Socio-emotional skills for innovation: boundary-crossing pedagogies and learning catalysts in university innovation education

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Declaration

I, Andrea del Carmen Detmer Latorre, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

This thesis explores how socio-emotional skills contribute to innovative behaviours and how these skills are promoted in university innovation education contexts. The notion of 'socio-emotional skills for innovation' (SESI) proposed here reflects the intrinsic socio-emotional nature of some skills enhancing innovation, such as empathy, communication and resilience. The literature on innovation discusses these skills implicitly and scarcely, disconnected from the socio-emotional literature, limiting skills' development in university innovation education. To overcome this issue, this thesis examines the following questions: What socio-emotional skills contribute to innovative behaviours and how do they support such behaviours? How are SESI pedagogically facilitated by educators in undergraduate innovation education programmes?

To answer these questions, the study employed an exploratory cross-country multiple case study design focusing on four Minors Innovation in Chile and the Netherlands, which are optional credited cross-disciplinary undergraduate specialisations. Fifty-seven semi-structured interviews were conducted with students, educators and managers, and analysed thematically through the lens of various theories. The SESI emerging from the data were mapped into five pre-existing socio-emotional categories: self-awareness, self-regulation, social awareness, relationship skills and responsible decision-making.

The findings are organised according to the triad of SESI, pedagogies and learning catalysts. The analysis revealed ten personal-level skills contributing to innovation behaviours, namely, self-reflection, self-confidence, autonomy, resilience, empathy, openness, respect and value of diversity, collaboration, interdisciplinary communication and responsible decision-making.

Pedagogically, innovation project-based work together with two boundary-crossing practices, cross-disciplinary education and community engagement, critically promoted SESI. The learners challenged their assumptions and interactions across these organisational (university-broader society) and disciplinary boundaries. Overcoming epistemological, relational, identity, and perspective-related tensions, permitted SESI development.

'Learning catalysts' emerged as facilitating conditions of SESI learning processes. Three catalysts are analysed: authenticity of learning experience, relation to otherness and protected autonomy. Comprehending SESI and their teaching-learning processes can further enhance innovation policies and university innovation education.

Impact statement

This thesis provides conceptual and empirical foundations to raise awareness about socio-emotional skills, especially in university programmes for innovation, and to support university educators in pedagogically promoting these skills.

Despite its fast development and instrumental contribution to societal development, education for innovation is under-researched. In addition, the technological rather than the socio-emotional abilities are usually investigated. Socio-emotional skills are recognised only implicitly and indirectly in the literature although they are as crucial as technological capabilities to fully unleash innovation's potential.

In this thesis, two distinct bodies of knowledge are combined: innovation skills and socio-emotional skills. Knowledge about the relevance of socio-emotional abilities for innovative behaviours is developed. The conceptualisations and development of SESI in university innovation education programmes are explored empirically. Teaching-learning dynamics experienced by crossing boundaries between disciplines (within the university), and between the university and the broader society, are examined. This allows better understanding about socio-emotional skills favouring innovation and its education.

This thesis' potential impact on future research is three-fold. First, by identifying and characterising ten key SESI in distinctive university settings, it provides a reference for further innovation education studies. Second, further investigations can leverage the theoretical work on pedagogies, specifically on cross-disciplinary education and community engagement. Third, future research about learners' experiences can be nurtured by the conceptual proposition of 'learning catalysts'.

The thesis can also contribute to the practice of innovation education and help university educators to integrate socio-emotional skills more comprehensively. Although each educational setting and learning experience are unique, the patterns hereby analysed can be used to inform educational policy and design. Enhanced understanding of SESI, their contribution to innovation processes, and pedagogies that facilitate their development, can help university educators, as well as managers and policy-makers, in deciding on the most appropriate strategies to include them in education programmes.

Overall, the thesis explores a relatively new and under-researched area of university education. The findings can potentially help universities to strengthen their role in knowledge and innovation

societies, by shedding light on the relevance of socio-emotional skills. This dimension is central for innovation, deemed traditionally as novel implemented products and practices, and also as personal innovation, for life.

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Chapter 1. Introduction: Why and how studying socio-emotional skills for innovation in university programmes?

A. My motivation for writing this thesis

This thesis explores the socio-emotional skills that facilitate innovative behaviours and their development by university learners. It integrates two topics, namely, socio-emotional skills and innovation skills, which have been studied separately until now. My interest in studying these skills in tandem in a university context emerges from my professional trajectory. In doing this, I intend to contribute to more a holistic understanding of the skills that favour innovation, and, ultimately, to enhance its learning in Higher Education (HE).

During my undergraduate studies in Civil Industrial Engineering in Chile, I always felt the need to work with people. Following a deep personal aim of serving society, I 'tried' the field of education through an internship at the UNESCO Office in Santiago, working with educational indicators and then writing my undergraduate dissertation on municipal-level education information systems. Through this experience, I realised that I could put my engineering background at the service of education! (now I understand how multi-disciplinary this field is). Following this, I felt strongly motivated to continue working in Education as a central means to help societal development and lessen the massive social inequalities I observed in my native Chile.

I now have an international portfolio in HE research, management and policy making of 17 years. During this period, a constant part of my work has been innovation in HE. I have designed, researched, and institutionally developed new forms of financial support for students, competency-based curricula, qualification frameworks, programmes for student innovation and entrepreneurship, university-industry interactions, and the valorisation of research results. Some of these activities, which may be regarded as innovations in the sector, are connected with the changing roles that HE institutions (HEIs), and universities specifically, are expected to have in broader innovation systems. I have observed that one of the universities' global and relatively recent forms of engagement in knowledge and innovation-based societies is the establishment of educational programmes aimed at facilitating the learners' understanding of innovation concepts and development of innovation skills, that is, innovation education (IE). However, despite universities' rapid development of IE into their offer, it is still necessary to have a better understanding of what the purposes of IE are; what is meant by being innovative, notably,

collectively; what types of skills support innovative behaviours; and how these abilities can be promoted.

In my view, generally in university education and more specifically in IE, formal education efforts are distributed unevenly, as more attention is given to the development of technological abilities, while socio-emotional skills are neglected. This hinders the recognition of different skillsets, producing a significant gap between social and technological skills' development. Our civilisation has accomplished impressive technological innovations, transforming our lives and the ways in which we conceive the Earth and beyond. However, at a human level of essential communication, respect and compassion for each other, I believe we, educationalists, are in debt. The intention, capacity and results of educational systems in ethics, relational abilities, emotional mastery, responsible citizenship, in other words, skills 'for life' are insufficient and deficient.

This social-technological skills gap is visible in IE, where governmental and institutional rationales for promoting IE tend to be based on the economic potential of innovation, rather than on its embedded socio-emotional aspects. The latter, as I argue in this thesis, are fundamental in being and becoming innovative, supporting not only innovation processes conceived traditionally (e.g. products, services), but also more broadly, i.e., innovating in life, as agentic citizens with the responsibility and potentiality of shaping societies. Both dimensions, nevertheless, (technological) innovation and socio-emotional abilities, are central for social, economic and environmental sustainability and wellbeing:

> "I have no doubt that the survival of the human race depends at least as much on the cultivation of social and emotional intelligence as it does on the development of technological knowledge and skills" (Darling-Hammond, 2015, p. xi).

Innovation education can thus contribute to these two critical aspects. However, these tend to be formulated separately in HE practice, research and policy. This disconnection may result from the contrasting underpinning ideologies and still separate bodies of knowledge about (technological) innovation and about socio-emotional skills. The conjunction of innovation and socio-emotional skills, therefore, has the potential to advance what we know about university IE and its exercise.

This thesis explores the role that socio-emotional skills play in innovative behaviours. It proposes the integrated notion of socio-emotional skills for innovation (SESI) and explores their development from the perspective of participants in university undergraduate innovation programmes. My purpose is to increase the awareness of socio-emotional skills in HE, and specifically in IE. I believe

that their recognition will contribute to the design of more balanced educational policies and practices, leading to models that integrate the two necessary, yet largely divided, aspirations of 'innovation for growth' and 'socio-emotional abilities for wellbeing'. This can enrich the unquestionable contribution of educational systems to societal, economic and technological development, strengthening further the path towards more democratic and peaceful societies.

B. Problematisation: the knowledge about innovation skills and socio-emotional skills is disconnected, hampering university innovation education

The role that socio-emotional skills play in being innovative is unclear, thus limiting skill-based innovation education. This thesis conceptualises SESI in university education, integrating knowledge about socio-emotional skills, skills for innovation and their development in innovation education.

1. The concept of socio-emotional skills

'Socio-emotional skills' refer to a range of abilities that complement, but conceptually differ from those of a cognitive and technical nature. The term 'socio-emotional skills' encompasses features supporting its pertinence to explore certain innovation skills. First, it incorporates the notion of 'skill'; as such, skills can be developed through practice (Winterton et al., 2006). The expandable, fruitful and social features of skills (Green, 2011) are central to explore their relevance in manifesting innovative behaviours and beneficial educational practices. Second, the 'socio-emotional' dimension involves awareness and regulation in the relationships with oneself and others (Zins and Elias, 2007), which also seems central in being innovative. Additionally, from a research perspective, the literature on socio-emotional skills and socio-emotional learning is in some areas advanced and relevant to study skills for innovation.

The notion of socio-emotional skill is contested. It is important to distinguish between socio-emotional skill and social and emotional intelligence. Seminal work on emotional *intelligence* deems it a mental process with and about emotional aspects, separating emotional intelligence from behaviour (Mayer et al., 2016; Mayer and Salovey, 1997). The integration of mental aspects with subsequent conscious and regulated behaviours has also been denominated emotional *intelligence* in other conceptualisations (e.g. Goleman, 1998; Wolff, 2005). These incorporate emotional regulation, i.e., the capacity to change the expression of emotions, which affect emotional experiences and social interactions (Kim et al., 2015). The notion of socio-emotional *skill* or *competency* makes explicit this capacity of being aware of and regulating emotions, and of guiding behaviours.

The development of socio-emotional skills is referred to as *socio-emotional learning* (SEL). Multiple SEL frameworks aim at enhancing its research and practice. These frameworks, however, focus on school-level education, rather than HE, where their development has been scarce (Conley, 2015). The Social and Emotional Learning framework (CASEL, 2016a), which is a comprehensive and contextualised SEL model, comprises five interrelated domains of cognitive, affective, and behavioural competencies. The first four dimensions agree with the previously introduced areas based on awareness and regulation, of oneself and others. These are: self-awareness, i.e., recognising one's own thoughts and emotions; self-management, i.e., regulating one's thoughts, emotions, and behaviours; social awareness, i.e., identifying social resources and perspective taking; and relationship skills, i.e., establishing and maintaining healthy relationships (Durlak, 2015). Examples of these skills include: self-awareness abilities such as accurate self-assessment and self-confidence; self-management skills of adaptability, initiative and optimism; social awareness skills such as empathy and service orientation; and relationship management capacities such as leadership, conflict management and collaboration (Wolff, 2005). The fifth dimension of CASEL's framework is responsible decision-making: taking constructive, responsible and ethical choices (Durlak, 2015). This involves assessing the consequences of actions on oneself and others (Weissberg et al. 2015). In studying skills for innovation, responsibility is critical as innovation may produce harm or benefit depending on how responsibly it is steered (Stilgoe et al., 2013). This potentiality shapes innovation policy and also innovation education (Tassone et al., 2018). Therefore, socio-emotional learning involves developing intra- and interpersonal skills, and a social responsibility dimension which is fundamental to research SESI in HE.

Overall, socio-emotional skills are malleable, manifest in action complementing mental comprehensions about emotions, and relate to the consciousness about, and regulation of, emotional conditions of oneself and others. Frameworks of socio-emotional learning are growing worldwide, especially for school-level education. I am aware of no framework of socio-emotional learning focusing on innovation in the literature, and those meaningful models of innovation abilities that do incorporate the socio-emotional character of some skills, do this rather implicitly.

2. Where are socio-emotional skills in innovation skills' frameworks?

My review of the literature on innovation abilities suggests that the *concept of socio-emotional skills* is absent from this body of knowledge despite the intrinsic socio-emotional character of some innovation skills. However, individual skills labelled as socio-emotional (e.g. empathy, resilience and communication) are included as important elements favouring innovative behaviours. These are

generally discussed in the innovation literature together with other skills, offering limited rationalisations of their relevance for innovation and barely elaborating on the meanings of said skills. This may be partly due to the contrasting disciplinary, and even ideological backgrounds from which these bodies of knowledge emerge. Research on socio-emotional skills and socio-emotional learning is based on education and psychology, exploring individuals, their relationships, and developmental processes. Innovation skills largely relate to business and economics studies, exploring the role of innovation in entrepreneurship, business creation, and economic growth. Unsurprisingly, these distinct baselines have kept knowledge on innovation skills and socio-emotional skills apart.

However, knowledge about innovation skills, beyond their connection with socio-emotional ones, also lacks a consistent typology and vocabulary. There seems to be no agreement on the specific skills that facilitate innovative behaviours. This derives from the paucity of research on innovation skills and from multiple interpretations of the concept of innovation, which has obscured the identification of helpful skills for innovation processes (OECD, 2011).

The vast literature on innovation, which exceeds the scope of this thesis, suggests that innovation is the collective process of developing and applying new approaches (largely products, processes and services), encompassing stages that range from need-finding to idea generation, design, testing and implementation. Within this broad frame, various definitions and rationales for the relevance of innovation in society coexist and evolve. Nevertheless, comprehensive frameworks related to *innovation skills* are scarce and tend to include socio-emotional skills without establishing their social and emotional features. They use other lenses to filter and organise skills. One of the few models highlighting a related dimension was developed to analyse the skills of HE graduates considering three interrelated categories: technical or subject-based skills, thinking and creativity skills (where imagination and creativity are categorised), and behavioural and social skills, which includes self-confidence, leadership, persistence, communication and collaboration (Avvisati et al., 2013; Scott and Vincent-Lancrin, 2014). While the social aspect is emphasised in this model, the emotional one is implicit. The comprehensive framework Innovation Competencies Development (INCODE) considers abilities in three social interaction levels, namely, individual, interpersonal and networking capacity (Watts et al., 2013), but it is distant from emotional awareness and regulation aspects. The Berkeley Innovation Index incorporates the dimension of people's mindset, including skills such as trust, resilience, belief, and collaboration (Sidhu et al., 2016). Here, while socio-emotional aspects are present, the dimensions are not labelled by the nature of the skills. Other models related to innovation skills, including practitioner-based analyses, reaffirm this tendency to

include socio-emotional skills but with limited substantiation of their socio-emotional nature and the mechanisms through which they contribute to innovative behaviours.

In sum, some of the skills necessary for innovation are inherently socio-emotional. However, this is implicitly and inconsistently discussed in the literature on innovation due to a) issues related to research on innovation skills, and b) its relationship with the distinct socio-emotional literature. Innovation is a complex, contested and evolving notion, and the way in which it is conceptualised shapes our understanding of innovation skills. Their features, however, are not acknowledged in comprehensive innovation skill models. This situation, in addition to the limited yet burgeoning body of literature on innovation skills, strengthens the absence of an agreed typology or characterisation of skills for innovation. Furthermore, within this diversity of approaches, the socio-emotional character of some skills for innovation is under-recognised and under-analysed, despite their centrality. The disconnection between knowledge about socio-emotional skills and innovation skills can be said to emerge from their distinct grounding disciplines, ideologies and epistemologies. This conceptual gap hampers the characterisation of innovation skills, the analysis of their contribution to innovative behaviours, and our understanding of how they can be developed. Connecting these fields can advance our knowledge about innovation skills and therefore contribute to the practice of university innovation education, one of the pathways through which universities contribute to innovative societies.

3. University innovation education

This thesis seeks to contribute to develop a more meaningful university innovation education by enhancing the development of socio-emotional skills favouring innovation. Thus, it is important to introduce the university innovation education context. Why is it important to study it? What drives this activity?

Innovation education in universities, as initiatives supporting the comprehension of innovation theories and concepts, and the development of skills that favour innovation (Detmer, 2017), are expanding worldwide. This rise of IE responds to evolving societal expectations of the role of universities in society, where interactions and attunement with the broader society are central. These processes are configured in *glonacal* modes*;* i.e., through agentic persons and institutions connected at local, national and global levels (Marginson and Rhoades, 2002). Two interconnected drivers (or two perspectives of a complex dynamic) seem to promote IE in universities: first, a societal vision (reflected in public policies) of universities as key actors in innovation societies; and

second, an institutional concern for graduates' readiness to successfully participate in these societies.

Universities, in enhanced cooperation with other actors, and as institutions that co-create and co-disseminate knowledge, play a pivotal role in the construction of innovation ecosystems. Innovation ecosystems represent networks of interconnected organisations involving users and producers, and creating value through innovation (Autio and Thomas, 2014). Boosting these ecosystems is central, especially because the transformational potential of innovation (Schumpeter, 1943/1994) is increasingly purposed to attend complex societal problems (Mazzucato, 2018a) and requires collective steering by the complex networks of actors involved (Stilgoe et al. 2013). Universities partake in unleashing innovation potentials in various forms, such as with industry and governments (Etzkowitz and Leydesdorff, 2001) and the civil society, and by considering natural environments (Carayannis and Campbell, 2012). Active universities in innovation ecosystems tend to be innovative or entrepreneurial institutions. The 'entrepreneurial university' (Clark, 1998) is able to produce innovation (Shattock, 2009) and to cross academic-industry boundaries, enhancing the valorisation of knowledge (Tijssen, 2006). Research on the role of universities in innovation ecosystems has centred on knowledge exchange rather than on education for innovation, despite the latter being a growing and fundamental activity for innovation. Persons, applying their abilities, make innovation happen, whether it is oriented towards economic growth, social wellbeing, environmental sustainability, or any other purpose. Because of the potential of innovation, it is critical to foster IE. This rationale has stimulated university IE together with other educational matters.

The universities' concern over their graduates' careers also seems to promote innovation-oriented programmes. This seems to derive from changing labour market prospects given technological advancement combined with broader HE dynamics, notably with the sector's massification, leading to an enhanced focus on education for work. Innovation education (and relatedly, entrepreneurship education) is regarded as beneficial for the graduates' work because innovativeness is a valued employability skill (Acar and Tuncdogan, 2019), as other specific innovation skills which vary by the type of innovation performed (Avvisati et al., 2013). The ability to perform in innovation-intensive contexts entails working on complex problems which require innovative interdisciplinary solutions (Greef et al., 2017). In tackling global challenges related to the environment, equality, economy and democracy, the role of HE is central in promoting adequate skills in collaboration with academic and non-academic partners (Unterhalter and Carpentier, 2010). Thus, university IE is contextualised in settings where societal challenges evolve and complexify, and where there is increased pressure

for pertinent education so that graduates contribute proficiently to innovation-based societies. However, the understandings of IE pedagogy are incipient (Shavinina, 2013) and less developed than in the related field of entrepreneurship education, which while focusing on business creation, also requires wider approaches encompassing socio-emotional skills (Lans et al., 2017).

Therefore, the promotion of skills for innovation in university IE is framed within broader transformations of HE and innovation societies. These dynamics stress the need to develop abilities for work, increasingly tackling complex interdisciplinary challenges. Nevertheless, educational practice seems to progress faster than research about skills for innovation in university-level IE, especially socio-emotional ones: the rationale, characterisation, contextualisation and understanding of pedagogical and learning processes to develop such capacities is still limited.

Overall, three specific knowledge gaps can be identified in IE. They relate to skills and innovation, socio-emotional aspects of innovation skills, and the development of innovation skills. First, the understanding of the relationship between different types of skills and innovation is still limited, restricting our comprehension of how certain skills promote innovative behaviours (OECD, 2011). Second, although some valuable typologies of skills for innovation have been developed (e.g., Avvisati et al 2013; Watts et al 2013), the socio-emotional nature of some of these skills is generally not tackled, acknowledged only implicitly and indistinctly in the innovation literature. While socio-emotional learning beyond innovation is a relatively developed field in school-level education, this literature is incipient in HE and conceptually disconnected from the notion of innovation skills, despite their underlying meaningful bond. Finally, knowledge on pedagogical practices for innovation education is also scarce (Shavinina, 2013). Nevertheless, the related subject of entrepreneurship education offers more literature on pedagogical methods, which may be partly relevant to innovation-oriented programmes[1]. Consequently, to unleash IE potentialities,

[1] It is relevant to recognise the intrinsic relationship between innovation and entrepreneurship, as it is conceptually and empirically present throughout the thesis. Entrepreneurship is a form of taking innovations to users. In HE, innovation education is related to entrepreneurship education, being both notions often integrated although they have different emphases. While entrepreneurship education orients more to developing business models to bring products or services to the market, IE focuses on the identification of needs and their creative solution. Yet the line between both is blurred and depends on the educational approaches taken by HEIs, programmes, educators and students. Conceptually, therefore, innovation and entrepreneurship are inherently linked and thus, separating them forcefully may shorten the analytical breadth.
From the cases studied, one Minor incorporates both, innovation and entrepreneurship, in its title. Another programme includes courses on entrepreneurship, and possibly the four cases, consider entrepreneurial aspects -in the sense of value generation- in teaching-learning activities. Participants discussed entrepreneurship, entrepreneurship education and entrepreneurship skills when innovation aspects were inquired, evidencing the innovation-entrepreneurship link.

particularly its socio-emotional dimension, further research is needed on the meaning of innovation skills, their contribution to innovative behaviours, and educational processes supporting their development in HE.

C. Developing a unified perspective on socio-emotional skills for innovation in university programmes

With the above as a backdrop, the purpose of my thesis is to develop a unified perspective on "socio-emotional skills for innovation" (SESI) in relation to their promotion in university innovation education programmes. By combining the hitherto separate bodies of knowledge about socio-emotional skills (and by extension socio-emotional learning) and innovation skills, this thesis aims to identify socio-emotional skills that enable innovative behaviours in university educational settings, and to explore how these skills may be pedagogically promoted.

The integrated study of SESI in HE is important to increase awareness of the relevance of socio-emotional skills in innovative behaviours, to devise a shared working vocabulary for innovation educators and learners, and to direct actions towards their development through educational policies and curricula, together with other aspects of innovation competence. Furthermore, it is key to offer proper credit to socio-emotional learning in HE, in this case, through innovation.

1. Research questions

The main research questions guiding this thesis are:

1. What socio-emotional skills contribute to innovative behaviours and how do they support such behaviours, from the perspective of participants in undergraduate innovation education programmes?
2. How are socio-emotional skills for innovation pedagogically facilitated by educators in undergraduate innovation education programmes?

The first question involves the identification, characterisation and importance of socio-emotional skills for innovation behaviours. It includes examining the rationale for the relevance of these skills to promote innovative behaviours. The second research question explores pedagogies promoting

It is inevitable therefore, and to an extent desirable, to integrate innovation and entrepreneurship, conceptually and empirically. Throughout the thesis I focus on innovation aspects, yet I connect regularly too, to entrepreneurial features. This is reflected in the literature review and the empirical analysis.

the development of SESI and students' engagement in their own and their peers' learning processes. Both questions involve the perspectives of students, educators and managers to explore these enquiries from multiple relevant viewpoints. This is framed within undergraduate (ISCED 5A) IE programmes.

2. Theoretical framework

To answer these questions, I have developed a theoretical framework that integrates learning, socio-emotional skills, skill development in HE and boundary-crossing. Altogether, these approaches emphasise the idea that innovation and learning are social processes whereby learners question, transform and expand their perspectives, particularly through interacting across socio-cultural boundaries. I present the framework in two sets: the first set comprises three learning theories; the second involves four theories and concepts operationalising the analysis of SESI development.

The three theories underpinning this framework serve as resources to clarify how socio-emotional skills for innovation might be learnt, deeming learning a participatory and transformative practice. The first theory, Situated learning (Lave and Wenger, 1991), highlights the intrinsic social character of learning. In other words, individuals participate in dynamic communities where they recreate practices and their meaning, and transform their own personal identity (Wenger, 1998). This is an underlying assumption throughout this thesis, particularly given the strong connection between innovation and social interaction (Welz, 2003). The second theory, Transformative learning (Mezirow, 1991), focuses on personal transformative processes, acknowledging their social relevance (Mezirow and Taylor, 2009). As individuals examine their dispositions and beliefs upon dilemmas, they develop alternative frames of reference that are more reflective, open and inclusive (Mezirow, 2012). Transformative learning supports the exploration of SESI development, considering that reframing, change and integration of perspectives are central abilities for innovation. I specifically draw on Transformative learning theory to construct the notion of 'learning catalysts' as elements facilitating significant and substantial learning. Through this conceptual proposition, I connect skills with their promotion through learning catalysts. Finally, the third theory used is the Systemic Social and Emotional Learning framework (Durlak, 2015; Zins and Elias, 2007), which provides a structure for the analysis of SESI. In discussing the nature of skills (first research question) and their facilitation in university programmes (second research question), I adopt the five dimensions of socio-emotional abilities of the CASEL framework: self-awareness, self-regulation, social awareness, relationship skills and responsible decision-making (CASEL, 2016a).

Therefore, I use Situated learning, Transformative learning and Socio-emotional learning as heuristics to analyse SESI and their facilitation in university innovation programmes.

Complementing the three previous approaches, I draw on four other theories and related concepts to operationalise the analysis of practices facilitating SESI (second research question): Project-based learning (PjBL), Cross-disciplinary education, Community engagement and Boundary-crossing. Key processes emerged from the findings that required further conceptual resources. I introduce these key elements in the theoretical framework to prepare the conceptual foundations for the findings' sections. Project-based learning theory refers to the active engagement in autonomous group work organised as projects that tend to respond to real-world problems with specific outcomes and solutions (Thomas, 2000). PjBL is increasingly used in HE (Prince and Felder, 2006) and I draw on its conceptualisations to explore how it serves as a strategy to facilitate other pedagogical practices like cross-disciplinary and community engagement activities. Students of different disciplines enrolled in the university innovation programmes I study, offering a platform for learning leveraging their different backgrounds. Thus, I use multi-, inter- and trans-discipline learning concepts (altogether referred to as cross-discipline) (Greef et al., 2017; Spelt et al., 2009; Woods, 2007) to research the extent to which SESI are promoted and developed by working across disciplinary boundaries, and how. In addition, the programmes' collaboration with the wider society in community engagement activities represents organisational boundary-crossing, which entails varied aims, roles and identities shaping interactions (Huisman and Fumasoli, 2014). I use conceptualisations of Community engagement for learning (e.g., Hardwick, 2013; Yamamura and Koth, 2018) to study activities facilitating SESI, which seem, however, under-researched. Then, the process of crossing cultural boundaries emerges as a central action in the promotion of SESI, given that the integration of diverse perspectives boosts innovation, which highlights the critical role of skills to collaborate in diverse settings. In Boundary-crossing theory, a boundary can be defined as the "socio cultural difference leading to discontinuity in action or interaction" (Akkerman and Bakker, 2011a, p. 133); crossing them thus implies learning opportunities (Wenger, 1998) as learners change or create new forms of expertise (Guile, 2011). I conceptualise cross-disciplinary learning and community engagement for learning as two central boundary-crossing practices that facilitate SESI in university innovation education. Therefore, Project-based learning, Cross-disciplinary education, Community engagement and Boundary-crossing theory support the analysis of educational practices enhancing SESI and complete the theoretical framework of this thesis.

3. Methodology

To study the notion of SESI and its development by university students, I designed an exploratory cross-country multiple-case study involving four Minor Innovation programmes, two in Chile and two in the Netherlands. Minors Innovation are small optional credited specialisations of four to six modules on innovation-related subjects, offered to undergraduate students of multiple disciplines. Minors Innovation were a suitable unit of enquiry because they focus on innovation and have a scale, timeframe and diversity of educational activities that enriched the dataset.

Innovation-oriented programmes are expanding in universities globally. Chile and the Netherlands have active university IE and their distinctive HE systems and social, economic and cultural contexts enhance the data. The country selection considered the existence of Minors Innovation, subject to the feasibility of the study. While the two countries were considered to enrich the analysis through their diversity, the study was not designed comparatively as I did not intend to compare systematically the phenomenon (Hantrais, 2009); instead, I explored its different variations in-depth.

The main data collection method was semi-structured interviews with actors involved in the programmes' aims, design, and implementation. The participants were undergraduate students from different disciplines, lecturers, central administration authorities, innovation unit authorities, programme managers, external collaborators and policy makers/experts at the national level. The interviews explored the participants' perceptions on the relevance and rationale of socio-emotional skills for innovation and pedagogical practices used in the Minors that intentionally or unintentionally facilitated the development of said skills. In total, 57 interviews were conducted. These were complemented with documents of the programmes.

The data were analysed thematically, predominantly across cases, signalling differences between cases where relevant. Inductive and deductive approaches were applied, the latter especially to organise skills into CASEL's categories of socio-emotional learning. The analysis was organised into three interrelated segments. The first one answers the research question of what socio-emotional skills favour innovative behaviours and why. The second addresses the second research question, focusing on the pedagogical approaches that, according to the participants, benefit the development of these skills, notably by crossing disciplinary and organisational boundaries. The third analytical section focuses on the notion of 'learning catalyst', which emerges as an important theme in the data, and which alludes to the facilitating learning processes promoting a substantial (important) and sustainable (enduring) development of SESI, further bridging SESI with pedagogy.

Three learning catalysts were identified in the context of the four Minors Innovation: authenticity of the learning experience, relation to otherness, and protected autonomy. Thus, the triad of skills-pedagogy-learning catalysts constitutes the analytical structure of the thesis.

D. Organisation of the document

This thesis is organised in ten chapters. Following this introduction, Chapters 2, 3, and 4 discuss the conceptual, theoretical and methodological frameworks for the study correspondingly. Chapter 2 reviews the literature on SESI. It first discusses the concepts of socio-emotional skills and socio-emotional learning. It then analyses the literature on innovation skills relevant to innovation as a collective and skills-based activity. I argue that the conceptual disconnection between socio-emotional and innovation skills hinders the understanding of skills that favour innovation and their development by university students.

Chapter 3 presents the theoretical framework guiding the analysis. I introduce the theories I used, justify their use in relation to the research questions, highlight key assumptions and explain their integration. The first section of the chapter elaborates on theories of learning adopted as a baseline: Situated, Transformative and Socio-emotional learning. The second section focuses on theories and concepts used to further conceptualise the pedagogical facilitation of SESI in university programmes: Project-based learning, Cross-disciplinary learning, Community engagement and Boundary crossing.

Chapter 4 presents the research methodology. It presents and explains my choice to develop the cross-country multiple case study. It introduces the four cases studies, drawing upon documentary data to describe the national, institutional and programme-level contexts. It then reports the data collection and analytical processes, states my positionality as a researcher, and discusses ethical considerations.

Chapter 5 presents the analysis of key contextual themes emerging from the data. I analyse three issues intersecting institutional and programme-level contexts that shape participants' understanding, promotion and development of SESI: diverse approaches to the concept of innovation, the implications of Minors' optionality and educators' challenges to enact academic freedom to pedagogically innovate.

The following four chapters answer the research questions focusing on skills (Chapter 6), key pedagogical approaches (Chapters 7 and 8) and elements facilitating learning (Chapter 9). Chapter

6 answers the first research question of what socio-emotional skills promote innovative behaviours and why. Ten key skills were identified through participants' perceptions: self-reflection, self-confidence, autonomy, resilience, empathy, openness, respect and value of diversity, collaboration, interdisciplinary communication, and responsible decision-making. The analysis is organised around CASEL's five dimensions of socio-emotional learning: self-awareness, self-regulation, social awareness, relationship skills and responsible decision-making. The findings are supported by existing knowledge to describe skills and unpack their contribution to innovation.

Chapters 7 and 8 answer the second question of how socio-emotional skills for innovation are pedagogically facilitated in undergraduate innovation education programmes. Two key issues related to this enquiry emerged from the data: cross-disciplinary learning and community engagement. Both pedagogical approaches appear to be largely developed in the framework of project-based learning activities. In Chapter 7, I examine cross-disciplinary learning, as an intra-institutional boundary-crossing practice. I analyse pedagogical practices and learning experiences focusing on the interaction between students with different disciplinary backgrounds. Chapter 8 centres on community engagement, an organisational boundary-crossing practice. I explore the dynamics of the collaboration between Minor Innovation participants, and members and institutions from the broader society. Each chapter discusses the drivers, features, challenges, and contributions of these pedagogical practices to SESI development.

Chapter 9 focuses on the notion of learning catalysts. Here I intend to capture some essential features of the learning processes that foster the development of SESI as voiced by the participants. Learning catalysts emerged as patterns in the learners' experiences that activated, stimulated, and deepened learning. Herewith, I conceptually connected the pedagogical practices and skills developed through learning processes. The chapter examines three learning catalysts, analysing their role in the development of skills. The catalysts of authenticity of the learning experience, relation to otherness, and protected autonomy are later discussed in three sections each. The meaning of the catalyst, its contribution to SESI, and illustrations of transformative learning experienced in relation to each catalyst are explored. The chapter concludes reflecting on the learners' agency, as manifested in the learning catalysts.

In Chapter 10, I draw the conclusions of this thesis integrating and identifying the main findings. I discuss how they may contribute to the theory of socio-emotional skills for innovation and to innovation education policy and practice.

Chapter 2. Literature review: innovation skills with socio-emotional lenses

My focus is on socio-emotional skills. I am interested in the ways and extent to which they facilitate forms of innovative action. I have investigated my assumed link between both issues in the following way. I reviewed, and attempted to combine, the literatures on socio-emotional skills and innovation skills. I analysed the concept of socio-emotional skills and related notions: skill and socio-emotional learning. This provided a background to analyse innovation skills from a socio-emotional perspective. Then, I examined innovation skills assessing its explicit and implicit connection with socio-emotional skills. This was framed by various approaches of the contested and dynamic notion of innovation.

I concluded from the review that there is a lack of integration between socio-emotional skills and innovation skills' bodies of literature. This fragmentation is partly because the relatively new area of innovation skills studies has centred on other aspects rather than on their socio-emotional dimension. It may also be explained because both bodies of literature emerge from different disciplines and are founded on distinct societal concerns. Socio-emotional skills and their development processes are fundamentally studied by social scientists in the fields of psychology and education. Innovation, and possibly innovation skills, are rooted in business, economics and organisational development. So, these bodies of knowledge remain separate, despite some potential enriching combinations. Thus, the integrated notion of 'socio-emotional skills for innovation' may offer a new and unified perspective on the contribution of socio-emotional skills to innovation.

The chapter is organised in four sections. The first section discusses the notion of socio-emotional skills and related terms. The second section reviews the literature on innovation skills, focusing on those of a socio-emotional nature and contextualised in diverse comprehensions of innovation. The literature review leads to the identification of several under-researched areas, presented in the third section, which guide the formulation of this thesis' aims and research questions, stated in the fourth section. This sets the foundations for the academic relevance of this thesis.

A. Socio-emotional skills

Socio-emotional skills and their development process, socio-emotional learning, are contested and dynamic notions. Tensions emerge from varied understandings of the terms social, emotional, and

relatedly, affective, relational and 'non-cognitive', and from also diverse approaches towards their skills, competencies, intelligences and their development. Key arguments observed in the literature encompass the individual versus collective nature of skills and their development, the distinction between socio-emotional skills and intelligence and the meaning of the term socio-emotional in relation to other terms. Overall, however, there seems to be some convergence about key pillars of socio-emotional skills. These relate to the awareness of thoughts, feelings and behaviours experienced by oneself and others, and to the capacity for guiding actions based on this awareness, directing oneself and considering it when relating to others. While the debate is ongoing and the literature growing, this section discusses key features of the notion of *socio-emotional skills* used in this thesis and the reasons for adopting it hereby. First, I discuss the notion of *skill*, then I review key literature about socio-emotional realm abilities, including emotional intelligence and emotional competence, finalising with socio-emotional learning, which explores the development of socio-emotional skills.

1. The notion of skill

The notion of skill embeds its social and expandable character, and its capacity to generate value through its exercise (Green, 2011). Skill denotes a "goal-directed, well-organised behaviour that is acquired through practice and performed with economy of effort" (Winterton et al., 2006, p. 7). Its malleability distinguishes the concept from innate abilities; skills can be learnt (Kucel et al., 2016). In skills' development, learners' belief that their capacities can be improved through training -a 'growth mindset'- is key (Dweck, 2008). There seems to be some agreement in the literature on the social, developable, practical and directed features of skills. Yet, categorisations and other characterisations of skills and of related terms, like ability and competence, differ.

Importantly, some definitions of skills emphasise skills' individual quality (e.g., OECD, 2015a), while others highlight their collective nature (e.g., Winterton et al., 2006), as abilities situated and developed in communities (Lave and Wenger 1991). The CEDEFOP publication reflects that most definitions of skills, and knowledge and competence, "are centred on the individual, these are viewed as independent of the social and task-specific context in which performance occurs, but the level of skill is a characteristic not only of a person but also of a context; people do not have competences independent of context" (Winterton et al., 2006, p. 8). In this line of thought, because skills are developed and enacted in practice, and such exercise is socially constructed, arguably there is always an element of mutual interaction with the social environment in the manifestation and learning of skills. That is, even if some skills' potentials may dwell in individual persons, their

expression and development are situated in a social context. Then, as contexts change, the resituation of knowledge supports learners' to exercise skills with new perspectives and strategies, beyond the simple transfer of skills (Griffiths and Guile, 2003). While socially contextualised, some dimensions of skills focus on the relationship with oneself and others centre on the interaction with others, as observed in socio-emotional skills' frameworks.

The relation between skills, competence and knowledge is also complex and inconsistently described in the literature. An apparent accord is that skills and competence include the application of knowledge for a specific purpose; a discrepancy is the position between competence and skills. These two terms are regarded as synonyms in cases (e.g., Green, 2011) or as one drawing upon the other, as deducted from other definitions. Focused in the HE context, skills have been defined as the "bundle of knowledge, attributes and capacities that enables an individual to successfully and consistently perform an activity or task, whether broadly or narrowly conceived, and can be built upon and extended through learning" (Avvisati et al., 2013, p. 224). From a lifelong learning perspective, skills are conceived as the "ability to apply knowledge and use know-how to complete tasks and solve problems" (European Commission, 2008, p. 11). Also emphasising directed resourcefulness, the related term competence refers to "the capacity to mobilise all types of resources (cognitive and social, among others) in order to make decisions and/or solve complex problems in an efficient way within a given context" (Ion et al., 2016, p. 631). Another approach to competence further regards knowledge and skills like some of the 'resources' defining it as a: "combination of attributes (with respect to knowledge and its application, attitudes, skills and responsibilities) that describe the level or degree to which a person is capable of performing them" (González and Wagenaar, 2008, p. 28). Thus, definitions of skill and competence appear to feature the directness towards a specific task and exercise of multiple abilities, including knowledge.

The notion of knowledge exceeds the scope of this thesis, but it is important to note that relevant literature on skills and competence highlight knowing as a situated process. Knowing and understanding, knowing how to act and knowing how to be, related the latter to the perception of, and interaction with others, all comprise competence as proposed for the HE context (González and Wagenaar, 2008). In the vocational training landscape, acknowledging discrepancies in the literature, it is argued that knowledge is "the result of an interaction between intelligence (capacity to learn) and situation (opportunity to learn), so is more socially-constructed than intelligence. Knowledge includes theory and concepts, as well as tacit knowledge gained as a result of the experience of performing certain tasks" (Winterton et al., 2006, pp. 6–7). Therefore, not only skills

comprise the application of knowledge, but, as the latter definition suggests, tacit knowledge is also nurtured from the exercise of skills.

Typologies of skills may help a bit to clarify these intricated concepts. In the context of skills policies, skills have been classified, for example, into cognitive and practical – referring the latter to manual dexterity (European Commission, 2008), excluding socio-emotional abilities. Another policy-oriented approach, organises skills into cognitive and socio-emotional (OECD, 2015a). However, multiple labels used for characterising socio-emotional related skills are also used, including 'relational', 'interpersonal', 'behavioural', 'soft', 'transversal' and 'generic', being sometimes unclear what these attributes mean. Furthermore, the term 'non-cognitive' is still widely used to distinguish "a set of attitudes, behaviours, and strategies that are thought to underpin success in school and at work" from "'hard skills' of cognitive ability in areas such as literacy and numeracy" (Morrison Gutman and Schoon, 2013, p. 2). This by-default definition tells about the need for further studying and characterising skills. Nevertheless, despite the use of typologies to understand skills' characteristics, it is also recognised that in practice, cognitive and affective, socio-emotional abilities are all imbricated (Krathwohl et al., 1964).

Overall, the literature on skills suggests that, being a debated concept, skills are generally regarded as abilities that can be developed through practice and exercised with orientation. While skills draw upon knowledge, knowledge -and particularly tacit knowledge- is also enhanced with the practice of skills. Skills appear to be social, in multiple senses: some are defined as abilities to interact socially yet moreover, their development and manifestation -which are intertwined- is socially contextualised. The landscape of socio-emotional abilities, on which this thesis focuses, is discussed next.

2. The socio-emotional realm: skills and intelligences

This thesis centres on socio-emotional skills, and in this context, it is relevant to acknowledge relevant literature on social and emotional intelligence and on the affective domain of learning because these have shaped the understanding of socio-emotional skills. Core characteristics of skills discussed above, including their development through practice, entanglement with knowledge and intrinsic social nature which in the case of some skills means that they are defined by the interaction with others, are central in understanding socio-emotional skills.

A foundational concept related to socio-emotional skills in the educational sphere is the affective domain of learning. Krathwohl et al., (1964) coined the 'affective domain' of educational objectives

(being 'cognitive' and 'psychomotor' the other domains). The authors emphasised that the affective domain is grounded in an emotional quality which is inseparable in practice from the cognitive one (although for research purposes they may be analysed apart) (Krathwohl et al., 1964). Moreover, they state that "nearly all cognitive objectives have an affective component if we search for it" (Krathwohl et al., 1964, p. 48). Affective educational objectives relate to "interests, attitudes, values, appreciation and adjustments" constituting the "emotional quality" a pillar of this affective domain (Krathwohl et al., 1964, pp. 25–26). The authors established a progression scale in the affective domain, evolving from awareness and perception of a phenomenon to guiding behaviours. The elements of the affective dimension are important foundations of what today is conceived as socio-emotional skills and learning.

Then, when discussing emotional abilities, the notion of emotion is central. Emotions are conceived as "short-term episodes involving feelings, cognitive appraisals, motivational action tendencies, motor expressions, and physiological changes", generally triggered by "occurring, remembered, or imagined events" (Shuman and Scherer, 2015, p. 526). Emotions are conditioned by sociocultural factors, through stimulation and by setting norms for evaluating emotions (Shuman and Scherer, 2015). Emotions primarily serve our communication needs, as a "social action by conveying information that provides insight into others' internal states" (Jang and Elfenbein, 2015, p. 483). Yet abilities regarding emotions, notably intelligence and skill, are object of diverse research perspectives.

An approach to *emotional intelligence* emphasises its abstract reasoning nature, manifested in four areas: the perception, appraisal and expression of emotions (in the self and others); the facilitation of thought using emotions; understanding and analysing emotions; and the reflective regulation of emotions (Mayer et al., 2016; Mayer and Salovey, 1997; Salovey and Mayer, 1990). Mayer et al. (2016) distinguish between emotional intelligence and behaviour, stating that "emotionally stable, outgoing, and conscientious people may be emotionally intelligent or not" (p. 291). Similarly, *social intelligence* relates to social cognitive abilities, such as social perception and understanding, which conceptually differs from social competence; the latter involves abilities and behavioural dispositions such as personality traits (Weis and Conzelmann, 2015). From these perspectives, emotional and social intelligence are cognitive and shape socio-emotional competences which affect behaviours.

The facets of perception and awareness of emotions and social stimuli ground other models about emotional abilities -not necessarily regarded as mental intelligence. They vary, however, in the

conceived relationship between emotional intelligence and actions nurtured by this capacity. Regulation is a central distinction, applying not only to the regulation of thoughts about emotions, but to the manifestation of emotions. Emotional regulation are "attempts to change the experience and expression of emotions" which affect future emotional experiences and social interactions (Kim et al., 2015, p. 452). Regulation is key in social and emotional competences or skills.

A renowned framework of *emotional competence* (Goleman, 1998) evolved into one of four domains of *emotional intelligence*: self-awareness, self-management, social awareness and relationship management (Goleman et al., 2013). Self-awareness and social awareness refer to the capacity to recognise one's and other's emotions, while self-management and relationship management indicate the ability to respond effectively to them. Self-awareness and self-management relate to oneself while social-awareness and relationship management correspond to the social competence sphere (Goleman et al., 2013), i.e., the two first are intrapersonal and the two latter are interpersonal. The four dimensions are interrelated: self-awareness informs consequent actions reflected in self-management and in the understanding of others; in turn, self-management supports the development of relationships with others. In this model, emotional intelligence is defined as "the capacity for recognizing our own feelings and those of others, for motivating ourselves, and for managing emotions well in ourselves and in our relationships" (Goleman 2004, 317). Therefore, in this model the management or regulation component is potentially expressed in actions.

Then, the consideration of socio-emotional *skills and competencies* encompasses the awareness of emotions, thoughts and behaviours of oneself and others, and consequent actions. These elements have anchored multiple policy and practice-oriented models, notably of socio-emotional learning, i.e. the development of these abilities. Guiding much of the work on socio-emotional development, social and emotional competence has been defined as:

> "the ability to understand, manage, and express the social and emotional aspects of one's life in ways that enable the successful management of life tasks such as learning, forming relationships, solving everyday problems, and adapting to the complex demands of growth and development" (Elias, 1997).

Consequently, the sphere of socio-emotional abilities is contested, including definitions of social and emotional intelligences as purely cognitive capacities and as abilities regulating behaviours. The latter approach assimilates to notions of socio-emotional *skills* or *competencies*, which as discussed in the previous section, entwine cognitive, social and other type of abilities, manifested and

developed through practice. For this thesis, the notion of socio-emotional skill is useful as I explore the ways in which this kind of abilities can foster innovative behaviours.

3. Socio-emotional learning

As skills in general, socio-emotional skills are developable through practice. The development of these skills is denoted socio-emotional learning (SEL). Through SEL persons develop and exercise the ability to "recognize and manage emotions, set and achieve positive goals, appreciate the perspectives of others, establish and maintain supportive relationships, make responsible decisions, and handle personal and interpersonal situations constructively" (Osher et al., 2016, p. 645).

