At the end of the course, two students developed this aspiration, but three aspiring founders changed their idea and chose another career path. Even though this might appear to be a bad outcome at first glance, we must evaluate this result based on the objectives of the course, which is to increase entrepreneurial skills rather than convince students to found a business. In fact, by adopting a different view,, discou-

raging some students from becoming entrepreneurs, at least in this type of course, can be seen as a beneficial outcome (von Graevenitz et al., 2010). It indicates that students have become more aware of the requirements of an entrepreneurial career and can make a more objective evaluation that is less conditioned by social desirability biases (Eesley and Lee, 2021).

Fig. 6: Change in attitudes towards entrepreneurship of HC.LAB to participants



Source: Authors' elaboration

Students' answers to the open questions seem to confirm the increased awareness and confidence acquired during the program. They offer some key quotes that describe how HC.LAB has proven to be a great learning experience for the students[3]. One student writes: *"I believe there are no words to*

[3] Note that students answered the questionnaire in Italian; therefore, quotes are translated from Italian by the authors.

express my gratitude to those people who allowed me to participate in this project. I have been able to understand and learn things that I didn't know before this course and which seemed impossible to understand". In general, students perceived that they acquired skills in generating and developing innovative ideas, in working in teams, and in communicating with others, in line with the course objectives. The reciprocal learning from other participants and the contamination, one the pillars of HC.LAB, was also greatly appreciated, as illustrated for example by this student *"I enjoyed a lot confronting myself with older people. It has been challenging but I recommend it to everyone who wants to learn and is curious"*. Interestingly, according to the students, the program is useful to empower them as people, not necessarily as entrepreneurs. This student well illustrates such an impression: *"The lectures often were very useful also for the private sphere, to face every-day life situations"*. In terms of criticalities, some students – especially the younger ones – say that they lacked the knowledge to fully understand some topics of the course. On the other hand, they were grateful to the faculty which helped them and did not take anything for granted. In the end, they felt that they were in the right place and learned from other perspectives. Moreover, some students expressed an interest to get some more knowledge about founding a business. While this is outside the scope of the course, the program stimulated students' interest towards creating a business and to realize the ideas generated during the program.

Another indicator that certifies the realization of the course objectives is the heterogeneous composition of the eight final teams. As shown in Table 2, the teams are characterized by heterogeneity in terms of the members' backgrounds, in line with the "contamination" goal of the program.

We also base the evaluation on the quality of the final presentations and on students' decision to work further on their entrepreneurial ideas. The audience at the final event appreciated the problems identified by the students and the proposed solutions. Moreover, through the final presentation, the faculty realized all of the progress made by the students with respect to the beginning of the course. Before starting this journey, most participants ignored entrepreneurship fundamentals and the features of the healthcare sector. They had no clue about developing entrepreneurial opportunities and working in heterogeneous teams. Also, they had much less confidence in talking in public and presenting in front of many people. This scenario completely changed in six months. Those students, previously almost unaware about spotting entrepreneurial opportunities, were able to generate a business model in a very complex sector like healthcare and present it in front of an audience of industry experts. This is a considerable result which fulfils the promise and the rationale for the efforts spent by the faculty, the students, and all of the stakeholders of the HC.LAB.

Finally, it is important to stress that for most participants the final event

of HC.LAB represents the end of a journey and the start of another one. In fact, more than half of the teams are so excited about their entrepreneurial opportunity that they have decided to further develop it into a business plan by joining the business plan competition StartCup. This represents another key result of HC.LAB. The program encourages students to further grow their entrepreneurial skills and, who knows, eventually create a venture to pursue the opportunity spotted in HC.LAB.

6. Discussion

Using HC.LAB as a revelatory case, this paper contributes to the advancement of EE research by showing how EE can be informed by insights from entrepreneurship research and general education. Notwithstanding the limited generalizability of single case studies, the approach described could inspire the design of EE programs in other contexts.

First, the program builds on the conceptualization of entrepreneurship as a process of opportunity identification and exploitation (McMullen and Shepherd, 2006). It focuses on a specific stage of the entrepreneurial process (i.e. opportunity development). Such a clear definition of the objective allows the design and proper alignment other elements of the program in terms of audience, content, methods, and evaluation.