Developing socio-emotional skills is important for individuals and society. Socio-emotional skills enhance academic achievement and effective learning (Durlak et al., 2011; Hallam, 2009); support healthy relationships and prevent conduct problems (Taylor et al., 2017); favour responsible citizenship and productivity (Elias, 1997); and support social progress (OECD, 2015a). While the scope of impact of socio-emotional skills is broad, and arguably relevant at all ages, their promotion and related literature has centred at the school and pre-school level (Conley, 2015), findings which are not necessarily applicable to HE (Mendzheritskaya and Hansen, 2019a). The study of emotions in HE has been neglected, yet emotions are part of students' learning outcomes and affect students' motivation for learning and their academic achievement (Jacob et al., 2019). The scant discussion on socio-emotional learning in HE has focused on its importance for helping students manage socio-emotional challenges and promoting social wellbeing (Conley, 2015). Still, an emerging body of literature centres on the role of emotions in HE teaching and learning, considering the engagement of both, learners and educators (Lincoln and Kearney, 2019).

Research into socio-emotional learning in HE students and their emotions has explored the relationship between emotions and pedagogical approaches, and between emotions and learning. Regarding collaborative learning, for example, Volet et al. (2019) found that in the context of collaborative science lab activities, first year university students to become primary school teachers experienced positive emotions with various effects on motivation and behaviour. Emotions related to joy supported playful engagement in learning, but were not necessarily sufficient to promote emotions related with interest, which favoured the understanding of scientific concepts (Volet et al., 2019). Also related to collaborative learning, Järvenoja et al. (2019) analysed the experience of HE students in a mathematics course, finding that student groups developed strategies for emotional regulation when facing collaborative challenges. The challenges entailed in collaborative

learning approaches can be cognitive, emotional, motivational and relational, including limited understanding between the group members and their lack of interest toward tasks and toward working in group (Järvenoja et al., 2019). The group emotional regulation strategies developed by these students were mapped as encouragement, increasing awareness, social reinforcement and task structuring, strategies which were related to the type of challenge faced (Järvenoja et al., 2019). Another study centred on students' achievement emotions, under the assumption that these emotions impact learning and academic success (Jacob et al., 2019). Jacob et al. (2019) analysed the influence of student-oriented and teacher-centred pedagogical approaches on achievement emotions, finding that although autonomy and participation were further experienced in student-oriented approaches, this did not lead necessarily to more achievement emotions (e.g. enjoyment and pride of learning). These studies illustrate the multiple implications of emotions on learning, which are affected by the pedagogical approaches used. A related body of research concentrates on emotions of academics and how this affects teaching styles (e.g., Mendzheritskaya and Hansen, 2019). The latter exceeds, however, this thesis' enquiry, although educators' emotional experiences likely affect students' socio-emotional learning.

Regarding frameworks of socio-emotional learning, researchers at the Ecological Approaches to Social Emotional Learning Laboratory at Harvard University recently launched a useful platform exploring several of these frameworks[2]. These emerge from different geographical and institutional contexts, including national-level SEL frameworks and guidelines by international organisations such as the EU, OECD and WHO. Research-based models are explored alongside practice and policy-oriented ones. Their commonality is the purpose of promoting SEL, yet the contexts, targeted population and theoretical underpinnings differ. For example, the frameworks focus on cognitive, emotion, social, values, perspectives and identity aspects, while over a hundred skills are represented in the range of frameworks (EASEL, 2020).

Approaches to the development of social and emotional skills are varied. They comprise formal and informal learning (OECD, 2015a). At the school-level include specific skill-development sessions, incorporation in the curriculum and systemic institutional approaches (Osher et al., 2016). Some educational models focus on specific aspects, such as employability, values and life skills, citizenship and health (EASEL, 2020). Within such diversity, it seems that the exercise of these skills is central for their development: "The best way of developing socio-emotional skills is through experience,

[2] http://exploresel.gse.harvard.edu/

appropriate training and practice" (Talavera Repetto and Pérez-González, 2007, p. 83). As with skills, in general, the practice of socio-emotional skills is contextualised.

CASEL Framework

A recognised and vastly used approach for developing socio-emotional abilities is a framework designed by the Collaborative for Academic, Social, and Emotional Learning (CASEL). The framework centres on the school-level and incorporates different levels of contextualisation (classroom, schools, home and communities). It comprises the previously discussed core dimensions of socio-emotional skills about awareness and regulation, in relation to oneself and others. The framework is acknowledged as a seminal contribution in the field: "The most ubiquitous and long-standing framework is CASEL's, which builds on SEL research more broadly" (Osher et al., 2016, p. 652). The CASEL framework consists of five interrelated domains of cognitive, affective, and behavioural competencies to deal effectively and ethically with daily tasks and challenges, which may be developed across different settings (Durlak, 2015). The domains are:

- Self-awareness: recognising one's own thoughts and emotions (e.g., self-esteem, self-efficacy);
- Self-management: regulating one's thoughts, emotions, and behaviours (e.g., self-directedness, self-motivation);
- Social awareness: identifying social resources (e.g., empathy, perspective taking);
- Relationship skills: establishing and maintaining healthy relationships (e.g., communication, conflict resolution skills); and
- Responsible decision-making: taking constructive, responsible and ethical choices (CASEL, 2016a; Durlak, 2015; Conley, 2015).

The first four domains relate to awareness and regulation aspects discussed in previous models. The additional fifth domain of responsible decision-making involves "the knowledge, skills, and attitudes needed to make constructive choices about personal behaviour and social interactions across diverse settings" (Weissberg et al., 2015, p. 7). Responsible decision-making includes the consideration of ethical standards, the evaluation of consequences of actions and the health and wellbeing of the self and others (Weissberg et al. 2015). The dimension of responsible decision-making is particularly relevant in the innovation context. As discussed, the enhanced awareness of the potential beneficial and detrimental effects of technology increases the debate on responsibility in innovation (Stilgoe et al., 2013). That is, the CASEL model integrates essential dimensions related to social and emotional *skills*. It includes intra- and interpersonal domains of awareness and

regulation leading to action. It also incorporates a dimension of societal responsibility which is central for the discussion of socio-emotional skills for innovation in HE.

The CASEL model is adopted as part of the conceptual framework used in this thesis and is detailed in Chapter 3. This framework is pertinent for the thesis as it integrates social and emotional aspects, it acknowledges entwined cognitive and affective dimensions in socio-emotional learning, it considers the increasingly relevant dimension of responsibility, it recognises the social context of Alternative frameworks, such as the intelligence models, centre on cognitive dimensions, whereas the CASEL model integrates in-practice social and emotional aspects, where this thesis focuses. Therefore, CASEL as a comprehensive, flexible and widely used model is suitable for the purposes of this thesis.

Conclusion on socio-emotional skills

Conceptualisations about socio-emotional skills and related notions are rich and contested. The notion of skill denotes a developable ability that is manifested in behaviours and exercised with a direction. Skills' exercise and development are socially constructed with potentially different manifestations in different contexts. Some dimensions of socio-emotional skills focus on oneself (self-awareness and self-regulation of one's thoughts, behaviours and actions), while others centre on understanding others (social awareness) and relating to others (relationship skills). The development of these abilities is studied and promoted mostly at the school level. While extant models about socio-emotional skills are useful for other contexts, the different settings are central to consider given these skills' social nature.

Therefore, the concept of socio-emotional skill provides a rich ground to bond with innovation skills, into a unified perspective about individual and collective socio-emotional skills contributing to innovation. But, the literature on socio-emotional skills at the HE level is scant, and focused on innovation, seemingly non-existent. An opportunity for contributing to this field is observed then, regarding the conceptualisation of socio-emotional skills for innovation (SESI) and their development in HE. A theoretical framework that integrates socio-emotional skills, skill development and learning theories in HE is required to understand SESI and their development. However, before that, it is necessary to explore how the innovation literature considers socio-emotional skills and their importance for innovation.

B. Innovation: a collective and skill-based activity

Innovation, as socio-emotional skills, is a complex, evolving and debated notion. While significant literature on innovation looks at its promotion and centres on organisational and systemic-level policies, the relationship between skills and innovation is underexplored (OECD, 2011). Moreover, research on innovation skills focused on those of a socio-emotional nature in HE contexts seems lacking.

Therefore, exploring socio-emotional skills that favour innovative behaviours requires other literature review pathways to understand their connection. This section reviews innovation skills' literature aiming to assess the presence of socio-emotional skills and rationalisations of their relevance for innovative behaviours. This review has three parts. First, I introduce the broad concept of innovation by focusing on three key features consistently emphasised in the innovation literature; innovation is novel, collective and applied. Second, I review key innovation theories looking at the implications on skills emerging from those paradigms. Third, I analyse a selection of innovation skills' categories, seeking specifically for their socio-emotional component. Overall, I conclude that although different skills may be needed for different innovation types, phases and contexts, the literature on innovation skills is underdeveloped and far from characterising the relevance of socio-emotional skills, as a dimension, in innovative behaviours. Individual socio-emotional skills are appreciable in the innovation skills literature, unacknowledging this nature. Therefore, examining innovation skills through a socio-emotional perspective seems promising as means to enrich the understanding of innovation skills.

1. Key features of innovation: novel, collective and applied

Innovation is an inherent human activity (Martinidis, 2017). Innovation can be regarded as a collective creational process. It denotes the creation of new or improved products, processes or services and their application and adoption by users. Such process is largely based on the exercise of skills, individually and collectively. Multiple understandings and types of innovation have been discussed in academic and policy innovation literature. Yet, in my views it may be concluded from the literature that innovation has three distinctive and interrelated features: it is novel, collective and applied.

Novel

First, novelty characterises the products, processes or services that are implemented through innovation, yet the generation of such ideas is usually expressed as creativity (Shavinina, 2013). Creativity then, is a prior stage of innovation processes whereby new ideas emerge from the past (van Tassel-Baska, 2013). In other words, creativity is "a transformative activity where emotion, meaning, and cognitive symbols are synthetized" (Connery et al., 2010, p. 12). Creativity "is based on something that virtually everyone is born with: imagination" (Trilling and Fadel, 2009, p. 57). Thus, there is arguably a universal potential for being creative. Imagination is a psychological function that originates within the social interaction and social context and needs both emotional and intellectual factors (Connery et al., 2010). Consequently, imagination stands as an originator, process or instrument for creativity. In turn, creativity initiates or nurtures innovation. Imagination offers the first visualization of new ideas which are combined and expressed in novel forms through the creative process. Innovation is founded on creative expressions manifested and implemented in socially contextualised new products, processes or services. Therefore, imagination and creativity cultivate innovation's novelty feature. These two elements grounding novel developments, imagination and creativity, have social and emotional aspects underpinning them, combined with cognitive processes.

The newness is judged by whom adopts innovation outcomes (Rogers, 1983). A framework of standards to assess the newness and evaluate the worth of creative developments is required as novelties are abundant and there is limited societal capacity to absorb new proposals (Csikszentmihalyi, 2010). The social effects of innovation, then, are determined by factors that influence the acceptance or rejection of innovation proposals (Barnett, 1953). A critical criterion for newness is the qualitative difference from what already exists rather than quantitative changes; it relates to the recombination of elements instead of their (de-)escalation (Barnett, 1953). The recombination process acknowledges the pre-existence of founding elements in innovation outcomes. This seems central in innovation's collective character.

Collective

"[I]nnovation is ultimately a team sport" (Kelley and Littman 2006, p. 262); "innovation is much less dependent on the creative individual than on the interaction within social milieux" (Welz, 2003, p. 255). A second characteristic of innovation is that it is collective, and this manifests in various phases from the generation of new ideas, through their development into applicable solutions, to their adoption. Creative outputs arise from the synergy of many sources and not from a single person's

mind, are shaped by environmental conditions, and are evaluated by a community to determine its worth and usage (Csikszentmihalyi, 2010). Csikszentmihalyi (2010) proposes a systemic model to understand creativity based on three elements: a *domain,* representing a set of symbolic rules and procedures; a *field,* where individuals monitor the domain; and the *individual person.* Creativity occurs when a person, using the symbols of a certain domain, has an idea or sees a new pattern, and when the corresponding field selects that novelty for inclusion in the relevant domain (Csikszentmihalyi, 2010). Forming creative ideas is social and enriched in the intersection of different cultures and beliefs that permit individuals to easily combine ideas (Csikszentmihalyi, 2010; Welz, 2003). That is, access to knowledge from different domains enhance possible combinations, resulting in expanded novelty (Tell et al., 2016). Therefore, creativity happens in the "interaction between a person's thoughts and a sociocultural context" (Csikszentmihalyi, 2010, p. 23). While an individual may be responsible for proposing a novel idea, the domain of previous intellectual work and the social mechanisms that recognise and spread innovations, are fundamental too (Csikszentmihalyi, 2010).Therefore, multiple phases of innovation, from idea generation where creativity is critical, to their development, assessment and implementation, are collective and socially contextualised.

Applied

A third key feature of innovation, intertwined with its novel and collective character, is its application. This distinguishes innovation from creativity, because it is "the implementation and diffusion that makes promising ideas useful" (Mulgan et al., 2007, p. 8). The process of implementing new elements grounds innovation definitions (e.g., OECD 2005), which in cases, however, also encompass the creation process of *solutions*, e.g.: "innovations come about when unprecedented solutions to either known or new problems are devised and then put to work" (Welz, 2003, p. 2). Moreover, innovation's purposefulness strengthens the social desirability of innovation, in its capacity to tackle societal problems.

The implementation of innovation relates to entrepreneurship. Entrepreneurship refers to "an individual's ability to turn ideas into action", to achieve certain objectives (European Commission, 2008, p. 7). Such capacity is also manifested at team, organisational and more aggregated levels, like regional or national levels.

Concluding, the novel, collective and applied features of innovation are observed consistently in the innovation literature and appear, therefore, as three essential characteristics of this process. Innovation, and its precursors elements of creativity and imagination, have important social and

emotional aspects, which in different ways nurture innovation's novel, collective and applied features. Innovation processes centrally occur through the exercise of skills, which -as previously discussed- include the application of codified and tacit knowledge and the practice of socio-emotional abilities (Winterton et al., 2006). Skills for innovation, as skills generally, are socially contextualised. In the case of innovation, arguably its contexts are shaped by underlying ideas about innovation and its value for society. These understandings are manifold. In studying skills that favour innovative behaviours it is important to understand key rationales of innovation narratives that possibly accentuate different relevant skills.

2. Notions of innovation shape the understanding of innovation skills

Numerous innovation models have been developed (Godin, 2012). As innovation theories evolve, they reflect innovation processes seeking varied ends. These foundations debatably guide the comprehension and practice of skills that shape innovation processes. Although in practice multiple theoretical standpoints may mix even without practitioners acknowledging the rationalisations involved, for researching socio-emotional skills for innovation it is useful to identify possible connections between grounding innovation concepts and related innovation skills. This section reviews key innovation approaches or models, exploring how they may shape the understanding of relevant skills for innovation.

In my views, the innovation literature, especially about innovation policy, has centred on the economic relevance of innovation. Seminal works by Schumpeter and Drucker, for example, have founded the understandings of innovation's economic value. Yet other aims and models of doing innovation have also shaped the concept of innovation and innovation skills. Besides innovation as an economic driver, I briefly discuss the related notions of open, social, mission-oriented and responsible innovation alongside the abilities that contribute to these approaches to innovation. These influential approaches in innovation management and innovation policy discussions certainly seek economic and societal progress, yet their distinctive accents re-frame valuable skills for innovation, including socio-emotional ones.

Innovation as an economic driver

Grounded in an economic perspective, Drucker (1985) proposed that innovation is the process of identifying resources and therefore value, which may include value from things that were previously considered not valuable, useful or profitable. Systemically, this re-creation process was coined *Creative Destruction*, that which "incessantly revolutionizes the economic structure *from within*,

incessantly destroying the old one, incessantly creating a new one" (Schumpeter, 1943/1994, p. 73). Schumpeter suggested that the main driver for economic evolution comes from new goods, technologies, methods of production, markets, and forms of industrial organisation (1943/1994). That is, multiple forms of innovation. The term radical innovation has been used to further explore this revolutionising and uncertain process entailing qualitative change in technological, economic and social dimensions (Toner, 2011) and that has transformed, for example, farming, transport, health and communications. Radical innovation contrasts incremental innovation, characterised by more predictable potentials (Scott-Kemmis, 2004). While Schumpeter's work was developed in the first half of the 20th century, this economic development rationale arguably still sustains innovation policy. In fact, the forms of innovation announced by Schumpeter shape a key definition of innovation. In the Oslo Manual, widely used in innovation policy, innovation is defined as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD 2005, 46). These types of innovation and ways to develop them, have been explored abundantly.

Concerning skills favouring innovation under this predominant perspective, different innovation types and innovation phases are central. This is reflected in the project INNO-GRIPS, which mapped sets of skills beneficial in various contexts (OECD, 2011). Skills vary according to the type of innovation pursued. For example, product innovation benefit among others from market research and team-working skills while organisational innovation requires leadership and communication skills (OECD, 2011). Skills also differ by innovation stage. For example, the ideation phase requires skills to form teams and to generate conditions for experimentation; the implementation and diffusion stages need project management and technology transfer skills (OECD, 2011). The range of skills included technical ones (like evaluating costs) and interpersonal skills (such as communication).

This prevalent rationale about innovation in which new products, services and organisational structures promote economic development, and that relevant abilities to support certain innovation types and stages can be specified, relates yet differs from other innovation paradigms.

Open innovation

Open innovation fosters purposeful knowledge diffusion across boundaries using knowledge flows to enhance internal innovation and to broaden markets to commercialise these (Chesbrough, 2003; Chesbrough and Bogers, 2014). Regarding the abilities required, open innovation reflects the

increased collaboration between different types of partners, enhancing knowledge flows through permeable boundaries to access technologies and enhance competitiveness (Tell et al., 2016). The boundaries to be bridged for knowledge flows can be organisational, geographical and knowledge-based, i.e., between types of expertise (Tell et al., 2016). Further investigation is required about abilities favouring open innovation (Bogers et al., 2017). There are hints, thus, about skills benefiting knowledge flows across boundaries but not yet a roadmap of skills for open innovation.

Social innovation

Social innovation refers to "new ideas that work in meeting social needs", or more *in extenso*, to "innovative activities and services that are motivated by the goal of meeting a social need and that are predominantly developed and diffused through organisations whose primary purposes are social" (Mulgan et al., 2007, p. 8). This approach orients to solving social issues rather than creating economic value, although the latter may be generated throughout. Developing a social innovation skills framework, multiple 'changemaker' attributes have been identified: self-confidence, perseverance, internal locus of control, self-awareness, action orientation, innovation and creativity, critical thinking, empathy, being reflective, communication, emotional intelligence and social intelligence, problem solving, leader, values-driven (Alden Rivers et al., 2015b). Building upon these attributes, a proposal for university social innovation education encompasses the promotion of "systemic and sustainable approaches to improving society through positive social change", supporting the development of persons that are "knowledgeable, socially and ethically responsible, as well as emotionally intelligent innovators, leaders and communicators" (Alden Rivers et al., 2015a, p. 388). Social innovation, therefore, requires multiple abilities, several of which are socio-emotional, alongside commitment with social change.

Mission-oriented innovation

Mission-oriented innovation, as open and social innovation, is also purposeful, yet it centres on systemically approaching societal challenges. Mazzucato postulates that missions should be defined with deliberate directions of change, addressing specific problems feasible to evaluate while encouraging innovation in multiple sectors and proactively creating new markets (2018b, 2016). This requires a mission-oriented innovation system focused on problems (missions) rather than solutions, conceiving this system as "the network of agents and set of institutions that contribute to the development and diffusion of innovative solutions with the aim to define, pursue and complete a societal mission" (Hekkert et al., 2020, p. 77). These networks need to be able to work across disciplines and in public-private-civil society partnerships able to experiment and take risk

(Mazzucato, 2018b). While conceptualisations of mission-oriented innovation are growing, key abilities seem to centre on setting meaningful, feasible and inclusive missions, and on working in partnerships with diverse actors.

Responsible innovation

Another purposeful and recent approach is responsible research and innovation (RRI). In this case, the underlying argument exceeds innovation's positive potentials and includes its harmful potentials, which together with innovation's unpredictable consequences and complexity as a networked process, require collective and responsible steering (Stilgoe et al., 2013). As the mission-oriented and social innovation approaches, RRI also emphasise the ethics and direction required for societally beneficial innovations. A proposed framework for RRI includes four dimensions to govern innovation: anticipation, reflexivity, inclusion and responsiveness (Stilgoe et al., 2013).

In the HE curricular landscape, Tassone et al. (2018) developed a RRI framework to support students to become responsible innovators through specific pedagogies and competence development. It centres on education for society, education with society and educating whole persons. It involves affective capacities because "collaborating, cultivating social attitudes and values, and nurturing a sense of care and stewardship are not merely intellectual exercises, but a way of being and of relating to ourselves, to others, and to the planet" (Tassone et al., 2018, p. 345). Multiple competencies (as knowledge, skills, dispositions and values) are organised in the four dimensions proposed by Stilgoe et al. (2013). The dimension of anticipation includes future-oriented ethical abilities and proactivity; reflexivity includes self-, situational and social awareness and empathy; inclusiveness comprises multi-perspective and inter-cultural communication, participatory ability, trans-disciplinary collaboration and openness and transparency; while the dimension of responsiveness includes the ability to navigate complexity, adaptability and agency (Tassone et al., 2018). These selected competencies reflect the variety of abilities relevant for RRI, many of which can be considered socio-emotional.

This section explored some well-established and important emerging approaches towards innovation. Starting with comprehensions of innovation as a key economic driver, I then briefly reviewed open, social, mission-oriented and responsible innovation, considering their required abilities. These few innovation approaches illustrate three things. First, the coexistence of various innovation conceptualisations, aims and ways to conduct it. Despite variations, it seems that innovation's novel, collective and applied character is increasingly oriented purposefully to tackle societal problems. Second, to some extent, these approaches entail different required capacities.

This is partly explained by the distinct levels and perspectives addressed (e.g., looking at persons, institutions or systems) and by the varied degrees of knowledge about related skills. Third, despite the consideration of different innovation conceptualisations, a range of socio-emotional abilities are valuable for innovation.

Another body of literature centres on skills, abilities and capacities for innovation rather than on innovation paradigms as the above set. In capacities-oriented literature, innovation paradigms seem to mix and/or become implicit. Specific studies on innovation skills are scarce (Shavinina, 2013) and emerge from academic and grey literature that report experiences from practice. The explicit focus on socio-emotional skills for innovation is nearly absent when looking at categories of skills, but visible when examining individual skills included in these categories. The next section explores categories of skills for innovation, centring on socio-emotional ones.

3. Categories of skills for innovation: search for socio-emotional skills

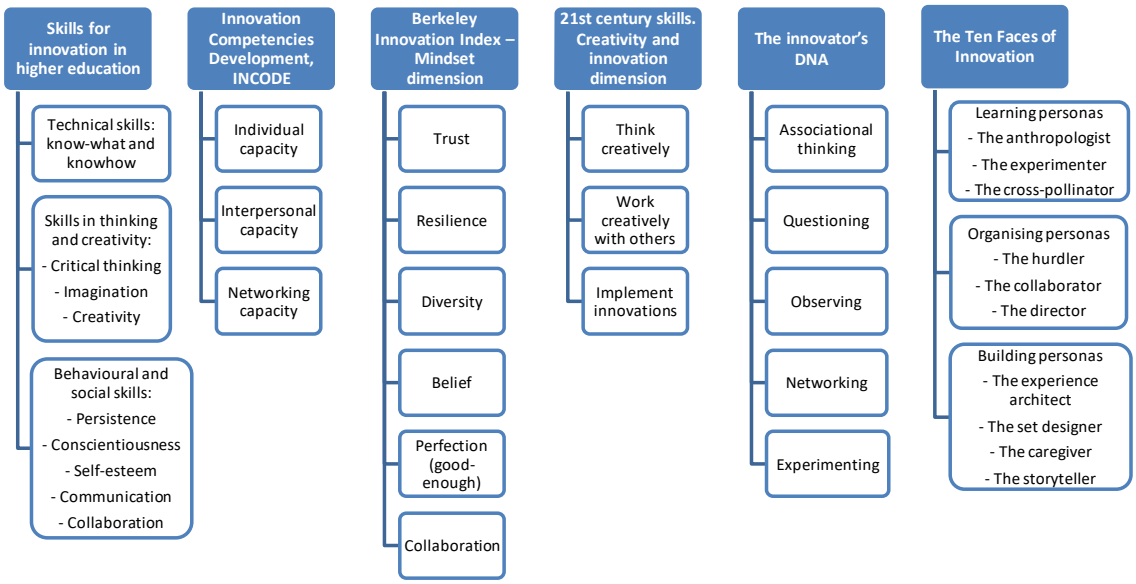
Innovation competence is regarded as a set of multiple distinct capacities and skills (Watts et al., 2013). The literature on innovation skills reflects this assortment, organising skills for innovation with varied logics. However, the socio-emotional nature of skills favouring innovation is generally unacknowledged. Nevertheless, some individual skills that appear to be socio-emotional are present. A key outcome of this literature review is that innovation skills encompass socio-emotional skills, but they are not named as such. Thus, the connection between literature around innovation skills and around socio-emotional skills offers an opportunity to further understand and characterise socio-emotional that facilitate innovation.

The identification of skills of a socio-emotional character in the literature on innovation skills is complex. Firstly because, legitimately, criteria to organise skills centre on other aspects such as skills' level of aggregation (from individual to group, organisation and broader), the innovation activities or phases where skills are relevant (e.g., explore needs, ideate, network, implement), and the nature of skills from a personal capacity perspective (e.g., cognitive-oriented, interaction-oriented). Socio-emotional abilities in the innovation skills' literature are hardly made explicit. Secondly, and relatedly, because in the literature skills of a socio-emotional nature are mixed with other types of skills. Therefore, by putting socio-emotional 'lens' for reviewing the innovation literature, socio-emotional skills can be revealed.

This section reviews six frameworks related to innovation skills, selected because they inform about socio-emotional skills important for innovation. The selection includes academic and grey literature.

The latter is included because it offers valuable perspectives within the limited number of studies pointing to SESI. The identification and description of specific socio-emotional skills favouring innovation varies across models. They also differ on the explanations of skills' importance for innovation; on why they matter. Still, aspects about connecting ideas and people, collaboration, exploration and self-direction seem to be common aspects across the models. It is also evidenced that both, the intra- and interpersonal features of socio-emotional skills discussed previously, are illustrated. The following figure summarises these approaches, which are reviewed next.

Figure 1. Innovation skills' categories used in six studies



Source: author's based on reviewed literature.

Skills for innovation in Higher Education

One of the few categorisations of skills for innovation established in relation to HE students distinguishes three interrelated categories (Avvisati et al., 2013, p. 224; Scott and Vincent-Lancrin, 2014, p. 78):

- Technical, or subject-based skills, related to knowledge in a field and its application: know-what and know-how;
- Thinking and creativity skills, considering higher-order skills and creative cognitive habits. These include critical thinking, imagination, creativity; and

- Behavioural and social skills, which include self-confidence, leadership, persistence, communication and collaboration.

The three kinds of skills set the basis for innovation capacities at the individual level. The analysis drew upon two university graduates' surveys and focused on graduates working in organisations that innovate. It resulted that different skills are required when developing different types of innovation (organised into product or service, technology or tools, and knowledge or methods) (Avvisati et al., 2013). Considering these three types of innovation altogether, the five most important skills for innovative jobs are: to come with new ideas/solutions, willingness to question ideas, present ideas in audience, alertness to opportunities and analytical thinking (Avvisati et al., 2013). Graduates were dissatisfied with their development of behavioural and social skills in their HE programmes, considering them weaker than thinking and subject-based skills (Avvisati et al., 2013).

This study informs on two relevant aspects for this thesis. It proposes an organisation of skills for innovation, which identifies the category of behavioural and social skills that closely relates to socio-emotional skills, although emotional awareness and regulation are implicit. Also, it reflects on HE programmes' shortfalls on socio-emotional related skills.

Innovation Competencies Development, INCODE

Another relevant categorisation of skills for innovation encompassing socio-emotional ones derives from the project Innovation Competencies Development (INCODE). A typology of innovation competencies was proposed, distinguishing three social levels: individual, interpersonal and networking. Each dimension contains behaviours, capacities and skills, being in total 25 aspects of innovative capacity. The model was designed to assess innovation competencies educationally, through self-assessment, peer-assessment and teachers' summative assessment (Watts et al., 2013).

Individual capacity comprises "behaviours or skills that allow a person to innovate in the personal execution of tasks" (Watts et al., 2013, 1). This includes the abilities to present creative ideas and new ways to implement them, evaluate the advantages and disadvantages of actions, face task from different perspectives, use available resources ingeniously, show enthusiasm, be persistent, take daring yet reasonable risks and be goal-oriented (Watts et al., 2013). As with other frameworks, thinking and social skills are mixed.

Interpersonal capacity enables persons to innovative through group interaction and entails the capacity to transmit ideas, listen to teammates, develop constructive group relationships, collaborate actively, take initiative, motivate others and face conflict flexibly to reach agreements (Watts et al., 2013). In this dimension, arguably communication and more broadly, 'relationship' skills stand out. Interestingly, the ability to face conflicts relates to responsible decision-making which requires constructive, responsible and ethical choices (CASEL, 2016a).

The dimension of networking capacity represents behaviours and skills that "enable a group to find appropriate solutions in the process of completing tasks in a broader environment than usual" (Watts et al., 2013, 1). It includes the ability to apply ethical values, consider the implications of actions for society, work in multidisciplinary and multicultural settings and network to reach goals.

This model seems the most comprehensive for the purposes of researching socio-emotional skills for innovation. It details innovation skills and their manifestation. However, the distinction between awareness and actions, and emotional regulation aspects seem implicit in INCODE.

Berkeley Innovation Index

The Berkeley Innovation Index (Sidhu et al., 2016) is a method for assessing individuals' and organisations' innovation capacities. The Index considers five dimensions: strategy and leadership, organisational innovation culture, organisational operations, people's mindset and tactical measures.

The dimension of people's mindset looks at personal-level abilities, relevant for this thesis. The mindset is modelled into six dimensions: trust (learning to trust others), resilience (plan to experiment and plan to fail fast), diversity (of networks), belief ("believe that you can change the world"), perfection ("perfection is no good but good enough is perfect") and collaboration (teams and partners) (Sidhu et al., 2016, p. 8). These areas manifest in 18 items. Given that the Index is wide-ranging, and people's mindset is only one of five aspects, it includes fewer elements regarding individual socio-emotional skills than other models. They relate, however, to both self-oriented skills (like resilience and belief) and relationship ones (trust, diversity and collaboration). The feature of perfection could relate to responsible decision-making as it implies assessing choices.

21st century skills

The study "21st century skills: learning for life in our times" by Trilling and Fadel (2009) centres on skills to innovate and on innovative learning. The model proposes three dimensions of skills:

learning and innovation skills, digital literacy skills and career and life skills. The first dimension of learning and innovation skills is the most pertinent for this literature review. However, the dimension of career and life skills includes abilities such as flexibility and adaptability, initiative and self-direction, social and cross-cultural interaction, leadership and responsibility (Trilling and Fadel, 2009), that arguably also favour innovation.

Learning and innovation skills lay the foundations for becoming a "self-reliant lifelong learner" (Trilling and Fadel, 2009, p.52). Trilling and Fadel (2009) propose this area as involving three sub-dimensions: critical thinking and problem solving, communications and collaboration, and creativity and innovation. First, critical thinking and problem solving centre on cognitive aspects. Second, communications and collaboration include the capacity to listen effectively, communicate in diverse environments, work effectively and respectfully in teams and compromise to reach common goals (Trilling and Fadel, 2009). These all appear as socio-emotional skills coincident with relationship skills acknowledged in other models. Yet 21st century skills also consider, for example, the capacity to use multi-media technologies, that exceed the scope of socio-emotional ones. Third, creativity and innovation skills comprise thinking creatively, working creatively with others and implementing innovations. Working creatively with others relate to important SESI and is defined in sub-skills which include to develop, implement and communicate new ideas to others effectively, be open and responsive to new and diverse perspectives, incorporate group input and feedback into the work, demonstrate originality and view failure as an opportunity to learn (Trilling and Fadel, 2009). Also, the ability to implement innovations entails taking conducive actions based on creative ideas (Trilling and Fadel, 2009). The latter implementation aspect closely relates to entrepreneurial skills.

It is significant for this thesis' argumentation to observe that this well-known study on skills for the 21st century importantly centres on innovation-related skills. Many of the skills discussed are arguably socio-emotional, although they are not labelled as such or organised into categories that other works focusing on socio-emotional abilities use.

The Innovator's DNA

This model derived from practice informs about categories of skills for innovation, including socio-emotional aspects. Dyer et al (2011) studied around a hundred disruptive innovators, who invented or led companies based on revolutionary products, services and business ideas. They identified consistent patterns of action framed as *discovery skills*, which then validated with over five hundred innovators and over five thousand executives in seventy-five countries. They proposed an innovators' profile based on five discovery skills. One is a cognitive skill: associating. The other four

skills are labelled as behavioural skills: questioning, observing, experimenting and networking. The four behavioural skills -the authors argue- support associational thinking by providing 'building-block ideas' which provide the grounding for innovative ideas. Each skill characterises innovative behaviours and is critical for innovation processes.

Associational thinking "happens as the brain tries to synthesize and make sense of novel inputs. It helps innovators discover new directions by making connections across seemingly unrelated questions, problems, or ideas" (Dyer et al., 2011, p. 22). Those connections may be across areas of knowledge, industries and geographies. Hence, innovators cross-pollinate ideas in their own minds and in others'. Associating is regarded critically for generating innovative ideas. Questioning represents innovators' enquiry to understand how, why and how things are and might be changed. Observing implies watching the world in detail, inspired by compelling questions, engaging multiple senses and developing insights for new ways of doing things. Networking is important as innovators actively talk to diverse people, finding and testing ideas seeking for radical new points of view. Finally, when experimenting, innovators "deconstruct—products, processes, ideas—to understand how they work", explore the world intellectually and experientially (Dyer et al., 2011, p. 144). Experimentation, in the authors' views, is the best technique for generating data on what might work. It amplifies the set of ideas that permit divergent thinking when associating. Dyer et al. argue that the capacity to generate innovative ideas is developed as these five skills are practiced consistently (2011).

This model coincides in some respects with previously discussed ones; for example, in the importance of daring to experiment and to network. It also sheds new light by emphasising abilities like questioning and observing which comprise cognitive dimensions yet require socio-emotional abilities too and are considered behavioural because they matter when manifested in actions.

Ten Faces of Innovation

Another relevant grey literature and practice-based model informing on socio-emotional skills is 'The Ten Faces of Innovation: Strategies for Heightening Creativity' (Kelley and Littman, 2006). It nurtures the analysis of SESI from the perspective of different *personas* that innovators play. These represent roles and expandable talents. The analysis focuses on teams and organisations, where roles are complemented, and personas represent a latent organisational ability, often underdeveloped or unrecognised (Kelley and Littman, 2006).

Ten different personas fostering innovation are organised into three types:

- Learning personas (anthropologist, experimenter and cross-pollinator): they support organisations in gathering new sources of information for growth. They are humble to question their own perspectives, remaining open to new insights.
- Organising personas (hurdler, collaborator and director): they understand and act upon the fact that "even the best ideas must continuously compete for time, attention, and resources" (Kelley and Littman, 2006, p. 262).
- Building personas (experience architect, set designer, caregiver and storyteller): they "apply insights from the learning roles and channel the empowerment from the organizing roles to make innovation happen" (Kelley and Littman, 2006, p. 262).

Most personas and their traits embed previously discussed innovators' skills. For example, the director represents leadership, the cross-pollinator manifests networking skills and the collaborator excels in team-working. Other personas, still, contribute with different views on the skills required for innovation. Such is the case of the caregiver, who anticipates others' needs and looks after them, the anthropologist that enhances the relevance of observing, and the storyteller who reinforces how communication skills may compel others into a common task.

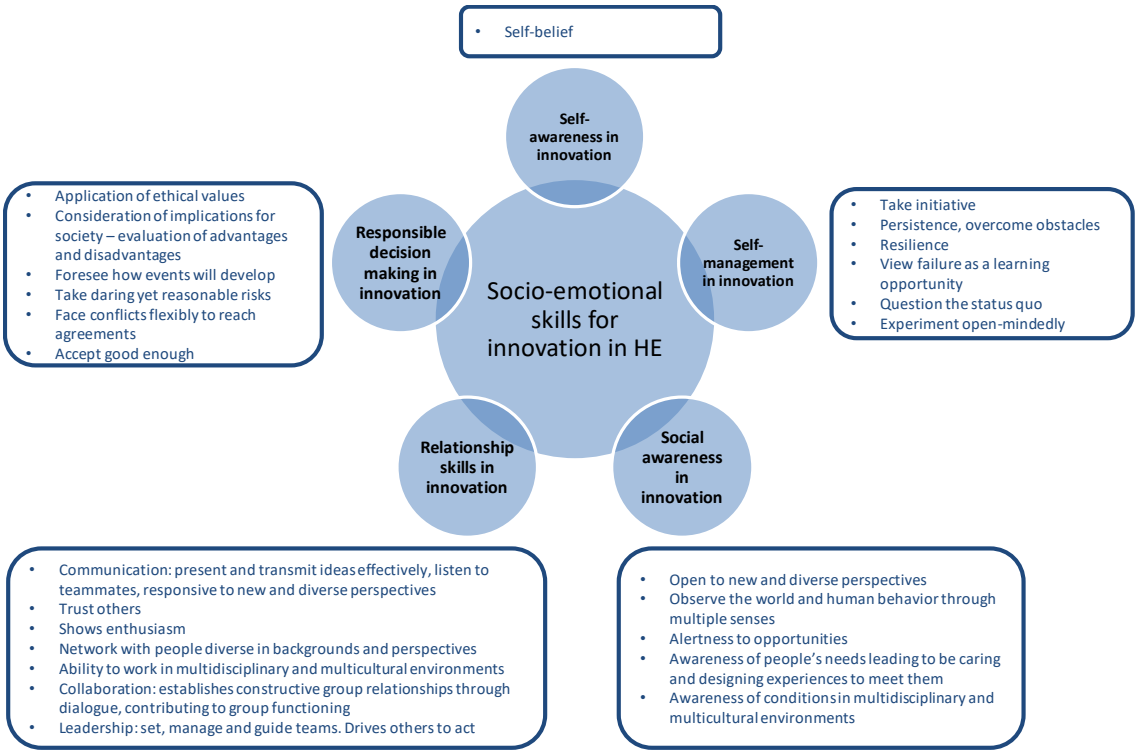
Discussion of innovation skills' categories

The six reviewed models emerge from different rationales, aims, enquiries and contexts. The methods used for identifying and analysing innovation skills also vary. The reviewed models aimed at: evaluating HE graduates' perceptions of the skills developed in HE in relation to those needed at work (Avvisati et al., 2013); contributing to innovation skills' development in HE (Watts et al., 2013); assessing personal and organisational innovation abilities (Sidhu et al., 2016); promoting learning in the context of current social, technological and work settings (Trilling and Fadel, 2009); understanding essential skills exercised by disruptive innovators (Dyer et al., 2011); and modelling roles that persons can dynamically play in innovation teams (Kelley and Littman, 2006). Considering these varied settings, the studies shed light on the presence of socio-emotional skills in the scope of innovation skills' literature. This is despite the implicitness of their socio-emotional character.

The specific skills that may be conceived as socio-emotional are described with varied degrees of specification and from different perspectives. Overall, however, from these studies it is possible to outline a set of socio-emotional skills that favour innovative behaviours. The next figure summarises them. They are organised into the five dimensions of the previously reviewed CASEL model of socio-emotional learning, i.e., self-awareness, self-management, social awareness, relationship skills and responsible decision-making. The lists of skills per category combine skills mentioned in different

models. They are not prioritised in the listing and they certainly overlap, both within and between categories. The organisation of skills into the five categories is based on my understanding of both, the skills as expressed altogether in the six studies and the five socio-emotional categories. Their labelling in certain categories may be debatable.

Figure 2. Summary of socio-emotional skills favouring innovation based on six innovation skills' studies



Source: author's based on reviewed literature and organised into CASEL's five categories of socio-emotional learning

As observed, considering the set of studies, the socio-emotional category of self-awareness is the less manifested one, showing only the skill of self-belief. Self-management displays a vaster range of skills, several of which I have labelled in this category because they show and require certain directedness, beyond awareness as the previous dimension. Abilities related to overcoming failure, such as persistence and resilience, are highlighted in the studies. This makes sense given the entailed uncertainty and risk in innovation processes. The dimensions of social awareness and relationship skills are well represented in this innovation skills' literature. The multiple skills outlined reflect innovation's collective character, in the sense that it is a process developed between people that network, collaborate and contribute with diverse perspectives in the ideation, development and implementation of novel solutions. Skills like openness and awareness of people's

needs are prominent in the social awareness dimension, which is consistent with innovation's purposiveness towards facing challenges. In the dimension of relationship skills, multiple aspects of communication and collaboration in diverse settings are emphasised. Finally, the dimension of responsible decision-making encompasses the application of ethical values and the consideration of decisions' societal implications. I have labelled in this dimension the ability to take daring yet reasonable risks because there is a response- ability in finding that balance. Yet, this dimension certainly incorporates significant intellectual aspects, which as previously discussed, in practice are inseparable from the socio-emotional sphere. Overall, the collection of skills emphasises more the interplay with others than with oneself. They reflect the collective nature of innovation, but probably underestimate the importance of knowing oneself in acting innovatively.

Some skills mentioned in the six studies that are not socio-emotional in essence, but rather technical or cognitive are not shown in this summary. An important aspect to report, however, are those related to creativity. As noted above, creativity underpins innovation through the collective creation of novel ideas (Csikszentmihalyi, 2010) and requires "non-intellective traits such as motivation, perseverance, and autonomy" (van Tassel-Baska, 2013), which may be regarded as socio-emotional skills. Creativity, however, tends to be labelled as a thinking skill, which seems coherent from a cognitive perspective but does not make explicit its socio-emotional aspects. Given the importance of these social and emotional aspects, notably the interaction with others in nurturing creative processes, I regard creativity in this thesis as both, a cognitive and a socio-emotional ability.

In the six reviewed studies, multiple skills related to creativity are discussed. These include the abilities to: be willing to question ideas, use a wide range of idea-creation techniques, associate and cross-pollinate ideas to create novel and worthwhile ideas, present creative ideas and new ways to implement them, evaluate and refine creative ideas, understand the limitations in adopting new ideas and understand creativity and innovation as a long-term cyclical process. Arguably, these skills required in creativity processes embed entwined cognitive and socio-emotional skills.

Concluding, these studies and their typologies of skills for innovation assist the conceptualisation of 'socio-emotional skills for innovation in HE' by informing on specific skills or families of skills that matter for innovation. However, the literature on skills for innovation is limited, especially when looking at socio-emotional skills and their characterisation. Models specifically dedicated to this subject are yet to be developed.

Conclusion on innovation and innovation skills

This section reviewed the concept of innovation and innovation skills, focusing on socio-emotional ones. It was organised in three sub-sections. First, I introduced the notion of innovation discussing three key features observed in the literature: its novelty, collective and applied character. Then, I examined how prominent approaches towards the dynamic concept of innovation shape ideas about the skills required for innovation. Finally, I explored the presence of socio-emotional skills in the innovation skills' literature.

Overall, innovation can be regarded as a collective process of developing and implementing new ideas which may transform aspects of society. Innovation is closely related to creativity and to entrepreneurship, and the boundaries between these concepts are blurred, varying according to the conceptual perspectives taken. Their relation may be outlined in that ideas are generated through creativity processes. Ideas are then arranged, developed and implemented in innovation processes, being entrepreneurship a phase where innovations are set to create societal and economic value. Innovation may be fostered systematically and capacities to enhance certain types of innovation are feasible to develop. This include personal, organisational and systemic-level capabilities. While innovation may support social progress and economic development, its unforeseeable nature may also lead to undesirable outcomes, according to the ethical lens used when judging its consequences. The multiple dimensions and perspectives encompassed in the notion of innovation imply that discussing skills for innovation, even at the personal level, entails many aspects.

Different understandings of innovation and its role in society inspire the need to develop varied sets of skills that support innovation processes. However, these distinct emphases are unnoticeable in the literature looking at skills for innovation beyond specific innovation's theoretical underpinnings. The innovation skills' literature is limited, though, and the used categorisations of skills tend not to consider the socio-emotional character of some skills. Still, several of these socio-emotional skills are included in the models, although this nature is unnamed. An exploration of six studies suggests that socio-emotional skills related to social awareness and relationship abilities are more prominent in the literature than those related to self-awareness and self-management. It is unclear, though, why the latter are discussed less. Also, the explanation of skills' relevance in innovative behaviours is generally missing. Thus, multiple knowledge gaps emerge from the literature review focused on socio-emotional skills for innovation, gaps which are accentuated when exploring these in the HE context.

C. Knowledge gaps

The literature review about socio-emotional skills that favour innovation evidenced a conceptual gap between the notions of socio-emotional skills and innovation skills. Their bodies of literature seem disconnected. However, their potential link is valuable because, as discussed in the review, many relevant skills promoting innovating behaviours are of a socio-emotional nature. These are, nevertheless, overlooked as such. That is, after examining the innovation skills literature from a socio-emotional perspective, I conclude that numerous skills possible to label as socio-emotional matter for innovation, but they are not characterised accordingly. This implies that the understanding of innovation skills and of their development could be improved by explicitly bridging the bodies of literature around innovation skills and socio-emotional skills. Consequently, the integrated notion of 'socio-emotional skills for innovation', which has been underexplored, offers potential benefits to the research and educational practice of innovation skills.

I observe multiple knowledge gaps and opportunities for research, grouped into three areas: the identification, characterisation and rationalisation of skills favouring innovation; the recognition of socio-emotional skills as part of innovation skills; and the means through which skills for innovation, and notably socio-emotional ones may be developed in HE contexts.

1. Identification and characterisation of skills that facilitate innovative behaviours, and the rationale for their contribution

The understanding of the relationship between different types of skills and innovation is still limited. The OECD (2011) stated this challenge clearly:

> "It is difficult to make explicit links between specific skills and innovation. The broad definitions of skills and innovation, the difficulty of measuring human capital and innovation outputs and outcomes, and the relative scarcity of innovation-specific empirical studies all serve to limit the identification of such relationships and thus the precision of policy messages" (p. 9).

That is, the **identification** of skills that favour innovative behaviours is discussed in various studies, but they do not seem to clearly converge. This may derive, however, from the multiple innovation stages and contexts which benefit from different skills. Still, despite variations on the identified relevant skills, their **characterisation** generally lacks explanations of skills' meaning in theory and practice. An exception is, for example, the INCODE project work that developed rubrics to describe

and assess skills (Watts et al., 2013). Importantly, the literature on innovation skills also tends to overlook the **rationale for the importance** of certain skills for innovation. The social and psychological processes through which skills promote innovation behaviours are generally omitted in the innovation skills literature.

2. Recognition of the socio-emotional nature of some skills for innovation

The socio-emotional dimension of some skills for innovation seems acknowledged only implicitly and indistinctly in the innovation literature. Innovation skills' studies include skills such as self-belief, perseverance, empathy and communication, that may be characterised as socio-emotional, but this nature is largely omitted. In studies categorising innovation skills (e.g., Avvisati et al 2013; Dyer et al 2011; Watts et al 2013), socio-emotional-related skills are mainly identified as behavioural, relational, interpersonal or non-cognitive. These other terms are of course legitimate and pertinent according to the qualities of skills being explored. However, surprisingly, the relatively developed notion of socio-emotional, used to characterise skills in other contexts including school-level education (e.g., Durlak 2015) and social progress (e.g., OECD 2015), is underused in the sphere of innovation skills.

Therefore, skills for innovation and socio-emotional skills (and socio-emotional learning) are still conceptually disconnected, despite their underlying meaningful bond. This disconnection hinders the understanding of innovation skills' nature and consequently, their intentional development. Recognising socio-emotional skills for innovation as such would facilitate their characterisation and promotion and bring into the sphere of innovation education the knowledge available in the area of socio-emotional learning. Enhancing a shared working vocabulary on skills for innovation, including terms to describe their nature, seems necessary for researchers and practitioners in the field of IE.

3. Development of skills for innovation, especially socio-emotional

As the previous literature review has illustrated, skills for innovation are developable. But knowledge on pedagogical practices for innovation education is limited: "[t]he number [of researchers] is getting even smaller if one looks at those scholars who address the issue of *how* to develop innovators" (Shavinina, 2013, p. xxvii). This is accentuated when focusing in HE, where arguably, theory lags practice. While innovation education programmes grow, the understanding of its learning processes is still limited. Educational and pedagogical strategies that foster the development of skills for innovation, including socio-emotional ones, require further exploration.

This implies understanding the nature of skills and exploring their (social) learning process, including the role of facilitators-educators and the implications of cultural contexts. Crucially, too, it requires exploring learners' responsibility and agency.

Knowledge gaps on the development of innovation skills in HE are heightened when looking at those of a socio-emotional character. In the socio-emotional learning literature, coincidentally, the HE sector is also disregarded, and the limited HE-oriented literature centres on health and wellbeing (Conley, 2015), rather than on academic-related purposes such as innovation skills. Thus, research on teaching-learning processes to foster socio-emotional skills in HE are restricted twofold: from the perspectives of socio-emotional learning literature that centres on school-level education and of innovation skills literature, that is in itself scant.

Consequently, the literature review suggests a significant gap in the understanding of socio-emotional skills that favour innovation, despite abundant yet separate knowledge on both, innovation processes and socio-emotional skills. The literature about the development of these skills, is even lesser. Therefore, studying the integrated notion of 'socio-emotional skills for innovation' (SESI) in HE may contribute to further understanding skills for innovation and their development processes, and to bring forth innovation education's full potential.

D. Research questions: What socio-emotional skills enhance innovation? How do universities promote them?

The literature review and the knowledge gaps identified, in dialogue with my interests as a researcher, led to the following directions for research. My purpose is to deepen our understanding of the socio-emotional dimension of skills for innovation and of their pedagogical promotion in universities active in innovation education. The research questions are the following:

Main research questions:

1. What socio-emotional skills contribute to innovative behaviours and how do they support such behaviours, from the perspective of participants in undergraduate innovation education programmes?
2. How are socio-emotional skills for innovation pedagogically facilitated by educators in undergraduate innovation education programmes?

Specific questions:

The first research question aims to identify, characterise and explain how socio-emotional skills enhance innovative behaviours, having the following sub-questions:

1.1 Which skills of a social and emotional nature enhance innovative behaviours?

1.2 How are these socio-emotional skills for innovation characterised by learners and educators participating in innovation education programmes?

1.3 Why are these socio-emotional skills relevant in promoting innovative behaviours? What is the rationale explaining the skills' importance in innovative behaviours?

The second research question involved the following sub-questions:

2.1 What types of pedagogical approaches are relevant in enhancing the development of socio-emotional skills for innovation?

2.2 What roles do students play in their own and their peers' development of socio-emotional skills for innovation?

The first line of enquiry explores skills for innovation from a socio-emotional perspective, in university undergraduate innovation education programmes. I acknowledge that different skills are relevant in different contexts. This includes varied innovation approaches, stages and types; innovation problems or challenges; and people working on them. This diversity is possibly reflected in innovation education in HE. Thus, I consider the term 'innovation' in this thesis widely. For the same reason, i.e., the vastness of manifestations of innovation, the study does not intend to hierarchise socio-emotional skills. Their pertinence is context dependent and throughout the analysis I characterise skills' contexts, as relevant and feasible.

The second line of enquiry aims to analyse pedagogical methods that -intentionally or not- support the development of SESI. As evidenced in the literature, innovation is a collective process aimed at developing novel solutions and involves socio-emotional skills which facilitate the understanding and relation with oneself and others. I thus remained alert during data collection and analysis to any issues about these relationships and implied collaborations that might be identified as impacting on pedagogy. This includes the students' partaking in their own and others' learning process, and collaboration with people with different backgrounds through networks, group work, engagement with the wider community and generally, activities entailing working with others.

Concluding, this thesis proposes and develops the notion of 'socio-emotional skills for innovation' and explores it empirically. SESI build upon bodies of knowledge that are generally disconnected: socio-emotional learning and innovation skills. The integration of these terms is underexplored, as is SESI's development in HE. The research questions focus on the identification and characterisation of socio-emotional skills that favour innovative behaviours and on SESI's pedagogical promotion in undergraduate innovation education.

Chapter 3. Theoretical Framework: lenses for understanding socio-emotional skills and learning

My interest in researching the nature, promotion and development of socio-emotional skills for innovation (SESI) in university settings, predisposes me to develop a theoretical framework that integrates ideas about learning, socio-emotional skills and skill development in HE. This range of theories illuminate the analysis providing relevant conceptual tools. They derive from different currents and are, in my view, compatible. In this chapter and throughout the thesis I establish conceptual bridges between the theories. The theoretical lenses used include foundational approaches identified before data collection in relation to the research questions (e.g., socio-emotional learning model) and others incorporated during the main analytical phase to conceptualise emerging patterns observed in the data that required other analytical instruments (e.g. boundary-crossing, community engagement). These are all introduced in this chapter to scaffold the concepts and theories illuminating the empirical analysis.

According to the literature review, both, socio-emotional skills and innovation skills, embed significant collective work, contextualised practice and personal growth in their learning processes. These aspects frame the integrated notion of SESI and their development, which I investigate. Consistent with these features, I consider that learners play a central role in their meaning-making processes (Biggs, 1996) and that learning is fundamentally social, entailing intrapersonal and interpersonal processes (Vygotsky, 1978), i.e., that learning is socially constructed. Further, learning as a social practice is based on the active participation in social communities (Wenger, 1998). Thus, I conceive learning as an inherently agentic social process. This complex process involves then, the integration of internal and external (direct or indirect) interaction between the learner and his/her socio-cultural environment, and three interrelated dimensions of learning: 'content', this is, what is learnt (knowledge, skills, attitudes, values, behaviours, among others); 'incentive' or 'emotion' (feelings, motivation and volition); and 'society' or 'interaction' (action, communication and cooperation) (Illeris, 2018, 2002). Learning's experiential, multidimensional, agentic and social features are represented in the following definition:

> "Human learning is the combination of processes throughout a lifetime whereby the whole person – body (genetic, physical and biological) and mind (knowledge, skills, attitudes, values, emotions, beliefs and senses) – experiences social situations, the perceived content of which is then transformed cognitively, emotionally and practically (or through any

> combination) and integrated into the individual person's biography resulting in a continually changing (or more experienced) person" (Jarvis, 2018, p. 19).

Amongst learning multiple facets and understandings, for analysing SESI and their development in university education, I put special attention to three aspects of learning: its social participation, transformational and socio-emotional dimensions. Thus, I centrally draw on ideas of Situated (Lave and Wenger, 1991), Transformative (Mezirow, 1991) and Socio-emotional (Durlak, 2015; Elias, 1997) theories of learning.

First, learning situatedness means that learning is a relational social practice in which persons negotiate meaning and where "agent, activity, and the world mutually constitute each other" (Lave and Wenger, 1991, p. 33). Situated learning emphasises learners' active participation in dynamic communities where practices are developed and transformed (Lave and Wenger, 1991). These notions are starting points for my analysis and are embedded assumptions throughout the thesis. They inform both lines of enquiry. Apprehending SESI as a social practice helps in examining the processes through which these skills support innovation -which is also a social practice (first research question). It also assists in studying SESI's promotion and development, as a relational and participatory process (second research question). This intrinsic social character of learning complements the rather personal viewpoint of transformative learning.

Second, Transformative Learning theory centres on the possibility of transforming perspectives as the frames of references, including assumptions and dispositions, are questioned, leading to the development of abilities and reintegration of new perspectives (Mezirow, 1991). The theory's initial individual cognitive focus has expanded into social, emotional, intuitive and spiritual dimensions as the theory evolves (Cranton, 2016). I draw on transformative learning to analyse learning experiences in the development of SESI, bridging the identification of SESI and pedagogical approaches that favour their development (integrated discussion of first and second research questions).

Third, given that I research socio-emotional skills, socio-emotional learning is a key conceptual tool. I resort to the model developed by CASEL, reviewed in Chapter 2. The Systemic Social and Emotional Learning framework (CASEL, 2016b; Durlak, 2015) offers a structure to organise socio-emotional skills into five dimensions, namely self-awareness, self-management, social awareness, relationship skills and responsible decision-making. I use this structure to analyse and characterise SESI (first research question) and to order the contributions of two emerging boundary-crossing practices, cross-discipline and community engagement, to SESI development (second research question).

These three theories of learning founding the theoretical framework highlight different facets of learning, yet they coincide in essential features. Situated learning, transformative learning and socio-emotional learning agree in the continuous meaning-making process experienced by the learner (noting to varied degrees entwined relational aspects). The theories conceive learning as a process of change, transformation and growth, leading to developed skills and shifted identities. They also consider the whole person, recognising (also with diverse emphases) cognitive and socio-emotional dimensions of being. These concurrent elements ground my understanding of learning and altogether define core assumptions about learning that I consider for analysing SESI and their development in university innovation programmes. These assumptions contend that learners experience and develop skills in unique learning processes dialogically built with the communities in which they participate, that learners can potentially transform their perspectives through learning experiences, and that these processes encompass social and emotional aspects.

I complemented the initial theories (situated, transformative and socio-emotional learning theories) with a second set of theories as a response to emerging issues and themes revealed by the empirical analysis of practices facilitating SESI in Minors Innovation (second research question). The findings required additional conceptual tools to complement the foundational learning theories. Project-based learning, cross-disciplinary learning, community engagement and boundary-crossing all help to understand the dynamics through which SESI development is facilitated in university innovation programmes. I introduce these theories in this chapter to keep consistency in the discussion of key concepts supporting the analysis, and for the readers to familiarise with these concepts that take more relevance as the thesis progresses.

It emerged from the data that the facilitation of SESI (intentional or unintentional) in Minors Innovation occurs largely through work in projects. That is, students work in highly autonomous groups tackling real-world questions or problems, exploring and designing solutions. These features characterise Project-based learning (PjBL) (Thomas, 2000). Therefore, I draw on this constructivist and learner-centred approach (Prince and Felder, 2006) to understand practices supporting SESI development (second research question). This PjBL platform serves as a strategy to promote learning by crossing disciplinary and organisational boundaries, other processes identified in the studied innovation education programmes.

Innovation and its underpinning creativity process are nurtured by integrating diverse perspectives (Csikszentmihalyi, 2010; Welz, 2003). Socio-emotional skills that contribute to innovation as reported in the literature include the ability to work in multidisciplinary and multicultural

environments (Watts et al., 2013). Boundary-crossing theory helps in explaining the practice and development of this and other SESI that improve through the association and collaboration between people from diverse cultures -in broad terms. Boundary-crossing is one of the practices that mediates learning, where learners deal with varied forms of expertise (Griffiths and Guile, 2003). A boundary represents a "socio cultural difference leading to discontinuity in action or interaction", and boundaries are present in all learning, manifested in varied forms (Akkerman and Bakker, 2011a, p. 133). Two types of boundaries were observed in the university innovation education programmes studied: cross-disciplinary and cross-organisational boundaries. Students may work in projects with peers from different disciplines and with partners from the broader community, outside the formal (increasingly diluted) university boundaries. I have framed cross-disciplinary learning and community engagement for learning as two forms of boundary-crossing that favour the development of SESI (second research question).

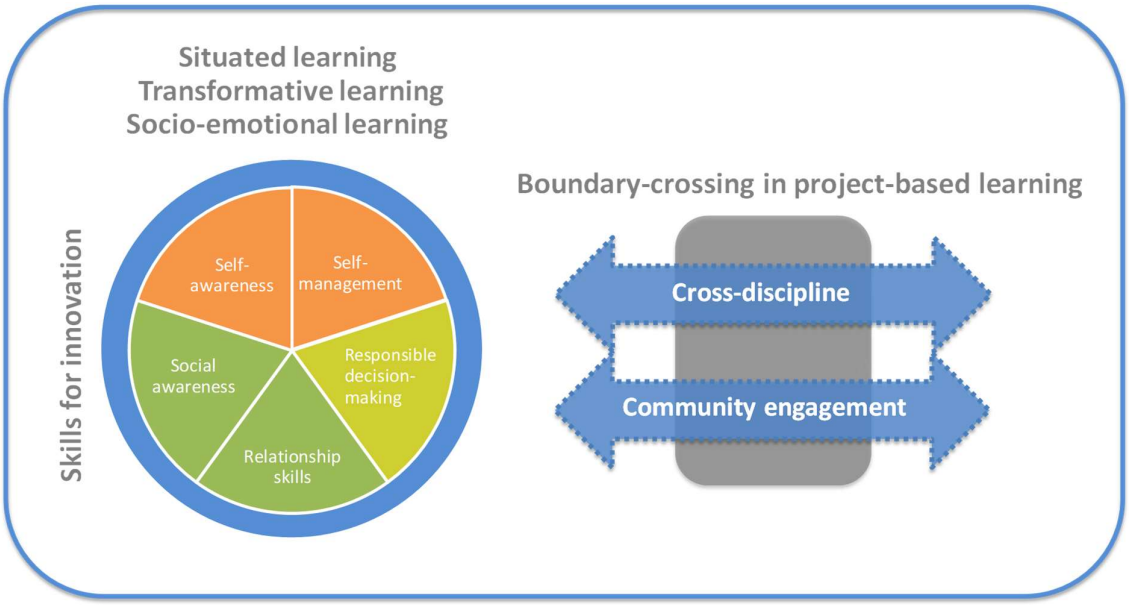
Work across disciplines permits different levels of disciplinary expertise assemblage. Multi-disciplinary work represents the juxtaposition, interdisciplinary shows the integration, and transdisciplinary denotes the creation of new disciplinary perspectives, which in the latter case may also incorporate non-academic insights (Greef et al., 2017). In the context of PjBL, work across disciplinary boundaries permits the development of skills favouring innovative behaviours.

I use the term 'community engagement for learning' to describe another key boundary-crossing process that as emerged, centrally encourages SESI. This occurs through universities' *glonacal* engagement, where persons and organisations collaborate at the local, national and global levels (Marginson and Rhoades, 2002). Community engagement has the potential to benefit both, student learning and societal development (Yamamura and Koth, 2018). Community engagement for learning helps to conceptualise the role of these alliances in developing SESI, notably by permitting students' connection with 'real-world' problems and problem-holders.

Therefore, in working on both lines of enquiry, i.e., the identification, characterisation and rationalisation of socio-emotional skills that favour innovative behaviours, and the analysis of their facilitation in university innovation programmes, I draw on multiple theoretical approaches rooted in socially situated, potentially transformative and socio-emotional conceptualisations of learning. The inherent innovation facet of SESI is considered based on concepts reviewed in Chapter 2. Importantly, I consider innovation as a collective, purposeful and skill-based activity nurtured by the integration of diverse perspectives for designing and implementing novel solutions.

The following figure presents the theoretical framework used. The specific contributions of each theory and their distinctions are discussed after.

Figure 3. Theoretical framework: Socio-emotional skills for innovation in university education



Source: author's, considering the five dimensions of the Systemic Social and Emotional Learning framework (CASEL, 2016b).

A. Baseline theories of learning

1. Situated learning

My interest in researching SESI and their development in HE, predisposes me to emphasise the social nature of learning, because as discussed, innovation is a collective creative process requiring social skills for collaborating, questioning premises and developing integrated novel solutions. Situated learning (Lave and Wenger, 1991), leading to Social theory of learning (Wenger, 1998), centres on learners' participation in the social world and their interdependency with the world in the development of collective understandings and practices.

This relational process was anchored by Lave and Wenger (1991) as 'communities of practice': social and dynamic learning systems where persons sharing interests regularly interact and realise transformational learning. Communities of practice build on three elements: their domain of interest, the community in which relationships are built and learning occurs, and the practice as a

specific type of interaction performed by practitioners (Lave and Wenger, 1991). The term 'practice' is considered broadly -not as distinguishing the theorical or abstract from the practical or manual, but encompassing all of these, as a 'social production of meaning' (Wenger, 1998, p. 49). The interaction among members of a community of practice considers a network dimension; however, not all networks are communities of practice since networks do not necessarily lead to a shared competence in a particular domain of practice (Lave and Wenger, 1991). This social creational feature determines the future of the community, which takes place in generative, developmental and reproduction cycles, transforming newcomers into old-timers (Lave and Wenger, 1991). In the context of these communities, learners develop new identities and individually and collectively forge meaning of experiences. Consequently, in Wenger's seminal proposition (1998), learning as social participation is founded in four elements: the community, conceiving 'learning as belonging'; practice, representing 'learning as doing'; identity, reflecting 'learning as becoming'; and meaning, denoting 'learning as experience'. These entwined dimensions establish Wenger's Social theory of learning (1998).

Learning in communities of practice may occur in any domain of human endeavour (Farnsworth et al., 2016). One of them may be innovation education in HE, including students, educators and other participants in educational activities and learning processes. As discussed in Chapter 2, innovation is a collective endeavour requiring abilities to work with others. Accordingly, I consider this idea that learning is situated and not only contextualised, but embedded in co-creational social systems, as a base assumption for apprehending SESI and their development in university programmes. This assumption has implications for the analysis. Learning is 'situated' not only in time, location and social context; but in the participation of the "person-in-the-world, as member of a sociocultural community" (Lave and Wenger, 1991, p. 52). That is, the Minor Innovation 'contexts' are interdependent with the relations among learners and between them and other participants, as they partake and co-develop social practices.

This approach also differentiates between intentional instruction and learning; while learning "can take place where there is teaching", intentional instruction is not "in itself the source or cause of learning" (Lave and Wenger, 1991, pp. 40–41). Agreeing with this fundamental distinction, throughout the analysis I attempt to distinguish -data permitting- between purposeful stimulation, unintentional facilitation and learning experiences.

An overarching claim of this theory is that through learning as social participation we *transform* ourselves, our communities and the practices in which we engage. This premise underlies this

thesis. The transformational aspect is consistent with, and highlighted in, the next fundamental theory of learning grounding my understanding of this social process.

2. Transformative learning

Transformative learning theory contributes with a compatible yet different theoretical lenses to this framework: it centres on the transformative potential of the person. Persons can expand their frames of reference through learning processes triggered by disorienting dilemmas, involving questioning of assumptions and beliefs, and developing abilities to reintegrate new perspectives in actions (Mezirow, 1991). Transformative learning theory has evolved, acknowledging critiques about its original abstract, de-contextualised and idealised nature (Taylor, 2007). The predominant centre on the individual has incorporated the social context (Mezirow and Taylor, 2009), the focus on cognitive learning has expanded into emotional, relational and spiritual dimensions (Cranton, 2016) and the theorisations about learning processes have incorporated practical aspects for its implementation in formal education settings (Taylor, 2007).

In that sense, transformative learning complements the other core learning theories supporting this thesis, social theory of learning and socio-emotional learning. Transformative learning focuses on the person yet recognises the relationship with the environment and the socio-emotional aspects involved. This theory nurtures the study of SESI because, as discussed in Chapter 2, innovation (and its precedent phase of creativity) requires new perspectives that imply examining and changing the frames of reference (Seelig, 2013). Moreover, the development of socio-emotional skills, for example in terms of self-knowledge and the interaction with others, are some of the abilities developed in transformative learning processes (Hoggan, 2016). I draw therefore on transformative learning theory to explore the processes of developing SESI in university students.

Proposed originally by Jack Mezirow (1991) as an adult learning theory, transformative learning considers perspective transformation as a central element. Mezirow proposed that a frame of reference is a meaning perspective: the structure of assumptions and expectations through which we select perception, cognition, feelings and dispositions, providing the context for making meaning (2000, p. 16). A frame of reference encompasses a habit of mind, i.e., “a set of assumptions- broad, generalized, orienting predispositions that act as a filter for interpreting the meaning of experience” (Mezirow, 2000, 17) based on our background, experience, culture, and personality (Cranton 2016). When a person revises prior belief systems, responding to an alternative habit of mind, transformative learning occurs (Cranton 2016). This process may be triggered by a single event, labelled a disorienting dilemma or can occur gradually (Cranton 2016).

Critical self-reflection of assumptions is central, implying a "critique of a premise upon which the learner has defined a problem" (Mezirow, 1998). Importantly, the results of transformative learning may be of a cognitive, relational and social critique nature (Cranton 2016).

Especially relevant in the context of innovation education, is the notion of 'reframing the problem', that is, adopting a new justified meaning perspective:

> "Transformative learning is a way of problem solving by defining a problem or by redefining or reframing the problem. We often become critically reflective of our assumptions or those of others and arrive at a transformative insight, but we need to justify our new perspective through discourse" (Mezirow, 2000, p. 20).

The capacity to reframe problems by questioning our assumptions is critical for innovation. In both, innovation and transformative learning theories, there is an intentionality in such reframing. In innovation, it permits different ways of understanding the innovation challenge and supports creative ideation. In transformative learning, although reframing does not instrumentally seek innovation (external, to the individual), it steers a perspective transformation, since people can self-direct towards being or not critically self-reflective (Cranton 2016). That is, we "transform our taken-for-granted frames of reference (meaning perspectives, habits of mind, mind-sets) to make them more inclusive, discriminating, open, emotionally capable of change, and reflective so that they may generate beliefs and opinions that will prove more true or justified to guide action" (Mezirow, 2012, p. 76). Still, the notions of perspective transformation and frame of reference have lacked conceptual precision in original transformative learning propositions, gaining clarity from empirical studies (Taylor, 2007).

Educationally, it is unpredictable which experiences will promote shifts in perspective, but critical self-reflection and self-knowledge "are fostered when individuals encounter a point of view that is different from their own" (Cranton, 2016, p. 120). Then, pedagogical practices that facilitate such encounters, like collaboration among people with different backgrounds, may promote transformative learning. Reviewing empirical studies drawing on transformative learning theory, Taylor (2007, p. 182) found that "learning experiences that are direct, personally engaging and stimulate reflection upon experience" were power tools to stimulate the transformation of perspectives. Also, prompted by the study programmes' timelines, milestones and assessments, students unleash a "desire to change" (Taylor and Cranton, 2013), generating openness for reviewing their perspectives. This is reflected in project-based learning, explored later in this chapter.

Transformative learning theory supports the analysis of university students' learning experiences, focusing on the critical questioning of assumptions, shift of perspectives and preparation for changed actions. Elements facilitating these processes are discussed through the notion I propose of 'learning catalysts' (Chapter 9), which draws on transformative learning theory to characterise transformative learning processes that in some cases seems to occur.

3. Systemic Social and Emotional Learning framework

A third key conceptual tool I draw upon is socio-emotional learning. It emphasises socio-emotional skills and their development, central to my enquiry. Socio-emotional learning complements and is consistent with the two other learning theories introduced, focusing on social participation and on the transformative potential of learning. In Chapter 2, I introduced the socio-emotional learning framework developed by CASEL, which I adopt in my theoretical framework. This section explores it further and supports my choice for selecting it.

CASEL, the Collaborative for Academic, Social, and Emotional Learning, is an institution conducting research and supporting policy and practice of socio-emotional learning. For the past two decades, CASEL has developed the Systemic Social and Emotional Learning framework, understanding socio-emotional learning as "the capacity to recognize and manage emotions, solve problems effectively, and establish positive relationships with others" (Zins and Elias 2007, p. 234). Key conceptual milestones of the framework's development are the publications "Promoting social and emotional learning: guidelines for educators" (edited by Elias et al, 1997) and the "Handbook of Social and Emotional Learning: Research and Practice" (edited by Durlak et al, 2015). This work regards aims to prepare people for our complex and rapidly-changing world, acknowledging that socio-emotional development is central in multiple facets of life, from academic achievement to healthy relationships and responsible citizenship (Elias, 1997), leading ultimately to more peaceful societies (Darling-Hammond, 2015).

The CASEL model is based on five interrelated domains of cognitive, affective, and behavioural competencies (Conley, 2015, p. 198):

1. Self-awareness: accurately recognising one's own thoughts and emotions, and their influence on behaviours; accurately assessing one's strengths and limitations possessing a well-grounded sense of self-esteem, self-efficacy, self-confidence, perceived control, and optimism;

2. Self-management: effectively regulating one's thoughts, emotions, and behaviours; managing stress; savouring emotional well-being; successfully engaging in skills such as coping, problem-solving, mindfulness, relaxation, and positive and productive thinking;

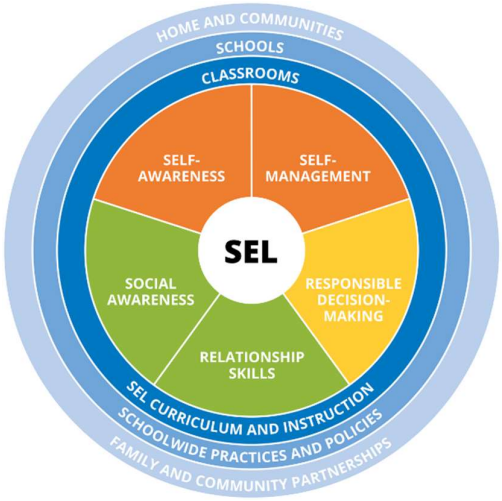
3. Social awareness: identifying appropriate social resources and supports; displaying accurate perspective taking, respect for others, and empathy;

4. Relationship skills: establishing and maintaining healthy relationships; seeking and providing help when needed; communicating effectively; negotiating conflict constructively; solving interpersonal problems; and

5. Responsible decision-making: making constructive, responsible and ethical choices that promote self and other well- being; effectively managing goals, time and tasks.

As shown in the next figure, the model emphasises the contextualised nature of learning, at different levels. Contextual elements include the curriculum and educational institutions in formal education settings, and the broader community (CASEL, 2016b). Learners, learning practices and learning contexts are mutually re-constructed; that is, learning is affected by the learning context and the context is also influenced by learning practices and their agents.

Figure 4. Framework for Systemic Social and Emotional Learning



Source: CASEL, www.casel.org

The CASEL framework supported the exploration of socio-emotional skills for innovation in this thesis. I analysed and organised SESI into CASEL's five interrelated socio-emotional dimensions: self-awareness, self-management, social awareness, relationship management, and responsible decision-making. The pertinence of CASEL framework for this thesis is manifold. First, the

framework suits the integration between socio-emotional and innovation skills. I formulate a dialogue between this framework of socio-emotional learning with other existing models of innovation skills, and centrally, with the empirical data on socio-emotional skills for innovation. The five CASEL dimensions apply to innovation skills and the framework is flexible enough for developing this intersection. Second, the framework supports fundamental principles of socio-emotional skills that I am considering, such as the integration of cognitive, affective, and behavioural domains, and the relevance of the learning context. Third, the framework stimulates agency, notably in students as they manifest socio-emotional skills. The dimensions of self-management, relationship skills and responsible decision-making show enacted skills, expressed in actions. This is central to the analysis of innovation skills, also exercised. Fourth, the framework considers the personal level which I research, while acknowledging the collective development of skills through the interaction between students and their peers, educators and the broader community in which students participate. Fifth, the four first dimensions agree with central aspects discussed in the broader literature in social and emotional skills. Awareness and action, about/with oneself and others guide the analysis. In that sense, it is a good integrative framework of literature on the subject. Sixth, the fifth dimension of the CASEL framework, responsible decision-making, is critical in the practice of innovation, given that innovation is not value neutral, and it has the potential to benefit or to harm depending on how systemic decisions are taken. Thus, for ethical innovation education it is critical to incorporate the responsibility aspect which the CASEL model proposes. Seventh, the framework's dimensions and associated competencies or skills have been applied vastly in educational settings. While the school-level setting has dominated, work in HE is increasing and relevant too. All of the above, added to the seemingly inexistence of a socio-emotional framework specifically for innovation education, makes the CASEL framework a good analytical structure for analysing SESI.

Therefore, three theories of learning provide the foundation for analysing SESI and their development: situated learning -focusing on the social participatory essence of learning-, transformative learning -examining the transformation of perspectives through the questioning of assumptions- and socio-emotional learning- analysing the development of socio-emotional skills. While these theories explore learning from different viewpoints, they seem compatible and altogether ground this theoretical framework.

B. Theories to analyse the practice of university innovation education

Complementing the theories discussed above, a second set of concepts and theories is used in order to support the analysis by centring on specific aspects of learning, pedagogical approaches and skill development. Developing meaning about the facilitation of SESI in university innovation education -my second line on enquiry- required the integration of additional concepts related to key emerging pedagogical approaches promoting SESI. As the empirical analysis unfolded, notions related to project-based learning, cross-disciplinary learning, community engagement and boundary-crossing gained relevance and these concepts, thus, were drawn upon.

1. Project-based learning (PjBL): group work in authentic innovation challenges

Project-based learning emerges as a key strategy used in innovation education that favours SESI and provides the practical basis for other pedagogical approaches. Thus, I draw on PjBL ideas to conceptualise the development of SESI.

During the last two decades, advanced economies have shifted the organisation of work from occupational and organisational specialisations towards interprofessional teams working around projects (Guile and Lahiff, 2017). This tendency has manifested also in HE, increasingly adopting project-based learning (PjBL) as means to prepare students for work life (Prince and Felder, 2006). PjBL is a constructivist, inductive, active, collaborative learner-centred pedagogical approach; that is, learners take significant responsibility for their learning, making meaning of their experiences and engaging cooperatively in questions or problems (Prince and Felder, 2006). In this sense, PjBL agrees with the agentic nature of learning proposed in situated, transformative and socio-emotional learning theories, although PjBL is a cognitive-oriented approach. Moreover, PjBL occurs collectively in what may be deemed as communities of learners bonded by the project as a common domain of interest. Situated learning theory thus, may shed light on PjBL processes from the perspective of leaners' interactions.

PjBL is characterised by two features: a question or problem that guides students' activities, and a resulting set of products or artefacts that tackle the problem (Blumenfeld et al., 1991). Based on a literature review, Thomas (2000) proposes that:

> "[P]rojects are complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision-making, or investigative activities; give

students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations" (p. 1).

Through PjBL learners may enhance technical, scientific and social skills (Heitmann, 1996). According to Heitmann (1996), "besides creatively solving a certain technological, industrial or societal problem, the main advantage of project orientation is the personal development focusing on skills and attitudes and not on comprehensive knowledge" (1996, p. 128). Such personal development relates to socio-emotional skills, unveiling therefore an implicit connection between PjBL and socio-emotional learning.

Motivation, self-regulation, collaboration and responsibility are some socio-emotional skills facilitated by PjBL. These relate to the authentic work involved in PjBL: the initial question or problem are based on real-world problems (Blumenfeld et al., 1991; Stefanou et al., 2013) and other aspects such as the tasks, roles, context, collaborators, products, audiences and assessment criteria used in students' work may be authentic too (Thomas, 2000). Teamwork with these characteristics approximates to professional work (Prince and Felder, 2006), tackling a theory-practice gap in education (Heitmann, 1996).

Intrinsic motivation also relates to students' chance to set goals, design strategies to meet them and feel autonomous, that is, to self-regulate one's learning process (Stefanou et al., 2013). PjBL, as other learner-centred pedagogies, favour self-regulated learning, entailing the conduction of one's thinking and behaviour (Stefanou et al., 2013). The design of PjBL activities shape the conditions for self-regulated learning, involving student autonomy, unsupervised work time and responsibility for the projects (Thomas, 2000). The educator-learner relationship entails therefore less teacher-regulated contexts favouring students' own regulation (Stefanou et al., 2013). Learners' responsibility for their learning – and their reflection on learning processes enhances student agency (Barron et al., 1998). Therefore, PjBL can create educational conditions that favour the development of multiple skills of a socio-emotional character, notably by enabling learners to actively engage, decide and lead their learning processes. Socio-emotional learning theory then, may illuminate the understanding of (some) skills development through PjBL, which in the PjBL literature are nevertheless not labelled as 'socio-emotional'.

The potentialities of this pedagogy entail, however, significant challenges, for both HE learners and educators, as observed in empirical studies of PjBL and the related approach, problem-based learning. For educators, these pedagogies demand more time, resources, coordination and stamina to handle uncertainties and undefinitions in the pedagogical approach (Kumpulainen et al., 2019).

Considering different learning styles, letting go the belief that "more is better" and opening to different assessment modalities also permit faculty's work with PjBL, as found in the re-design and implementation of an engineering project-based curriculum (Stolk et al., 2009). Learners experience similar challenges to those faced by educators when working with PjBL, as revealed in empirical studies. Students are challenged by the lack of experience with (real) project work (Ríos et al., 2010), the perceived additional time required compared to traditional approaches (Musa et al., 2011) and the shift from individual to group grading (Hellström et al., 2009). Then, the implementation of PjBL requires participants' adaptation to several modified dimensions of the teaching- learning process.

PjBL may be developed in conjunction with other active methodologies. Some consider that PjBL has an embedded multidisciplinary orientation (e.g., Perrenet et al., 2000) or that it contributes to multidisciplinary education (e.g., Heitmann, 1996). PjBL can also involve engaging with communities beyond educational institutions, contributing to meaningful learning experiences (Barron et al., 1998). Moreover, constructive investigation is a central activity developed in PJBL exploring solutions for real-world problems (Thomas, 2000), which may be regarded as innovation processes. As we will see, the connections between PjBL and other pedagogical approaches such as cross-disciplinary learning, community engagement and experiencing innovation processes were observed in this research too. Thus, PjBL supports the analysis of SESI development, combined with other concepts reflecting different practices that also nurture university innovation education.

2. Multi-, inter- and transdisciplinary learning: learning with disciplinary 'others'

Students from different disciplines participate in the studied Minors Innovation, offering potentials for leveraging this disciplinary diversity for learning crossing disciplinary boundaries. I paid attention to the potential relevance of multidisciplinary classes in the development of SESI. As it will be discussed in Chapter 7, this potentiality was critical. This entailed the need to consider in the analysis the theoretical underpinnings of cross-disciplinary learning, which ground on the notions of multi-, inter- and trans-discipline. These represent different degrees of integration and interaction across disciplinary boundaries.

In the literature, conceptualisations of cross-disciplinary learning focus on cognitive learning rather than on socio-emotional skills. However, some socio-emotional skills are acknowledged- albeit generally not with this term-, such as communication and openness, as required skills in the process of developing interdisciplinary understanding and as resultant competencies. Moreover, the central value of working across disciplines coincides with a central process in innovation: jointly creating novel perspectives that allow seemingly unrelated connections. Thus, my theoretical framework

includes cross-disciplinary concepts and notably as explained next, inter-disciplinary learning in HE contexts.

Key concepts

Cross-discipline encompasses different degrees of engagement between disciplines. Multi-, inter- and transdiscipline are core distinctions. Multidiscipline is defined as the juxtaposition, involvement or addition of different disciplinary knowledge (Ivanitskaya et al., 2002; Klein, 1996; Spelt et al., 2009). This applies to research and teaching. This means that the activity (investigation or education) benefits from different disciplinary perspectives but the approaches remain distinctive. When different perspectives are contested, synthesised and combined the process takes an interdisciplinary nature: integration is the key characteristic of interdisciplinary work (Greef et al., 2017; Klein, 1990; Lattuca et al., 2004; Spelt et al., 2009). Then, when disciplinary perspectives fuse into a new joint creation it becomes transdisciplinary; a new perspective is generated. Further, transdiscipline is also understood as a process crossing not only disciplinary boundaries, but also frontiers between academia and the broader society; it represents the synthesis between academic-based disciplinary knowledge and non-academic knowledge (Greef et al., 2017). Therefore, the distinction between multi-, inter- and transdisciplinary work is based on "the source of insights and on how much and by whom they are integrated" (Greef et al., 2017, p. 29). They represent different types of interaction across disciplinary boundaries. Distinguishing between multi-, inter- and transdisciplinary work enriches the analysis of pedagogical practices that foster the development of SESI in innovation programmes. Arguably, different types of cross-disciplinary interaction may favour SESI differently.

Disciplines

Disciplines ground the existence of multi-, inter- and transdisciplinary processes. The notion of discipline is understood as three inter-related aspects: field of study, body of knowledge and community of scholars (Holley, 2009). In other words, discipline is "a field of science with a particular object of research and a corresponding body of accumulated specialist knowledge" (Greef et al., 2017, p. 28, referring to Menken and Kestra 2016). Academic 'tribes' and 'territories', as proposed by Becher and Trowler (2001), are widely used to discuss disciplines (Woods, 2007). Academic territories denote the ideas or knowledge structures intertwined with academic disciplinary tribes who share academic cultures (Becher and Trowler, 2001). Academic cultures denote "sets of taken-for-granted values, attitudes and ways of behaving, which are articulated through and reinforced by recurrent practices among a group of people in a given context" (Becher

and Trowler, 2001, p. 23). Becher and Trowler argue that the form and focus of disciplinary knowledge, i.e. its disciplinary epistemology, is mutually dependent with disciplinary cultures. While originally the notion of tribes and territories explored research practices, it has been applied to other activities (Trowler, 2014). Educationally, "[d]iscipline-based education provides students with a set of standards – an established way of framing problems, key theories and methods"; in interdisciplinary education, in turn, students understand how varied disciplinary perspectives can altogether contribute to tackle real-world problems (Greef et al., 2017, p. 11).

From an innovation perspective, disciplines and the relationship between them, are fundamental in knowledge creation, notably through transdisciplinary research, that allows the creation of new disciplines. Disciplinarity and interdisciplinarity mutually enable each other (Chettiparamb, 2007). The integration of perspectives is thus crucial in the advancement of knowledge. Arguably, most innovations emerge from some sort of cross-disciplinary integration, applying though narrow or broad definitions of the encompassed disciplines. In that sense, one may regard innovation as an 'interdisciplinary discipline' because the integration of expertise permits the creation of innovation.

Integration

Integration is a key parameter defining different types of cross-disciplinary work. Interdisciplinary research and interdisciplinary learning integrate perspectives focusing on a central theme. Interdisciplinary research characterises by orientating towards shared issues cutting across various disciplines and involving researchers from multiple fields (Holley, 2009). Interdisciplinary learning design, which actively pursues the integration of different disciplinary perspectives through specific methodologies and curriculum (Greef et al., 2017), also centres around a main theme (Ivanitskaya et al. 2002). In interdisciplinary education, this central theme can relate to the project, problem or challenge in which students work. That is, there is a focus, a problem, a theme, around which the integration takes place.

Interdisciplinary higher education and socio-emotional skills

Interdisciplinary learning is increasingly pursued by HEIs for multiple reasons, which are similar but not necessarily combined with aims driving innovation education. These coexisting rationales include the need for professionals able to tackle complex societal problems requiring interdisciplinary approaches (Greef et al., 2017) and the contribution of cross-disciplinary education to students' learning in terms of understanding the strengths and limitations of one's discipline (Woods, 2007), the comprehension of cross-disciplinary concepts (Ivanitskaya et al. 2002) and the

development of various skills including curiosity, openness and communication (Woods, 2007). While beneficial, interdisciplinary learning is a complex process and appears to require certain conditions to be successfully implemented in HE. Learners need an adequate balance between knowledge and skills, and guidance to develop over time the ability to work across disciplines, which is challenging given the exposure to different epistemologies and ways of teaching (Spelt et al., 2009).

Despite being scarce, the literature on interdisciplinary learning tends to converge regarding resultant skills and necessary learning conditions (Spelt et al., 2009). However, it does not seem to converge on the role that socio-emotional skills take. Some analyses of interdisciplinary learning, consider student personal characteristics like curiosity, respect, openness, patience, diligence and self-regulation as conditions for interdisciplinary thinking (Spelt et al., 2009). Other studies denote certain socio-emotional skills as "subtle" learning outcomes, such as "modified perspectives and attitudes (e.g., enhanced sensitivity to the ethical dimensions of issues)" (Ivanitskaya et al. 2002, 101). Because skills are enhanced through practice (Winterton et al., 2006), skills exercised in learning processes become strengthened learning results. Yet, the distinction in narratives matters in understanding the role that socio-emotional skills have on interdisciplinary learning. While rationales on the role of socio-emotional skills in interdisciplinary learning vary, specific socio-emotional skills appear as important although their socio-emotional nature is generally unacknowledged. An exception is, for example, an empirical study analysing the impact of a university interdisciplinary intervention (with students of two disciplines), finding a significant improvement in two explicitly mentioned socio-emotional areas, emotional perception and emotional management (Pertegal-Felices et al., 2017). Thus, interdisciplinary education was found beneficial for socio-emotional skills' development.

As interdisciplinary learning depends on the capacity to integrate different disciplinary knowledge (Ivanitskaya et al. 2002), this ability to synthesise or integrate is a key learning objective of interdisciplinary education and is denoted interdisciplinary understanding or interdisciplinary thinking (Greef et al., 2017; Spelt et al., 2009). Interdisciplinary understanding is defined as a complex cognitive skill, which "consists of a set of interrelated constituent subskills, knowledge structures and attitudinal aspects that together enable the synthesis of disciplines and the construction of a more comprehensive perspective" (Greef et al., 2017, p. 35). Greef et al. operationalise interdisciplinary understanding into three core skills: critical thinking, collaboration, and reflection (on content, experiences and performance). The ability to collaborate relies on effective communication across disciplines and entails situation awareness, negotiating meaning,

formulating a common goal, resolving differences and developing shared understanding and shared leadership (Greef et al., 2017). Communication, thus, is an important capacity for collaboration which in turn fosters interdisciplinary understanding.

Overall, some socio-emotional skills, such as communication, respect and patience, support interdisciplinary learning by permitting collaboration. Interdisciplinary learning can in turn boost other socio-emotional skills, although the latter is less explored in the literature. However, given that practice enhances skills, arguably skills supporting interdisciplinary learning are improved as a result. So different narratives about this relationship imply varied foci of non-linear and mutually nurturing dynamics.

Concluding, cross-disciplinary conceptualisations support the empirical analysis of SESI and its pedagogical approaches in Minors Innovation. These concepts are relevant because the cases studied hold a learning potential derived from the participation of students from multiple disciplines. Moreover, interdisciplinary work and innovation share a central process: the shift in perspectives by challenging (disciplinary) assumptions and opening to new/ integrated perspectives. Finally, the limited socio-emotional skills identified in the literature about cross-disciplinary learning, notably communication and collaboration, are also central for innovation because working with others, and especially with persons offering different perspectives, enriches creative insights.

The analysis of practices facilitating SESI (second research question) centrally draws on cross-discipline and community engagement -explored next- to conceptualise pedagogical approaches emerging from the data that support SESI.

Throughout the thesis, when referring in general to teaching-learning practices based on collaborative work between people of different disciplinary backgrounds and when the distinction between multi-, inter- and transdisciplinary interactions is unclear, I use the term cross-discipline.

3. Community engagement: learning together with the wider society

In addition to cross-disciplinary learning, another aspect emerging from the data that took major relevance in the empirical analysis was the collaboration between universities and the wider society for learning purposes. These activities, which I refer to in the thesis as community engagement, appeared to centrally support SESI development. I thus resorted to the incipient literature on

community engagement for learning searching for concepts to understand and substantiate the empirical analysis.

University-community linkages have been conceptualised as instrumental to both, accomplish the university third mission, and to advance the educational and research roles. The third mission represents universities' contribution to societal and economic development through interactions with the wider society, beyond the core functions of knowledge creation and degree-conducing education. The third mission, then, denotes a related yet distinct role from universities' research and education responsibilities; this distinction, however, becomes increasingly blurred as community engagement may occur while researching and educating, and as these core activities progressively evolve into models *with and for society* that implicitly embed community engagement.

The third mission

The third mission aims, as conceived generally, to support progress framed in the knowledge economy (Hardwick, 2013). The third mission stemmed from research, aiming to create "adapted intermediary structures that would fill the gap between fundamental research and development" (Laredo, 2007, p. 20). However, third mission activities relate also with education when universities engage with communities beyond the boundaries of universities, for example in the form of industrial doctorates (Walczak et al., 2017), student placements and curriculum alignment with societal needs (Mollas- Gallart, 2002). Thus, although the third mission is conceptualised distinctively from research and education, a significant *mission overlap* hinders its identification and analysis (Mora et al., 2012). Universities themselves also suffer from *mission confusion* (Jongbloed et al., 2008) and *mission overload*, challenging the relevance of community engagement in institutional strategy (Benneworth et al., 2017). Bounded by their institutional autonomy, universities attempt to balance the multiple, changing and in cases inconsistent societal expectations towards the HE sector (Morphew et al., 2018). Consequently, universities need to act strategically, prioritising and targeting their relationships with their communities (Jongbloed et al., 2008).

Governmental and institutional efforts to unleash community engagement potentials have arguably prioritised research and its valorisation rather than education, at least across the university sector[3].

[3] This can be derived from studies on related concepts, including the third mission (e.g., Laredo, 2007), university-business collaboration (e.g., Lambert, 2003) and entrepreneurship in universities (e.g., Uslu et al., 2019).

The focus on the economic benefits of community engagement (because of its entrepreneurial linkages) shadows the relevance of community engagement learning-oriented initiatives with the civil society in universities (Hardwick, 2013). Yet a range of community engagement activities for learning have been developed by university and societal partners, promoting learning-by-doing and developing skills in practice. These learner-centred third mission or community engagement activities appeared to play an important role in the facilitation of SESI in innovation education programmes, my second research question.