Second, entrepreneurship is a socially embedded phenomenon that is stimulated by the exchange of domain-specific knowledge through local ties (Dahl and Sorenson, 2009). Accordingly, the program offers a specific industry focus, taking advantage of the strengths of the local economy.

At the same time, to generate entrepreneurial opportunities, domain-specific knowledge must be seen from different angles (Hahn et al., 2019). Here comes the third key element of originality that can inspire other initiatives. The program builds on contamination as the main pillar. Designing programs attended by students from different campuses is challenging from an organizational point of view, but it offers much richer learning opportunities. Moreover, involving teachers and speakers with different backgrounds further allows students to take advantage of the cross-fertilization among multiple perspectives.

Finally, entrepreneurial learning is a life-long process (Cope, 2005). Therefore, in line with recent recommendations about ecosystems for student entrepreneurship (Wright et al., 2017), the program does not work in isolation. The program is strategically embedded in the EE offered by the university and acts in synergy with other courses. It motivates and prepares students to better take advantage of programs dedicated to more advanced stages of the entrepreneurial process.

6.1 Contributions to research

This case study offers two main contributions to research in EE. First, the research addresses the gap between the design of EE and the development of both the entrepreneurship field and the general education field, thereby addressing one of the reasons that limits the advancement of EE scholarship (Fayolle, 2013). To do so, we have shown how different streams of entrepreneurship research (e.g., opportunity, teams, knowledge spillovers, learning and cognition) as well recent recommendations of innovative learning environments (e.g., experiential-based and social learning, connection with different subjects and with the external world) can help to design the elements of EE programs in terms of objectives, audience, content and methods, and assessment.

Second, the paper shows how EE programs can be positioned in the pedagogy-andragogy continuum (Hägg and Kurczewska, 2019) through a combination of different teaching methods with the aim to allow a progressive maturation of learners along a structured program. By doing so, we endorse the view that both pedagogy and andragogy have their merits in the context of EE, and they can be synergistically employed to motivate and enable students to acquire knowledge from lectures and develop skills through practice-oriented labs.

Finally, this paper contributes to the literature on student entrepreneurship by showing how to combine technological and entrepreneurial knowledge synergistically in one program (Shah and Pahnke, 2014). By doing so, universities can equip students with the skills necessary to undertake an entrepreneurial career, if they decide to do so.

6.2 Limitations and future research directions

Before discussing the practical implication offered by the paper, the authors present its limitations, which generate opportunities for future research on CLabs for the next years. For example, the case study focused on the results of a specific program, which limits the generalizability of the results (Shih and Huang, 2017). It would be interesting to compare the effects of different programs using matching techniques. Within the same program, experimental research designs could also help to track the causal effect of specific measures. Using control groups of students who did not attend EE, would also allow conducting quasi-experimental research (Rauch and Hulsink, 2015), thereby assessing more rigorously the impact of the program. Ethnographic research or experience-based sampling approaches could provide us with further insights about the self-reflection and learning processes experienced by students during the course in terms of stress and well-being (Secundo et al., 2021). Moreover, taking advantage

of multiple cross-sections and of longitudinal research designs, it would be intriguing to observe CLab students' careers in the long term (Eesley and Lee, 2021). Finally, while this paper focuses on the edition of HC.LAB not affected by the outbreak of Covid-19, future research could look at the implications of the pandemic and the resulting digitalization of education on the design and outcome of the program, as compared to previous editions (Ratten and Jones, 2020; Secundo et al., 2021).

6.3 Practical implications

The experience of HC.LAB offers several practical implications for the design of EE programs. In particular, the research encourages the development of courses that allow participants to connect with individuals from other disciplinary areas and with the specific sector on which they are focusing. The possibilities offered by digitalization should make this even easier (Bacq et al., 2020). This case also suggests preparing students for more experiential-based learning through lectures and keynotes, thereby combining elements of pedagogy and andragogy. Blended learning approaches, combining distance learning and in-presence activities, could be particularly useful for this purpose (Ratten and Jones, 2020).

7. Conclusions

To conclude, offering programs such HC.LAB represents a challenge which requires substantial effort. It requires a strong relationship with the local business community, commitment from the university to attract students and professors from different areas, and synergy with other EE offerings. However, the resulting experience provides students with a unique opportunity to develop a combination of skills, which will be useful for whatever career they decide to undertake.

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