Community engagement for education

Community engagement includes a range of sustainable relationships, alliances and collaborative activities between HEIs and their members, and the broader society; these may be formal or informal, and involves connecting with communities at local, national, regional and international levels (Jacob et al 2015). These models vary regarding the priorities given to student learning, the community engagement activities and their contribution to societal development. Some advocate for a type community engagement that explicitly seeks a mutually nurturing relationship between HEIs and the community, with equal emphasis on campus and community impact (e.g., Yamamura and Koth 2018). Discussing place-based community engagement, Yamamura and Koth (2018) appeal for a model of long-term strategic institutional collaborations with prioritised foci and with networks of local community partners. They differentiate this approach from "isolated individual actions" (Yamamura and Koth, 2018, p. 12). While the specific collaborative activity may be similar, the scale, duration and sustainability of partnerships determine students' learning opportunities and the potential collective impact on the local community (Yamamura and Koth, 2018). This model appeals to an integrated education and third mission approach, supporting learners and the broader community.

Arguably, the promotion of strategic institutional collaborations entails centralised management. While this may occur in some HEIs, community engagement activities can be decentralised at the programme or module levels, or a mix. While decentralised initiatives and potentially one-off collaborations possibly have more limited impact than wider-scale and longer-term alliances, the consideration of expectations and benefits for both, university members and broader community members, are still relevant.

Overall, conceptualisations of community engagement related to students' education seem less advanced than research valorisation-related ones. Community engagement for learning tends to emphasise either the goal of contributing directly to socio-economic development- usually local or

regional-, the centrality of learning, or the need of creating collaborative models for the benefit of both, communities and HEIs and their members. Ultimately, however, advancing societal development is the overarching aim. In terms of the scale or institutional level in which its take place (e.g., centralised in the university management, programme, module or activity level), conceptualisations are unclear, although claimants of strategic long-term collaborations with society frame these as university-wide and thus probably centralised. These notions, despite their limited literature, inform the analysis of SESI development at the boundaries between the university and the wider community.

4. Boundary-crossing learning: changing perspectives by encountering difference

Boundary-crossing theory provides a helpful framework for analysing practices that facilitate the development of SESI, skills which as discussed in Chapter 2 are nurtured by the association and collaboration between people with diverse cultures -in broad terms. As will be analysed in chapters 7 and 8, the contribution of these practices to SESI largely ground on the interaction across two types of social boundaries: between HEIs and the broader society, and between disciplines.

As a socially and culturally contextualised process, learning is mediated by multiple practices, including boundary-crossing, where learners deal with varied forms of expertise (Griffiths and Guile 2003). Boundaries are socio-cultural differences hindering interactions (Akkerman and Bakker, 2011a) and these discontinuities are "revealed by the learning involved in crossing them", which involves transformation (Wenger, 1998, p. 103). Boundaries are learning resources inasmuch the actions or interactions across them, boundary practices, are identified, coordinated, reflected upon and established or transformed (Akkerman and Bakker, 2011b, 2011a). Through these learning mechanisms, both persons and organisations, may change or create new forms of expertise and activity between organisations (Guile, 2011).

Crossing boundaries involves "encountering difference", entering in unfamiliar territories (Suchman, 1993, p. 25). The need for dialogue and meaning-negotiation derived from dwelling "nobody's land" with potentially new results (Akkerman and Bakker 2011b, 141–142), is especially pertinent to consider in the development of interpersonal skills favouring co-creation processes leading to innovations. In fact, such SESI correlate with those required in boundary-crossing 'brokering'. Brokers "introduce elements of one practice into another" and essentially requires to make connections across communities and to "open new possibilities for meaning" (Wenger, 1998, pp. 105, 109).

In the interaction between communities across boundaries, communities use boundary *objects* as bridging artefacts; these need to be flexible and meaningful across boundaries permitting the communication of different perspectives (Star and Griesemer, 1989). Anchoring the term boundary object, Star and Griesemer proposed:

> "In conducting collective work, people coming together from different social worlds frequently have the experience of addressing an object that has a different meaning for each of them. Each social world has a partial jurisdiction over the resources represented by that object, and mismatches caused by the overlap become problems for negotiation… The objects thus come to form a common boundary between worlds by inhabiting them both simultaneously" (1989, 412).

In innovation processes, especially when conceived as a networked process, boundary objects are central in integrating knowledge, notably when the expertise required includes personal, tacit and thus hard to formalise knowledge (Mäenpää et al., 2016). In fact, innovation problems tackled collectively may be regarded as boundary objects framed by knowledge across boundaries and entailing different meanings and implications; the possibly resultant innovation – whether it is a tangible object, or not- may also be represented as a boundary object, in construction.

Learning across boundaries permits horizontal development, whereby learners mediate in varied contexts and forms of expertise, developing in such diversity (Griffiths and Guile, 2003). This horizontality of learning across different types of boundaries permits collaboration between people across organisations or diverse teams (Guile 2011). In that sense, boundary-crossing differs conceptually from the notion of 'transfer' because while transfer generally applies to moving from learning to application in single one-sided transitions, boundary-crossing refers "ongoing, two-sided actions and interactions between contexts" (Akkerman and Bakker 2011, 136). Further, learning is facilitated by the resituation of knowledge and skills: learners' capacity to see and act in new situations from a perspective of newness, opening to different opportunities rather than solely transferring knowledge into different contexts (Griffiths and Guile, 2003). Relevant to innovation processes, resituation allows learners to set new strategies and actions that allows them to see beyond immediate solutions (Griffiths and Guile, 2003). The concepts of horizontal learning and resituation of knowledge and skills help the analysis of learning processes in innovation education programmes, where students may interact with people offering diverse perspectives and expertise.

Learning across boundaries , however, entails difficulties for learners because of the tensions resultant of working with different standpoints (Guile, 2011; Star and Griesemer, 1989). This incites

learners' critical assessment of assumptions and permits learning through at least the four mechanisms above-mentioned (identification, coordination, reflection and transformation) (Akkerman and Bakker, 2011b). Boundary work, then, fosters learning based on diversity. Centrally, cross-boundary theory highlights the value of working through differences, rather than avoiding them (Akkerman and Bakker, 2011a). This is crucial for creativity and innovation, which benefit from the integration of distinct perspectives. In fact, innovation management tools pursue work between persons with varied perspectives, as a source of creativity. Recognising, valuing and benefiting from diverse perspectives is essential too for the development of multiple socio-emotional skills, like openness and interdisciplinary communication.

Concluding, crossing boundaries requires abilities to recognise differences and to (re)create practices and meaning across them. This capacity resembles some of the abilities needed in innovation, because innovation entails crossing boundaries for the creation of novel and usually collective solutions. That is, boundary-crossing reflects an ingrained process benefiting innovation, generally, as a co-creational process enriched by diversity.

In the studied Minors Innovation, students worked with peers from other disciplines and collaborated with the broader community. It emerged from the analysis that these two specific boundary-crossing practices strongly facilitate learning. Thus, boundary-crossing theory illuminates the conceptualisation of educational practices facilitating SESI twofold: by making explicit some processes embedded in innovation (i.e., questioning assumptions and re-framing problems drawing on different perspectives) and by characterising two educational approaches (i.e., cross-discipline and community engagement) central in the development of SESI in the studied university innovation programmes.

C. Conclusion theoretical framework

This thesis aims to explore socio-emotional skills favouring innovative behaviours and their facilitation and development in university innovation programmes. These lines of enquiry require theoretical tools related to this type of skills, learning and skill development. I draw on a range of theories and concepts organised in two groups. One integrates three theories of learning establishing my baseline understanding of learning for the thesis. The other one comprises four theories and concepts related to pedagogical practices that appeared to be critical in facilitating SESI in university innovation education.

My baseline comprehension of learning emphasises the social and transformational character of learning, focusing on its socio-emotional dimension. Situated learning theory conveys learning as social participation in communities that share and jointly develop practices (Lave and Wenger, 1991). This guides my understanding of innovation, as a collective creational activity, and of learning when experiencing innovation processes. Transformative learning centres on the personal shift in perspectives occurring when assumptions and beliefs are questioned and new ones, connected with expanded abilities, are reintegrated (Mezirow, 1991; Cranton, 2016). This approach demonstrates the depth that learning processes may reach, which exceeds the development of specific skills and elicits personal transformation. Transformative learning theory supports my conceptualisation of 'learning catalysts' (developed in Chapter 9), as elements that, as experienced by learners, facilitate significant and sustainable learning. These situated and transformative dimensions of learning conceptually complement socio-emotional learning. The Systemic Social and Emotional Learning framework developed by CASEL (Durlak, 2015; Zins and Elias, 2007) considers five core dimensions: self-awareness, self-management, social awareness, relationship skills and responsible decision-making. I use this model to organise the analyse of SESI regarding both research questions, SESI's identification and development. These three theories establish my underlying assumptions about learning and are complemented by a second set of theories, which together with CASEL's model, are used more instrumentally and explicitly for the empirical analysis.

The second research question exploring how SESI are pedagogically promoted in undergraduate innovation programmes required the consideration of four other theories and concepts: project-based learning, cross-disciplinary learning, community engagement and boundary-crossing. PjBL portrays the organisation of educational activities in Minors Innovation. PjBL considers group work in authentic challenges with a project structure, alike professional work. The project configuration facilitates the development of other educational activities. As analysed in Chapter 7, cross-disciplinary learning in Minors Innovation tends to rely on project work and is viable as students from different programmes/disciplines partake in the Minors. Concepts about multi-, inter- and transdisciplinary (which I overall refer to as cross-disciplinary) learning aid the analysis of this fundamental emerging practice supporting the development of SESI. PjBL also frame much of the activity that Minors' students experience with the broader community. As discussed in Chapter 8, community engagement for learning emerges as another key practice encouraging SESI. Finally, boundary-crossing theory encircles the two main emergent approaches facilitating SESI: cross-disciplinary learning and community engagement for learning. Boundary-crossing theory explains the learning potentials and challenges entailed in working across socio-cultural differences. Arguably, innovation itself requires crossing boundaries to collectively construct novel solutions.

These four approaches, entwined with the three theories setting my premises about learning, comprise this thesis' theoretical framework.

The framework's bottom line is that both, learning and innovation, are social processes whereby perspectives are transformed, and this is enriched by collaborations across different types of socio-cultural boundaries. Having established the theoretical and conceptual framework guiding the analysis, I continue explaining the research methodology.

Chapter 4. Research methodology: explorative multiple case study

The thesis, as the previous chapters have identified, investigates what and how skills of a socio-emotional nature contribute to innovative behaviours, and how this type of skills are pedagogically promoted in university innovation education programmes. To do so, I chose to use an explorative cross-country multiple case study methodology based on qualitative interviews. This is the most appropriate methodology because it was necessary to investigate the under-researched topic of SESI in universities in their context of deployment, with some contextual variety and exploring in-depth emergent dynamics with a range of participants.

Case study methodology enabled me to investigate SESI in the specific context of undergraduate IE, considering the perspective of participants in these programmes. Case studies permit the open exploration of phenomena (Lincoln and Guba, 1990), especially important when studying relatively under-researched topics (Miles et al., 2014), such as SESI in HE. I explored *how* SESI foster innovation and *how* they are promoted in university settings, and case study methodology is particularly fit for researching this kind of enquiries considering contextual aspects (Jones, 2010; Yin, 2011). Furthermore, inquiring through cases permitted me to analyse practices and perspectives in varied settings, enriching the dataset and analysis.

In this context, I adopted qualitative interviews as data collection method because this would allow me to obtain the appropriate type of data to explore my research questions. Semi-structured interviews help in capturing participants' perceptions through active, profound and open conversations (Miles et al., 2014). Through this type of conversations with IE participants (students and educators), I explored their views on SESI, and specifically, on the processes through which these skills contribute to innovation and pedagogical practices that -intentionally designed or unintentionally helpful- promote students' development of SESI. It is important to emphasise that the enquiry focused on pedagogical practices adopted and valued by participants as beneficial for the development of SESI; my intention was not to contrast instructional design with application.

Within this frame of case study methodology, I developed an explorative cross-country multiple case study to investigate SESI's rationalisation and promotion in Minor Innovation programmes. I chose a multiple case approach to strengthen the evidence and the validity of findings (Miles et al., 2014; Yin, 2018). The cross-country design aimed at exploring SESI in IE -a phenomenon in

universities worldwide- considering different manifestations of it. Hence, I intentionally selected countries with different HE and innovation systems, conditions which arguably shape the development of IE. I expected this diversity to enable data triangulation and the examination of similar and distinct features of SESI development in university IE. I purposively selected four Minor Innovation cases, two in Chile and two in Netherlands. Both countries have significant development of undergraduate programmes dedicated to innovation; their distinct HE, innovation and broader socio-economic contexts could enrich the analysis; and they both offer Minor Innovation programmes, unit of inquiry which I adopted for reasons explained next. Moreover, from a practical perspective, I considered the study's feasibility regarding language, funding and access to cases (Jones, 2010), being viable for me to conduct data collection in the Netherlands and Chile.

The unit of inquiry defined was *Minors Innovation*; these are small (around five courses) undergraduate university level (ISCED 5A) programmes aimed at developing skills for, and knowledge about, innovation offered, offered optionally to students from different disciplines. I considered Minors Innovation as an interesting and feasible unit to study SESI because of their focus on innovation, size of programmes and offer to students across disciplines. The latter feature appealed me because as discussed in Chapter 2, innovation is enriched by different perspectives, which may emerge from varied disciplinary backgrounds.

The interviews were conducted with a range of participants involved in the design and implementation of the four Minors Innovation offered by Dutch and Chilean universities, including students, educators, managers and external collaborators. My intention was, as I explained above, to analyse my data in such a way that I could cross-check the converging and diverging views I received and form some general conclusions about what socio-emotional skills matter for innovation and how they can be facilitated in university education. This is consistent with Corbin and Strauss' view that "[a]nalysis is a process of generating, developing, and verifying concepts" (2008, p. 57). I conducted 57 interviews with students, lecturers, programme managers, innovation unit authorities, central level authorities, and external partners, at the case level, and policy makers and experts at the national level. The core analytical phase was based on themes emerging from the empirical data integrated with topics derived from the theoretical framework. That is, I used both, inductive and deductive analytical approaches. This dual approach supported analytical conceptualisations and work towards coherent generalisations (Miles et al., 2014).

Epistemologically, i.e., "how we know what we know" (Crotty, 1998, p. 3), the understanding of skills' relevance for innovation and their promotion in universities was co-constructed between the

participants and I, as the researcher, integrating further, other researchers' perspectives through previous works. I served as a voiced channel to interpret and communicate participants' experience. This was an active channel given the unviability of doing social research in an "epistemological vacuum", disregarding the researcher's preconceptions, knowledge and attitudes towards the research topic (Braun and Clarke, 2006, p. 12). "[K]nowledge is created through action and interaction", explain Corbin and Strauss (2008, p. 2). Therefore, my background and positionality as a social researcher inevitably affected the research process and research results, including my communication with participants and with other researchers through their previous works.

In that sense, the knowledge construction paradigm reflected in this thesis approximates to social constructionism. Social constructionism assumes that "our knowledge of the world, including our understanding of human beings, is a product of human thought rather than grounded in an observable, external reality" (Burr, 2015, p. 222). I conceive that the nature of SESI and learning processes, may be accounted from multiple coexisting perspectives. This relativist approach towards knowledge and its construction, and the consequent need of being critical with our assumptions in understanding the world, are embraced by social constructionism (Burr, 2015) and apprehended in this thesis. While acknowledging categories as human constructions (Burr, 2015), I used them for comprehending, developing and communicating constructed concepts around the notion of SESI. Throughout the thesis, I analyse SESI and related concepts aiming to further their understanding, acknowledging knowledge creation as a collective process (in this case, with the study's participants and other researchers' previous works; not with co-researchers). This epistemological stance is compatible with case studies, given case studies' epistemological flexibility (Yin, 2018).

Then, I acknowledge my active predisposition as a qualitative researcher, who in the words of Miles et al (2014) is a central instrument in the study, co-developing comprehensions of phenomena. A methodological way of aiming for a high-quality research, while acknowledging the researcher's predispositions is to make these inclinations explicit (Braun and Clarke, 2006). Therefore, I expose next my standpoint on the research topic and my awareness on how my previous experience and knowledge shaped the thesis' development.

As explained in Chapter 1, my professional experience centres on HE and innovation research, management and policy-making. Prior to my doctoral studies, thus, I had views on university teaching-learning approaches, innovation education, and university-enterprise partnerships. Complementing the literature review with my previous experience, I shaped the focus of enquiry,

engaging in the interviewing process with the intention of understanding SESI and their development, and their relationship with broader contexts. Key assumptions about university IE that I questioned throughout the thesis were: the formal yet flexible, dynamic and bottom-up character of IE; an appreciation of socio-emotional skills without a straightforward manifestation of them in learning aims or learning activities; a strong collaborative approach in IE; and given the flexibility and innovative spirit of IE initiatives, opportunities for students to engage actively in their learning processes. These notions were contested, as discussed in Chapters 5 to 10.

I addressed and complied ethical aspects, which are central for research quality and reveal throughout the research project (Miles et al., 2014; Yin, 2018). I took care of ethical compliance throughout the thesis work, from design to reporting stages, including participants' confidentiality and anonymity.

The next sections discuss further the research design, the data collection process, the main analytical approaches and tools, my positionality, the research legitimisation, ethical aspects and other methodological considerations.

A. The research design

The research questions, aimed at identifying socio-emotional skills that favour innovative behaviours and at analysing pedagogical approaches used in university innovation programmes to develop these skills, required *exploring* the notion of SESI from different angles. Practice seems to be evolving faster than conceptualisations of SESI and their development, as deduced from the fact that undergraduate innovation programmes such as those studied in this thesis to some extent aim at developing skills categorizable as socio-emotional (Chapter 5), yet the literature on this specific intersection of concepts is scant (Chapter 2). Also, multiple actors participate in innovation education as a global phenomenon, with limited literature about their roles and interactions. Therefore, given the subject's newness and the multiplicity of actors involved in unknown and possibly diverse ways, I applied an explorative cross-country multiple case study methodology considering various types of participants. The multiple case study was complemented with further theoretical enquiries to explore both research questions, about the skills that support innovative behaviours and their pedagogical development in HE. This sets the research methodology, as the rationale for the choice of methods leading to desired outcomes (Crotty, 1998).

1. Cross-country multiple case study of four Minors for Innovation

An explorative cross-country multiple case study approach of four Minors for Innovation, two in Chile and two in the Netherlands was used. The incipient study of SESI led to pose explorative research questions on the importance of some skills for innovation and their development. Also, it was expected that institutional and national contexts would relate to the understandings of SESI and pedagogical practices. Therefore, a case study approach was appropriate since the topic is a complex contemporary social phenomenon explored through "how" and "why" research questions guided by existing theories and considering contextual elements (Jones, 2010; Yin, 2011).

My research featured three interrelated aspects represented in case studies: the type of research, the research method and the unit of inquiry (Yin, 2018). That is, case studies is a qualitative inquiry approach (Creswell and Poth, 2018), with specific procedures such as selecting cases (Yin, 2018) in which part of the research tools, level of data collection and analysis are cases. First, methodologically, i.e., how I thought and studied the social phenomenon (Corbin and Strauss, 2008), case-study was a central methodological decision, used to study SESI and their development in HE. Second, research methods, and specifically data collection techniques, were designed around cases and interviews. Third, the unit of analysis, which frames the phenomenon in a bounded context characterised by its conceptual nature, size, location and temporality (Miles et al., 2014), included the cases and other elements too. Cases were the undergraduate Minor Innovation Programmes located in specific universities at the time of study. Inquiring on specific skills and pedagogical practices that promote them, I also analysed other units, namely: SESI, students and their interaction with other students and participants in their learning processes, educators, pedagogies, learning processes, institutional networks, among other aspects. That is, I used multiple units of analysis depending on the specific inquiries. A significant part of the analysis was transversal across cases, distinguishing and assessing contextual conditions of the Minors where relevant.

Moreover, I adopted a case study approach because it offers flexibility to investigate relevant unforeseen aspects (Timmons and Cairns, 2010), which was expected given the limited specific literature around the research questions. Case studies also support inquiries where "the boundaries between phenomenon and context may not be clearly evident" (Yin, 2011), such as innovation programmes and their institutional and broader contexts. Further, in qualitative enquiry, the consideration of the phenomenon's embeddedness in the local context enhances the chance of understanding "latent, underlying, or non-obvious issues" (Miles et al., 2014, p. 11). Thus, the

exploration, flexibility and contextual sensitivity permitted in case studies, were important methodological features required and applied in my thesis.

a. Unit of inquiry: Minors Innovation

Minor Innovation programmes were considered a suitable and feasible option to study the concept of SESI and their development in HE, because they intend to develop skills and/or knowledge that support students' engagement in innovation through credited sets of modules offered to students from multiple disciplines involving applied learning components. University programmes for innovation include curricular and extra-curricular initiatives; mandatory and optional modules; single modules/courses[4], packages of modules or full programmes; offered at undergraduate and postgraduate levels. The unit of Minors Innovation was selected as an appropriate unit of analysis for the study. Minors Innovation are packages of credited courses that altogether form a mini-specialisation in Innovation, offered optionally to undergraduate students of different disciplines. Minors are curricular alternatives within the sections often denominated 'other disciplines' or 'general training optional courses'. These are mandatory credits to complete the undergraduate qualifications which students can choose from a variety of options, generally outside of their core discipline and which include Minors. I chose Minors Innovation to enquire the research questions given their following features:

- Size: Minors comprise a small number of courses (around 5) that allow students to develop certain depth in the specialisation topic. This magnitude of courses permitted the exploration of different pedagogical practices, while not leading to a full degree entailing multiple approaches hard to study in detail.
- Credited courses: Minors are offered formally, therefore the Minors and the courses constituting them are institutionally validated. The existence of Minors Innovation arguably represents an institutional commitment with IE (or at least openness).
- Optional: Minors are offered optionally to students as one of their choices to fulfil the mandatory optional credits within their undergraduate degrees. Methodologically, this feature was appealing given the underlying assumption that students' agency was expressed in their choice to participate in Minors. (This hypothesis proved partly incorrect: in at least one case, students register with a grade-based priority system implying that the taken Minor is a viable but not necessarily a first option. The effects of optionality are further discussed in Chapter 5).

[4] I use the terms "module" and "course" indistinctively referring to academic units typically lasting one term/semester.

- Cross-disciplinary offer: Minors are offered to undergraduate students from multiple disciplines (usually all students except those to which the Minors' content is included in their mainstream study programmes). The mix of students from different disciplines was methodologically interesting in the study of skills for innovation given that innovation is enriched when different perspectives are integrated. During the fieldwork, I observed that some Minors are offered by faculties and lecturers with different disciplinary backgrounds, diversifying further the expected approximations to innovation.

Furthermore, the figure of "Minor" programmes is not studied often in the context of innovation education (no study was found considering this unit). This is partly because only some HE systems have curricula that consider this figure. The previously mentioned characteristics of Minor programmes, including their formal credited optional cross-disciplinary offer, provided an opportunity for novel perspectives in the study of university IE.

Alternatives to Minors were considered: first I thought of courses offered in Engineering education, a discipline prone to innovation. However, this limited my possibility of exploring the richness that diverse disciplinary perspectives bring to innovation, and of acknowledging IE as a cross-disciplinary phenomenon occurring not only in STEM areas. Another option was mandatory full programmes on innovation. However, given their magnitude, these were unsuitable for in-depth exploration of SESI in a multiple-case study.

Therefore, Minors for Innovation, academic programmes specifically aimed at developing skills (and knowledge) on innovation at the undergraduate university level (ISCED 5A), was conceived as the best unit of inquiry. The analysis, then, was conducted considering Minors as a whole, not individual modules composing them. The feasibility and definition of this unit of inquiry depended on the actual offer of Minors -the possible cases- and to the definition of national contexts.

b. Multiple case study

A multiple-case approach, considering four purposefully selected cases, was designed to analyse the understandings of SESI and their pedagogical strategies in different contexts. I worked with multiple cases to increase the validity and trustworthiness of findings by allowing deep understanding and explanations (Miles et al., 2014), and to offer more compelling evidence than single-case studies (Yin, 2018). Further, as Miles et al (2014) assert, a multiple-case approach enhances the generalisability of possible emerging theories. Generalisability is strengthened when considering different contexts. Thus, I sought diverse national and institutional contexts (cases

permitting) while promoting in-depth explorative analysis. This balance was achieved by studying four cases in two countries, a viable number for this thesis that provided enough diversity.

I predominantly analysed data across cases; i.e. focusing on patterns across the four Minors Innovation and examining contextual differences when pertinent. Yin (2011) differentiates two analytical procedures for in-between cases: to develop cross-case analysis after discussing single case studies separately and to analyse across the multiple cases. I adopted the latter method because it proved more suitable given the strong presence of patterns about the inquired issues across cases.

c. Cross-country approach: Chile and the Netherlands

Innovation education is a global phenomenon. The literature revealed incipient yet global interest on the subject, discussing experiences across the five continents. Innovation education is strongly contextualised, locally, nationally and globally in innovation societies. This responds to innovation's social and collective character and relates to universities' connections with other segments of society. Acknowledging varied contexts, in different levels, was relevant for understanding the drivers, main courses of action, challenges and cultures where innovation education takes place, specifically around SESI. Therefore, I considered two countries offering some national-level diversity, subject to the operational feasibility.

The definition of country and unit of analysis were inter-dependent. I sought for feasible cases that would meet the research purpose. Originally, three countries were explored: Chile, the Netherlands and the United Kingdom. These were pre-selected considering the study's feasibility regarding access to cases, funding, language proficiency (in my case, programmes offered in English or Spanish) and potential contribution (Jones, 2010). I explored undergraduate programmes for Innovation using the following procedure. In the Netherlands and the United Kingdom, universities in the QS World University Rankings 2016-2017 were considered. In the United Kingdom, the top 25 universities plus few others were explored by searching in their websites for programmes in innovation. The results were several single modules, some bachelor programmes in innovation integrated with other subjects, one minor, and also programmes at the Master level. Minors did not appear as a common form of credited IE programmes[5]. In the Netherlands, all 13 universities present in the QS ranking were explored through their websites. The results included single modules, multiple initiatives and centres, and ten Minor programmes in Innovation and/or

[5] This is probably because Minors are infrequently used (beyond innovation).

Entrepreneurship. One of the Minors is offered jointly by three institutions. Therefore, 12 of the 13 universities offered Minors in innovation and/or entrepreneurship. In Chile, programmes were explored differently given my knowledge of the system. The top universities appearing in the QS ranking were explored, plus others nationally recognised for their innovation-related activities. Four Minors in innovation and/or entrepreneurship were found in addition to single modules and other initiatives.

Considering the programmes offered in the three countries and the previously discussed benefits of working with Minors Innovation as unit of inquiry, I decided to study Minors Innovation in Chile and the Netherlands. This was subject to the successful access to cases. Chile and the Netherlands, present- albeit different levels of socio-economic development- active national contexts in university IE. These distinct country-level contexts would likely enhance the diversity of approaches to SESI and their development. As the countries' contexts may affect the data, the corresponding settings, including HE and innovation national-level systems, were considered in the analysis as the data permitted. Language aspects were contemplated; the programmes considered in the Netherlands were offered in English, and those offered in Chile, in Spanish, both languages spoken by the researcher. The selection was purposeful, as explained after.

d. Purpose of the case study

The multiple case study design aimed at enriching the dataset with diverse experiences, promoting robust generalisable results while acknowledging the cultural context in the construction of meaning. Despite studying four cases in two countries, the design was not of a comparative study; "not all international research is comparative, and not all comparative research is international or cross-national" (Hantrais, 2009, p. 1). While some conceive 'comparative education' as the analysis of educational practices and policies in different settings (Clarkson, 2009), the intentionality must be considered. Comparative research intends to apply systematically the same research tools to compare different manifestations of a phenomenon (Hantrais, 2009). In this study, the research questions did not intend to compare situations across countries. The use of cases in two countries intended to widen the scope of SESI's manifestation than the expected in a single country, fostering richer analyses. Thus, it was not designed under comparative research logic.

Notwithstanding, it is relevant to analyse the extent to which diverse contextual conditions affect the apprehension and promotion of SESI. Therefore, when contextual elements of the institution and country seemed to shape the conceptualisation of SESI and their development, and data were available, these were considered. Yet I acknowledge two caveats: two cases do not fully represent

the countries' situation, and circumstances are not attributable only to the context, as many other aspects might be in place. Possible relations between SESI and the specific contexts are examined in Chapters 6 to 8, when discussing the findings on SESI and the pedagogical approaches, connecting to the cases' contexts introduced in this chapter and further analysed in Chapter 5.

e. Purposive selection of cases

Four cases were selected purposively, framed in the country selection of Chile and the Netherlands, and the definition of Minor Innovation as unit of inquiry. Two cases per country in two different countries was suitable and feasible for this thesis. This number of cases was defined conceptually rather than statistically, i.e., selecting for enhanced confidence in analytical generalisations (Miles et al., 2014). I sought for cases with similar structural characteristics in the design of the programmes, while exposing institutional variety. This aimed to reach common grounds on Minors Innovation and analytically exploit the richness provided by diverse institutional and national settings. I intended to study 'good' cases; i.e., Minors that were well-established within the university and which had developed a robust academic programme for students.

The Minors Innovation were studied via, and subject to, the information available online before contacting the persons responsible for the programmes. The Minors consisted of flexible packages of between 4 and 6 modules in innovation-related subjects. Usually students chose among a wider variety of courses. All Minors centred on innovation, but the accents varied, relating, for example, with entrepreneurship, or focusing on specific aspects of innovation such as technological innovation or responsible innovation. The selection criteria encompassed the following features, seeking for cases that would likely contribute to answering my research questions (Yin, 2018):

- Focus on innovation, or innovation and entrepreneurship, but not only entrepreneurship, as reflected in the titles of the programmes;
- Offered to undergraduate students of varied disciplines;
- Availability of information online, to assess the Minors as potential cases (and estimate the capacities built for the programmes);
- The institutional innovation ecosystem. A secondary-level criterion appraised online was the development of other innovation-related activities, including other innovation education initiatives, business incubators and innovation (research) centres; and

- The location, related to financial feasibility for doing the fieldwork[6].

After exploring and pre-selecting the cases, I asked the programme managers for permission to study the Minors. Their openness and willingness were crucial in the actual study of cases.

Primarily, the selection criteria were the above. I also thought of between-cases complementarity to enrich the data. Yet in practice, the limited number of available and desirable cases according to individual criteria did not permit a between-cases-based selection. It occurred, however, that the institutions indeed held diverse rationales for the Minors' offer.

Yin (2018) suggests *bounding* the case in spatial and temporal terms, distinguishing data about the phenomenon studied from contextual data external to the case. In this thesis, while institutional and national-level aspects are considered contextually, the boundaries between object and context blur when exploring beyond the formalities and into the tacit understandings and informal practices. Given the centrality of these multiple levels of 'contexts' in understanding the phenomenon, dialogues between Minor-level and contextual-levels are developed throughout the thesis. Temporarily, the cases were studied during the 2016-2017 and 2017-2018 academic years in the Netherlands, and the 2017 academic year in Chile. The structure of programmes existing in those periods were the main reference. However, previous versions of the programmes –and plans for the future- were also mentioned by interviewees. The Minors and relevant aspects of their institutional and national contexts regarding innovation education in HE are briefly introduced in section G this Chapter.

2. Data collection methods: semi-structured interviews and documentary data

Semi-structured interviews was the main data collection method – a common approach in case studies (Yin, 2018)-, engaging with a variety of Minors' participants. That is, the unit of data collection was individual persons interviewed, while the unit of inquiry was the Minor, and multiple units of analysis were considered, including Minors. Interviews were complemented with documentary data. I aimed to "capture data on the perceptions of local participants from the inside through a process of deep attentiveness, of empathetic understanding, and of suspending or bracketing preconceptions about the topics under discussion" (Miles et al., 2014, p. 9), attempting to acknowledge critically my presumptions. Specifically, with the interviews I intended to explore the participants' perceptions, attitudes and meanings (Yin, 2011) on SESI, their viewpoints regarding

[6] In Chile, both cases were selected in Santiago because of financial feasibility. In the Netherlands, the location was not a limitation given the ease of travelling by train.

the relevance for innovation and the rationale for contributing- or not- to innovative behaviours, and their experience of how SESI were promoted and developed in the Minors. Interviewing is an "active process where interviewer and interviewee through their relationship produce knowledge" (Kvale and Brinkmann, 2009, p. 19). Therefore, during the interviews and throughout the consecutive analysis, the participants and I as the researcher co-developed new understandings of SESI and their development in HE. This data collection and analytical approach agrees with an underlying socio-constructivist epistemological perspective.

Interviews were complemented by documentation on the Minors, as secondary data. The documentary data concentrated on description of the Minors (structure, courses, activities, evaluation mechanisms and models of innovation processes used) and syllabus of courses conforming the Minors. It also included institutional-level innovation-related strategies. Documentary data were collected online and reviewed in advance as background information -when available-, guiding and enriching the interviews' questions.

I considered important to discuss on SESI and their development with different types of participants in the Minors to build a comprehensive picture of their perceptions and triangulate data, strengthening therefore the results. Thus, semi-structured interviews were conducted with the following types of participants (in parenthesis, targeted number per case).

- Students (4-6)[7]
- Lecturer or professor (3)
- Programme manager (1)
- Innovation unit authority (1)
- Central administration authority (1)
- External collaborator (3; e.g., industry partner, innovator practitioner lecturing)

These types of participants were considered the most important ones in the Minors' design and development; specifically, in the possible inclusion of SESI as learning objectives in the programmes, in the pedagogical plan, and in the experience of educating and learning. Students, lecturers and programme managers are directly involved in the daily operation of the Minors. At the central level of universities, a central administration authority and an innovation unit authority were sought to understand the general institutional educational perspectives and the specific institutional

[7] Originally, three interviews with students per case were considered. My upgrade panel suggested to increase the number of students and I targeted between 4 and 6 per case.

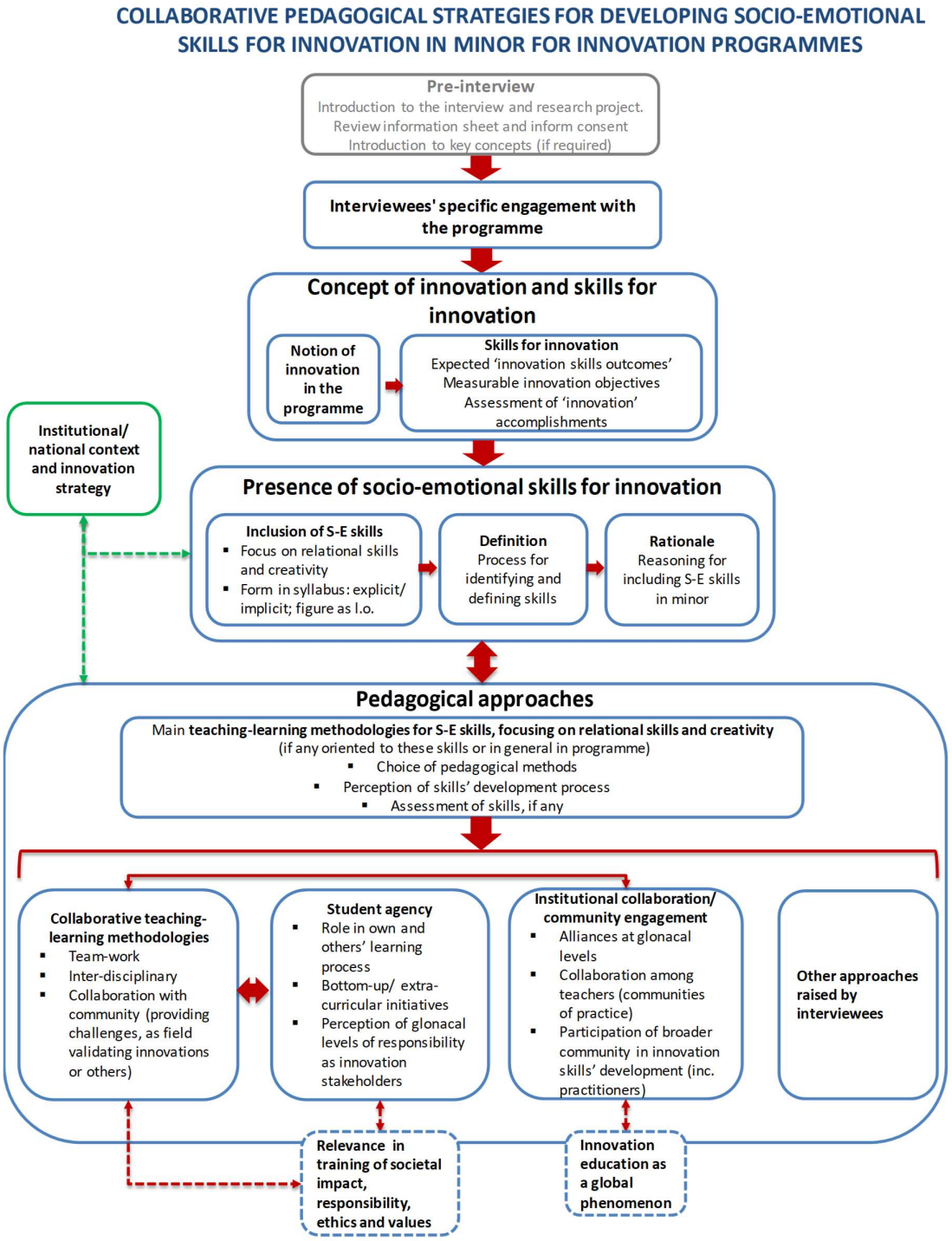
innovation paradigms, if any. These could affect the institutional approaches to Minors, and specifically SESI. External collaborators were sought for 'outsider' perspectives from persons that somehow collaborated in the Minors but were not central in their implementation. These were included given the expected collaboration with persons beyond the formal university boundaries in IE activities. The definition of external collaborator was broad to allow the inclusion of persons with different roles, such as mentor, guest speaker or innovation problem-provider.

Additionally, two interviews per country to national-level experts or policy makers on HE or IE were pursued. Then, between 13 and 15 interviews were foreseen per case, and between 56 and 64 in total. The estimated length of each interview was between 45 and 60 minutes.

I created a fieldwork protocol, including a guide for the interview questions, specific background information on each case and on the interviewees- when available-, and the approved procedures for assuring ethical compliances, notably the forms for informed consent and confidentiality.

The interviewing guide was a practical instrument to help me explore the participants' perceptions on SESI and their development in students. I intended to give space for emerging aspects and explored multiple aspects that could inform both research questions. These included: participants' views on the concept of innovation as conceptualised in the Minors and institutions; key skills for innovation; promotion of socio-emotional skills in the programmes; pedagogical approaches used in the Minors and their choice; collaborative approaches including team-work, cross-disciplinary work and collaboration with the community; student agency in their own and others' learning process; extra-curricular activities complementing the Minors that could represent students' interest in innovation; students' sense of responsibility at local, national and global levels as innovation agents; institutional collaborations according to the type and scale of alliances, collaboration between academics and participation of the wider community in skills development; relevant aspects of the institutional and national contexts; consideration of innovation responsibility; and consideration of innovation education as a global phenomenon. The guide included multiple possible questions, detailed in Appendix 1. The following figure summarises the 'map' of topics for the interviews. It served me to guide the interviews.

Figure 5. Diagram of interviews' topics and flow



Source: author's.

The suitability of the research instruments was validated by a pilot case study, discussed in the data-collection process section.

B. The data collection process

1. Documentary material

Documentary material as secondary data were collected and analysed, mostly before the interviews, to understand more fully the cases. Material was accessed through the programmes' websites. Documents described the Minors and/or its modules, focusing mainly on the programmes' structures and learning objectives. The type and detail of the information available varied across cases and even between modules of one same Minor. Overall, this data served to understand the aims and structure of the Minors. In cases, also to know teaching-learning approaches.

2. Fieldwork

The data were collected during three fieldwork trips: in the Netherlands during July 2017 where a pilot study was developed; in Chile during September 2017; and in the Netherlands during December 2017. In total, 57 semi-structured interviews were conducted: 52 with participants of the four Minor Innovation cases and 5 with national-level experts and policy makers (three in Chile and two in the Netherlands). The following table summarises the interviews with university participants, by case and type of interviewee (the terms used to refer to the programmes are explained in section G).

Most planned number of interviews were achieved. At the national-level, four interviews with policy makers/experts were planned and five performed. The policy makers/experts interviewed in the Netherlands worked one at the Ministry of Education, Culture and Science and one at the Association of Universities in the Netherlands. Those interviewed in Chile worked one at the Ministry of Education, one at the National Council of Innovation for Development and one in the private sector, having been involved previously in innovation initiatives in the public sector.

At the case-level: one interview with innovation unit authorities, one interview with central administration authorities, one interview with programme managers and at least three interviews with professors/lecturers were conducted for each case. Students were hard to access, even with the assistance of programme managers. Possibly this was due to students' intense workload and that any explicit reward was offered for this one-hour commitment. In three out of the four cases I interviewed four or more students, but in one case I interviewed three students. Despite a lesser number, the interviews were rich and diverse in perspectives. Students had either completed

recently or were taking the Minors at the time of the interviews. External collaborators were also hard to reach. This was partly because of the definition of the figure, not evident or existent in all cases. In total, eight instead of 12 interviews with external collaborators were conducted. Again, while the executed number was less than planned, external collaborators provided distinct views from other participants' opinions. Therefore, the dataset based on interviews was plentiful, diverse and suitable for the analysis.

Table 1. Number of interviews, by case and type of participant

Type of interviewee	Collaborator, the Netherlands (5-12/07/2017; 5-8/12/2017)	Networker, the Netherlands (5-8/12/2017)	Explorer, Chile (4-8/09/2017)	All-rounder, Chile (11-15/09/2017)	Total
Central administration authority	1 (with 2 persons)	1	1	1	4 (with 5 persons)
Innovation unit authority	1	1 (with 2 persons)	1	1	4 (with 5 persons)
University professor or lecturer	3	4	3	3	13
Programme manager	1 (with 2 persons)[8]	1[9]	2 (with 2 persons)[10]	1 (with 2 persons)	5 (with 7 persons)
Students	4	3	6	5	18
External collaborator	2	1	1	4	8
Total	12 (with 14 persons)	11 (with 12 persons)	14	15 (with 16 persons)	52 (with 56 persons)

The eight external collaborators interviewed had different profiles. This included: practitioners working on innovation supporting courses as mentor or evaluator of students' projects, part-time lecturers and a person from industry providing innovation challenges for students to work on. The

[8] The person responsible for managing the programme was a professor. This person is considered as programme manager in this record.

[9] Same as above.

[10] There are two managers. Two interviews were developed, one with one manager and one with both.

way I counted part-time lecturers depended on the university teaching staff structure. In three cases, established academics (regular members of staff) lectured in the Minors. In these cases, part-time lecturers were considered as external collaborators (one per case, in a case as teaching assistant) to differentiate from established lecturers/professors with 'insider' perspectives. In one case, most teaching staff are part-time and in fact, all lecturers interviewed seemed to have another (main) activity besides lecturing at the university. In this case, part-time lecturers were considered as lecturers.

The development of the pilot case and the fieldwork completion are described next.

a. Pilot

The pilot study aimed to confirm the suitability of the research instrument and the feasibility of accessing participants, and to assess required adjustments for the fieldwork. The pilot fieldwork was developed for the Collaborator Minor, emphasising institutional aspects (interviews to central administration and innovation unit authority) from the perspective of one of the universities. This case was regarded as the most complex of the four cases for two reasons. First, it is a collaborative initiative among three institutions with a multidisciplinary approach. I expected implications of the (varied) approaches on innovation skills and pedagogical practices. Second, the programme focused on responsible innovation. This topic is increasingly relevant in research and innovation policy, and likely connected to certain social skills, adding certain specificity to the discussion of SESI. Consequently, the Collaborator Minor Innovation offered the maximum expected complexity regarding foreseeable aspects to examine and to handle during the fieldwork. Selecting a complex case for the pilot compared to expected cases is a strategy to face the data collection challenges that may appear throughout the fieldwork (Yin, 2018). This decision was useful and the pilot was successful. I conducted eight interviews in four nearby cities and one online, as the interviewee was not available in person. Most aspects of the interviewing protocol proved adequate:

- Contact with institution: The request to consider the Minor in the study and as the pilot case was kindly accepted by the professor in charge of the programme who generously supported my research.
- Contact with participants: Most types of participants, except students, accepted effortlessly to meet. Key persons in the programme were interviewed, offering critical and informed insights.
- Documents supporting ethical procedures: All interviewees received an information sheet (sent also in advance by email) and signed the consent form, choosing their anonymity status for reporting.

- Interview guide: The instruments for guiding the interviews proved useful and pertinent. For the pilot I had pre-selected questions to focus on depending on the type of interviewee. This was unnecessary as the specific questions were posed in feedback with the interviewee, flowing in the conversation into areas relevant for the research questions. Moreover, I used mostly the diagram (rather than the full list of questions) for guiding the interviews.
- Venue for interviews: with persons working at the university, we met in their offices. With the student interviewed in the pilot, as with others later, the location was a cafe or meeting space. In cases the background noise was inconvenient, yet the interviews were fruitful.
- Time of interviews: The eight conducted interviews had in general a duration of between 45 and 60 minutes each, being a couple extended to 90 minutes and one (with an external stakeholder) developed in 30 minutes. This duration is in addition to the time used for introducing the topic and for signing the consent form. The interviewees with whom the interviews were longer than planned, were willing and accepted to extend the meeting time, in cases mentioning that they were enjoying the conversation.
- Recording and fieldnotes: All interviews were audio-recorded. During the interviews, I took notes of key aspects to follow-up later in the interview and to analyse. I balanced notetaking with being present engaging visually with the interviewees. In cases, after the interviews, I recorded audio-memos with analytical reflections.

The following aspects required further planning:

- Contact with students: Students were hard to access. Only one (of around 20) accepted to participate during the pilot, despite invitation emails from the professor in charge of the Minor. That student did not arrive for our agreed meeting, yet we managed to meet in another moment. I discussed the situation with my supervisors and with the professor responsible for the Minor. A couple of options were explored: doing a focus group instead of interviews, which was not pursued as it would likely not solve the problem of students' interest in participating; or offering a voucher to students, but I was not prepared for the expense implied and did not want to motivate students through a monetary incentive. In the words of Miles et al. (2014), I considered that "the offer of money may unduly influence participants' responses to become more favourable and positive that they really think" (p. 61). Therefore, I continued with no monetary incentive approach, aiming that other students would be keen to participate, especially as the student interviewed offered help to contact his peers. I foresaw that contacting students could be a challenge in the other cases. Also, I decided to remind students about the interviews before the meetings.

- Introduction of the notion of socio-emotional skills for innovation: The familiarity with the notion of 'socio-emotional skills' varied among participants. Some interviewees asked for clarification of its meaning. Then, I used two sources to introduce the concept: the five dimensions used in the CASEL framework of socio-emotional learning (self-management, self-awareness, social awareness, relationship skills and responsible decision-making) and examples of social and emotional skills mentioned in varied sources. This implied a conceptual baseline offered by the interviewer to the interviewee. The pilot experience triggered reflections on how to achieve a balance between introducing appropriately the notion of SESI, when required, and allowing interviewees to interpret the concept themselves. I decided to continue introducing briefly the concept when required, aiming not to fix the concept to the examples given. In that sense, I intended to allow interviews to manifest their perceptions of SESI, offering when necessary a minimum overview of *a* way in which SESI may be apprehended.

Overall, the pilot fieldwork was positive: the data collection method and instruments proved appropriate. Thus, the pilot case and pilot interviews were considered in the main dataset. The case interviews were completed later in the year. The interviewing protocol was performed in similar ways for the next three cases.

b. Fieldwork completion

The fieldwork was completed in two further trips. In one fieldtrip to Chile, I collected data for the two Chilean cases, Explorer and All-rounder, and interviewed policy makers/experts. In the second trip to the Netherlands, I completed the data-collection for the Collaborator case, developed fully the Networker case and interviewed policy makers.

The access to cases in both, Chile and the Netherlands, was favourable, despite differences in my local networks. In the Dutch cases I did not know people involved in the Minors before the fieldwork. At Collaborator and Networker, the professor/lecturers in charge of the programmes were extremely welcoming to my request. At Explorer in Chile, I was contacted through a former colleague with the programme manager who also cordially accepted my request. At All-rounder, in Chile, the participation in the study was also accepted openly, yet I knew the institution and the programme from previous work. I appreciate that all interviewees in the four cases were open, respectful and generous with their time and opinions. I am profoundly grateful to all them.

All interviews in the Netherlands were developed in English; all interviews in Chile were developed in Spanish, except for one performed in English with an English-native speaker. In the consequent

analytical stages, coding and analysis was developed in English, translating original Spanish quotations into English when necessary.

Generally, the development of the interviews was smooth, and the following challenges were faced and solved.

- Contact with students: The challenge of reaching the desired number of students persisted but was overcome. Evaluating the reality of accessing students, I re-set as a feasible minimum three students per case. The form of access varied by case: in two cases the coordinator contacted students and those interested followed-up with me; in one case, the Minor coordinators contacted students and agreed the interviews; and in one case, I accessed students' emails and contacted them directly. In one case with insufficient number of students, a generous and proactive interviewed student contacted me with other students. The restricted and varied access to students across cases represented a research challenge, which nevertheless was overcome thanks to students' openness and honesty in their comments, which enhanced the data.
- Venue for interviews: as I met more people without a private office after the pilot, finding a space where to meet was challenging. We continued using hallways or cafes, which despite being noisy and therefore limiting the concentration on the conversation, worked. In a case, the programme manager booked a room, helping substantially.
- Online interviews. Due to weather conditions (snowstorm) and to personal agendas some interviews were realised via Skype. Five out of the 57 interviews were online. The online interviews worked well, and detailed engaged conversations were developed.

The fieldwork was conducted successfully. The experience was enriching, and abundant relevant data were collected.

C. Approaches to data analysis

My analytical process included reflections when defining the research questions, considering the conceptual framework, designing the case-study, during the interviews, throughout the coding and in the writing stages. That is, the analysis was an extensive process, including data-collection, recursive coding and reporting (Miles et al., 2014; Braun and Clarke, 2006). In this iterative analytical process, I used thematic analysis with inductive and deductive approaches, and multiple analytical techniques, such as pattern finding and triangulation. These different and interwoven stages represent "three concurrent flows of activity": data condensation, data display, and conclusion drawing and verification (Miles et al., 2014, p. 12).

I approached data condensation, the continuous analytical process of "selecting, focusing, simplifying, abstracting, and/or transforming the data" in empirical materials (Miles et al., 2014, p. 12), intending to identify possible patterns, and then themes, around my research questions. A central activity in data condensation was coding, the interpretative process of "[d]eriving and developing concepts from data" (Corbin and Strauss, 2008, p. 65). Codes are labels to assign symbolic meaning to part of the data, in descriptive or inferential ways (Miles et al., 2014). I coded the transcribed data using NVivo 11 and 12 software, looking at data from different angles and focusing on participants' expressed ideas rather than their form. I coded extracts inclusively to later understand the context of the code, and coded for multiple possible patterns (Braun and Clarke, 2006). When coding, I used multiple approaches, including values' coding, conceiving values as "the importance we attribute to ourselves, another person, thing, or idea" (Miles et al., 2014, p. 75). This was important to understand participants' conceptions about SESI, the perceived relevance that these skills have in innovation and the appropriateness of pedagogical approaches. Relevant discussions about the purpose and values of IE emerged, discussed in Chapter 5. Yet beyond, participants' values and beliefs regarding SESI are imbedded and interpreted throughout the thesis.

For displaying data, I used methods such as diagrams to draw conclusions by organising and concentrating information making its meaning accessible (Miles et al., 2014). I also showed patterns in the form of narratives.

Drawing and verifying conclusions was a continuous process interwoven with data condensation and display. In developing conclusions, I used several of the techniques suggested by Miles et al., (2014): identified patterns and themes by clustering similar elements, triangulated data, used metaphors to see new theoretical possibilities, compared and contrasted, observed relations between elements, created logical chains of evidence, and attempted to develop conceptual coherence. After initial propositions, I confirmed the findings, using multiple approaches too. I assessed the potential effect of my predispositions on the analysis, weighted the evidence (without seeking representativeness but assessing the importance in the overall dataset), explored the meaning of outliers (for example, through the views of one critical disengaged student), and searched for negative evidence and for 'rival explanations' (Miles et al., 2014).

1. Thematic analysis (across cases)

Throughout these analytical stages I used thematic analysis, integrating inductive and deductive approaches. Thematic analysis is "a method for identifying, analysing, and reporting patterns (themes) within data" (Braun and Clarke, 2006, p. 6). I chose thematic analysis as a key analytical

method because it offers theoretical and epistemological flexibility, including a compatibility with constructionist approaches, and allowing rich and detailed analysis (Boyatzis, 1998; Braun and Clarke, 2006). Themes showed patterns of responses or meaning in the dataset that were important for the enquiry, according to my judgement as researcher rather than by quantifiable measures of the themes' presence in the dataset (Braun and Clarke, 2006).

Acknowledging the non-linearity of qualitative analysis, I developed six stages of thematic analysis explained by Braun and Clarke (2006): familiarisation with the data, generation of initial codes, search for themes, review of themes, definition and naming of themes and production of the report. The first five phases largely coincide with the data condensation process described above, whilst the sixth aligns to drawing and verifying conclusions. In the first stages of knowing the data and initial coding, I approached the data openly, paying attention to both, issues evidently linked with the research questions and other implicit yet possibly meaningful aspects. After sorting the codes into potential themes, I refined them aiming to capture their essence and defined hierarchies of meaning by using themes and subthemes (Braun and Clarke, 2006). Finally, when reporting I attempted to provide "a concise, coherent, logical, nonrepetitive, and interesting account of the story the data tell – within and across themes" (Braun and Clarke, 2006, p. 23). In coding and theme-definition I progressed from descriptive semantic analysis to interpretative work, examining and theorising the underlying ideas (Braun and Clarke, 2006). This iterative process leading to increased conceptualisation is reflected, for example, in the analysis of 'learning catalysts', resulting from conceptualising patterns presented in the data and formulated through the 'catalyst' metaphor (Chapter 9).

As explained, I analysed the data predominantly across cases. When pertinent, I identified distinctive elements between cases and sought for possible relations with the cases' contexts -both, institutionally and nationally. However, I was cautious when exploring connections between the phenomenon and its contexts; this study is qualitative and thus I did not work under a statistical representativeness paradigm. I did not attribute situations only to the context, also because other non-observed aspects may affect the manifestation of SESI in universities. The cross-case approach supported the analysis two-fold: by increasing the potential generalisability of conceptual propositions, perhaps applicable to different university IE context (or other HE contexts), and by providing sufficient data from different cases to understand in-depth SESI and their development in HE. Thus, I chose the analytical possibility proposed by Yin (2011), whereby "your entire composition may consist of the cross-case analysis… each chapter or section would be devoted to a separate cross-case issue, and the information from the individual case studies would be disperse

throughout each chapter or section" (pp. 227–228). Still, I introduced each case individually to understand the respective contexts.

2. Inductive – deductive strategies

I analysed data integrating both, deductive and inductive analytical approaches to suit analyses conducive to answering the research questions. Different subjects and stages of the analysis benefited from these approaches. However, inductive and deductive strategies represent tendencies rather than categorical distinctions since usually deductive approaches have inductive analytical phases and vice versa (Bryman, 2016). Essentially, I used these tools to map "what is happening and why", by driving differentiation and integration, and coding iteratively, both deductively and inductively (Miles et al., 2014, p. 93).

Deductively, I developed a first-level characterisation of the nature of socio-emotional skills, based on the research questions and conceptual framework (Miles et al., 2014). As I attempted to identify the skills of a socio-emotional nature that promote innovative behaviours, I relied on the existent CASEL model and its five dimensions of socio-emotional skills, which represent an apparent convergence in the literature. This component of the analysis, thus, was underpinned by my prior theoretical assumptions and framework (Braun and Clarke, 2006). This was useful in ordering and qualifying data on SESI. This deductive analytical phase set the foundations for approaching the first research question.

Centrally, I also used inductive approaches leading to insights regarding both research questions. Inductive analysis is data-driven and involves coding that does not seek to fit data into a pre-existing frame (Braun and Clarke, 2006). Thus, I inferred the findings' implications to theoretical developments (Bryman, 2016), for example, about boundary-crossing pedagogical approaches supporting SESI development. Inductive codes emerged progressively, allowing me to 'uncover' important factors (Miles et al., 2014). Notably, these relate to the rationale about the importance of certain skills for innovation and to the assorted (planned or unplanned) processes that nurture SESI development.

As announced in Chapter 3, though, data and theory dialogued continuously, implicitly or explicitly. In dimensions of the enquiry approached predominantly inductively, such as students' role in their own and their peers' learning process, I drew upon existing theories to construct meaningful understandings of the data, resorting to them in rather later stages of the analysis, when drawing conclusions. Furthermore, the integration of inductive and deductive approaches supported

conceptualisation and theorisation exercises, since theorising occurs in "the interplay of making inductions (deriving concepts, their properties, and dimensions from data) and deductions (hypothesizing about the relationships between concepts)" (Corbin and Strauss, 2008, p. 56).

3. Analytical techniques

During the iterative cross-case thematic analysis, steered by both, theory and data, I attempted to "think upwardly conceptually, rather than downward into the domain of individual variables" (Yin, 2018, p. 197). I used multiple analytical tools, i.e., mental strategies used when coding (Corbin and Strauss, 2008), throughout different analytical stages; notably pattern finding and triangulation.

a. Pattern- finding

In multiple-case studies, such as this thesis, pattern-finding provides the foundation for analysing common themes across cases (Miles et al., 2014). Accordingly, I worked predominantly with cross-case patterns, relying on their "argumentative interpretation" (Yin, 2018, p. 198). The process of finding patterns entailed selecting and comparing data, identifying regularities, incorporating further data to question and strengthen these patterns, and drawing inferences that relate to other conceptualisations (Miles et al., 2014). I identified, for example, patterns across cases that benefited the development of SESI: students interacting with different others, working in real-life problems, and taking responsibility for tasks while feeling supported. These patterns substantiated the conceptualisation of "learning catalysts" (Chapter 9).

In finding patterns, I explored potentially relevant contextual variations. While the context does not determine the experiences, it sets conditions for manifestations which in turn may impact the conditions (Corbin and Strauss, 2008). Therefore, the context, in this case predominantly the university environment, shapes the circumstances in which IE occurs and the developments of Minors Innovation may potentially affect the university context. While this study does not seek to explore comprehensively the university (innovation) ecosystem, important contextual aspects are considered in the analysis insofar as they relate with the development of SESI. For example, Chapter 5 discusses key aspects of university IE in the Netherlands and Chile that affect the promotion and development of SESI.

b. Triangulation

This thesis relies on multiple sources of evidence, facilitating data triangulation, a quality of case studies (Yin, 2011). Triangulation refers to the "process of using multiple perceptions to clarify

meaning, verifying the repeatability of an observation or interpretation" (Stake, 2005, p. 454). I used data triangulation (i.e., varied data sources) and theory triangulation (i.e., different perspectives) (Patton, 2002) to interpret my data.

I triangulated data between different cases and types of participants. Triangulation between cases was central in the validation of emerging concepts and I used this approach in all analytical sections. Triangulation between types of participants was important given their different engagement in Minors Innovation. Students, lecturers, managers, authorities and external collaborators had different roles and certainly offered varied perspectives. This was partly because their formal participation differed. Students participated in all or most courses comprised in Minors. Lecturers usually knew in detail dynamics occurring in the courses they led. Innovation unit and central administration authorities had generally an overview of the operation of the Minor, whilst external collaborators only saw their part of involvement (although few had participated before, as Minors students). Thus, participants' views complemented each other as data sources, presenting various perspectives on SESI and their development. In some analytical sections I considered predominantly the perspectives of particular groups (e.g., of educators – including lecturers and authorities – to analyse the drivers for using certain pedagogical approaches), while in others I integrated educators and students' views (e.g., to analyse the forms of pedagogical approaches supporting SESI).

The theoretical framework, encompassing multiple theories, was essential in triangulating both, in-between theories and between theory and data. In-between theory triangulation, included for example combined claims of boundary-crossing and cross-disciplinary theories, or of socio-emotional and innovation theories, to develop certain arguments. Theory-data triangulation contributed to the rationalisation and theorisation of empirically emerging notions. For example, to understand why certain socio-emotional skills highlighted by participants are important for innovative behaviours. Both types of triangulation using theoretical resources supported the analysis and conceptualisation across-cases.

I used triangulation and pattern-finding as interrelated and fundamental techniques for the analysis; triangulation facilitated the corroboration of patterns across cases, different types of participants and conceptual perspectives. Certainly, these were not the only analytical techniques used; these were entwined with others such as alerting of special situations and exploring "so what?" and "what if?" reflections derived from initial analyses (Corbin and Strauss, 2008). I combined all these methods in various analytical stages and as required for answering the research questions, considering -as many suggest (e.g., Braun and Clarke, 2006; Corbin and Strauss, 2008;

Miles et al., 2014)- that qualitative analysis is an iterative extensive process requiring multiple mental tactics to transform data into patterns, themes and concepts.

4. Analytical structure

The overall analysis of the thesis is organised around the two main research questions: first, which skills of a socio-emotional nature support innovative behaviours, and second, how is SESI development pedagogically facilitated in Minors Innovation. A third major analytical element connects specific skills and pedagogical approaches, focusing on students' learning process. This learning-oriented and learner-centred analysis is discussed using the metaphor of catalysts, as elements stimulating learning processes. Therefore, the analysis is structured in three parts: 'which' skills, 'what' pedagogies, and 'how' the learning process occurs. Yet two caveats are important. First, the latter learning aspect arose from the empirical data. The study does not centre on analysing the effectiveness of pedagogical practices. In any case, pedagogical instruction differs from learning experiences (Lave and Wenger, 1991). Second, the analysis of 'which' skills considers participants' perceptions on skills that favour innovation, which are not necessarily the same as those promoted, explored through 'what' pedagogies, or developed, analysed in 'how' learning occurs. Despite this clarification, nevertheless, there seems to be a logical consistency in educators' narratives between what is considered relevant for innovation and what is promoted in Minors Innovation.

The stage for the three analytical sections is set in Chapter 5. It draws on empirical data to discuss emerging themes about the educational conditions for the promotion and development of SESI. The analysis of 'which skills' is based on participants' consideration of skills relevant for innovation and is organised around the CASEL model of socio-emotional learning (Chapter 6). After, pedagogical approaches used in the promotion of SESI are discussed as boundary-crossing practices. I analyse two central pedagogical practices: cross-disciplinary learning (Chapter 7) and community-engagement (Chapter 8). The third component on learning catalysts integrates and furthers the analyses of the previous chapters. A "latent" theme across the majority of the dataset (Braun and Clarke, 2006) was identified as learning catalysts. Three learning catalysts that enhance SESI are discussed: authenticity of the learning experience, relation with otherness and protected autonomy (Chapter 9).

In all these chapters, and notably in Chapter 9, I intended to conceptualise the analysis, to contribute with a language that facilitates understanding and then, practice. In that sense, this was a theorising exercise. Theory-building is about integration and the development of a reasonable

explanatory scheme which becomes cohesive by using an "overarching explanatory concept… that, taken together with other concepts, explains the what, when, where, and why of something" (Corbin and Strauss, 2008, p. 55). As Corbin and Strauss (2008) remark, defining the conditions or contexts under which certain concepts may apply is crucial for conveying precise meanings. Therefore, in the conceptualisations developed in the thesis, I attempted to emphasise relevant contextual characteristics in the discussed phenomenon.

D. Researcher's positionality

The researcher's predispositions affect the research process and results: "what is discovered about "reality" cannot be divorced from the operative perspective of the knower" (Corbin and Strauss, 2008, p. 4). Our previous beliefs and understandings shape our positionality, which is reflected in our interrelated epistemological, axiological, theoretical and methodological standpoints.

Epistemologically, in this reflective reporting stage, I recognise my inclination towards socio-constructivist approaches which conceive the construction of meaning dialogically between the researcher and the 'subject' being researched. "[T]he basic generation of meaning is always social, for the meanings with which we are endowed arise in and out of interactive human community" (Crotty, 1998, p. 55). I strongly acknowledge the importance of this interaction in my thesis, notably in the co-construction of meaning with the participants "who are trying to explain and make sense out of their experiences and/or lives, both to the researcher and themselves" (Corbin and Strauss, 2008, p. 10, thoughts of Corbin). The conceptual dialogue with other researchers' previous works to me also represents a co-construction through conceptual scaffolding. Yet, my socio-constructivist epistemological grounding is not absolutist. Creswell and Poth (2018) argue that in social constructivism researchers inductively develop theories based on patterns rather than starting with theories. As explained earlier, I used both, inductive and deductive analytical approaches, relying theoretically on the socio-emotional learning framework to organise data around skills, and drawing upon multiple other theories throughout the analysis. I worked significantly also on 'latent' themes arising from the data, which tends to agree with constructionist perspectives (Braun and Clarke, 2006). Thus, in this qualitative explorative piece of research where I heavily relied on participants' views for the analysis, I lean towards a non-purist socio-constructivist approach.

Axiology relates to the role of values in research; which in a socio-constructivism paradigm manifest in the belief that "[i]ndividual values are honoured and are negotiated among individuals" (Creswell and Poth, 2018, p. 35). This implies acknowledging that researchers practice values while researching and it is necessary to make them explicit, communicating researchers' positionality

regarding the context of the study (Creswell and Poth, 2018). My values regarding SESI and their development are expressed throughout the thesis. Hereby, I emphasize my recognition of ideological tensions underlying the literature on skills for innovation and socio-emotional skills, and my belief that despite these differences, their conceptual integration may benefit not only both bodies of knowledge but crucially, the practice of university IE and the appreciation of socio-emotional skills (including an enriched vocabulary) in university education.

My theoretical perspective, which grounds the logic and criteria for the research (Crotty, 1998), was interdisciplinary, flexible and responsive to the data, as reflected in the theoretical framework introduced in Chapter 3.

Finally, methodologically, I expose in this chapter my standpoints, the reasons for adopting a cross-country multiple case study and methodological limitations.

E. Research legitimisation

Criteria to assess the quality and legitimisation of qualitative research and specifically of case studies, are contested, and depends on the interpretation of these types of research and the knowledge generated. Epistemological standpoints affect its judgement. Criteria varies also between the quality of the research process and the research output (Lincoln and Guba, 1990). I consider that the following elements discussed in qualitative research methodology literature are relevant for the legitimisation of my thesis:

1. **Consistency in research foundations.** I have expressed my positionality and aimed for consistency in the research decisions, acknowledging the literature's controversiality in multiple criteria for seeking and assessing quality in qualitative research. In doing so, I have attempted to assure coherence between key elements of research, namely, the epistemology, theoretical perspective, methodology and methods, to support the robustness of my research and its outcomes (Crotty, 1998). This integrity relates to the 'resonance' criterion posed by Lincoln and Guba (1990) for judging the quality of case study reports, referring to the fit between the report and the belief system underlying the research.

2. **Explicitness of researchers' assumptions.** Another central aspect of quality on qualitative research is making explicit the researcher's underlying assumptions (e.g., Braun and Clarke, 2006; Crotty, 1998). This requires self-awareness, a quality criterion in qualitative research (Corbin and Strauss, 2008), demanding from the researcher "an obligation to be self-examining, self-

questioning, self-challenging, self-critical, and self-correcting" (Lincoln and Guba, 1990, p. 54). Throughout the thesis I intended to make explicit my underlying preconceptions, and to question them during the analysis, with openness towards the participants' contributions and others' previous works.

3. **Relevance and applicability.** I intend to do research that is relevant for practice. This is a core driver in my professional and academic commitment, believing that constructive (bidirectional) dialogues between knowledge-creators and knowledge-users (which in my epistemological view are intrinsically related) may benefit all (acknowledging the value of 'basic' or ground-breaking research that may require substantial further work and time to reach 'application'). This thesis' subject is based on its potential use: innovation education is expanding, innovation requires socio-emotional skills and there is limited understanding on what these skills are and how to promote them, in practice. The relevance and applicability are quality criteria of qualitative research, varying the conceived types of uses and contexts of application. For example, the empowerment that case studies promote, is emphasised by Lincoln and Guba (1990) referring to the ideologically non-neutral facilitation of readers' consequent actions and increased awareness. Regarding multiple case studies, this thesis' methodology, Miles et al. (2014) invite to question the applicability of the findings in other similar settings. The latter is contested in the discussions on generalisability and transferability, mentioned next.

4. **Validity, reliability and generalisation.** The suitability of these criteria is contested in qualitative studies and when using constructivist approaches. Yin (2018) summarises four frequent ways of assessing the quality of empirical social research: construct validity, internal validity, external validity and reliability. Guba and Lincoln (1989) proposed, already three decades ago, "parallel" criteria for constructivist studies, based on the "conventional" criteria acknowledged by Yin, yet discussing construct validity instead of objectivity. In the parallel approaches, credibility replaces internal validity; transferability, parallels external validity; dependability supplants reliability; and confirmability relates to objectivity. What do they mean and what is their pertinence to this thesis?

First, construct validity refers to the identification of "correct operational measures for the concepts being studied" (Yin, 2018, p. 42). The critical concept in this thesis is SESI and I aimed to explore it integrating diverse knowledge from previous research with participants' perceptions. Thus, epistemologically 'correct' or 'incorrect' operational measures for the concepts are likely inapplicable in this study. Nevertheless, the coherence and consistency of the constructs developed

was indeed sought. I used multiple sources of evidence and developed chains of evidence (Yin, 2018) as tactics to enhance such consistency. This agrees with the confirmability criterion, which determines "the extent to which constructions, assertions, facts, and data can be traced to their sources" (Guba and Lincoln 2001).

Second, internal validity seeks to establish causal relationships and is applicable mostly to explanatory and causal studies, rather than for exploratory research (Yin, 2018), as is this case. Yet, some aspects of the analysis significantly benefited from tactics used for internal validity. This include pattern matching, explanation building, addressing rival explanations and using logic models (Yin, 2018). The credibility criterion, accomplished, among others, by continuously checking the constructions developed in relation to those possibly expected beforehand (Guba and Lincoln 2001), suits this thesis' research approach.

Third, Yin (2018) discusses external validity relating to the generalisation of findings. However, others reject generalisability in case studies, supporting *transferability* between similar contexts and other types of applications where contexts may be dissimilar (Lincoln and Guba, 1990). The possibility of developing research that may be generalisable supported the choice for a multiple-case approach. This reassures that "the events and processes in one well-described setting are not wholly idiosyncratic" and by understanding the relation to the local conditions, permits "more sophisticated descriptions and more powerful explanations" (Miles et al., 2014, p. 101). Acknowledging the relevance of contextual elements, some findings hereby presented are arguably generalisable -which does not mean, however, that knowledge can be simply transferred to other contexts but rather resituated (Griffiths and Guile, 2003). This includes the conceptualisation of SESI, certain learning dynamics observed in the development of SESI in multidisciplinary and community engagement contexts and learning catalysts. These refer to analytical generalisations (rather than statistical generalisation), as principles or lessons that may serve theory development and concrete applications (Yin, 2018). Crucially, generalisations originate from the case study, not the case(s), and may derive from initial theoretical propositions or emerge from empirical findings (Yin, 2018). In this case, the potentially generalisable conceptualisations arose deductively (e.g., identification of SESI) and inductively (e.g., learning catalysts). In either case, "the generalization will be at a conceptual level higher than that of the specific case" (Yin, 2018, p. 38). Importantly, however, is the agency of 'receivers' in judging the pertinence of certain research in other contexts, emphasised by Guba and Lincoln (2001) when discussing transferability. The generalisability and transferability -or resituate-ability- of knowledge is one of the possibilities for the applicability discussed above.

Finally, reliability consists on "demonstrating that the operations of a study- such as its data collection procedures- can be repeated, with the same results" (Yin, 2018, p. 42). I would argue that that general procedures of my thesis are replicable (e.g., the use of same guiding questions for interviews); however, the specific experience or practice of developing the research, and moreover the results, are not fully replicable. Research, as a practice, may be conceived as "extra-individual, relational, emergent and subject to ongoing formation and reformation" (Skourdoumbis and Lynch, 2017, p. 274). The temporality and persons involved in this thesis- including myself as the researcher, the participants, and our relationship during the interviews- is unique and unrepeatable, and therefore highly unlikely that the creative process developed in this confluence of persons and practices would result in exactly the same specific results. The essence of the findings would probably remain, but their detailed conceptualisations would probably vary. This is not incompatible, however, with the previously discussed generalisation of high-level concepts, as this refers to the subsequent application of ideas developed in a particular setting, into other contexts.

Consequently, I strove for quality in the dimensions accounted by Yin (2018). I validated the constructs developed by working with different sources of evidence and by constructing rationales for important pieces of evidence, such as the relevance of certain SESI for innovative behaviours. I worked on the internal validity by triangulating the abundant dataset and questioning 'rival explanations'. Further, I analysed the conceptual generalisability of the findings, discussing its applicability to both, other innovation education contexts and broader learning environments. Also, I documented the research procedures, however I doubt the feasibility of the study's complete replicability.

Broader quality criteria for qualitative research is discussed in the literature, some of which has been sought in this thesis: sensitivity for the topic, depth and variation (Corbin and Strauss, 2008), clarity, precision, simplicity, independence, courage, egalitarianism (Lincoln and Guba, 1990), and logic and creativity (Corbin and Strauss, 2008; Lincoln and Guba, 1990).

F. Ethics

Ethical standards in research are required throughout the research process, and not only in the data-collection stage. It implies holding responsibility to scholarship, evaluating the worthiness of the project and assessing the required expertise for developing the research competently (Miles et al., 2014; Yin, 2018). Thus, an important component of exercising ethics was to prepare myself as a researcher for the research activities. I further trained in interviewing skills and educated myself in

research methods. Also, I exposed my research proposal through various means to validate the relevance of my thesis.

I also took responsibility for working systematically with the dataset, giving appropriate attention to each data item (Braun and Clarke, 2006). This was especially important in the first stages of coding the abundant data, where I attempted to be fair in the data treatment, while focusing on the main lines of enquiry.

Crucially, and as acknowledged more often, research ethics includes protecting the participants and respecting privacy and confidentiality. This involves having participants' informed consent to participate in their study (Yin, 2018), referring to their access to full information about what the study involves (Miles et al., 2014) and how their contribution will be disclosed or reported (BERA 2011). In this study it consisted of institutional and individual consents. Institutionally, it was agreed with the counterparts of the four Minors that the respective institutions will be acknowledged. Despite this authorisation, I chose to anonymise the cases for further confidentiality of participants. Individually, all participants agreed to participate, stating their willingness to remain anonymous in their opinions or not (most interviewees consented to be identified). In reporting, participants' names are anonymised. The corresponding cases and their roles (e.g., student, lecturer, etc.) are disclosed because that is relevant for interpreting the data and meets confidentiality criteria. I abbreviate these features as explained earlier when introducing the four cases. Ethical compliance and materials were informed to, reviewed and approved by the Institute of Education Ethics Committee. The information sheet for participants and personal consent form are presented in the Appendices.

Importantly also, acting upon and expressing ethical principles helped me in the relationship with participants, specifically in their notable openness to express their views. That is, acting ethically enhanced the quality of my data. The conveyed and practiced principles included: confidentiality of research data (signing agreements); declaration of my interests as researcher (explaining upfront what the planned uses of information were); and honesty and transparency (Jones, 2010; Kvale and Brinkmann, 2009).

The next section describes key contextual aspects at the national and institutional levels and characterises the Minor Innovation programmes, based on extant documentary information. This follows by Chapter 5, where I draw on empirical data to analyse central themes that appear to condition the development of IE and pedagogical practices supporting SESI.

G. The four cases and their institutional and national contexts

The four cases conforming this study are developed in different institutions and countries, the Netherlands and Chile. Contextual aspects, such as "social, political, cultural, racial, gender-related, informational, and technological" facets interweave in complex ways and are important in analysing a phenomenon (Corbin and Strauss, 2008, p. 8). The institutional and national-level contexts matter when analysing SESI and their development because the interaction with the socio-cultural environment is embedded in learning processes (Illeris, 2018). That is, the environment, participants and education and learning practices mutually shape each other (Lave and Wenger, 1991), in noticeable or inappreciable ways. Thus, when pertinent and feasible maintaining the general anonymisation of universities throughout the thesis, I consider contextual aspects related to the perceived importance of SESI and their promotion in HE. This section briefly introduces the selected cases, and their institutional and national contexts around IE.

1. National level context

National systems of HE and innovation are relevant for the analysis of SESI in Minors Innovation because they contextualise the countries' need and preparedness to develop innovation education programmes. Both, HE and innovation systems, likely shape the form and intensity of innovation education. This may occur through direct policies for IE -which seem very limited- and through research and valorisation policies, which may boost academics' engagement in innovation related activities, nurturing consequently educational programmes.

The Netherlands and Chile represent undoubtedly different contexts regarding their HE and innovation systems, both in terms of structure and degree of development. Some international measures reflecting these differences are summarised in the following table.

Table 2. Figures and features of Innovation and Higher Education systems in the Netherlands and Chile

	the Netherlands	**Chile**
National innovation context		
Investment in R&D as % of GDP (a)	1.98%	0.39%
Percentage of R&D expenditure in experimental development (a)	29%	32%
Position in Global Competitive Index[11] (b)	4	33
Position in 'innovation ecosystem' dimension of Global Competitive Index: business dynamism/innovation capability[12] (b)	2/10	47/53
National Higher Education context		
Structure of HEIs	Binary system: research-oriented higher education- mostly offered by research universities- and higher professional education- mainly offered by universities of applied sciences (c). The government funds 13 research universities, the Open University and 36 universities of applied sciences. Private and 'approved' institutions do not receive governmental funding (c).	Three types of HEIs: universities, technical training centres (CFT) and professional institutes (IP). CFT offer short technical qualifications (ISCED 5B), IP offer the previous ones and professional qualifications not requiring a bachelor's degree (ISCED 5B and 5A), and universities grant technical and professional qualifications, bachelor, master and doctoral degrees and post-graduate diplomas. The system is

[11] The Global Competitiveness Index is developed by the World Economic Forum and assesses national-level competitiveness. The Index comprises 103 indicators in four dimensions: enabling environment, markets, human capital and innovation ecosystem.

[12] The innovation ecosystem dimension of the Index comprises two aspects: business dynamism and innovation capability. Business dynamism includes administrative requirements and entrepreneurial culture. Innovation capability considers interaction and diversity, research and development, and commercialisation. Innovation capability is the weakest of all dimension for Chile (ranked 53) and one of the lowest within the Dutch profile, being much stronger though in the global context (ranked 10).

	the Netherlands	Chile
		composed by 162 HEIs: 60 universities, 44 IP and 58 CFT (f). Governmental funding is disparate; universities conforming the Council of Rectors of Chilean Universities (CRUCH) receive direct lump-sum state funding that other HEIs do not. CRUCH members are mostly state or private universities existing or derived (as former campus branches) from universities existing before the reform of 1980.
Governance of HE and innovation	The Ministry of Education, Culture and Science is responsible for HE (c). The Ministry of Economic Affairs is responsible for innovation policy and applied R&D (e). Both ministries collaborate in promoting innovation and entrepreneurship (e). The Association of Universities in the Netherlands (VSNU) and the Association of Universities of Applied Sciences (VH) gathers the respective HEIs and act as employers' organisations, negotiating collective labour agreements (e).	The Ministry of Education oversees HE, while the newly created Ministry of Science, Technology, Knowledge and Innovation leads R&D efforts. The Ministry of Economy through its agency CORFO has historically promoted innovation and entrepreneurship. The highly privatized system (77% of the HE enrolment is in private HEIs (g)) sustains an heterogenous system, despite the existence of quality assurance policies and competitive public funding instruments available to private HEIs.
Enrolment rate at tertiary level: first-time entry rate / entry rate for younger than 25 years old (OECD averages: 68% and 51%) (d)	70% / 57%	87%/ 67%

	the Netherlands	Chile
Financial investment in tertiary education as % of GDP (OECD average: 1.6%) (d)	1.7%	2.35% (0.97% by public sources and 1.38% by private ones)

Sources:

(a): OECD, 2013

(b): World Economic Forum, 2019

(c): Nuffic, 2018

(d): OECD, 2016

(e): OECD and European Commission, 2018

(f): National Council for Education, 2017

(g): own calculation based on data by the National Council for Education, 2017

The Netherlands has a strong position in the global economy partly given its innovation ecosystem, while Chile's economic profile is weakened by its innovation performance (World Economic Forum, 2019). In research and development (R&D), fundamental for breakthrough innovation, both countries display different realities. The Netherlands invests 1.98% of its GDP in R&D, less than the OECD average of 2.36%, while Chile lags behind, presenting the lowest rate of expenditure in OECD countries, with only 0.39% (OECD, 2013), a stagnated figure. However, the distribution of funding by type of R&D is similar in the Netherlands and Chile; specifically, around 30% is experimental development in both countries. Experimental development is arguably closer connected to innovation outcomes than basic and applied research– at least in direct terms, although basic research may be fundamental for paradigm-shifting innovations. This similarity may suggest alike policy rationales in both countries regarding investment for innovation development. Despite that, however, the Netherlands shows a significantly stronger position than Chile regarding their innovation systems. This situation possibly shapes and is shaped by the development of innovation capacities through IE in HE.

The structure of HE systems in both countries differ. The Dutch publicly funded research-oriented HE sector seems more harmonised than the heterogeneous and highly privatised Chilean university sector. Furthermore, in Chile, the funding system relies heavily on cost sharing, charging high fees to students. This means that Chile is the fourth OECD country with a greater proportion of private funding (OECD, 2016), corresponding mostly to fees.

Enrolment rates are above the OECD averages in both, the Netherlands and Chile. Yet, while the HE system in Chile has rapidly massified, access to HE (and certainly quality) is unequally distributed among income groups. The HE enrolment rate, for the lowest income quintile, increased from 4.5% in 1990 to 34.4% in 2013 -still presenting a huge gap with the highest quintile, whose rate rose from 39.7% to 89.6% in the same period (OECD, 2015b). Inequity, heterogeneous quality across the system and student indebtedness due to fees drove powerful student-led manifestations in the past decade. This resulted in HE reforms which, among others, ensured 'free education' to the 60% poorer of the population through an enhanced student-aid system. In this sense, HE policies in Chile are still sorting critical structural challenges that possibly diminish innovation policies.

These few indications acknowledge contextual differences and similarities between both countries in aspects that, albeit indirectly, may affect IE related governmental policies. For example, the Netherlands has developed innovation and entrepreneurship education policies already for a couple of decades related to its broader innovation agenda. Also, Chile's HE system heterogeneity is reflected in the varied development of IE.

2. Institutional level context

While the unit of inquiry is Minors Innovation, the institutional contexts are also important when exploring the relevance of SESI and pedagogical approaches to promote them. To introduce the institutions, it is first necessary to explain how the cases are referenced.

Four Minors Innovation, two in the Netherlands and two in Chile, are studied in this thesis. The Minors have been anonymised, although the programme managers responsible for the Minors at the moment of data collection consented to disclose the programmes and the universities involved. Throughout the thesis, the programmes are referred to using terms associated to important characteristics of the programmes, which somehow also reflect institutional features.

The cases in the Netherlands are denominated 'Collaborator' and 'Networker'. Collaborator is a programme offered jointly by three universities in the Netherlands. Networker is offered by one university, strongly engaged with its local innovation and entrepreneurship ecosystem. Collaborator and Networker are offered in different regions of the country. The cases in Chile, denominated 'Explorer' and 'All-rounder', are each offered by one university located in Santiago. Explorer is characterised by an organisational disposition to try new approaches. All-rounder is a programme extended throughout multiple academic departments, offering many different modules. All four cases focus the titles of the programmes on 'innovation' and one of them

additionally includes the term ‘entrepreneurship’. Three cases call the programmes ‘Minor’ and one uses another term, referring to the same type of undergraduate credited optional programme offered to students from multiple disciplines. When referring to the four Minors altogether, I use the term ‘Minors Innovation’.

Participants’ quotations are referred to by codes composed of the country, programme, number of participant by case and type of participant. The countries and cases are abbreviated as follows: the Netherlands: NL, Chile: CL, Collaborator: COL, Networker: NET, Explorer: EXP and All-rounder: ALL-R. Thus, a code could look like ‘NL.NET.9.student’, individualising the anonymised participants.

The following table introduces the anonymised institutions offering the programmes. Descriptions of Minors Innovation follow.

Table 3. Key features of the universities offering Minors Innovation

"Collaborator", the Netherlands	**"Networker", the Netherlands**
The Minor programme is offered jointly by three Dutch public long-standing government-funded research-intensive universities. The three institutions formalised a strategic alliance in the decade of 2010 aiming to collaborate according to each institution's strengths and focusing on complex challenges. Collaborative multidisciplinary research and education is developed. Educationally, joint bachelor, master, minors, honours, MOOCS and further education programmes are offered. The studied Minor, which emphasises responsibility in innovation, is one of them.	The Minor is offered by a government-funded research-intensive institution, founded in the 19th century. The University conveys an ethos of collaboration with governmental agencies, business and Dutch and international universities. Innovation is a central element in the institution's strategy and multiple innovation-related initiatives are developed, including a unit supporting innovation capacity development, an incubator and educational programmes, such as the studied Minor programme.
"Explorer", Chile	**"All-rounder", Chile**
The Minor is offered by a private university founded in the 1990s. It has campuses in Santiago (where the fieldwork took place) and in another city in Chile. Since the beginnings and until now, there is a close institutional attunement to innovation. This has manifested among others, in international partnerships, notably with universities in the United States strong in innovation and entrepreneurship education. A Vice-rectory for Innovation and other initiatives established early in the university history reflect the institutional innovation-oriented vision.	The Minor is offered by a long-standing research-intensive private university, member of the Council of Rectors of Chilean Universities and thus subject to direct public funding. The institution founded in the 19th century is denominational. It is recurrently positioned among the highest in Latin America according to international rankings. Excellence in knowledge creation and transfer is at the core of the institutional mission and multiple initiatives have been developed over time, including a large-scale innovation unit and several innovation educational programmes.

Institutional features described above, such as the inter-institutional character and the long-term alliance of the universities involved in Collaborator, the strong network ethos and locally engaged character of Networker, the innovation orientation and private governance of the university offering Explorer and the complex and rich research and innovation context at the university offering All-rounder, are important aspects to consider in the analysis of SESI.

3. Minors Innovation

The four Minors Innovation, Collaborator, Networker, Explorer and All-rounder, share key attributes: they are composed by a small number of courses on the subject of innovation (and related topics, such as entrepreneurship); these are credited courses counting formally for students' qualifications; Minors are offered optionally as one of the paths that students can choose to accomplish their required optional credits; and Minors are offered to undergraduate students from a range of disciplines, forming classes with students from mixed disciplinary backgrounds. The programmes also have distinctive features, discussed next alongside the rationales for choosing the anonymised labels.

Collaborator is offered by three Dutch universities, who also collaborate with other social actors for key educational components of the Minor. The universities contribute with varied expertise allowing students to engage with different disciplines and institutional cultures. The programme is cohort-based, and students apply for the programme rather than separate modules. A key pedagogical tool is an innovation cycle with defined phases that students work on. The inter-institutional and multidisciplinary educational setting together with a mandatory hands-on module are central learning resources of the programme.

Networker and the university offering it are strongly engaged locally, and also nationally and internationally. The university is recognised as a key player in the regional innovation and entrepreneurship ecosystem, based on its research and knowledge exchange activity. The Minor is also connected with the broader environment for educational purposes. Local companies, non-profit organisations, and boundary organisations, such as university start-ups and a university-based incubator, participate in the Minor.

Explorer is managed by a professionalised interdisciplinary innovation unit. The unit has proactively designed, tested and reshaped the Minor. This includes expanding the range of academic departments involved, trying different pedagogies -such as theatre improvisation for developing communication skills- and creating a platform for students involved in various IE initiatives. University-wide partnerships with international institutions in the field of innovation education and social entrepreneurship inform the pedagogical methods used in the Minor.

All-rounder programme is one of over 30 interdisciplinary Minor-type of programme offered by the university to undergraduate students, in addition to many other disciplinary ones. The programme has reached 34 courses listed (yet not all offered) at the moment of fieldwork. The modules are led

by many academic departments and the programme has limited centralised management. The institution's broader agenda for innovation, reflected in multiple alliances, academic programmes and a dedicated space for innovation nurture the educational activities of the programme.

The next table summarises these and other relevant attributes of the Minors. The sources are mainly documentary information available online, yet some aspects were clarified or informed by participants. The information accessed online are Minors' syllabi and presentations, and in cases, modules' descriptions.

Table 4. Key features of Minors Innovation

Case/ Features	Collaborator	Networker	Explorer	All-rounder
Origins of the Minor	Strategic alliance between three universities, each with its disciplinary strengths, seeking to promote collaboration among institutions and disciplines. Leadership of an academic who led the programme's creation, focusing on responsible innovation. National context promoting this type of inter-institutional collaborations.	Confluence of three factors: internal group interested in entrepreneurship education, governmental funding and institutional call to fund minors. Context of institutional modernization.	Created by a unit within the university to promote innovation, especially with an interdisciplinary approach.	Devised by a multidisciplinary group of academics and some management staff, who created also other innovation education initiatives.
Leading faculties	Framed in an institutional alliance, professors leading the Minors belong to multiple faculties related to technology, policy, management and humanities.	The programme is led by academics in social sciences.	The unit managing the Minor stemmed from the faculties related to design, engineering, business and economics, and has expanded over time.	The programme's coordination is responsibility of the Faculty of Engineering.
Management (in all cases, in coordination	The responsibility for the Minor is alternated	The professor leading the Minor is responsible for the	The Minor is overseen by the innovation unit's	Two professionals from the Faculty of Engineering oversee

with the central administration registration's units)	between the three universities.	management too, supported by central administration staff.	director and two professionals are responsible for its operation.	basic operational aspects.
Structure of Minor: courses and areas of courses	6 thematic courses and a project in groups. The thematic modules are offered by the three universities and include topics related to responsible innovation, innovation management, ethics and others. (Taught in English)	4 courses: 3 mandatory and 1 choice out of 3 options. The mandatory courses relate to science, technology, entrepreneurship and management. The optional courses focus on business, management, economics, innovation, and design. (Taught in English)	Students choose 4 courses out of 6. These relate to innovation, social innovation, creativity and technology ventures. (Taught in Spanish)	Students choose one course of each of 5 areas. The areas relate to entrepreneurial skills, opportunity creation, development of clients, funding and legal aspects, and business models. 34 courses were listed, but half were offered during the term of the fieldwork. (Mostly taught in Spanish, except one or more courses in English)
Offered to:	All third-year bachelor student of the three universities.	All bachelor students except from related programmes with overlapping courses.	All bachelor students.	All bachelor students (with restriction of no overlapping courses with main disciplinary programmes).
Sense of cohort (all students together in all courses)	Minor is offered to a cohort who take modules together during one term (student cohort)	Students can take courses at different times (no student cohort)	Students can take courses at different times	Students enrol in individual courses at different times and may or not register in Minor. To

			(no student cohort)	complete the Minor, they need to fulfil courses from each area (no student cohort)

These essential characteristics of Minors Innovation and their institutional and national contexts set the scene of the case study. Chapter 5 complements this introduction to the cases by analysing key themes emerging from the empirical data that condition IE and the promotion of SESI in the Minors.

Concluding, I applied a qualitative explorative methodology based on a cross-country multiple case study. Four Minors Innovation were studied, two in the Netherlands and two in Chile. I collected data through 57 semi-structured interviews, with students, educators, managers and institutional authorities at the case level, and with national-level policy makers and experts. The thematic analysis predominantly identified patterns across-cases, noting exceptional contextual elements. While the organisation of SESI into five dimensions of socio-emotional learning was deductive, most analytical processes were inductive. The analytical structure is formed by a triad of: skills favouring innovation, pedagogies supporting SESI's development, and learning catalysts that help learners to deepen and sustain learning. Participants and their educational contexts are central in the analysis, especially as a socio-constructivist epistemological approach guides the study.

Chapter 5. Analysis of institutional and programme-level conditions affecting the promotion and development of socio-emotional skills for innovation in Minors Innovation: participants' views

This chapter is based on empirical data to analyse the educational context of Minors Innovation. It discusses educational conditions at the institutional and programme levels - including some references to the national context - that critically affect the promotion and development of SESI in the Minors. This brief chapter complements the descriptive section "The four cases and their institutional and national contexts" presented in Chapter 4, based on documentary data. This chapter contextualises the analyses presented in Chapters 6 to 9, by identifying key conditions and their implications for understanding and facilitating SESI. Chapter 5 focuses on emergent themes discussed by participants that frame the examination of both research questions: What socio-emotional skills contribute to innovative behaviours and how do they support these actions? How are socio-emotional skills for innovation pedagogically facilitated in undergraduate innovation education programmes?

The empirical analysis suggests that many features of universities and Minors Innovation influence the promotion of innovation skills, and specifically SESI. Three themes emerge prominently: the various conceptualisations of innovation by Minors' participants shaping educational practices; the Minors' optional character affecting participants' experiences; and educators' academic freedom to pedagogically innovate which is in cases contested, hindering pedagogies potentially favourable for SESI. While these elements may be regarded as 'contextual', educational activities developed in the Minors can also affect these contexts inasmuch university communities are deemed co-creational social systems (Lave and Wenger, 1991). These elements are manifested and explored regarding Minors Innovation but given their direct link with institutional dynamics, I analyse these institutional and programme levels altogether. The three themes are discussed next, highlighting differences between cases.

A. The concept of 'innovation' in Minors Innovation

Institutionally and specifically between and within the Minors Innovation, understandings of the term 'innovation' differ. The data shows that innovation concepts in the Minors relate to social

responsibility, ethics, citizenship, business creation and entrepreneurship. These concepts shape educators and learners' perspectives of skills for innovation, including SESI. I discuss next the main emphases observed in the data, by case using the anonymised terms.

The 'Collaborator' Minor Innovation, offered by three Dutch universities, emphasises ethics and responsibility, together with technical and managerial aspects of innovation, denoting an innovation systems perspective. This entails cross-disciplinary integration, as illustrated by an educator: "Responsible innovation is… the radical multidisciplinarity where the humanities, the social sciences, behavioural sciences and engineering are coming together" (NL.COL.9.lecturer). Further, the Minor discusses innovation at various levels, from project teams to institutions and systems.

The 'Networker' Minor in the Netherlands, differently from the three others, includes 'entrepreneurship' in the programme's name. It highlights business creation entwined with an environmental ethos: "where entrepreneurship education might be more about self-interest, sustainability is self-transcendence, from an origin, as a point of departure" (NL.NET.7.lecturer). Innovation and entrepreneurship are understood and promoted as networked processes, and students engage with multiple actors, mainly locally.

The 'Explorer' Minor in Chile emphasises innovation as an interdisciplinary process. Other innovation notions, developed partly in collaboration with international partners, are social responsibility and technological-based innovation. Beyond, the Minor conveys the value of IE for students' professional future, appealing to capacities for creative and collective work on complex problems, required by the labour market. Hence, innovation skills are also sought tactically to enhance employability.

The 'All-rounder' programme in Chile displays multiple coexisting narratives including technological innovation, social innovation in terms of serving society and secondarily, frugal innovation. The large number of courses and academic departments involved, and the programme's loose governance prompt various innovation meanings. Participants notice the active university innovation culture and multiple initiatives, but do not perceive an institutional or programme-wide conceptualisation of innovation.

Therefore, connotations of the term 'innovation' differ across the four cases. They also vary within Minors, i.e., between modules of a programme according to educators and learners' orientations. One key distinction emerging from the data is between socially oriented innovation and

entrepreneurship oriented one, focused the latter on business creation that may -but not necessarily- have rather personal economic drivers. Accents on environmental sustainability, technological development and economical innovation are also present. These and other dimensions are integrated in the notion of responsible innovation that requires systemic and ethical considerations.

The institutional and programme-level approaches to innovation possibly relate with national-level understandings and policies towards innovation (and relatedly, entrepreneurship) education. The data suggests that in the Netherlands, innovation and entrepreneurship education have been driven for over two decades by both, the Ministry of Education, Culture and Science and the Ministry of Economic Affairs, connected to knowledge valorisation policies. The initiatives have entailed different objectives and terminologies (NL.policy-maker/expert.1; NL.policy-maker/expert.2). Entrepreneurship education policies, as discussed by a policy maker, was "mostly economical; so to have a competitive economy, we need entrepreneurs and innovative students" (NL.policy-maker/expert.2). But other societal aims are visible too, as an expert commented regarding the City Deal Programme: "The idea is that you involve students, teachers, researchers in solving big city problems… it's not only about broad skills… it's also how you can add to society and even make the education more entrepreneurial" (NL.policy-maker/expert.1). Both purposes, related to economic development and to broader societal impact, are interrelated and reflect central drivers of the Ministries primarily involved in innovation and entrepreneurship education. As participants suggest, the involvement of both Ministries has affected the language around innovation and entrepreneurship education, and specifically around skills, as illustrated next.

> "A lot of these skills for me are also entrepreneurial skills or innovative skills or 21st century skills… For us it's not really relevant how they call it; for us is just that some skills should be included… It makes it of course more difficult if you can't make it concrete. Then you have high level discussions but at the end everyone goes its way" (NL.policy-maker/expert.1).

The conversations with policy makers working in innovation and entrepreneurship in Dutch HE reaffirm the diagnosis concluded from the literature review: skills of a socio-emotional nature are central in innovative behaviours but are generally not labelled as such nor characterised in detail by those involved in IE and their research and policy making. This confirms then, the need for research on the subject to support these skills' operationalisation and active promotion.

In Chile, some innovation and entrepreneurship education initiatives have also been supported by the Ministries of Education and Economy. Innovation education was sharply judged by the three

experts/policy makers I interviewed in Chile. They consider it slow, diverse and instrumental, arguing that cultural and systemic structures need to transform towards more holistic and less mechanistic conceptions of innovation. This critique is illustrated next:

> "The problem of public policies, the problem in universities… [is that] the argument is reduced to a topic "that we do not have the method, that we do not have the experience"… then well "we get a *gringo* that teach us Lean Startup or Design Thinking" and we believe that is enough. And I think that is a stupid fallacy… [it has to do with] how we relate, how we conceive ourselves, how we measure risk, what we consider success and not success, the value we give to failure or successes. A much more contextual and cultural thing, than a methodological thing" (CL.policy-maker/expert.1).

The significance of innovation in Chile frames IE. Interviewees agree that IE in broad terms (and further, education at large), in Chile is unfit: "our young people realise or feel like the discordance between what they receive as training and what they need in the world and they rebel… there is a gap [so] they no longer trust in that system as the guarantor of success…" (CL.policy-maker/expert.3). A critical aspect is the disregard of socio-emotional aspects:

> "What we do in the educational system and in the political and public system, is to ignore the existence of the socio-emotional. So we are super badly equipped to deal with this… We have been trained by approaches that have dominated our understanding of the world as Westerners that have made us overvalue the cognitive and underestimate the rest. But since that is a cultural heritage, we are not aware that we were born in that 'soup' and therefore we do not question it… But also, when someone makes you see it, you feel half naked and incompetent in the face of this new thing, for which you were not trained, in which you do not feel comfortable." (CL.policy-maker/expert.3).

A key idea, therefore, is that socio-emotional aspects of innovation are ignored because of weak understandings of that socio-emotional world despite concerns on how to manage those unnameable dimensions. Thus, interviewees in Chile highlighted a mechanistic approach towards innovation neglecting socio-emotional dimensions. In the Netherlands, participants portrayed certain jargon confusion about innovation and entrepreneurship skills. This reaffirms the need to strengthen the comprehension and language around SESI.

These national-level views do not necessarily represent the situation of each of the cases studied. Yet they are relevant to acknowledge as may have implications in the promotion and development

of SESI. Overall, these multiple emphases on innovation at the programme level, and the national context, can shape participants' perceptions of the skills required for innovation, including socio-emotional ones. As pertinent and feasible, I analyse SESI's characterisation and promotion considering these varied perspectives on 'innovation'.

B. Optionality of Minors Innovation

The four Minors Innovation are offered optionally to students. Students need to fulfil optional credits for their bachelor's degrees and can choose among Minors, loose modules and other activities such as internships. This optionality means that Minors Innovation are credited and thus need to fulfil certain academic criteria and administrative procedures, but do not pertain to the mainstream curriculum of any undergraduate/bachelor programme[13]. Optionality is an interesting academic feature; it allows students' self-direction in designing their learning path. But constraints may apply, such as restricted access to desired options in academic modules' 'markets' where students' choice depends on their previous academic grades. Also, the Minors' design and modules' offer may hinder students' ability to complete the programmes. Furthermore, choice relates to motivation. Participants convey various degrees of motivation for participating in Minors Innovation, possibly depending on their capacity to choose the programmes and on their educational engagement more broadly. Additionally, due to Minors' optionality, students seemingly expect that Minors are or should be 'easier' than mandatory modules, i.e., have a lower academic workload (despite, in some cases, having the same number of academic credits). These aspects emerge from the data across cases, with variations between them.

The Collaborator case has a cohort-based design and students enrol for the full Minor. Students apply to Minors and are selected according to grade-given priorities. That means that students taking the Minor choose it with varied interest. Some select the Minor strategically as a first option, seeking to learn about innovation and/or to experience the Minor's inter-institutional setting. Others regard the programme as a 'plan B', when their priority to choose highly demanded alternatives is insufficient or they are late for other options, as illustrated next: "…so initially I wanted to do an internship, but I wasn't assertive enough… to organise that in time" (NL.COL.10.student). As the data suggests, these choices may affect learners' dispositions towards the Minor.

[13] Certain modules comprised in the Minors may be mandatory in some programmes, in which case, students enrolled in Minors cannot choose these overlapping modules.
This usage of the term 'Minor' differs from subspecialisations within a specific bachelor curriculum.

The other three Minors are not structured as a cohort and students can take modules individually, registering or not in the Minor. Yet, the Minors' completion is not necessarily straightforward. At All-rounder, students need to fulfil certain requirements of modules in areas, but as modules are not all offered systematically, some participants struggled to complete the programme.

Students also expressed a sense of self-direction in their learning career by deciding how to use the required optional credits. Optionality then represents an educational resource through which learners can enact their agency. Reasons for choosing the Minors centre on widening (disciplinary) perspectives and preparing for work. As illustrated by students: "I wanted to meet more people, see different perspectives" (NL.COL.11.student); "I decided I wanted to do this minor six months before I did it. Because I wanted to develop myself in a bit of a broader perspective on the world" (NL.NET.10.student); "I thought at the time that it gives you a plus… to the CV, the experience" (CL.ALL-R.12.student). Thus, Minors' optionality permits students to choose and feel agentic, designing part of their learning paths in flexible curricular components.

However, such flexibility is also regarded as informality or inferiority. In the views of educators and students themselves, students expect that Minors and their modules, as optional programmes, ought to be less demanding than mainstream modules: "I believe that [optional modules] are always highly regarded in less" (CL.EXP.10.student). In one of the four cases this may be because "they have less credits, therefore, the responsibility they feel or the resistance to failure is less because it weighs less" (CL.EXP.6.lecturer). In the other cases this credit-related reason does not apply. The optional character of Minors affects students' dispositions and effort. It also shapes educators' attitudes towards pedagogical innovation as discussed after in this chapter. Also, in at least one case, evidence suggests that the Minor's optional and cross-faculty features loosen the programme's academic governance: "but the truth is that we are not under the protection of a formal, academic structure that, in the end, ensures that the [programme]…" (CL.ALL-R.3.programme-manager). Thus, reduced academic steering may derive partly from the programmes' optionality.

Consequently, Minors' optionality, a shared feature of the four cases, appears in the data as shaping students, educators and managers' experiences. This includes learners' motivation, agency and their possibility of registering and completing the programmes. Another emerging theme centres on educators and their willingness and possibility to engage in inductive teaching-learning practices relevant for SESI.

C. Academic freedom for pedagogical innovation

The empirical analysis suggests that educators' academic freedom to innovate in pedagogical practices in the Minors Innovation is in cases hampered. This matters for the thesis' research questions, as it affects educational processes leading to the promotion of SESI in students. This dynamic differs across the four cases, so I distinguish contextual aspects when pertinent.

As in other studies, Minors' educators seem challenged when implementing collaborative project work, which as it will be discussed in Chapter 7, favours SESI. Kumpulainen et al. (2019) report the following difficulties for educators when collaborating with external partners in a problem-based setting: planning and coordination requiring further time and resources; methodological definitions on problem-based teaching; competence challenges to work on unfamiliar topics; and relatedly, a self-questioning of university educators' expertise when working on an equal basis with external partners. Evidence in this thesis agrees with the two first mentioned difficulties (logistical and methodological) and to a lesser extent, the latter two challenges. Further, educators in the Minors highlight another key aspect: their academic freedom for pedagogical innovation.

Teaching teams in Minors Innovation are integrated by academics, usually of different departments, and by professionals whose work is primarily non-academic, including innovation and entrepreneurship practitioners. Altogether, they educate Minors' students using varied teaching-learning methodologies. The adoption of learner-centred inductive approaches such as PjBL, the participation of practitioners and the subject of the Minors, innovation itself, all leads to innovativeness in educational processes. This includes leveraging on multidisciplinary classes and collaborating with the broader society, themes discussed in Chapters 7 and 8. Educational innovation, which in this case applies to innovation education, entails multiple challenges to educators. As with any innovation process, educators need to frame the question (how to educate for innovation), and to explore, design, test and improve solutions (pedagogical approaches).

Most lecturers participating in this research demonstrated commitment and enthusiasm for IE, e.g.: "it became a bit like a son… you know we grew with the course and we wanted to change it also" (NL.NET.5.lecturer). Educators were keen to innovate pedagogically aiming for students to experience innovation abilities. In this 'being' innovative, socio-emotional dimensions are critical, but pedagogical practices promoting their development seem restricted by organisational conditions.

The Minors are approved institutionally as credited programmes and regulations circumscribe the programmes' and educators' activities. As suggested by some participants with variations across cases, organisational mechanisms about educational 'quality' support pedagogical status quo rather than innovativeness. Exploring novel practices entails risk, in terms of the pedagogical effectiveness and students' evaluations of academics' performance. "If I get bad evaluations I lose my job" (NL.NET.3.lecturer&programme-manager), illustrates the risk of students being unsatisfied with novel teaching styles[14]. Educators thus need to satisfy regulations whilst innovating educationally.

Lecturers' risk of pedagogical innovation in the Minors partly relates to the promotion of SESI-type of skills. Pedagogies that differ from mainstream styles and that foster socio-emotional learning through activities such as self-reflection and discussion of emotions seem to be scrutinised by some lecturers and students. This does not apply equally though to other collaborative practices like PjBL. Pedagogical freedom and certain pedagogical practices seem in tension. Lecturers emphasise their academic freedom to choose pedagogical methods (e.g.: "what's within my module, this is my choice" (NL.COL.4.lecturer)). However, some educators highlight others' judgements of educational practices involving learners' emotional engagement, reflection and discussion. A lecturer illustrates: "[students] must follow a methodology… [we assess whether s/he] understood what a judgement is as opposed to an affirmation… it's not that we look at the eyes, cried or not cried... the thing is that they need to apply it [the subject] to their lives" (CL.ALL-R.5.lecturer). The lecturer alludes to socio-emotional learning practices that may be criticised overlooking its substance.

This type of situation can challenge academic careers, e.g.: "I felt it was inhibiting my freedom to do what I wanted to do in my classroom… so now my mission is really how can I shape my tenure track in such a way that I can remain true to my own values and my own teaching" (NL.NET.3.lecturer&programme-manager). This case exemplifies tensions between commitment to educate innovatively, concerns about pedagogical innovation risks and the need to satisfy academic regulations. A paradox then, is that in *innovation* education, educators are subjected to institutional conditions, such as academic career structures and standard assessments, that hinder their own innovative spirit and innovative ways of educating.

Overall, academic freedom emerged from the data as conditioning SESI-related pedagogical practices, i.e., influencing responses to the second research question about pedagogies for SESI. IE involves the opportunity and possibly, the need of adopting novel pedagogies. Socio-emotional

[14] Arguably, this affects more academics seeking tenure tracks than part-time lecturers teaching sporadically.

learning seems favoured by experiential and inductive pedagogical practices, at times regarded unconventional. Pedagogical innovation entails risk for lecturers regarding the practices' effectiveness and students' assessments about lecturers' performance. Organisational conditions, thus, seem to affect pedagogical freedom. Data on this dynamic, however, varies across cases and further research would be beneficial to explore circumstances affecting innovativeness in IE.

Chapter 5 analysed relevant features of institutional-programme contexts affecting educational experiences in Minors Innovation, including also some national-level references. This chapter complements the descriptive introduction of cases presented in Chapter 4. Three themes outstand in the data: varied approaches to the concept of innovation, Minors' optionality and educators' academic freedom to pedagogically innovate. These three themes shape participants' involvement in the Minors, including the promotion and development of SESI. This discussion of educational conditions influencing the promotion and development of SESI frames the analyses presented in the following chapters.

Chapter 6. Socio-emotional skills that matter for innovation: educators' perspectives

This chapter presents key SESI emerging from the data, responding to the first research question: What socio-emotional skills contribute to innovative behaviours and how do they support such behaviours, from the perspective of participants in undergraduate innovation education programmes? Findings centre on the identification, characterisation and analysis of personal-level socio-emotional skills relevant for innovation. Most of these personal-level skills are defined in relational terms and are exercised and developed collectively. The identification of key SESI is based on empirical data, considering both, educators' and students' perspectives of skills' significance for innovation, using, however, more data elements from interviews with educators, who further elaborated on this aspect. Ten socio-emotional skills were identified as crucial for favouring innovative behaviours, although many more were also considered valuable. The selected skills were organised into the five dimensions of socio-emotional learning presented in the CASEL framework, i.e.: self-awareness, self-regulation, social awareness, relationship skills and responsible decision-making. Nine specific skills relate to the first four dimensions, while the dimension of responsible decision-making is analysed altogether. The five dimensions and ten skills are intertwined. Their relationships are discussed if critical in the promotion of innovative behaviours. The discussion of each skill, identified empirically, is nurtured by extant literature to support skills' descriptions and their relevance in innovation.

The analysis focuses on specific socio-emotional skills that participants value for innovation. That is, the selection of SESI emerges from the empirical analysis. The selection considers skills describable as socio-emotional (according to the literature review) regarded as critical for innovation in participants' views, mainly by 'educators'. 'Educators' play different roles and include lecturers, programme managers (who in two cases are also lecturers), central administration authorities, innovation unit authorities and external collaborators. This group of interviewees analysed the meaning of skills and their relevance for innovative behaviours more than students, who centred on their own experience in skills development. The views of students, and national-level experts and policy makers are considered in this Chapter in few occasions complementing educators' perspectives, data permitting. The importance of skills for innovation was assessed through patterns emerging inductively from data across the four cases and two countries. The significance for innovation that participants grant to skills is both, conceptual and practical; i.e., it reflects participants' normative views on skills supporting innovative behaviours and their

experiences in exercising these skills (or observing others doing so). Still, it is important to emphasise that the relationship between certain skills and innovative behaviours is not linear or automatic. As illustrated by an educator: “we don't assume that it's possible to train people on specific sets of skills, and then innovation happens” (NL.NET.1.innovation-unit-authority). That is, skills’ development and skills’ manifestations– in this case directed towards innovation- are person, community and context-dependent processes expressed in innumerable forms.

The discussion centres on individual-level skills, rather than on group or organisational competences. However, innovation skills expressed by individuals include, fundamentally, abilities manifested in the interaction with others and developed collectively; they relate to individual, interpersonal and networking capacities (Watts et al., 2013). The relationship between skills are intricate and multi-directional; internal and social relations interplay. For example, self-reflection contributes to the development of other skills, notably in the dimensions of self-awareness and social awareness. Personal reflection is arguably an individual rather than collective process. Nevertheless, collaboration with others –and remarkably with different others- appears in the data as a collective element promoting multiple skills, including self-reflection (Chapters 7 and 8 discuss pedagogical approaches supporting SESI).

A key conclusion is that all socio-emotional skills may potentially enhance innovative behaviours. The selection of skills discussed in this chapter is contextualised in four Minor Innovation programmes. The ten skills outstand as crucial for innovation, but a wider variety of skills are appreciated by participants in their capacity to contribute to innovation. This leads to the conjecture that – provided an open definition of innovation and diverse circumstances and innovators– any socio-emotional skill could, in different ways and to varied extents, favour innovative behaviours. Acknowledging the relevance of multiple skills, this analysis centres on the most important skills that favour innovative behaviours, according to participants.

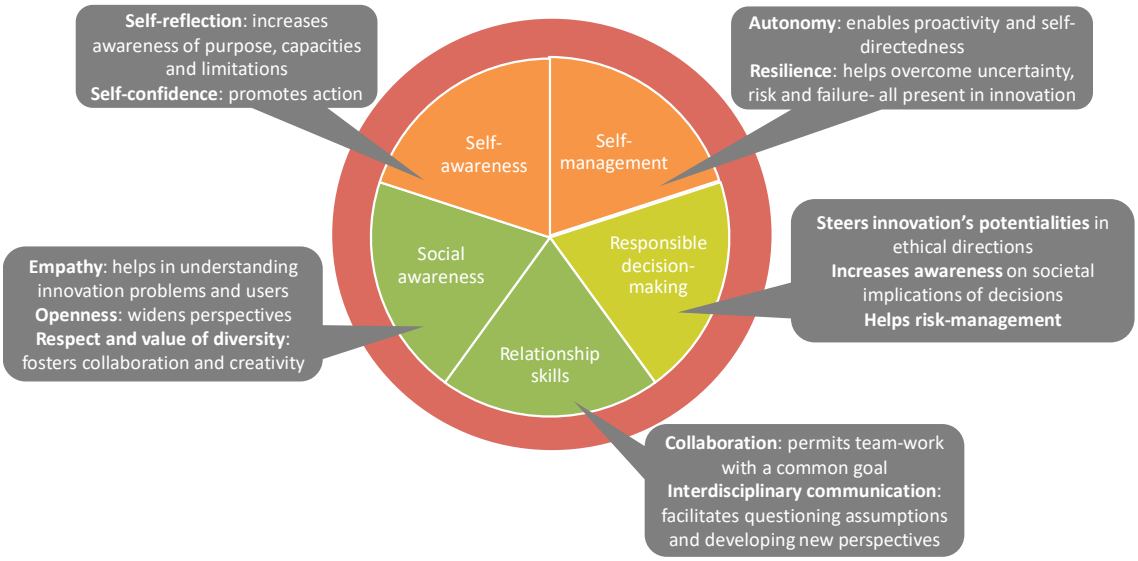
Considering the potential relevance of multiple socio-emotional skills for innovation, some skills appear to be more aligned with the wider socio-emotional learning literature, while other skills appear to be more specific to innovation. For example, autonomy – one of the skills highlighted by participants as critical for innovation – is also highlighted as a key skill relevant for project work and developed in PjBL (Thomas, 2000). Similarly, the ability to collaborate – another crucial skill for innovation – is central in collaborative inductive learning approaches (Prince and Felder, 2006), being acknowledged in the wider HE learning literature. On the contrary, skills such as resilience and empathy, emphasised by Minor Innovation participants, appear to be more particular to the

innovation context. This reflects different degrees of overlap between general socio-emotional skills appreciated or promoted in HE, and SESI. Clarifying the specific reasons for their convergence/divergence, which possibly relate to current wider HE aims such as developing 21st century skills, requires further research. The contrast between specific-to-innovation and generic socio-emotional skills appreciated in HE is complex because both elements are wide or under-explored. This chapter focuses on one of the elements: the identification, characterisation and rationalisation of key skills for innovation.

The empirically driven analysis of SESI is enriched by literature on innovation and on socio-emotional skills/ learning. Innovation literature helps analyse skills' significance for innovation. Socio-emotional literature informs on skills' definitions and meanings. Participants' views are expressed through illustrative quotes or pattern summaries. The significance that educators give to skills may relate but does not necessarily agree with declared learning objectives of the corresponding modules or programmes, nor with the skills developed by learners. This chapter focuses on the rationale that supports certain skills' contribution to innovation.

The analysis is organised around the five dimensions of socio-emotional learning from the CASEL model. Nine specific skills are discussed in the dimensions of self-awareness, self-management, social awareness and relationship skills. Skills in the dimension of responsible dimension-making are analysed combined. The selected skills and the rationale for their importance in innovation processes and behaviours are presented in the following figure.

Figure 6. Central socio-emotional skills for innovation and their relevance for innovation, based on empirical analysis



Source: author's, based on empirical analysis, organised into the five dimensions of CASEL framework.

A. Dimension of self-awareness

Two key SESI emerging from the data correspond to CASEL's dimension of self-awareness: self-reflection and self-confidence. Self-awareness essentially means to know one-self; to be conscious of one's thoughts and emotions, strengths and limitations, and to appreciate oneself. Self-awareness guides one's actions, i.e., supports self-management. Also, being aware of one's thoughts and behaviours facilitates understanding others' thoughts and behaviours, i.e., social awareness. Therefore, self-awareness nurtures skills in other socio-emotional dimensions, distinguished anyways, by blurred boundaries.

Participants in Minors Innovation acknowledged various self-awareness skills supporting innovation processes, e.g., self-esteem and self-efficacy. Yet self-reflection and self-confidence stood out in the thematic analysis.

1. Self-reflection

Self-reflection appears in the data as a fundamental skill in the practice of innovation that allows self-awareness of one's motivation and purpose, capacities and limitations. Being conscious of personal drivers and abilities permits meaningful goal-setting and direction towards their achievement. This self-reflection capacity is central to innovation as it helps establishing the

foundations of one's aspirations, objectives, abilities and actions in innovation processes. An educator-innovator illustrates:

> "If you have such a strong drive to change the world and… you have your values that are pushing you, you also really need to learn your own boundaries of what can I do with my capacities, and where do I need to reach out, or ask for support, or build a team… it's very valuable to practice self-reflection and… to really be conscious of who you are, and what you can contribute to the world and to humanity, that is really coming from a deep insight and purpose" (NL.NET.3.lecturer&programme-manager).

Self-reflection about one's purposes is important because such awareness mobilises growth and defines professional pathways, including as an innovator. As explained by a practitioner:

> "I feel that the purpose makes meaning and gives you the strength and energy to be for example, persevering… how are you going to be able to offer yourself to the labour market or to a venture or whatever, if you do not know what your attributes are? Then I feel that there is little self-knowledge, yes, and that helps you define your self-purpose… to be able to work in what you like is the key" (CL.ALL-R.13.external-collaborator).

Reflecting about one's professional purpose at large, or about specific goals, is promoted in Minors Innovation through learning activities where students experience innovation processes in groups (aspect further analysed in Chapters 7 and 8). The potential of this practice-based purpose-defining process is consistent with other studies finding that establishing an innovation cause (and its undertaking) may develop through reflection of collective work practices (Fuller et al. 2018), i.e., being involved in the issue to be addressed innovatively. Finding purpose and working upon it facilitates the development and exercise of other skills important in innovation, as determination, risk-management and persistence. Further, as participants narrate, having a clear innovation purpose may conduce to a sense of transcendence through co-creation.

Reflection and reflexivity have nuanced connotations: reflection refers to in-depth examination of situations, while reflexivity "is finding strategies to question our own attitudes, theories-in-use, values, assumptions, prejudices and habitual actions; to understand our complex roles in relation to others" (Bolton and Delderfield, 2018, p. 10). Thus, reflexivity permits better reflection. Minors' participants pointed especially to self-reflection as the capacity to reflect about oneself. This self-reflection capacity can be experienced with different degrees of criticality and encouraged through

various means, including by interacting with the learner's community (Hughes, 2009), as explored in this thesis in Chapters 7, 8 and 9.

Reflexivity is a key dimension of responsible innovation, comprising reflexivity of actors and institutions, entailing the observation of one's activities and assumptions, and understanding that problems may be framed differently (Stilgoe et al., 2013). Reflexivity fosters responsible innovation partly because it "challenges assumptions of scientific amorality" claiming for openness and leadership in innovation communities (Stilgoe et al., 2013, p. 1571). Questioning one's assumptions is also central in self-reflection from the perspective of transformative learning. Reflexivity entails critically questioning a premise based on which a problem was defined (Mezirow, 1998), which may lead to more open and justified beliefs and perspectives (Cranton 2016). The process of reflexivity represents internal conversations manifested in different modes (Archer, 2012). These internal conversations may lead directly to action, require external confirmation before leading to action, entail critical evaluations of previous inner dialogues and of actions in society (meta-reflexivity), or may not lead to "purposeful courses of action, but intensify personal distress and disorientation resulting in expressive action" (Archer, 2012, p. 13). Therefore, reflexivity promotes change and understanding, but does not ensure consequent changes. This exemplifies the distinction between self-awareness (including self-reflection) and self-management, the latter enabling enacted self-direction.

Self-reflection appears in Minors Innovation as a skill radically enhancing self-awareness -a key socio-emotional dimension. The views from educators and students coincide: these inner conversations favour innovation by strengthening students' self-awareness about their motivations and capacities, and by questioning assumptions about innovation challenges and collaborators.

2. Self-confidence

Self-confidence matters for innovation because it helps persons to take action and manage risk, which is embedded in innovation processes. Risk of failure and rejection are common in innovation where boundaries are moved from what is known, adopted and accepted, to new fields. Therefore, innovators need to feel comfortable with going into unexplored areas. Critically, self-confidence helps in differentiating the failure or rejection to a solution (e.g. design, process, service) than to the person. This fosters resilience, another relevant skill in innovation. The case study evidences the relevance of self-confidence (and relatedly, self-esteem) in innovation; e.g., by inspiring the creation of at least one course and addressed emphatically in another. Two lecturers narrate:

> "We discovered that... the main limitation in kids ("chiquillos"), not so much in creativity, but I would say that entrepreneurship and innovation was... self-esteem problems. The kids did not feel capable, safe or with the tools for them to start something new on their own. That's when we realised that it was not enough to stimulate creativity and stimulate the development of new businesses, but we had to work on the kids… That's when we created the entrepreneurship course" (CL.ALL-R.4.lecturer).

> "In my experience at least, it is much more terrible... self-censorship than group censorship... I work much more [with students] in self-confidence and in self-assurance so that afterwards it is a consequence that there is security and trust in the other also" (CL.EXP.5.lecturer).

Self-confidence is understood as "a tendency to be self-assured and to make decisions without needing a lot of input from others" (ACT, 2015, p. 32) or "a person's belief that he or she can succeed", in context-specific tasks or activities (Perry, 2011, p. 219). In innovation processes, self-confidence supports innovators in different stages. It is needed to network and communicate with others as: "it may be a lack of confidence that prevents you from reaching out to people you don't know" (Dyer et al., 2011, p. 127). Self-confidence also boosts leadership by inspiring confidence in team members (Kelley et al., 2006). Centrally, being confident permits risk-taking, including the capacity to explore and to create novel solutions, which may or not result fruitful.

Overall, two specific skills, self-reflection and self-confidence, were highlighted by participants as relevant for innovation. Self-reflection permits knowing oneself and therefore defining meaningful pathways, while self-confidence boosts the capacity to act. These abilities strengthen self-directedness, central in innovation.

B. Dimension of self-management

Self-management corresponds to the second socio-emotional dimension explored, and refers to the capacity to regulate and direct one's thoughts, emotions and behaviours (Durlak, 2015). To self-regulate, persons adopt behavioural standards and contrast their exercise (Bandura, 2018). Self-management involves multiple abilities such as self-care, self-motivation, coping with adversity, goal-setting, and developing strategies for their achievement like planning and time-management. These skills contribute to innovation in multiple ways and as with self-awareness, participants in

the study consider the importance of multiple self-management skills. Autonomy and resilience are especially appreciated by educators in their capacity to nurture innovative behaviours.

3. Autonomy

Autonomy is central to innovation in its capacity to enable action. Participants relate autonomy with proactivity and self-directedness:

> "In the sense of being proactive, that you have to set your own schedules, you have to set your goals, you have to keep developing… because you also have to be super practical to learn, that is, to be super self-taught" (CL.ALL-R.14.external-collaborator).

The capacity to be autonomous is manifested in goal-setting abilities, time-management and self-directed learning, all central in innovation processes, as illustrated next:

> "Hopefully you'll have stimulated them [students] enough so that they will become self-directed… Self-directedness so you can make people self-directed in their learning. Setting their own learning objectives, acting upon it, and evaluating them on themselves. Then you have a lot from learners. That the Holy Grail of learning" (NL.COL.1.innovation-unit-authority).

As with other SESI, autonomy is appreciated as a valuable skill for innovation, and more generally, for professional life:

> "Autonomy is one of the eight competences that we declare as a university... I consider it a fundamental element and I value it. I believe that education in innovation and entrepreneurship can develop professionals that are much more autonomous and one can put other words as proactive, motivated, well, and that I think that can produce a tremendous value from the point of view of professional training" (CL.EXP.2.central-administration-authority).

Autonomy, therefore, is appreciated by participants for enabling proactivity and self-directedness, both critical for innovation. However, autonomy has been placed against interdependence in dualistic academic debates, limiting the appreciation of collective agency (Bandura, 2018). Such dualism is counter-intuitive to the collaborative and networked process of innovation, where the will to act collectively is key. Having will means that persons "can make things happen intentionally and for reasons" (Hill, 2012, p. 18). Purposeful reasons may be defined or identified through self-

reflection, as discussed above. In innovation, for developing 'collective agency' in Bandura's terms (2018), shared goals are necessary.

Group goals are indeed a key feature of project-based learning, which as discussed in Chapters 7 and 8, is a common practice in Minors Innovation. The data suggests autonomy is perceived as an individual and a group-level ability (e.g., the project group is autonomous), reflected notably in the conduction of group innovation-oriented activities.

4. Resilience

Being resilient to persevere in adversity is central in innovation processes: "It is necessary to be wrong sometimes. Plan to Experiment. Plan to Fail (Fail Fast). Analyze, adapt and repeat" (Sidhu et al., 2016, p. 8). The creational and novelty aspects of innovation entail risk and potential difficulties, uncertainties and defeats. Overcoming such challenges requires "positive adaptation during or following exposure to adversities that have the potential to harm development", i.e. resilience (Masten, 2007, p. 923). The importance of such adaptive capacity in innovation is emphasised in the data, as illustrated next:

> "[In the innovation context] we see that there's more uncertainty, complexity, and ambiguity and you have to teach the ability to adapt to this… And I would like them [students] to become resilient. So, if something goes wrong, which, by definition, will happen, because if you go into really hard stuff, it'll go differently than you expected, then, you have to be resilient, and adapt to changing circumstances" (NL.COL.1.innovation-unit-authority).

A lecturer asserts: "losing the fear of error is fundamental, because if you fear being wrong you will never engage in anything". When asked how he works this with students: "Showing that the error is much more creative than being right" (CL.EXP.5.lecturer). Thus, participants convey that resilience ultimately permits risk-taking in being creative and innovative.

This is in line with the literature; tolerating failure is an essential ability of innovators (Wagner and Compton, 2012) and one of the dimensions of resilience. Looking at countries' contexts, the fear of failure in Chile and the Netherlands is similar according to the Global Entrepreneurship Monitor 2018/2019: around 20% of people aged 18-64 seeing opportunities fear failure in both countries (Bosma and Kelley, 2018). Yet, in this thesis' data, a national adverse context towards failure appeared stronger as a limiting factor for innovation in the Chilean than in the Dutch cases.

Participants in Minors Innovation in Chile indicated the burden of failure as a relevant cultural constraint to innovation, as exemplified next:

> "I feel that we were educated and raised for success… In the Chilean culture, it is super painful when a person does not want to tell what he is doing, because it's is not very good... deep down you cannot prototype, because you finally want to have a perfect solution and it will never be perfect, but it's your fear of showing yourself vulnerable" (CL.ALL-R.13.external-collaborator).

The perception of a cultural context against failure is shared by students in Chilean cases; for example: "[to develop creativity, you need] to start with, to leave the error taboo… if you made a mistake, that is unforgivable". When asked where is that taboo based: "I believe that in the country. Like the fear of making mistakes is too high" (CL.EXP.11.student).

The capacity to take risk, accept possible failures and recover from adversity is central in innovation stages when ideas are exposed, tested and evaluated. While cultural contexts and associated challenges vary in the data, resilience is a common and conclusive valued skill for innovation.

Concluding, two self-management skills, autonomy and resilience, emerge from the data as critical for innovation. Educators emphasise self-directedness and proactivity as key abilities related to autonomy. They also affirm – agreeing with previous studies- that resilience facilitates managing uncertainty and failure, which are usually present in innovation processes. Autonomy, however, seems to be more widely recognised as an important socio-emotional skill in the HE sphere (e.g., Jacob et al., 2019) than resilience, which seems more associated with risk-taking and thus innovation.

C. Dimension of social-awareness

Social awareness, the third socio-emotional dimension, corresponds to the capacity of understanding, empathising, respecting and appreciating others, who may think, feel or behave differently. Perspective-taking is central in developing awareness of diverse others. It is also important in apprehending people's necessities, crucial in innovation 'need-finding' processes.

Empathy, openness and appreciation of diversity were acknowledged by Minor Innovation participants as interrelated key skills allowing sensitivity to multiple cultural contexts, and therefore boosting innovation.

5. Empathy

Participants in Minors Innovation vehemently conveyed the importance of empathy in innovation processes. The orientation to potential innovation users is central and expressed in taking "a customers' perspective" (NL.NET.7.lecturer), to "satisfy the needs of your stakeholders" (NL.COL.7.external-collaborator). That is, "the starting point of this chain is the topic of empathy with the user and in the end, put in his shoes, understand him, interview him, know what he needs and know what can be done, and achieve something concrete" (CL.EXP.13.student). Empathy permits creating suitable results and requires openness towards others' experiences: "If we take a position of "I'm different to you", you don't get to understand the totality of the other's situation… I feel that empathy gives you the further step to feel how they feel…. If one doesn't put in that situation one can get to a result that it is of no use to them" (CL.EXP.11.student). In participants' views, therefore, empathy is critical in understanding innovation's problem-holders and in connecting to their feelings, which permits creating adequate solutions. These represent 'cognitive empathy', i.e., take others' perspectives; 'emotional empathy', i.e., join others' feelings; and 'empathetic concern', i.e., mobilise to help (Goleman, 2013).

Empathising is experiential: "you submerge yourself into their world" (NL.COL.7.external-collaborator); "you have to understand the real needs of people to understand what problem to solve… you cannot learn it from a book, it is impossible… you have to have stepped the environment where you will be, you have to have talked to somebody" (CL.ALL-R.6.lecturer). This practical insight permits to "understand from multiple viewpoints what is it that we are tackling" (CL.ALL-R.2.central-administration-authority), leading to reframing the problem and therefore creating varied solutions. Empathy in innovation processes allows "to find that connection that for all is invisible but it is not for the innovator… that is why it is so critical that process of empathising, observing, seeing, giving it a thought, questioning why we do it like that. Without that step there is no innovation" (CL.ALL-R.13.external-collaborator). Exercising empathy connects with sensitisation "that things are hanged together, that things require different voices, different perspectives, different inputs, different disciplines… it's the awareness of that, and not in an intellectual sense, but also in an emotional sense" (NL.COL.9.lecturer). Therefore, experiencing innovation processes and connecting with problems and problem-holders help in developing this skill-in-practice, as discussed in Chapters 7 and 8.

In the innovation context, the term "empathy" represents both, the skill, and the skill applied in a specific innovation stage where the problem, challenge or opportunity is explored by observing,

connecting and understanding the potential users. Empathy means "relating to others with acceptance, understanding, and sensitivity to their diverse perspectives and experiences" (Smith et al., 2016, p. 7). This approach towards relationships nurtures innovation, underpinned by observing and reframing problems (Kelley and Littman, 2006). The frames people create based on experiences, both inform and limit our thoughts; thus, to enhance imagination leading to innovation it is essential to question and shift our frames of reference through observing from different individuals' perspectives (Seelig, 2013). This observation and reframing process conducive to innovation needs' characterisation is denominated *empathy process*, and grounds on exercising empathy with problem-holders and potential innovation users.

Therefore, the skill of empathy in innovation process coincides with the common meaning of "standing in others' shoes", acknowledged as a central skill in general socio-emotional frameworks (e.g., Durlak, 2015). However, empathising with potential users is also an instrumental phase to understand and reframe innovation challenges, leading to better solutions. In this role, the skill of empathy stands out as a main innovation skill according to participants.

6. Openness

Participants in Minors Innovation conceive openness as a stepping-stone in the creative process, which requires also empathy and humbleness. This because, in the words of a participant, innovation needs "skills that make you sensitive to all kind of processes around you. So, thinking out of the box means not being biased, be open to other theories, other cultures" (NL.COL.2.central-administration-authority). Being open entails the willingness to let go preconceptions:

> "First of all, be very attentive to everything that happens and do not have that semi-despotic concept that most human beings have to believe that my way of doing things is correct and therefore I will not leave my comfort zone and to be closed and not permeable to external ideas… break the autopilot and really listen and be attentive to the environment, because people who are comfortable and who do not leave their comfort zone, can rarely be creative" (CL.EXP.5.lecturer).

An open approach is non-judgemental and permits exploration of different perspectives resulting in permeable ideas: "be open-minded, like not judging before actually investigating things, but going further and even if it sounds idiocy, listening to it" (CL.EXP.11.student). This entails to accept that "the way I have to innovate is first to know that I do not know" (CL.ALL-R.5.lecturer) so that new ideas may be received.

Openness is important to widen perspectives on problems and on solutions, crucial in innovation. Being open to diverse ideas and to people who may convey different views may enrich innovation processes as those involved act openly. Conceptually, "[o]penness is seen in the breadth, depth, and permeability of consciousness, and in the recurrent need to enlarge and examine experience" (McCrae and Costa, 1997, p. 826). Breadth refers to the range of interests, depth to the density of creative associations between ideas, and permeability to the shift of mental boundaries that open people experience (Sutin, 2015). Openness involves a motivational dimension reflected in personal curiosity for variety and novelty (Sutin, 2015). This eagerness for newness nurtures innovation behaviours, as data confirms.

Openness also enables other abilities required in innovation, such as questioning critically and collaborating: "I would like them to learn how to be curious, so how to ask the right questions and how to be open-minded, which is also an important part of the interdisciplinary work" (NL.COL.1.innovation-unit-authority). This educator, as other participants, allude to the importance of varied interests and malleable mindsets, key elements of openness. This ability relates to other SESI, including the capacity to self-direct oneself towards open approaches, active listening and collaboration.

7. Respect and value of diversity

A source of innovation is the juxtaposition and further, integration, of seemingly unrelated ideas. Diverse viewpoints support this. Thus, to draw on diversity, it is necessary to accept, value and promote diverse viewpoints. This implies challenges, especially for persons or cultures not used to appreciating differences, or even promoting homogeneity. Participants in Minors Innovation transversally value diversity for innovation, e.g.: "the more diversity, the better… the core value of diversity is that you get, at the end, better results" (NL.COL.4.lecturer). Educators promote diversity, notably through interdisciplinary work. Students discuss how this process of knowing, respecting, understanding, valuing and integrating others' perspectives boosts their sense of respect and openness and -despite challenges- supports innovative approaches.

The essence of collaborating in diversity is explained by a lecturer in the context of multidisciplinary learning:

> "Overall the base has to be "I respect you, I respect that you are an other, with all your ideas and I am this other"... [that leads] to interact, to be able to contribute to the other,

> because I do not feel diminished with what the other thinks, but finally to build a world together" (CL.ALL-R.5.lecturer).

This view agrees with 'appreciating diversity and difference', an interpersonal awareness skill emphasised in other socio-emotional frameworks: to "[a]ppreciate that part of our shared reality is the diversity, uniqueness, and difference of individuals and groups, learning to respect those differences and the way they add to our collective life" (Center for Contemplative Science and Compassion-Based Ethics, 2017, p. 26). The value behind appreciating diversity is multifaceted. From a creativity and innovation viewpoint, these are nurtured in diverse environments where people with different perspectives interact. Csikszentmihalyi (2010) asserts that historical centres of creativity "tend to be at the intersection of different cultures, where beliefs, lifestyles, and knowledge mingle and allow individuals to see new combinations of ideas with greater ease" (2010, p. 9). While creativity is then a systemic process, individuals' contribution in recognising a potential novelty requires "openness to experience" and a "fluid attention that constantly processes events in the environment" (Csikszentmihalyi, 2010, p. 53). In that sense, the previously discussed skill of openness is likely a condition to respect and value diversity, which promotes creativity and innovation. At a personal level, the diversity of experiences, networks and ideas expands the breadth of knowledge that helps engaging in divergent thinking, enhancing therefore the capacity to innovate (Dyer et al., 2011).

Respecting diversity requires accepting and not fearing differences or disagreements, as pointed out by an educator: "innovation is how you look at a problem from another point of view... it has to do with different views, not being afraid of having a different view. I can understand the other's view without agreeing" (CL.ALL-R.5.lecturer). The contextual conditions for expressing diversity, however, vary, and if unfavourable, may restrict this appreciation. In the Chilean cases, participants report cultural limitations to innovation due to a lack of appreciation of diversity:

> "I think we're also in a country where being different is ugly, you laugh loud and everyone looks at you, you're dressed differently and everyone looks at you… then deep down, being different is bad. Then children grow up, trying to be the same... they try to unify us and to be equal… so I think that as long as we continue promoting that being equal is good, we will not generate much innovation either" (CL.ALL-R.13.external-collaborator).

Thus, participants agree on the value of diversity for innovation. As a societal value, however, it manifests differently in Chile and in the Netherlands. Despite this gap, participants in the four Minors Innovation value diversity for innovation. Pedagogical decisions taken by Minors' educators

reflect their interest in promoting diversity in class, by mixing students with distinct disciplinary, cultural/nationality (when feasible) and ability dimensions. This is illustrated next:

> "We put together the teams [of students]… they described their profile. Then we put together teams in which there was a creative, a leader, a collaborator and that were, hopefully represented all types, personality types, as varied as possible. And the argument was always, "hey in life you'll have to work with diverse people, therefore, I do not want you to work with friends, I want you to work in diversity of the contributions"" (CL.ALL-R.4.lecturer).

Overall, an underlying innovation principle evidenced in the data is that as people with varied perspectives mingle, chances that creative ideas emerge increase. Valuing diversity, therefore, is a basic condition for innovation. It is intrinsically relational, may be exercised as a personal-level ability and promoted as a systemic feature. In the wider educational scope, respect and value of diversity are appreciated too, yet not necessarily for permitting creativity and innovation, but for promoting supportive learning environments (Zins and Elias, 2007) and societal wellbeing (Chernyshenko et al., 2018).

Three interrelated social awareness skills were highlighted by participants as critical for innovative behaviours: empathy, openness and value of diversity. Empathy is a socio-emotional skill grounding the 'empathy process', where innovators approach potential users to understand and reframe the innovation problem in novel ways, widening solutions. Openness permits such shift in paradigms and allows connections with others. Appreciating diversity permits collaboration with different others and having varied experiences, both of which nurture innovative results.

D. Dimension of relationship skills

Innovation is a networked process enriched through the integration of multiple perspectives; thus, being able to relate to others contributing with different views is central. Relationship skills are multiple and involve the capacity to establish and maintain healthy relationships (CASEL, 2016a). This includes communication (encompassing active listening and expressing oneself), negotiation, leadership, and networking, together with the ability to resolve conflicts with others. Educators and students of Minors Innovation discuss several of these skills, highlighting collaboration and (interdisciplinary) communication.

8. Collaboration

The ability to collaborate is central for developing novel ideas leveraging on multiple perspectives and capacities. Collaboration requires several other skills, especially in diverse settings, instrumentally sought for innovation. Collaboration with a common goal needs openness, generosity, awareness of one's skills, thoughts and beliefs, and awareness of others' perspectives too. Participants in the Minors emphasised these aspects and their contribution to innovation.

"It is increasingly clear that nothing very relevant can you do alone" (CL.ALL-R.7.lecturer), explains a lecturer alluding to the centrality of collaboration in innovation processes. This allows that "ideas are not fought or repelled from each other, but can be merged and transformed into bigger ideas" (CL.EXP.5.lecturer). The main value of collaboration for innovation is the integration of different viewpoints: "We are all different, all have different value proposition as a person or professional, and all my opinions are complemented with the one besides, and finally there we manage to generate innovation. I find it hard to think that one alone in a laboratory will innovate" (CL.ALL-R.13.external-collaborator). However, despite the benefit of collaboration, in this case for innovation, it is not necessarily easy. "I think this is one of the big problems that we have, failures of collaboration and pro-social behaviour" (NL.COL.9.lecturer). Thus, collaboration entails multiple activities and requires different skills.

One aspect relates to sharing one's views and receiving feedback. This may be challenging because: "it has a lot to do with making yourself vulnerable. So, vulnerable on the one hand because you have to show them what you know… And you know they're going to give feedback. And you know they're going to be critical" (NL.NET.6.lecturer). Another aspect of collaboration refers to its form, commonly through collaboration in established teams. This requires common goals, task allocation, shared responsibilities and identifying the role that each person plays in the team. "The common goal is stronger than this delegation of tasks... collaborative work is when the whole team is moving forward as if they were hand in hand or helping each other" (CL.ALL-R.13.external-collaborator). Shared team responsibility is also discussed: "you are accountable for your outcome. Rather than your team effort, you are accountable for the complete outcome. And then, you control each other" (NL.COL.7.external-collaborator). The forms of 'controlling' may vary, but in collaboration there is a sense of interdependence. Despite such shared responsibility, people have specific roles and in innovation processes it is important to know one's own and others' strengths to build upon them. As narrated by a student: "it is very important to identify what is the role within a group, what is your specific task with which one feels more comfortable" (CL.EXP.13.student). This is consistent

with models describing different roles that persons take in innovation processes (e.g., Kelley and Littman 2006).

Overall, participants' views correlate with collaboration features discussed in the literature: "to work effectively and respectfully with diverse teams", to practice "flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal" and to "[a]ssume shared responsibility for collaborative work, and value the individual contributions made by each team member" (Trilling and Fadel, 2009, p. 55). Minors Innovation participants also highlight collective work through networking, a skill related to collaboration. "To be a good connector for example... to be someone who is capable of generating diverse and broad networks, I believe that, again, in an innovator is very important" (CL.ALL-R.1.innovation-unit-authority). Therefore, collaboration with others requires and nurtures multiple skills. This includes communication, entailing another related set of abilities centrally conceived for innovative behaviours.

9. Interdisciplinary communication

Communication- and specifically interdisciplinary communication- was perceived by Minors' educators as critical for innovation. "We try to be very explicit with them [students] and tell them the fact that working together in interdisciplinary groups is going to make them more creative, make them aware of that and they realise that themselves" (CL.EXP.1.innovation-unit-authority). Interdisciplinary communication entails recognising the value of others' perspectives, one's own perspectives and underlying assumptions in those viewpoints. An initial step in interdisciplinary communication is awareness of other disciplines and their value because "you cannot become a proficient- or an expert in your field whatever academic discipline you have and hope to contribute to society usefully if you if you are unaware of the different disciplinary perspectives" (NL.COL.9.lecturer). This is consistent with the idea that interdisciplinary communication grounds interdisciplinary collaboration, which in turn is instrumental for tackling global complex problems innovatively (Greef et al., 2017). From a creativity and innovation perspective, interdisciplinary communication favours the contestation and integration of different views. This enriches creativity and innovation because at the intersection of cultural and knowledge schemes less effort is required to see new ideas (Csikszentmihalyi, 2010).

Understanding one's discipline to communicate its contribution effectively and to empathise with the interlocutor is also central:

> "[Interdisciplinary work] forces you to present your disciplinary knowledge in a simple way, because you have to be interacting with others... To be able to speak in simple you have to fully understand the discipline. And on the other hand, I believe that you develop empathy a lot because you have to put in the place of the other and what the other wants to understand" (CL.ALL-R.2.central-administration-authority).

Importantly, effective interdisciplinary communication enables participants to question one's assumptions, permitting openness to diverse solutions. Interdisciplinary communication, "the ability to synthesise or integrate insights from different perspectives" entails the negotiation of meaning between disciplines, the capacity to resolve differences, to develop shared understanding and shared leadership, and needs as a basis, the understanding one's own discipline (Greef et al., 2017, p. 31). Negotiating meaning requires learning the language of different disciplines (Spelt et al., 2009) and encompasses both, rewards and challenges (Woods, 2007). Communication then certainly has cognitive dimensions, yet it also has fundamental socio-emotional aspects that enable relationships and interactions between persons, in this case, with different disciplinary cultures.

Concluding, interdisciplinary communication, involving expression and listening, enriches innovation processes by allowing participants to interact, present different perspectives, question their assumptions and develop new joint understandings that facilitate the design of innovative solutions. Interdisciplinary communication relates to other innovation skills, notably to collaboration, and to self-awareness and social awareness abilities.

Minors Innovation participants conceived relationship skills, and particularly collaboration and interdisciplinary communication, essential for innovation processes. Relationship skills permit interaction and the exchange, questioning and transformation of perspectives, which nurture novel ideas. These relationship skills are well recognised in the wider socio-emotional and HE learning literature, in multiple capacities related to yet exceeding the innovation scope. For instance, collaboration benefits group work coordination (Barron, 2000) while interdisciplinary communication permits tackling real-world problems (Greef et al., 2017). Certainly, these processes matter for innovation but as other SESI, are also relevant beyond innovation. The rationales for their importance, though, vary.

E. Dimension of responsible decision-making

Responsible decision-making in innovation steers innovation's potentialities in ethical directions. That is, directing innovation towards beneficial rather than harmful societal results. Explicit acknowledgement of responsibility as an innovation value was manifested differently in the four Minors. One of them (Collaborator) centred on responsible innovation, while in the other three cases responsibility and ethical decisions were discussed secondarily by educators.

Generally, Minors' educators discussed innovation-related responsibility issues requiring multiple socio-emotional skills, without highlighting specific ones. These skills seem to be imbricated altogether. Therefore, this fifth dimension of responsible decision-making is discussed as a whole, without differentiating skills as in previous dimensions.

Responsibility in innovation is considered by participants at both, individual/group and systemic levels, considering their inherent and mutual relation. A professor involved in the establishment of the Collaborator Minor explains foundations of responsible innovation grounded on systemic and ethical perspectives: "it as a very powerful integration driver from two sources. One is the systems point of view, where you know we're working on things that are indeed very much connected. And then the other one is the ethics kind of light that shines on it that also integrates these different perspectives" (NL.COL.9.lecturer).

The expert deepens on responsible innovation regarding multiple socio-emotional skills. One is collaboration, as ethical choices are based on considering multiple relevant perspectives: "The other thing that integrates or facilitates their [students'] collaboration and their talking to each other is the fact that you've chosen ethics. Because ethics in and by itself provides you with a perspective that is in and by itself holistic… an ethical analysis is by definition one that takes all relevant aspects into account" (NL.COL.9.lecturer). Ethical responsible choices also require empathy -or sensitisation since:

> "Ethics is a way of training to see certain things that other people just don't see. So, I give the example… in a bus you're sitting, it's very full-packed, someone enters into the bus and you look around and you see that it's a pregnant woman with a heavy bag. Right. So you offer her your seat. Other people look around the bus, and they look around five times, ten times, they don't see it. It's something that you need to see. And so that I think is very very important. So sensitization" (NL.COL.9.lecturer).

Ethics then, incorporates the concern for others' wellbeing and requires the sensibility to 'see' others' needs. Reflexivity, skill also highlighted by participants and previously discussed, contributes to responsible decision-making in innovation by fostering understanding of one's and others' values, to be considered in choices. "So ethics is in a very important sense about stepping back from your own value pattern, so reflecting upon your own value pattern" (NL.COL.9.lecturer) especially as "I [we] have all kind of moral values without even me [we] noticing it (NL.COL.3.lecturer&programme-manager). This entangles with recognising others' values "because if you hear other people talk about their values then you suddenly realise that you do it differently" (NL.COL.9.lecturer). Thus, reflexivity permits recognising different values, nurturing ethical choices.

Yet the central challenge is pondering values, especially "with the problem of what we call moral overload" (NL.COL.9.lecturer), i.e. of multiple ethical demands:

> "The core question of ethics is how to weigh those different and how to respect those different values. But one of the core ideas of this responsible innovation is that it is worthwhile trying or actually, it is an obligation that you have to try to accommodate as many of those values as you can… So that one of the tricks of this responsible innovation is that you try to come up with a solution that allows you to respect as many of those values as you can" (NL.COL.9.lecturer).

Nevertheless, because of moral overload, "the problem here is that there is no guarantee that there will always be such a solution", which requires trade-offs (NL.COL.9.lecturer). Thus, responsibility in innovation entails the complex task of envisioning contested values and tackling them altogether.

From a practical perspective, participants appeal to the benefit of connecting with the problem and problem-holders to consider different values in taking responsible decisions. "It helps in taking responsibility, because, if something is fictional, you don't weigh it… When you don't see those national challenges, you cannot take responsibility for them" (CL.ALL-R.13.external-collaborator). This relates to pedagogical practices with authentic innovation settings, intending to close the academic-practice gap. Students assess enhanced responsibility in real learning contexts: "It's a real-life case. So, in fact, it really matters. They expect something from you… [requires] some sincerity that is really serious. And then you, of course, you want to make good decisions, so that you improve the outcome. It makes you feel responsible (NL.COL.7.external-collaborator). Therefore, participants consider that innovation decision-making processes are facilitated and foster responsibility by apprehending problems practically.

Another aspect of responsibility in innovation is risk-management: “to innovate implies a risk and when you assume a risk, you take responsibility for the consequences of that risk” (CL.ALL-R.13.external-collaborator). Innovation, and entrepreneurship, entail risks of different sorts: technical (regarding novel processes’ or products’ design), financial (implementation phases require investment) and personal (in the sense of facing potential failure). Risk embeddedness in innovation requires risk-managing skills: “to understand the phenomenon of risk, risk analysis, risk mitigation, because in the end... the realisation of innovation goes along with mitigating risks” (CL.policy-maker/expert.1). More personal understandings of risk involve “daring to make unusual steps… [thus, it is necessary to] educate people to go further (NL.COL.2.central-administration-authority). While risk-management is strongly technical, in experiencing innovation processes it requires too socio-emotional skills like self-confidence, resilience and responsible decision-making.

Responsibility is also discussed by participants beyond formal innovation processes and with one’s life. This is framed in educators’ aspirations of enhancing learners’ responsibility as active agents: “is really about developing active, responsible citizens that can be change makers in their own ways” (NL.NET.5.lecturer and programme manager). Another educator emphasises: “the objectives we seek to be experienced, [include] the responsibility of being protagonist and victim of your own life and in a process of self-learning and unlocking towards new ways of learning and being in the world ... responsibility first of all, responsibility with his/her life" (CL.ALL-R.5.lecturer).

Understanding the complexity of responsibility in innovation is conceived by some educators (notably in the Collaborator Minor) as a fundamental learning aim:

> “that students have an understanding of what responsibility is and how complex it is, how the concept itself is ambiguous depending on the stakeholders, of course, depending on all different perspectives… they need to realise that is immensely difficult being responsible, being a responsible innovator” (NL.COL.3.lecturer&programme-manager).

The dimension of responsible decision-making skills is embraced in both, recent innovation and socio-emotional learning literatures. Innovation’s multiple engrained processes and unpredictable outcomes -in addition to diverse ethical perspectives- complicates responsibility in innovation. This complex systemic challenge has been debated in responsible research and innovation (RRI) academic and policy literature. RRI embraces varied aspects including the governance and orientation of innovation aims, the system’s responsiveness and the recognition of innovation as “collective activities with uncertain and unpredictable consequences” (Owen et al., 2012, p. 751). Responsible innovation has been defined as “taking care of the future through collective

stewardship of science and innovation in the present" (Stilgoe et al., 2013, p. 1570). Ethical, sustainability and societal desirability aspects of innovation processes are pillars of RRI (von Schomberg, 2012). As commented in the Self-awareness section, Stilgoe et al propose a RRI framework comprising four connected multi-level dimensions: anticipation (foresight), reflexivity (individual and institutional), inclusion (wider public) and responsiveness (capacity to respond and change) (2013). Minor Innovation participants tend to agree on these dimensions, especially as noted in previously discussed socio-emotional skills; e.g., self-reflection (reflexivity), value of diversity (inclusion) and collaboration (responsiveness).

In the socio-emotional learning context, responsible decision-making corresponds to the "capacity to make choices based on realistic evaluations of consequences, well-being, ethics, safety, and social norms" (Osher et al., 2016, p. 646). This decision-making process needs knowledge, skills and attitudes to make constructive choices in varied contexts (Weissberg et al. 2015). Ethical decisions consider self and other wellbeing and involve "managing goals, time and tasks" (Conley, 2015, p. 198). That is, manifold considerations, skills and aims shape responsible choices. Aspects of responsible decision-making intertwine with features of responsible innovation, although the socio-emotional learning literature focuses on personal-level decisions while the literature on responsible innovation considers also systemic governance responsibilities. Understanding and weighing ethical and wellbeing implications is a responsibility perspective manifested by participants across the four cases, yet notably in the Collaborator Minor, founded under responsible innovation principles.

Overall, Minors Innovation participants highlighted multiple SESI related to responsible decision-making, that are present in the socio-emotional and responsible innovation bodies of literature. Socio-emotional skills appear relevant to both, individual/group and systemic responsibility. Some of the skills evidenced as critical for ethical and responsible innovation choices are empathy, collaboration, reflection and awareness of contested societal values.

F. Discussion on socio-emotional skills for innovation

This chapter explored the importance of specific socio-emotional skills for innovation, as observed by educators involved in the four Minors Innovation. This addressed the first research question about key socio-emotional skills facilitating, and the means for promoting, innovative behaviours. The empirical thematic analysis evidenced the relevance of multiple socio-emotional skills for innovation processes and behaviours, and particularly of ten skills: self-reflection, self-confidence, autonomy, resilience, empathy, openness, respect and value of diversity, collaboration, interdisciplinary communication and responsible decision-making. These ten skills were organised

into the five dimensions of the CASEL framework. Although skills' potential is in cases individual (e.g., self-reflection), in all cases their collective development and exercise is central, as examined in Chapters 7 and 8. The analysis of skills included the rationale of their importance for innovation as expressed by participants, complemented by literature on socio-emotional learning and innovation to explore skills' meanings.

The empirical identification of SESI somehow differs with the review of (limited) literature on the subject (Chapter 2). Notably, the preponderance of self-awareness skills in the case study is stronger. Minors' educators emphatically pointed to self-reflection as a central skill, which is only latent in the literature. Self-confidence relates to self-belief, the single SESI identified in the literature. Abilities in the other dimension agree more, yet emphases vary. For example, empathy stands out in the data but no so in the literature, compared to other social awareness skills. Leadership, on the contrary, appears secondarily in the data and relatively centrally in the literature. Other empirically selected skills like resilience, value of diversity, collaboration, communication and responsibility are similarly visible in the literature. Gaps may reflect both, the emerging state of literature on (socio-emotional) skills for innovation and the framing of this study.

The resulting set of SESI and their rationale for innovation may contribute to a possible framework of skills for innovation serving educational purposes. The development of innovation skills in undergraduate education shares challenges with progress on research skills. One obstacle in developing research skills at the undergraduate level is the lack of a skills framework that identifies core skills and promotes a shared vocabulary, guiding educators and learners (Hughes, 2019). This problem applies similarly to innovation skills, and particularly to socio-emotional ones. The analysis presented in this chapter provides an empirical-based foundation to consider in undergraduate innovation education.

Important considerations frame this analysis. First, the selection of skills emerges empirically from a case study of four Minors Innovation. Across cases, the relevance of selected skills is overall convergent. Only few skills manifest different degrees of importance given cultural/educational contexts. For example, responsible decision-making is emphasised more in the Collaborator programme than in others because this Minor focuses on responsible innovation. Also, respect and value of diversity is relevant transversally yet seemingly harder to exercise in the Chilean cases, given cultural homogeneity problems acknowledged by educators. Second, skills are inherently interconnected, within and between socio-emotional dimensions, as elaborated in the discussion. Isolating them only serves the purposes of conceptual analysis; in practice, they are interdependent

and inseparable. Neither independence nor hierarchies of skills are proposed hereby. Third, innovation processes are collective. SESI's exercise and development occur in learning communities, yet certain skills -notably related to self-awareness and self-management- strongly rely on 'internal conversations'. Fourth, innovation processes are multiple and diverse, requiring distinct capacities (OECD, 2011). I analyse the general importance of skills for innovation behaviours, but skills may vary for specific processes. Fifth, I have intended to distinguish participants' views on the relevance of skills for innovation, from their active promotion in Minors Innovation. Of course, both are connected, and the former shapes the latter. Beyond these considerations, the empirical analysis strengthens an overarching question on the nature of socio-emotional skills for innovation.

Skills for innovation, skills for life?

An important empirically emergent aspect of SESI that does not fit in the discussion of any particular socio-emotional skill or dimension, is the correspondence between socio-emotional skills that favour innovation and those that more generally serve in life. Their parallel depends on the conceptions of innovation. If innovation is conceived as a daily practice of identifying and defining problems, and collectively exploring, designing and testing solutions, naturally skills for this kind of innovation process resemble those for managing day-to-day activities. Yet even when more technical views of innovation are considered, involving the application of specific techniques, socio-emotional skills such as those reviewed in this chapter – which arguably are relevant for life in general too- appear as relevant. Empirically, some educators participating in Minors Innovation explicitly point in the direction of this convergence, arguing varied extents and forms of coincidence.

One perspective is fully overlapping: "entrepreneurial skills are rather transversal skills, it is like a new way to package them only" (CL.ALL-R.6.lecturer). Explaining that many issues compete for entering educational curricula, involving different terminologies for certain skills, the educator suggests: "you have to remove these hats from the names and in that sense, concern ourselves more about the skills; whether they're called A, B or C, I do not care" (CL.ALL-R.6.lecturer). While the lecturer uses entrepreneurial rather than innovative terminology, the underlying argument is still valid: that as different educational topics (and trends) develop, the naming for core skills vary but in essence, they remain. Certainly, emphases on specific skills and pedagogical approaches evolve, yet the query on skills' conjunction is posed.

The inclusion of socio-emotional skills in teaching-learning processes and their acknowledgement

is a related discussion. “I never thought of these emotional-social skills before. Perhaps they are so implicit in education in general… it’s important to realise that and to acknowledge that you teach these skills, perhaps, implicitly, but you should make it explicit” (NL.COL.3.lecturer&programme-manager). This issue exceeds SESI and alludes to the arguable secondary attention that socio-emotional skills receive in university education compared to cognitive and technical ones. Yet it also expresses the embeddedness of socio-emotional learning (even if unnoted) in learning in HE.

Framing entrepreneurship (and relatedly, innovation) as a life ‘business’ is another approach used by educators. “Entrepreneuring life… entrepreneuring as a verb” (NL.NET.3.lecturer&programme-manager) expresses the development of an entrepreneurial mindset towards life, promoted in these university programmes for innovation and entrepreneurship. Another educator working with coaching techniques, explains the principles guiding the module she leads:

> “Ultimately, the same skills that you use to [act entrepreneurially] in business, are the ones you use every day in life entrepreneurship, which ends up being your most important business... I see this for everyone in terms of how we can become happier, more leaders of our own lives, more protagonists -as we put it in the module- through being the ones who make the decisions [of] where we are going... What is entrepreneurship? an attitude towards life, for business, personal development… finally we are moving from being victims to protagonists” (CL.ALL-R.5.lecturer).

These perspectives on skills for life and their convergence with skills for innovation and entrepreneurship are posed by educators in different HEIs. In these illustrative quotes the term ‘entrepreneurship’ is more frequent than ‘innovation’, which raises questions on their centrality in educational discourses. Still, arguments for strong connections between skills for life and SESI are valid. Arguably, a key difference is the purpose that skills serve through their exercise. While the core ability may remain, the context of skills’ application may vary (including ‘for innovation’ and ‘for life’). This may diverge teaching-learning narratives.

However, despite variations in specific aims and terminologies, it appears that SESI are regarded by some educators as abilities that learners develop in processes of ‘becoming’ with and through learning communities, co-creating ‘practices’ (Wenger, 1998), which in this case are framed as innovation activities. These are socially embedded processes of *self-formation*, in which agentic learners reflexively steer their lives and their “changing selves” (Marginson, 2014, p. 18). It appears then, that Minors Innovation educators consider the collective exercise of SESI as self-formation processes, exceeding the scope of specific abilities for innovation activities and reflecting a more

substantial dimension of learning and growth in HE. As asserted by Marginson (2018), though, the relation between the individual and collective dimensions of this process of *socially-nested self-formation*, might be a difficult aspect to conceptualise. In discussing findings about the development of SESI in Minors Innovation, I explore this socially-nested aspect through the relationships between learners and other persons in learning.

Chapter 6 analysed socio-emotional skills relevant for innovation in the views of participants, answering the first research question. Chapters 7 and 8 analyse pedagogical approaches promoting SESI, answering the second research question. As derived from the data, skills deemed important are generally promoted by educators, but there may be differences between both. Data permitting, I distinguish these.

Chapter 7. Crossing boundaries inside the university: findings on cross-disciplinary education and the development of socio-emotional skills for innovation

The second research question explores if and how SESI are pedagogically facilitated by educators in the four Minors Innovation. Findings show that SESI are promoted with experiential approaches, in the sense that students experience innovation processes. Multiple learner-centred inductive collaborative pedagogical approaches are used, notably project-based learning where students collaborate in projects targeting an innovation challenge. As emerged from the data and discussed in Chapter 3, PjBL serves as a platform for boundary-crossing practices, which nurture collective learning experiences by interacting across socio-cultural boundaries. Two boundary-crossing pedagogical practices stand out in the data as centrally promoting SESI: cross-disciplinary education and community engagement, referring the latter to collaborations between university members and the broader society. I thus focus the analysis on these two emergent pedagogical approaches.

Findings on pedagogical practices that facilitate SESI are presented in Chapters 7 and 8. Chapter 7 centres on the boundary-crossing practice of cross-disciplinary education. Chapter 8 is dedicated to the second boundary-crossing approach analysed, community engagement for learning. The discussion in both chapters is illuminated by theories and concepts introduced in Chapter 3, including both baseline learning theories (Situated, Transformative and Socio-emotional learning) and the specific conceptual tools around PjBL, boundary-crossing, cross-disciplinary learning (Chapter 7) and community engagement (Chapter 8).

The present chapter is organised as follows. Before analysing cross-disciplinary education and SESI, I analyse the wider scope of pedagogical practices fostering SESI in the Minors Innovation. Section A briefly discusses innovation-oriented PjBL, which permits the boundary-crossing practices. The rest of Chapter 7 focuses on cross-disciplinary education, introducing the main findings in section B. The following sections discuss the drivers for educators to utilise cross-disciplinary activities (section C), key features of these practices (section D), challenges and conditions for their implementation (section E) and the contribution of cross-disciplinary learning to the development of SESI (section F). Conclusions on cross-disciplinary education and SESI are drawn afterwards (section G).

A. Findings on pedagogical approaches in Minors Innovation: experiential innovation education through project-based learning

The findings suggest that educators across the four Minors Innovation aim to enhance students' preparedness for engaging in innovation societies. The pedagogical approaches used for that are wide-ranging. This includes activities where students experience innovation processes, notably by working in groups on real-world innovation challenges. It also comprises study about innovation concepts and theories based on lectures and textbooks. These two types of approaches, inductive skill-oriented experiential activities and knowledge-oriented deductive teaching, complement each other, within and between Minors' modules. As explained by participants (both, educators and students) across the four cases, pedagogical approaches of the first sort, namely experiential and collaborative, contribute -intentionally or not- to the development of SESI. In these activities, students exercise self-directedness in their learning paths, and enhance their individual and collective agency. I thus centre the analysis of pedagogical practices facilitating SESI on this type of experiential agentic and collaborative approaches.

The overarching educational aim sought by Minors' educators is to prepare students for actively and responsibly participating in innovation processes and societies. Educators emphasise three interrelated educational objectives. First, to help students exercise agency in society and to collectively recreate it through innovation. This societal role is underpinned by various conceptions of innovation, which differ among participants but overall entail responsible innovation, social innovation and more generally, relevant innovation to tackle todays' global grand challenges. Second, and instrumentally to achieve the previous, educators seek to support students in developing specific innovation skills, such as the abilities to *see* societal problems, to empathise with problem-holders and to collectively design solutions. This requires acknowledging that innovation benefits from the integration of different perspectives, leading to boundary-crossing educational practices. Third, educators aim to boost students' employability. Work prospects are expected to improve by exercising these capacities to work innovatively in resolving important problems. Consequently, individual and societal aims blend as educational drivers of Minors Innovation.

These aims lead to multiple pedagogical approaches. As mentioned above, the findings suggest that those fostering SESI tend to be experiential and based on students' practice of innovation. That is, students participate in innovation processes, encompassing in-situ exploration of customers' needs, ideation through brainstorming, rapid and frugal prototyping, and conceive-design-implement-

operate cycles. The implementation phase, which closely relates to entrepreneurship, in cases includes taking innovation products or services to markets. Hence, the pedagogical approaches observed in the Minors Innovation resemble Doing, Using and Interacting (DUI) innovation approaches, based on practical know-how (Jensen et al., 2007). Especially in knowledge-oriented modules, these possibly mix with Science, Technology and Innovation (STI) models, drawing upon the technical expertise of universities.

These innovation activities are largely framed in the Minors as PjBL; i.e. organised as projects where students work in autonomous groups on a problem or challenge involving research and devising solutions (Thomas, 2000). As evidenced when contrasting the concepts, innovation phases and PjBL share important features: the orientation towards a challenge, group work and design of solutions which may be objects, services or new organisational structures. These concurring approaches make PjBL a suitable pedagogical tool to work on innovation skills and is used in the Minors Innovation. In the four cases, PjBL features are discussed consistently by participants as shaping pedagogical practices which promote SESI. In one case though -Collaborator- PjBL defines one module where students work throughout the term in a group project developed with a company or organisation and using an innovation cycle. Therefore, PjBL facilitates experiential IE and is used across cases, varying its preponderance between modules and Minors.

Multiple features of PjBL entail opportunities for students to exercise SESI. This includes the identification and characterisation of innovation challenges, which may be led by students, educators and/or problem-holders; the definition of common objectives for the group; the management of tasks and deadlines; and the required interaction among group members (which may have different disciplinary backgrounds). Moreover, the data confirms the assertion that through PjBL, in this case oriented to innovation, students hold significant responsibility for steering their learning process (Prince and Felder, 2006) and educators take facilitation roles (Stefanou et al., 2013), enhancing students' agency.

From a social learning perspective (Lave and Wenger, 1991), PjBL activities in the Minors Innovation may be regarded as entailing 'temporary' learning communities. These centre on a domain of interest (the innovation project), a community enabling social learning (the persons involved in the projects) and a practice; i.e., the specific interaction between community members, which takes multiple forms essentially representing the project work. The temporary nature of this communities is given by the official start and end of PjBL educational activities, although in cases learning communities may last beyond formal Minors Innovation activities. This view of learning as social

participation encompasses learning as belonging in communities, learning as doing in practice, learning as becoming through transformed identities and learning as experience by creating meaning (Wenger, 1998). These four elements are embedded in the promotion and development of SESI through innovation PjBL activities.

Yet project-based learning processes also entails difficulties for Minors Innovation students. One could argue that the question or problem guiding PjBL in cases represents a 'dilemma' experienced by learners, as conceptualised in transformative learning theory. A dilemma can trigger the questioning of assumptions and beliefs, leading to transformed perspectives (Mezirow, 1991). The dilemma for students emerges from the need to work in projects with others that may have different views about it. This may lead to shifted viewpoints enhancing the project outcome and to learning opportunities through collaboration.

In the context of experiential innovation education with PjBL characteristics, meaningful pedagogical approaches promoting SESI share a boundary-crossing nature, which are precisely based on the potentially fruitful yet challenging interactions between people with different socio-cultural views. It is through the identification and (re)establishment or transformation of these interactions that learning potentials emerge (Akkerman and Bakker, 2011a), in this case for the development of SESI. The data evidences that this process of encountering different others (Suchman, 1993) occurs through interactions across disciplinary paradigms and organisational (or theory-practice) perspectives.

First, the students' varied disciplinary backgrounds serve as a learning resource; i.e. by (re)-establishing interaction across (disciplinary) boundaries they expand and resituate their expertise (Guile, 2011). Multi-, inter- and trans-disciplinary learning experiences contribute to SESI development in the Minors. These approaches, analysed throughout Chapter 7, encourage students' reflection and transformation of perspectives, their ability to communicate, collaborate and negotiate across disciplinary boundaries, and their appreciation of diversity for innovation.

Second, community engagement for learning is a central pedagogical platform in Minors Innovation. Students cross organisational boundaries by interacting with the broader society in the identification, framing and ideation of solutions to problems. They collaborate with problem-holders, i.e., people, organisations or sectors experiencing the problems (e.g., elderly people with mobility difficulties) or with problem-providers, holding responsibility for tackling problems (e.g., municipalities). These collaborations involve crossing cultural and social boundaries existing

between HEIs and other social settings, and specifically between students' and their counterparts' backgrounds and perspectives.

In these boundary-crossing processes framed in innovation processes, Minors Innovation students work on innovation challenges and develop innovative solutions, both of which may be regarded as boundary objects. Boundary objects evidences differences in perspectives held by those across boundaries and help them to negotiate meaning (Star and Griesemer, 1989). The data confirms how students are driven by innovation challenges and solutions in-progress to dialogue, reflect and transform their distinct perspectives. The practical, DUI-type of innovation approaches used in innovation PjBL reaffirms the relevance of tacit informal expertise, in which context boundary objects particularly support knowledge integration (Mäenpää et al., 2016). That is, students' development of SESI is boosted by engaging in boundary-crossing practices, notably crossing disciplinary and organisational boundaries. The innovation challenges in which students work and the resulting devices they develop (whether physical or not), as boundary objects, help students to contest and integrate varied expertise. In that process and the interactions encompassed with those holding different views on the objects, learners develop multiple SESI. In this sense, Minors Innovation represent boundary territories where students "encounter difference" (Suchman, 1993), which entail opportunities for situated learning and the collective development of understandings (Wenger, 1998), notably by integrating perspectives. Through collective work in these contested boundary territories, students develop socio-emotional skills favouring innovation.

It is important to clarify that these innovation-oriented PjBL-based boundary-crossing pedagogical approaches favour the development of SESI in the Minors, intentionally or unintentionally. The findings suggest that some educators incorporated certain pedagogies seeking to boost specific skills; e.g., to mix students from different disciplines in student groups to develop communication abilities. I consider this to be intentional, whether the skills were expressed formally as learning objectives or not. In other cases, pedagogies appear to support skills development unintendedly. For example, through community engagement activities some students enhanced their self-confidence, which appears as an unintentional result. The intentionality towards SESI, however, was difficult to map with the data available. I analyse the forms and mechanisms through which SESI, intentionally or not, and making explicit their socio-emotional nature or not, were promoted and enhanced in the Minors Innovation. I do not intend to contrast learning objectives with achieved outcomes nor to assess, consequently, the efficacy of programmes in achieving declared aims. Certainly, the educational design affects the actual practice, but I do not evaluate their alignment or gap. That exceeds the objective and methodological feasibility of this thesis. Thematic

analysis is used to analyse the presence, relevance and mechanisms through which pedagogical approaches nurture the development of SESI in the views of participants. Distinctions between cases are analysed when pertinent.

Therefore, the findings suggest that the pedagogical facilitation of SESI in the four Minors Innovation is based on pedagogical approaches which promote students' active engagement in innovation process. This is often framed in projects where students interact with peers of other disciplines and with the wider community. The analysis of pedagogies favouring SESI focuses on this kind of practices that most evidently contribute to SESI development. The rest of the chapter centres on the boundary-crossing practice of cross-disciplinary education.

B. Cross-disciplinary education and the development of socio-emotional skills for innovation in Minors Innovation

A key pedagogical approach promoting SESI, in the views of participants, is cross-disciplinary education. As explained in Chapter 4, the four Minors Innovation are open to, and taken by students from different disciplines. This provides a basis for learning by interacting across disciplines. This potentiality was a known aspect of all Minors. Yet two critical aspects were unknown. First, the extent and forms in which this potential was activated, i.e., the pedagogical deployment of cross-disciplinary education. Second, learning dynamics promoting SESI. That is, if and how multidisciplinary educational settings (i.e., the juxtaposition of persons with different disciplinary backgrounds) and active cross-disciplinary pedagogies (in the forms of multi-, inter- and trans-discipline, as discussed in Chapter 3) promote the development of SESI and through which mechanisms. Here I analyse these issues, exploring learners' interactions across disciplinary boundaries.

The data confirms that multidisciplinary classrooms facilitate the development of SESI in the four Minors Innovation. The relevance of this approach for innovation skills lies in the fact that innovation is enriched by integrating multiple perspectives, as discussed in Chapter 2 and as emphasised by participants. As students experience innovation processes within the Minors, these experiential learning activities, including skills favouring innovation, are then enhanced by their different disciplinary expertise. Across cases and according to various types of participants, however, cross-disciplinary learning potentials also entail challenges, both organisational and in learning processes per se, given the learners' confrontation of perspectives and work styles. Despite

these obstacles, lecturers and students leverage on this multidisciplinary learning potential through various types of cross-disciplinary interactions and pedagogical approaches.

The data evidences that cross-disciplinary integration is experienced to different degrees in these educational activities. Multi-discipline as the juxtaposition of disciplinary perspectives, interdiscipline as their integration (Spelt et al., 2009), and transdiscipline as the generation of new perspectives and the synthesis of approaches between academic and non-academic knowledge (Greef et al., 2017), are all observed as educational practices in the Minors Innovation. These appear to be affected by pedagogical decisions but generally the different degrees of cross-disciplinary integration are not made explicit in educators' drivers for using these approaches.

The educational aims guiding cross-disciplinary activities in the Minors Innovation centre on boosting students' experiences of innovation processes and promoting innovation skills' development. This is based on the importance of cross-disciplinary abilities for working on complex innovation problems and for graduates' professional preparedness. As discussed by participants, combining disciplinary perspectives help various phases of innovation processes: it enriches problems' framing or definition; it boosts creativity leading to innovative solutions through the integration of seemingly unconnected ideas; and it contributes to the comprehensive assessment of potential solutions. Thus, the resulting innovation outcomes are enhanced.

When this innovation outcome-orientation becomes preponderant in the Minors, however, it can generate some tension with the central objective of supporting students' growth (Detmer, 2017). I observed this issue in the data, for example, when participants discussed learning outcomes focusing on the quality of innovation devices versus students' reflections of their learning processes. While emphasising the relevance of innovation results may motivate students to engage in their project work, this may also be to the detriment of actual learning, if the latter receives less attention, especially through formal assessments. Thus, the expected products or artefacts, a central component of PjBL (Blumenfeld et al., 1991), can stimulate students yet can also shift the focus from learning to the problem solutions, depending on how the teaching-learning process is led and experienced.

In the implementation of cross-disciplinary education in the Minors, participants distinguish between the platform given by classes with students from multiple disciplinary backgrounds from pedagogical approaches intended to unleash these cross-disciplinary learning potentials. Moreover, in three of the four cases, Minors' modules are taught by lecturers from different faculties, enriching the opportunities to engage with different disciplinary perspectives. The data suggests

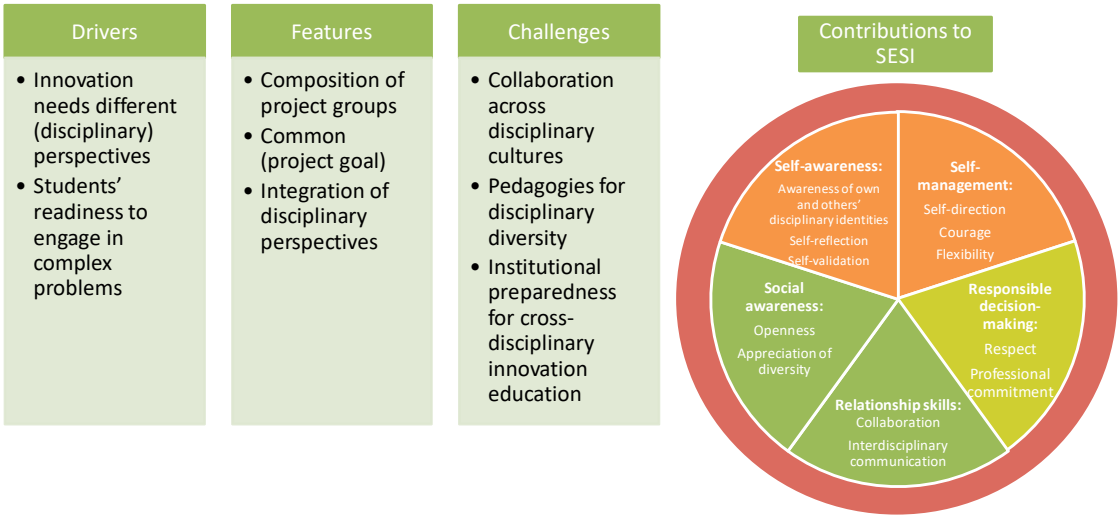
that students across cases experience various degrees of contestation and integration of disciplinary perspectives, aligned to concepts of knowledge integration examined in the literature (e.g., Greef, 2017). Minors' students juxtaposed cross-disciplinary ideas, i.e., multidiscipline; questioned and integrated perspectives; i.e. interdiscipline; and, less evidently in the data than the previous, developed novel indivisible viewpoints, integrating academic and non-academic sources of knowledge; i.e. transdiscipline. In addition to these forms of cross-disciplinary work, two themes emerging from the data that shape students' development of socio-emotional skills are the composition of student project groups and the definition of shared objectives to direct their collaboration.

Cross-disciplinary work in the Minors Innovation entails learning, teaching, and organisational challenges. For students, a central difficulty is the contestation of epistemological standpoints, that is, processes whereby learners expose, question, understand and expand their ways of conceiving truth and knowledge. Epistemological boundaries defy interdisciplinary understanding, yet when overcome, enhance students' learning. There seems to be a yielding point in learners' defiance towards others' perspectives. In the words of Woods (2007), when they become ready to "suspend disbelief about other disciplinary cultures and belief about one's own" (p. 859). After surrendering resistances and experiencing greater openness, learning, and specifically SESI, seem to flow easier as students enjoy the benefits of cooperation. Lecturers can struggle to find suitable pedagogical approaches that contribute to students, considering their diverse disciplinary cultures, knowledge and skills. Organisational challenges concern the conditions and resources for cross-disciplinary learning in the Minors.

In this context, Minors Innovation students develop SESI through cross-disciplinary learning, albeit initial resistances, discomfort or even mistrust. Skills developed relate to the five dimensions of socio-emotional learning. A central ability is interdisciplinary communication, which entails not only relational abilities but self-awareness and social awareness, to understand one's own and others' standpoints. The capacity to reflect upon personal ways of thinking, analysing problems and addressing them is developed. Students also enhance self-direction skills enabling them to overcome fears to relate with different others. Consequently, openness to otherness also outstands. Some students boost their attitudes of acceptance, respect, tolerance and value of the diversity. In cases, especially in Collaborator, the multiplicity of disciplinary perspectives conveys the need for ethical choices, as responsibility –and responsible innovation- requires the consideration of as many relevant perspectives as possible.

The main findings on the boundary-crossing practice of cross-disciplinary learning are presented in the next four sections. These dedicate to educators' drivers for using cross-disciplinary pedagogies, aspects characterising and shaping the forms that cross-disciplinary education take, challenges in these approaches, and their contribution to SESI development. The following figure summarises these findings.

Figure 7. Summary of findings on cross-disciplinary learning and the development of SESI



Source: author's.

C. Drivers of cross-discipline in innovation education

Considering the multi-disciplinary setting that the participation of students from multiple disciplines in the Minors Innovation offer, the thematic analysis suggests that educators across the four cases value cross-disciplinary pedagogies twofold. First, innovation requires the integration of multiple perspectives and therefore, innovation education benefits from work across disciplines, offering different viewpoints. Second, this pedagogical approach enhances students' preparedness for work, which increasingly requires the ability to combine expertise. Yet beyond professional life, some educators conceive cross-discipline as collective personal growth, reflecting the role of higher education in students' self-formation (Marginson, 2018).

These educational drivers for cross-disciplinary pedagogies in the four Minors Innovation assimilate with the motivations exposed in the literature of both, cross-disciplinary education and innovation education. From an innovation perspective, underlying and interrelated concerns include the relevance of innovation skills for work (Acar and Tuncdogan, 2019; Avvisati et al., 2013), which

include the capacity to work in multidisciplinary and multicultural environments (Watts et al., 2013). From a cross-disciplinary viewpoint, the recognition that professional work increasingly requires cross-disciplinary teamwork (Woods, 2007), implies focusing on graduates' readiness to engage in resolving complex problems that require innovative solutions that reconcile, combine and integrate insights from different disciplines (Greef et al., 2017). Therefore, the overlap in the drivers for interdisciplinary education and innovation education in HE observed in the literature, also manifests in educators' narratives in the Minors Innovation. These are grounded on the role of HE in society and graduates' contribution to innovation-based societies. While these rationales for drawing on cross-disciplinary pedagogies are interrelated, their emphases may nuance teaching-learning experiences.

1. Innovation requires different (disciplinary) perspectives

Cross-disciplinary work emerges as a pedagogical pillar of Minors Innovation because it enriches the analysis of complex problems tackled through innovation. Thus, in experiential IE, multidiscipline is a valuable learning resource. As the data confirms, crossing disciplinary boundaries supports various innovation processes experienced by students: problem framing (the characterisation of the challenge becomes richer), ideation and creative process (more and diverse solutions are devised) and ethics for responsible innovation (contested disciplinary values nurture ethical choices). These processes boost multiple SESI, discussed in section E.

Innovation is a practical activity oriented to creatively resolve challenges. Increasingly, challenges addressed innovatively are complex and require multiple perspectives to tackle them effectively and ethically. This rationale grounds educators' drivers to use cross-disciplinary pedagogical approaches. A lecturer asserts: "the rest was already invented" (CL.ALL-R.5.lecturer), meaning that mono-disciplinary teams are no longer pertinent for today's challenges. These are "wicked problems, basically. And they require interdisciplinary approaches. So the nature of the assignments which are authentic problems, they require a multidisciplinary lens" (NL.NET.7.lecturer). These multidisciplinary perspectives enhance, in the views of participants, three central innovation processes: problem-framing, creating solutions and assessing alternatives.

- Framing or re-framing the problem, that is, characterising the problem or question being addressed is enriched in multidisciplinary settings. "Reframing to me is the main… I really want to understand from multiple viewpoints what is it that we are tackling… so that dialogue I think is essential… that makes one challenge the traditional, mono-disciplinary paradigm that can be in use" (CL.ALL-R.2.central-administration-authority). That is, working

with multiple perspectives contributes to the initial stage of defining the innovation challenge.

- Creativity is fuelled collectively: the process of creating novel ideas is boosted by integrating different viewpoints. This creativity premise (e.g., Csikszentmihalyi, 2010) is claimed too by Minors' educators, as illustrated next. "When you manage to combine the two thoughts, there innovation arises, there creativity arises, because you put a point of view, but the other takes that point of view and transforms it for what he understands" (CL.ALL-R.13.external-collaborator), comments a social entrepreneur who sees creativity "in diversity rather than in the creativity of a person, when creativity is born from the team" (CL.ALL-R.13.external-collaborator). The integration of perspectives, thus, characteristic of interdisciplinary work, permits innovation.
- The evaluation of possible solutions and discrimination of their application is enriched by cross-disciplinary work, which fosters ethical choices. A professor explains: "So if you want to do a good analysis of a design project, for example, you would have to elicit as many values as you can" (NL.COL.9.lecturer). Multidiscipline prompts this diversity of values that refine analyses.

Therefore, in participants' views, cross-disciplinary work enhances innovation processes, which are experienced by Minor Innovation students.

2. Students' readiness to engage in complex problems

While the previous rationale for using cross-disciplinary pedagogies centres on innovation processes, a related one focuses on the learner. Educators emphasise that cross-disciplinary education can help students to develop abilities for working in multidisciplinary teams, through practice. These abilities are valuable, as perceived by educators, for work and beyond: for active citizenship and personal growth.

Students' readiness for professional life is a key aim, as illustrated next:

> "So you would have to be able to engage with them [persons with different disciplines] and feel very comfortable in talking beyond the boundaries of your own discipline because otherwise you're going nowhere basically because all of the problems are nowadays, with the exception of a few, but are problems that will touch upon so many things" (NL.COL.9.lecturer).

The ability to work in this kind of settings enhances students' agency in society, which connects with their skills' development:

> "We want to educate students to citizens who can contribute to the problems of our society, so innovation is a part of that. At the other side, you want to develop the talents of students in the most optimal way, to offer them a range of possibilities, opportunities to engage in" (NL.COL.2.central-administration-authority).

Learning opportunities in cross-disciplinary settings, especially in a "very unbonded education" are considered to support SESI such as adaptability, humbleness and openness (CL.ALL-R.6.lecturer). Yet it exceeds specific abilities and supports personal growth; "they also have to talk to people that have different logics than you… it makes you a more complete person, in my view" (NL.COL.1.innovation-unit-authority). This personal growth occurs collectively. Interaction across boundaries is central: "I cannot live without interdisciplinary teaching to be honest… because you lift each other up" (NL.NET.3.lecturer&programme-manager).

This focus on the learner, as a professional, citizen and person, entwines yet contrasts the idea of better innovation outcomes, discussed earlier, as rationales for developing cross-disciplinary education. As exemplified next, these motivations appear somehow separate, but the latter is instrumental to the former. "The more diversity, the better, in the groups… The core value of diversity is that you get, at the end, better results" (NL.COL.4.lecturer), proposes a lecturer. When asked about the extent to which educators value the quality of innovation solutions developed by students, the lecturer explains that it is "more a learning experience than we assess [in] the final result" (NL.COL.4.lecturer). Nevertheless, an educational challenge is that project outcomes are simpler to assess than skills or learning more widely and thus, when the focus is on the resulting innovation outcomes, students may perceive that these results matter more than their actual learning.

Therefore, Minors Innovation educators appreciate cross-disciplinary education as means for both, boosting innovation processes and results, and collectively enhancing students' preparedness for work and life in society. These are naturally connected; as students develop abilities, they can engage better in innovation processes.

D. Key aspects of cross-disciplinary education

The previous aims lead to various cross-disciplinary pedagogical practices. These leverage on classes with students from different study programmes, and to a lesser extent, multidisciplinary teaching teams. While lecturers coincided in the value for students to work with peers from different disciplinary backgrounds, they used different tactics to promote their collaboration. Three themes emerged from the data as critically shaping these activities in Minors Innovation: ways of defining students' groups for PjBL-type of activities; the importance and implications of having a common goal in students' innovation group work; and approaches to the integration of disciplinary perspectives. These aspects are discussed next.

1. Composition of project groups

A key pedagogical approach in the Minors Innovation is PjBL, where students work in groups. The mechanism for project's group-forming is a central theme, affecting students' experiences and their development of SESI. Notably, students' agency expressed in their decision-making power for forming groups is encouraged differently through various group-forming approaches. Through different approaches though, learners participate in PjBL-oriented communities, and the opportunities for situated learning in the sense of learners' engagement and transformation in, through and with those communities (Lave and Wenger, 1991) probably depends on the group-forming approaches.

Lecturers lead the composition of project groups by offering guidelines to students, requiring certain mixing criteria or deciding groups' formation. Overall, more freedom allows students to experience the implications of choosing or not to work in diverse groups. Learners may exercise agency and self-directedness as they take decisions about their learning. The downside is that such reflection and learning may not occur, and that cross-disciplinary learning experiences may be limited. On the contrary, predetermination of groups by lecturers benefit students by providing group diversity exposing them to different perspectives and having the need to manage these. A disadvantage is that learners are less active in designing their learning setting and therefore, possibly less conscious of its consequences. Thus, predefined groups enhance students' collaboration fostering disciplinary boundary-crossing interactions, while allowing them to choose promotes their sense of responsibility towards their learning process. Educators also mix and change these approaches as educational experiences unfold.

An approach is that students form groups, allowing them to work in homogeneous groups if they choose. In cases, as illustrated next, team members realised that they needed different expertise for the project's challenge, they took action to diversify and the lecturer re-shuffled groups:

> "It was a smart flowerpot, with humidity and temperature sensors and an application on the mobile phone that told you, 'you have to water or fertilize'... There were agronomists, but they told me "you know, professor, we need people from other scopes… we need an engineer to help us with the sensors and the application, but we also need an educator, because this is for children…"" (CL.ALL-R.4.lecturer).

This exemplifies that projects -depending on their definition- can influence students' learning by determining (diverse) necessary resources for their fulfilment. Even with difficulties -"they initially resist, but they thank it in the end" (CL.ALL-R.4.lecturer)- Minors' students recognised in cases that distinct disciplinary perspectives are useful and held responsibility for their choices. This illustrates at least two group emotional regulation strategies identified by Järvenoja et al. (2019) when analysing collaborative learning, increasing awareness and task structuring. From an epistemic perspective, students created awareness about a lack of knowledge and alleviated such lack by requiring additional information (from peers from different disciplines). These actions represent shared epistemic agency (Damşa et al., 2010) enacted when manifesting too socio-emotional skills, such as self-regulation and openness. Thus, student-led group-forming permit students to experiment and reflect on the benefit of collaborating in diverse settings. From a community of practice perspective, their sense of belonging to chosen rather than imposed groups may be stronger, at least in initial phases and despite lesser transformation potentials.

Other modalities for group-forming in the Minors is that students chose after doing preparatory work and receiving specific guidelines. The same professor from the previous example in another academic term, before designing groups, asked students to self-assess their skills. The enhanced self-awareness guided students' group-forming choices. This aim to complement team-members' abilities is suggested in the innovation literature (e.g., Kelley and Littman, 2008), not necessarily referring to cross-disciplinary work. Educators also offer guidelines for group-forming allowing students to decide:

> "They are free to form themselves, but we give some rules… I mean we are at university level and this is also entrepreneurial somehow, so we want them to do it, on their own. But we give some indications… different countries, different backgrounds, and genders" (NL.NET.5.lecturer).

This illustration emphasises the ownership for one's learning and the innovative and entrepreneurial attitude fostered in students, considering the university innovation context. This reflects various aspects of university education experience: the potential for encountering different perspectives where disciplinary diversity is present, educators' responsibility in choosing what values to prioritise (e.g., self-direction versus experiencing such diversity) and the 'learning as doing' element of learning communities which gains an innovative or entrepreneurial accent in experiential IE.

A different method is for lecturers to design student groups ex-ante, assuring diversity, e.g.:

> "What I do is try to make them be with a different one… they are also allocated from different areas in such a way that they understand that the vision of different problems that each one of them has is totally different, and can be complemented with that of the other" (CL.EXP.7.lecturer).

Predefined groups oblige students to work with peers from other disciplines, leading, as the data suggests, to resistances due to both, personal fears to expose oneself and interact, and judgements towards others, as a student narrates:

> "At the beginning I was like super nervous, I did not like doing things in group and in the Minor everything was in a group… she [the lecturer] chose and distributed the study programmes so that nobody knew each other... I found that was good because we began to see different points of view. My point of view was different from that of an engineer classmate, so we complement each other a lot" (CL.EXP.12.student).

This group-forming approach, thus, boosts learning and SESI by having the (assured) chance to work in diversity. Students are nudged to question their habits of mind, i.e., their assumptions and predispositions (Mezirow, 2000), by questioning standpoints and opening to different ones. Possibly, though, students' self-directedness may be less exercised than in student-led group-forming approaches.

Different group-forming approaches can promote different learning dynamics. Studying collaborative blended learning contexts, Hughes (2010) analysed identity congruence which supports the learner's emotional stability in the group. She distinguished three interrelated dimensions of identity congruence between learners and their learning groups: social (related to social relationships), operational (alignment of practices) and knowledge-related (to various types

of knowledge) (Hughes, 2010). The findings showed that knowledge-related identity congruence was critical for formal learning, the operational one was necessary and the social identity congruence was the lesser important and could even be counter-productive (Hughes, 2010). The data from this thesis tends to agree with the idea that aligning social identities of group members was undesirable ("possibly don't work with your friend because you can see your friend after lesson" (NL.NET.5.lecturer)). The operational identity congruence mattered especially given the project-based context and was developed throughout the project work. The knowledge-related identity congruence was the most important, and complex. As discussed, educators promoted group-formation of students from different disciplines to inform the work on innovation challenges from distinct perspectives. Depending on the group-forming approach, initially students tended to prioritise the social rather than the knowledge dimension. In cases they shifted, appreciating that complementing knowledge permitted a better operation of the project. As discussed after, integrating disciplinary perspectives was not necessarily easy, but enabled innovation processes and the development of SESI.

Two further considerations matter in student-groups composition: the importance of project groups in modules and the wider institutional contexts of modules and Minors. First, the significance of a single project group within a module or Minor varies, having group-formation different implications. As discussed earlier, in Collaborator, one module is fully project-based, and students work on the same project throughout the term. In other cases -including thematic modules of the same Minor- PjBL is more delimited. Therefore, the impact of group-formation as a process affecting the collaboration across disciplinary boundaries, may vary according to the centrality of group projects in each module. Second, lecturers' pedagogical choices interplay with institutional arrangements. The multi-institutional Collaborator programme is anchored in the benefit of multiple disciplinary perspectives, associated to different HEIs. This value, thus, steers educational practices: "I think we wouldn't allow that you have a group only from [one partner university]. We wouldn't do that. So, there should be this mix of the three university" (NL.COL.3.lecturer&programme-manager). In this case, the inter-institutional collaboration also determines the importance of mixed project groups. Interestingly, a desired project-oriented learning community is defined in this case by the disciplinary diversity given by various institutions. This entails certain socio-cultural, and institutional boundaries, offering learning challenges and opportunities.

Student groups and their cross-disciplinary formation are critical in the Minors' educational activities, notably in the widely used innovation PjBL approach. Yet in other cases, as suggested by

the data, emphasising disciplinary differences where these are irrelevant may create fruitless divisions among students. In one Minor, theatre improvisation is used to develop communication abilities. The lecturer explains:

> "I asked in the first class "what degree are you from?". And then I realised that it didn't help me much. In fact, it was even harmful, because expectations were loaded on those who came from a bit softer degrees… Then I decided, I don't even ask... I downplay it, I don't mention it and I talk about us as a work-team, and that all the elements, all the pieces are key... And I think it works" (CL.EXP.5.lecturer).

In this context where the relevance of disciplinary expertise is less important, or less evident, and where judgements towards others' disciplines hinder collaboration, another mixing strategy is used: avoiding differentiations. In other words, the sense of belonging to a learning community is fostered by focusing on the commonality.

Concluding, in experiential IE, where students often work in groups around innovation challenges, the composition of groups is an important pedagogical tool. Educators use different approaches to group-forming, fostering learning experiences that emphasise students' agency (in student-led formations) or cross-disciplinary work (in lecturers-led formations). Where disciplinary expertise matters less for educational activities, a choice (less visible in the data) is to avoid disciplinary identifications.

2. Common project goals

In students project work, and despite group-formation mechanisms, having a common goal is central. The empirical analysis reaffirms this aspect reported in both, PjBL (e.g., Blumenfeld et al., 1991) and interdisciplinary learning (e.g., Holley, 2009) literature. Goal definition is important in terms of who, how and what is set as the common objective. In PjBL, goals depend on the problem being tackled and the expected outcomes[15]. As suggested by some educators- but not widely across cases- problems for student work must require both, different disciplinary contributions and innovation-related knowledge and working methods. As explained by a programme manager:

> "We realised that in order for interdiscipline to occur, there must always be a problem in common for students to solve. Otherwise it is very difficult for them to put their tools to solve this problem... Now in the Minor we are trying to strengthen it, that students also

[15] This aspect relates to managing expectations in community engagement, discussed in Chapter 8.

contribute from their degree, not only from innovation and innovation methodology" (CL.EXP.3.programme-manager).

In terms of goals' characteristics, a cross-disciplinary consideration is that solutions to complex innovation challenges imply compromises: "sometimes you have to say "well you know, there's a trade-off, or if we do this, then we kind of cannot do that"" (NL.COL.9.lecturer). This kind of project-definition means that project work requires not only varied expertise, but negotiation and communication skills. However, in other cases, projects and goal definitions did not rely on disciplinary expertise, so the potential cross-disciplinary tension encompassing learning opportunities is less visible, as exemplified next: "we weren't really working on anything very specific, we were working on a very broad thing. So it [the disciplinary diversity] didn't hold us back" (NL.NET.10.student). Therefore, the goals sought in PjBL in the Minors ranged from those evidently requiring varied disciplinary expertise to others where this was less important. Where the integration of perspectives matter, students' interdisciplinary communication proficiency is central, facilitating or hindering the goals' achievement.

The definition of goals, especially in PjBL, is central for Minors' educational activities because it determines learning opportunities and skills required. From a boundary-crossing perspective, innovation challenges and their goals represent boundary objects enabling meaningful creations and interactions for those involved. However, in the words of a participant: "that's basically forgotten… that people with different backgrounds and different ideas in interdisciplinary teams should also have a certain goal, shared goals" (NL.COL.8.external-collaborator). As the data suggests, this was more preponderant when discussing common objectives in community engagement activities than in cross-disciplinary work, which in practice in the Minors largely overlap.

3. Integration of disciplinary perspectives

A central process in the Minors Innovation which favours multiple SESI (discussed in detail in section F) is the contestation, and possible combination, of students varied disciplinary perspectives. Educators across the four Minors agree on the value of promoting disciplinary boundary-crossing in IE, but their pedagogical approaches for boundary 'brokering', i.e., to facilitate connections and new development of meaning across boundaries (Wenger, 1998), differ between cases and modules.

Minors Innovation educators agree that *interdiscipline*, as the contestation, synthesis and integration of disciplinary approaches (Klein, 1990), requires intentionality; multidisciplinary classes are a starting point, but do not assure, interdisciplinary collaboration. As the leader of an innovation unit at Collaborator describes, interdisciplinary learning requires pedagogical design, including the previously discussed aspects of setting goals and approaches for group work:

> "But if you want to work interdisciplinarily, you have to create an arena. You have to create the boundaries and within those boundaries, you provide some question and challenges and hurdles, and obstacles and the way students go through them in their own way" (NL.COL.1.innovation-unit-authority).

This design for interdisciplinary learning is, in one case, framed at an institutional strategic level. At Explorer, the university was -at the time of data collection- re-structuring its educational model for students to experience several interdisciplinary activities throughout their degrees. A participant explains:

> "We are going on a path that interdiscipline is intended, is designed. Therefore, you have to generate spaces for collaboration, methodologies and programs that achieve effective disciplinary interaction to form interdisciplinary skills" (CL.EXP.2.central-administration-authority).

Intended interdisciplinary collaboration, requires therefore, practical methods. Skills for interdisciplinary skills develop progressively, as some educators assert, e.g.: "So you have to build up that, scaffold that process... So it starts, we read together articles and then we summarize them together. Simple things like that. We work together on the protocols for interviewing…" (NL.NET.7.lecturer). These activities permit the (re)establishment of meaningful interaction across students' disciplinary boundaries.

The learning progression, which may be paralleled with different degrees of knowledge integration in multi-, inter- and transdisciplinary modes, is achieved to varied extents in Minors Innovation. "At the highest level is that you also really develop new knowledge together. I'm not sure if they reach that level, to be honest. But I do think that they make initial steps in that" (NL.NET.7.lecturer). The lecturer explains that the degree of perspective integration is hard to assess. However, the thematic analysis distinguishes some experiences that appear as the juxtaposition of ideas (multidiscipline) and others denoting the reflection, questioning and integration of approaches, expanding in cases, students' epistemological standpoints.

Multidisciplinary cases are often illustrated in the Minors through cases whereby students distribute the tasks considering their disciplinary expertise and then present the results altogether. Some students would like to take more advantage of contrasting perspectives, as exemplified next: "I did not like that they [lecturers] did not make you talk about the creative part more or that visions would clash a little, it was more like splitting the work" (CL.ALL-R.8.student). This basic level of cross-discipline may, or not, be a starting point for further integrative discussions.

Questioning underlying disciplinary paradigms, and reflecting upon them, is a further stage in the integration of perspectives, conducive to interdisciplinary understanding. The action of examining each other's arguments is key in developing this skill. A lecturer illustrates this type of interaction by narrating the case of a student group who felt inquired by a peer from another discipline:

> "At first, they hated her, because she questioned everything. Then, I told them, "Doesn't it seem fantastic that you're questioned? You take it all for granted, because everyone studied the same modules, have the same training, but notice that she hasn't gone through any of those modules, she has all the right to question it and the more it's questioned, the more it will reinforce you, because you'll have to learn to argue"" (CL.ALL-R.4.lecturer).

This type of perspective contestation enhances students' capacity to critically reflect upon their assumptions, to reason and argue, and to deepen their disciplinary understanding. The educator expands:

> "The interdisciplinary approach, where it contributed the most was in the questioning of the paradigms, of the paradigms of people of the same discipline… They have to argue, therefore they have to know about the subject... arguing opens their minds to thinking... it changes the focus, the focus of how they are facing the problem and the solution" (CL.ALL-R.4.lecturer).

Participants appreciate these interactions which may result in shifts in perspectives and ways of relating across disciplinary boundaries. In other words, when interdisciplinary learning occurs, a key result is the development of advanced epistemological beliefs, entailing "a personal recognition of the dual validity of objective and subjective means of reasoning" (Ivanitskaya et al. 2002, 108). A facilitating element in this process is, as discussed above, having a common goal: "they suddenly realise that they are all contributing to that kind of bigger thing" (NL.COL.9.lecturer). The disciplinary diversity of groups, related to group-forming, is evidently critical for transforming interactions across disciplinary boundaries; in monodisciplinary groups this would unlikely occur.

The previous quotations illustrate aspects discussed in the literature of interdisciplinary learning design, which includes a preparation phase to raise awareness about disciplinary and interdisciplinary practices, the experience of interdisciplinary purposeful collaboration, and reflection on interdisciplinary collaboration (Woods, 2007). Different participants focus on these awareness-raising, experience and reflection processes. In some cases, interdisciplinary learning is pedagogically intended, by "provoking students in contrasting and conflicting disciplinary perspectives combined with developing a critical stance" to "stimulate students to depart from their notion of absolute knowledge" (Spelt et al., 2009, p. 374). Educators acknowledge though, difficulties in reaching this aim.

Overall, Minors' educators encourage students to contest their disciplinary perspectives, through various mechanisms and with diverse results. This process is deemed complex and progressive; it requires intentional actions. Cross-disciplinary educational practices are shaped by institutional strategies. Yet fundamentally, it is learners that collectively engage in such processes and develop skills. In advanced forms of cross-discipline, interdisciplinary learning entails understanding and challenging the assumptions of one's own disciplinary culture and engaging in other cultures, tackling problems that may be authentic in processes that require multiple skills and notably the ability to collaborate and communicate with others.

Concluding, the learning potential offered by multidisciplinary classes in Minors Innovation is developed in various forms. The thematic analysis suggested three themes shaping cross-disciplinary education. First, the composition and process of forming student project groups which affect students' agency in self-directing their learning trajectories. Second, the definition of projects and their goals determine the project's complexity, the needed for cross-disciplinary interaction and thus, the required and possibly developed skills. Third -and reflecting the essence of cross-disciplinary work- the contestation and integration of disciplinary perspectives is sought and developed differently within and between cases, although both, educators and students, agree in the value of this process. There is also agreement, amongst different types of participants, about the challenges embedded in cross-disciplinary work. Key difficulties are discussed next.

E. Challenges and conditions for the implementation of innovation cross-disciplinary education

The organisation, implementation and practice of cross-disciplinary teaching and learning activities in the Minors Innovation entail challenges for students, lecturers and institutions as a whole. The

thematic analysis showed various difficulties, that I organised into three topics: collaborating across disciplinary cultures, designing pedagogies that support students with varied expertise, and managing organisational aspects.

1. Collaborating across disciplinary cultures: a challenge for learners

Cross-disciplinary collaboration in the Minors entails working with students with different disciplinary cultures. This involves other values and ways of working, which are interrelated with their epistemological positions (Becher and Trowler, 2001). Minor students –even if they study at the undergraduate level- appear to feel identified with certain disciplinary ways of thinking. That is, they have disciplinary identities (Becher and Trowler, 2001), that their peers and educators also perceive.

This academic or disciplinary cultural diversity is likely one of the core underlying values in interdisciplinary learning contributing to SESI development. Innovation and creativity are unleashed by shifting paradigms. Such transformation involves the development of SESI because persons learn to self-reflect on their own (disciplinary) identity and capacity, and those of others, and they learn to interact with different people. However, the process of handling and integrating contested perspectives may be challenging for both, learners and educators as facilitators of such processes. This difficulty is manifested to various degrees in the data, likely depending on the extent of disciplinary cultural differences which lead to questioning and transforming assumptions.

Students work in innovation projects with peers holding different epistemological standpoints. Their underlying assumptions about knowledge and its creation, is confronted especially through processes that seek the integration of perspectives (rather than their juxtaposition). While this integration enhances innovation processes, the observation, validation, experimentation and even adoption of other ways of understanding and constructing knowledge, may be hard. In other words, students may transform their epistemological identities in leaning communities and this process of 'learning as becoming' (Wenger, 1998), can be challenging, as illustrated next. A professor discusses the case of life sciences students participating in social sciences-led innovation modules:

> "It sort of becomes clear that they are coming from a reality where they can calculate the truth, and they come with us, and they are co-creators of the truth, and there is actually no truth, but there is, you know, they are co-creators of their reality and this is very difficult for them" (NL.NET.3.lecturer&programme-manager).

The professor continues to explain that after several terms:

> "they saw the benefit and the value of having these two different perspectives, the social science and the life science perspective, and that they felt comfortable with it… they are sort of embodying it… and they start exhibiting that entrepreneurial behaviour" (NL.NET.3.lecturer&programme-manager).

Although inconclusive, data suggests that students from STEM areas experience more difficulties than students from the social sciences and humanities in apprehending others' ways of thinking. An educator illustrates: "We get technical students that have to think now in a form from of a social science point of view; they get very agitated by that, and almost frustrated" (NL.NET.7.lecturer). It may be that the nature of innovation processes experienced by students propose a multiplicity of pathways and possible solutions. This opposes to a 'single right answer' approach, usually characteristic of the natural sciences.

Apprehending knowledge differently interrelates with doing differently, including problem-solving habits. That is, experiencing new practices represents 'learning by doing' opportunities (Wenger, 1998), facilitated by participating in these disciplinary diverse communities. In cross-disciplinary settings, Minors' students experience other ways of working and reporting their work, illustrating the role of PjBL in preparing students for work life (Prince and Felder, 2006). A student exemplifies: "I've talked to some of the engineering students and they were quite challenged with writing essays… they enjoy the Minor but they're looking forward to returning to the engineering faculty, where everything is clear" (NL.COL.10.student). Therefore, students' learning experience is diversified in terms of the approaches to knowledge and truth, and in the type of educational activities.

This engagement with different disciplinary cultures represent boundary-crossing processes, which despite hardship due to contested perspectives (Star and Griesemer, 1989) entail learning opportunities (Akkerman and Bakker, 2011a), promoting the development of new expertise (Guile, 2011) and of multiple socio-emotional skills such as openness, appreciation of diversity and interdisciplinary communication. Unleashing these learning opportunities in cross-disciplinary settings implies challenges for students, but also for educators, as discussed next.

2. Pedagogies for cross-disciplinary innovation education: a challenge for educators

The data suggests that students' different disciplinary backgrounds present challenges for educators. Pertinent pedagogical approaches differ from those used in monodisciplinary settings, which tend to be more common in HE. This is illustrated next.

> "Basically, professors or lecturers here are used to giving classes to groups of students from just one faculty. And those students act in a certain way, you know some are quieter, some are louder, some are more punctual, but each faculty, I think, has a characteristic and a culture… So, when they do come and teach in the Minor, in the Minor they are very surprised because certain students don't act in that way or they kind of bring a new atmosphere, a new energy to the classroom" (CL.EXP.1.innovation-unit-authority).

That is, in multidisciplinary classes there is a wide range of students' backgrounds, personalities, previous expertise, approaches to knowledge creation and validation, among other features. This encompasses various challenges for Minors' educators.

A central difficulty is to contribute to all learners, recognising their disparate levels and types of knowledge and skills: "For some people there will be a lot of newness and they will start like "well what is this?". [For others] there might be some repetition" (NL.NET.4.lecturer). Defining appropriate learning aims seems central. An approach discussed by educators is to focus on knowledge integration rather than on deepening mono-disciplinary perspectives:

> "Students come from a lot of different academic backgrounds. And it's the challenge not to teach them more in-depth knowledge of their own but it's a challenge to learn how to—well, navigate and integrate the knowledge of the others" (NL.COL.1.innovation-unit-authority).

Moreover, students' understanding of their core discipline also concerns lecturers:

> "Especially in the bachelor it's very difficult, because they're not used to it. So they really are novices there. And it requires a lot of support because they don't even understand their own discipline at that point- so let alone the cross-discipline. So there's a lot of people that say "This is impossible"" (NL.NET.7.lecturer).

This seems to occur despite relatively anchored disciplinary identities, as discussed above. Do students embody certain aspects of their disciplinary cultures before developing significant

understanding of the knowledge underpinning them? This thesis dataset is not suitable for answering this question, but the thematic analysis confirms that students strongly identify themselves and their peers through their discipline of origin.

In handling students' disciplinary diversity, some educators need further pedagogical tools to work with such diversity without attempting to level students' skills, as illustrated next.

> "It's really complex. But I always wonder what is my responsibility, as a teacher… and what also as an institution, so the university. Because I cannot fulfil the gaps of many students coming from so many different programs only with my way of teaching… I struggle also sometimes with the issue of different backgrounds, but I don't have the weapons, you know, to fight the problem" (NL.NET.5.lecturer).

Therefore, Minors' educators may require further institutional support in pedagogical training to face the multiple challenges involved in cross-disciplinary education. Learning communities among Minors' educators could also help in facing these pedagogical challenges, but as the data evidences, these are underdeveloped. Two main explanations are deducted from the data for the underdevelopment of learning communities of innovation educators. First, the conception of a common domain of interest is restricted by philosophical discrepancies between educators about the educational aims and teaching-learning approaches in IE. Second, organisational barriers, such as inconducive incentives to collaboration and excessive academic workload inhibit educators' meetings. However, the potential benefit of innovation educators' learning communities is recognised, entailing efforts to develop them. Opportunities for continuous learning, sense of belonging for academics and improvements in the programmes' delivery are central values. Two quotations illustrate this: "But I want to know the others, and what they are doing because then we can align better what we do" (NL.NET.5.lecturer); "this issue [innovation education] advances very quickly, one quickly stays behind and it's important to inject training through alliances, more practical than theoretical… it is nice to share, to learn, to dare, to feel accompanied, it is many things really" (CL.ALL-R.6.lecturer). These multiple needs may be summarised into comprehensions of learning in community as belonging, doing, becoming and experience (Wenger, 1998). Therefore, among the challenges faced by Minors Innovation educators to implement pedagogical approaches in cross-disciplinary education is the lack of learning communities with peers, despite acknowledging their potential benefit in learning together how to educate.

Summarising, these educational difficulties include to convey the value of cross-disciplinary work to students; determine feasible cross-disciplinary learning objectives considering students'

disciplinary diversity; and design and implement teaching-learning activities that nurture all students, acknowledging their diverse levels of expertise on certain subjects or skills. These issues overlap with organisational aspects affecting educators and other participants' experiences in the Minors.

3. Institutional readiness for cross-disciplinary innovation education: a challenge for universities

Cross-disciplinary learning entails challenges for students, lecturers and HEIs as a whole. Participants analyse the need for institutional conditions that facilitate cross-disciplinary education and learning. A starting point is the awareness of the cross-disciplinary education potential, and the interest and willingness to manage it.

The existence and robustness of an organisational structure behind Minors matters and varies across cases. In both Dutch cases, Collaborator and Networker, programme coordinators were professors teaching in the Minors, so they were embedded in the academic activities and were responsible for coordinating the programmes. While participants agreed that closer interaction between lecturers in each Minor was desirable, the educational design and its operation was overseen by the coordinators-educators. Moreover, in Collaborator, the inter-institutional partnership required additional significant coordination between lecturers from the three universities. At Explorer, the interdisciplinary innovation unit running the Minor had a team supporting lecturers and students, and monitoring and updating the programme's design. On the contrary, at All-rounder, the programme had basic administrative services, with limited attention about its educational aspects. In the latter case, the programme comprises many more modules than the other Minors, offered by different faculties, representing further opportunities for cross-disciplinary education, which were seemingly under-exploited. However, despite the relevance of organisational support structures, lecturers –mostly individually- held much of the responsibility for designing, managing and leading the educational activities.

Beyond the direct organisational structure supporting the Minors, and lectures' work, wider institutional conditions promoting and permitting interdisciplinary collaboration are important too. This is especially noteworthy in the Explorer case, where two authorities interviewed discussed the issue of academic silos and how the university was encouraging education across them. In the views of an IE leader:

> "Most universities don't have interdisciplinary collaboration because, there's a lot of challenges, I mean, basically faculty still have their own, you know, KPI's per faculty. They don't measure in terms how much they collaborate… [Explorer] at least is changing in terms of the interdisciplinary, as interdisciplinary is becoming a strategic pillar" (CL.EXP.1.innovation-unit-authority).

Another authority at Explorer (CL.EXP.2.central-administration-authority) furthered about institutional strategy, proposing that institutional readiness for interdisciplinary education (possibly also research) can be represented by the rate of institutional complexity and flexibility. That is, for interdisciplinary work, certain institutional complexity in terms of disciplinary diversity is necessary. Yet, flexibility in the governance is also important for interdisciplinary collaboration to occur. Complex rigid universities are probably not suitable settings for interdisciplinary collaboration. 'Simple' flexible ones neither. This proposition may be expressed as:

Institutional readiness for interdisciplinary education = f (institutional [complexity/ flexibility])

While this proposition was not tested, data elements suggest that disciplinary complexity within institutions shapes disciplinary diversity, and therefore, students' learning experience. For example, a participant narrates her experience of studying in an institution mostly oriented to engineering (not one of the four cases): "You can notice that solutions are always the same… there is no diversity, almost like at school, in uniform" (CL.ALL-R.13.external-collaborator). That is, institutional disciplinary diversity is regarded as a condition that favours innovation through the potential cross-disciplinary work that diversity offers.

In that sense, participants highlight how disciplines shape universities' organisation and activities, through its tribes and territories. While these are dynamic and contextualised, disciplines have "recognizable identities and particular cultural attributes" manifested through artefacts, jargon and epistemological standpoints, elements anchoring the sense of belonging of academic tribes' members (Becher and Trowler, 2001, p. 44-45). As discussed above, participants deem this cultural diversity a necessary component for interdisciplinary work. Furthermore, as analysed in section E.1 of this chapter, a central challenge for students derives from interactions between disciplinary tribes. While these tend to involve difficulties in collaboration, this boundary-crossing process represents learning opportunities and may lead to new integrated understandings.

Therefore, institutional conditions may facilitate or hinder interdisciplinary learning. Important conditions are the support for lecturers, the flexibility to arrange educational activities differently

from mono-disciplinary modules, and the diversity of disciplines permitting rich cross-disciplinary work.

Concluding, the cross-disciplinary dimension of Minors Innovation presents valuable learning opportunities for students but entails also, hurdles to overcome for students in their learning process, educators in leading pertinent educational activities and organisations more amply, in providing adequate conditions for all participants involved.

F. Contributions of cross-disciplinary education to the development of socio-emotional skills for innovation

Participants across cases value cross-disciplinary education as critical in students' development of SESI, despite its embedded challenges. This section examines processes through which various cross-disciplinary pedagogical approaches and learning experiences contribute to SESI. The analysis is organised into CASEL socio-emotional categories: self-awareness, self-management, social awareness, relationship skills and responsible decision-making. This section is based mostly on students' views, considering too educators' perceptions of learners' development. As previously discussed, the data suggests that SESI may be facilitated by pedagogical approaches that intended or not these skills' development. Data permitting, I distinguish such intentionality; however, the focus is on the ways in which certain practices promote SESI. Overall, a central learning process is the shift of perspectives towards others and others' disciplines, and towards one's own professional collaborative attitude. Such transformation of perspectives relates to multiple SESI in the five categories of socio-emotional learning.

1. Self-awareness: interacting with disciplinary others boosts self-reflection and self-validation

Awareness of one's own and others' disciplinary identities and disciplinary epistemologies, and of judgements or prejudice about these, is a key theme in the data. This reflects a central process of 'learning as becoming' and 'learning as experience' (Wenger, 1998), occurring by actively participating in learning communities and interacting across disciplinary boundaries. Reflection on the interaction between one's and others' disciplinary standpoints emerges in the data as an important trigger of SESI learning processes and of perspective transformation. In other words, the question 'who am I in relation to different others?' is key in SESI's development in Minors' students.

Work in multidisciplinary groups nudge students to reflect about their own identities and epistemologies, and to legitimise their contribution in cross-disciplinary contexts. Learners realise how they see the world in disciplinary terms that allow or hinder the expression of their value in project groups. A student comments:

> "Since I'm from landscape architecture we also learn a lot of design… it's a little bit not nice to say but these technical guys are just farmers, they are really farmers and they can calculate everything so if you start to say that you need a good design for these ponds they are like "do we need this?"… [so] you [need] to show them like "what I can do is also very important"… But, on the other hand, if you make them your own design they would be like "ooh, that's really cool, I'd never thought of it". Yeah, it can be a challenge but I think is more like an asset… so then I started to show like "I'm also needed"" (NL.NET.9.student).

Students' self-reflection on their own disciplinary identity is interdependent with reflection on others' identities. Looking beyond their disciplinary boundaries fosters self-reflection. Students express judgements of one or the other being 'better', 'worse' or simply 'different' and thus, potentially supplementary. The same applies to values: "the two things go hand in hand of course, because if you hear other people talk about their values then you suddenly realise that you do it differently" (NL.COL.9.lecturer). In other words, working with peers from different disciplines "gives them a mirror on their own background… I think that's the biggest outcome for students" (NL.COL.1.innovation-unit-authority). This mirroring processes permit the examination, questioning and potential transformation of frames of reference that shape the meaning of experience (Mezirow, 2000).

Self-validation in the face of contested views is anchored through actions that make visible and promote acceptance of those differences (like expressing a different opinion). From a transformative learning theory perspective, this represents the reintegration of new perspectives in actions (Mezirow, 1991). Communicating students' own value to others is a key turning point for validating their identities (and developing self-confidence) in cross-disciplinary contexts. A student illustrates:

> "I was by myself, the others they all knew each other because they were all from engineering… I was a bit shy… It kind of helped me to face my fears or to talk to different people and to give my other point of view, because generally, they had a perspective and I, that was from a different programme, realised that I had a different contribution to their

> ideas, that they didn't see. And on the other hand, it was a challenge for me being able to give my opinion, not fearing to say something" (CL.ALL-R.11.student).

In this case, self-worth goes hand in hand with a sense of pertaining to a learning community and contributing to the collective practice and reflection. This determination to claim one's worth to others that may not recognise it, however, does not always occur, as exemplified here: "he was quite intelligent but for everyone it was hard to bring over his point of view and why is he important for the group work. I think at some point he just skipped that and said "okay, then I don't give my input"" (NL.NET.8.student). That is, not all student groups overcome the barriers to express and understanding different viewpoints. Consequently, in Wenger's terms (1998), some students may not develop a sense of belonging to such communities; or, collectively the group may not be able to establish conducive interactions across their disciplinary boundaries (Akkerman and Bakker, 2011a). The difficulty to communicate one's views and be understood, may lead, as in this case, to being reluctant to collaborate.

However, other cases in the data indicate that in manifesting one's position to peers with different perspectives, students may strengthen their self-awareness about their own values. As a student narrates:

> "I feel like this Minor is literally just like another world, you know… it was just feminism and I don't know. Like I was discussing those things with people from my [student project group] and then like the two people from [another university] were like, "Oh, cry me a river, you know. It's not the biggest problem in the world." And I'm like, "it's important, though, you know"" (NL.COL.11.student).

So the Minor's multidisciplinary settings permit students' interaction with persons holding different viewpoints, encouraging students to question their own values, and offering opportunities to understand others' values.

Awareness of how one is perceived by others is also developed in these cross-disciplinary programmes. This may lead to feelings of discrimination when some academic 'tribes' (Becher and Trowler, 2001) feel superior to others, e.g.: "there are people who reject you like for seeing you or [for] the same fact of my career for example, ahh agronomy, ok [dismissively]" (CL.ALL-R.11.student). It may also reflect how students' abilities are regarded when moving beyond their core discipline, as illustrated next: "I have generally been told that I have good communication skills, in the degree I have always been the most renowned for that. In innovation no, because I have

always met colleagues who are better" (CL.EXP.10.student). This kind of situations enhances students' awareness about others' perceptions of their capacities in cross-disciplinary contexts, as increasingly is professional work.

Overall, cross-disciplinary learning experiences in the Minors Innovation help students in being more aware of their disciplinary identities, values and epistemologies. By interacting across disciplinary boundaries, students also become more consciousness about their abilities in different contexts.

2. Self-management: in cross-disciplinary education learners can develop self-directedness, courage and flexibility

In multidisciplinary classrooms and project groups, Minors' students interact differently than in mono-disciplinary classrooms because their varied expertise permits taking certain roles and requires exercising some socio-emotional skills. Building upon enhanced self-awareness, students develop self-management skills. Emerging themes relate to overcoming fears to be exposed and experiencing higher degrees of freedom to express one's disciplinary perspectives.

As discussed above, cross-disciplinary settings may hamper students' willingness to share different ideas. It can also encourage it, as students may become the 'expert' in their fields when classmates know less about their subjects. This learning opportunity derives from the group-forming pedagogical decision discussed in section D.1. The following quotation illustrates why some students feel comfortable to contribute from their disciplinary perspectives:

> "The multidisciplinary part… it doesn't put me under such strict scrutiny of people that do the same thing as I do, so there's more freedom or more acceptance for not knowing something, and knowing something else more… in International Studies, where I'm from, everyone has the same courses, the same background, so there's of course much more competition in one very specific area, and that makes you much more self-conscious about what you say and what you think even maybe" (NL.COL.10.student).

Therefore, students' unique disciplinary expertise in multidisciplinary settings can encourage them to expose their knowledge expecting less examination of its correctness. However, this may entail reduced disciplinary self-consciousness compared to mono-disciplinary work, where, as the student expresses, scrutiny is more likely. This contests the aim in cross-disciplinary education, declared by

some educators, of enhancing students' understanding of their own discipline. Yet the latter also occurs.

Students' responsibility for being the 'expert' of their field in project groups can strengthen their command of their original disciplines, as a student illustrates:

> "assuming that you are an expert, well, at that time I was in the second year, clearly I was nobody in engineering, I did not know much, I knew the most basic modules, so they [student group peers] assume that you know a lot and that is challenging, because you start to catch up... you study... then clearly I put myself a backpack of "hey you're the engineer of the group"" (CL.ALL-R.9.student).

Thus, students self-direct their learning, reinforcing their disciplinary expertise as they feel responsible for 'being the expert' in project groups. This empirical finding agrees with Stefanou et al. (2013) in that PjBL can favour self-regulated learning, yet adding in this case, the 'expert' component offered by multidisciplinary classes. From a boundary-crossing perspective, these experiences reflect learners' resituation of abilities, i.e., their capacity to approach new situations and define new actions to further exercise their knowledge and skills (Griffiths and Guile, 2003). By interacting with peers with varied expertise, students appear to self-direct themselves, resituating their abilities and taking multiple roles.

Some students discuss how they broaden their epistemological standpoints, possibly leading to interdisciplinary understanding as the capacity to integrate approaches from different disciplines. The following quotation illustrates a student's process of critically appraising his disciplinary assumptions and opening to adopt others.

> "Everything they told us in [Economics and Business Administration][16], everything is maximizing, restriction, etc. Then getting out of that world a little and forgetting about the restrictive parameters, I think it is a step like that was hard for me at first because you are not used to it. Because if they tell you there is no restriction and you start to question oneself. So well, after doing that exercise and being able to overcome this non-restrictive barrier, I think that one can take advantage of it and creativity flows…

[16] Approximate equivalent of "Ingeniero Comercial", an undergraduate degree in Chile that integrates Business and Economics.

> For being a business administrator… at least, I do not know if one boasts about it, but always one kind of has the height of sight and believes that his idea is better than those of others and just like that, so facing that and maybe become a bit more flexible, open the mind a little bit, listen to others, I think it is a very positive exercise, both for me at that time, as well as for me in life onwards" (CL.ALL-R.12.student).

Several processes about developing self-management skills based on self-awareness are illustrated: awareness of restrictive disciplinary approaches hindering creativity, awareness of other problem-solving possibilities, critical appraisal of disciplinary hierarchy beliefs, and consequently, a decision to adopt more open approaches for learning and life.

Concluding, the data suggests that key self-management skills favouring innovation developed by Minors' students, relate to dynamics of 'overcoming fears to express oneself' (courage and self-confidence), 'allowing shifts in perspective' (flexibility) and 'becoming the expert' (responsibility). A central skill is self-direction, exercised by engaging in new cross-disciplinary learning experiences. Self-regulation and critical appraisal of established patterns and assumptions is necessary to set new directions. Such questioning involves self-awareness and social awareness.

3. Social awareness: openness and appreciation of diversity can be enhanced in cross-disciplinary education

Students' learning experiences expand in Minors Innovation. They meet students from other disciplines, encountering their different ways of thinking, problem-solving approaches and values. Therefore, students enhance their social awareness skills as a necessity for their work on innovation processes in cross-disciplinary learning contexts. Developing social awareness, however, implies difficulties, as explained by participants, including the frustration of not understanding others (or being understood). Also, social awareness requires facing beliefs about others which may restrict collaboration. Changing perspectives is demanding. Openness, humbleness, flexibility and acceptance are required. While the development of these skills is unique for each person, the transformation of perspectives in Minors Innovation is partly driven by learners' willingness to do what is needed for fulfilling the innovation projects aims. The degree of depth and sustainability in the learning, based on intrinsic motivation or external pressures, is nevertheless, debatable. That is, students may simply 'accept' others' perspectives to move on with their work, but only as removing obstacles in their dialogue, not necessarily associated to comprehending and appreciating their viewpoints. On the contrary, some participants reported profound shifts in perspectives,

deepening their understanding and acceptance of different others after enhanced awareness of their social and cross-disciplinary backgrounds.

The data suggests that a core difficulty in understanding others is prejudice and judgement towards others' disciplines. Students note how they perceived others- having or not strong foundations- and how they felt judged by others; i.e., they recognised or established certain boundaries from other disciplinary 'tribes'. Implicit disciplinary hierarchical beliefs ground some of the judgements. For example, discussing about students' biases towards other disciplines and professions, a lecturer tells that a typical standpoint observed in students as terms start is ""What is the nurse going to teach me about this"" (CL.ALL-R.6.lecturer) while modules typically end with students reflecting that they learnt the most of nurses. Students' opinions about others' disciplinary features manifest in their approaches to innovation problems and their capacity to work on them. Students illustrate: "In Agronomy nobody can think of creative things, because they are very closed" (CL.ALL-R.11.student); "the prejudice that I am a psychologist and I do not know about numbers remained" (CL.EXP.10.student); "the team that I got was super engineering-like in that sense, super squared-minded… I had to take the role of leader because… they do not take much initiative to get to that problem and solve it" (CL.ALL-R.12.student). As discussed in the Self-awareness section, views on one's own and others' disciplinary identity and epistemology shape each other. In the latter case, for example, the student's leadership role emerges because of others' perceived shortcoming.

Overall, despite seeing others as more or less capable in certain regards, a key conclusion is that students from different disciplines experienced cultural and epistemological distance that challenged their connection and mutual understanding. "It became apparent in one of the courses that people from a social background have a different way of thinking… and that's a bridge that you have to gap, a bridge you have to cross, a bridge you have to build between the people" (NL.NET.10.student). The data suggests that students generally recognise the limitations and challenges in boundary work. However, the identification of beneficial skills to cooperate across disciplines and the willingness to exercise them, varies between students.

Openness is recognised as an ability facilitating cross-disciplinary interactions; e.g., "the disposition or openness to be willing to share with people who are not of the same degree as one, generates good changes" (CL.ALL-R.11.student). Yet openness is not always manifested: "I see their point but at the same time, I'm just like we all have our own opinions. It's just that like yours is wrong and yeah, I'm like, mine is right" (NL.COL.11.student). The student continues explaining that "it's just I have ideas, it's just I'm not very good at explaining them" (NL.COL.11.student). Therefore, the

interest in exploring others' views is possibly related to one's capacity to express one's own ideas, and therefore, be able to have a voice in the dialogue. Multiple skills entwine, likely related to self-confidence, communication and others' empathy. This exemplifies the interconnectedness between multiple SESI and thus, the non-linearity of their development in unique learning processes.

Concluding, Minors Innovation students recognise limitations in their interactions with peers across disciplinary boundaries. These obstacles are founded in judgments towards others' disciplines and ideas. Social awareness skills, such as openness, appreciation of diversity and more implicitly, humbleness, are developed by students – to varied degrees- as they transform their relationships with different disciplinary 'others'.

4. Relationship skills: collaboration and interdisciplinary communication are key skills developed by interacting across disciplinary boundaries

Relationship skills are promoted by educators in Minors Innovation given their centrality for innovation. The data confirms that these skills build upon the skills discussed in the three previous dimensions. That is, knowing oneself, managing oneself and being aware of different others help learners to relate with others.

Interdisciplinary communication stands out in the data as a central socio-emotional skill developed by Minors' students, which is also deemed as critical for innovation by Minors' educators (Chapter 6) and highlighted too in the literature about innovation (Chapter 2) and interdisciplinary learning (Chapter 3). Thus, interdisciplinary communication, from the perspective of data triangulation is a central SESI. It embeds the ability to communicate and collaborate across disciplines, reaching a common integrated understanding. As emphasised by students this requires both expressing and listening to different ideas. This section thus discusses general aspects of relationship skills focusing on interdisciplinary communication.

Collaboration between students from different disciplinary backgrounds are promoted by educators, and experienced by learners as critical for innovation:

> "They force you to collaborate. And what they always say, like, the co-creation was, like, the basic of every part of the process. 'Cause you rarely work alone. And I think that that was the message they were giving to us: innovation is always a group-process. It's never by yourself" (NL.COL.6.student).

This premise becomes a central driver for students to establish relationships with peers across disciplines; different disciplinary expertise is instrumental for tackling the innovation problems they work on. This depends, however, on the projects' definition. Thus, in cases students develop abilities to collaborate strategically for fulfilling their academic requirements. A lecturer exemplifies: "They immediately realise, well "I don't have the answer either, so perhaps, I should listen to him or her""(NL.COL.3.lecturer&programme-manager). Furthermore, time restrictions for developing the project work, permits students, according to some participants, to show "rapid progress in how they talk about these things, discuss these things, allowing each other's face for voicing their different perspectives on things" (NL.COL.3.lecturer&programme-manager). These educational conditions can then trigger a desire to change perspectives (Taylor and Cranton, 2013). Other participants, however, emphasise that cross-disciplinary communication requires time: "in a semester you are not able to develop the capacity of interdiscipline" (CL.EXP.6.lecturer). In three of the four cases studied, students take Minors' modules in various terms; this consecutiveness facilitate learning progression, as illustrated by a student discussing her development of cross-disciplinary communication skills:

> "At first it was complicated, like I think the first module I took, I remember that it was a bit difficult, because deep down [it was] coming out of your circle or maybe your comfort place, but later in other courses it was easy for me to join a group or do the work, it wasn't that hard" (CL.ALL-R.10.student).

Therefore, features of the innovation projects in which students work stimulate their cross-disciplinary interaction. Skills facilitating this communication are regarded differently by participants in terms of the time required for their progression.

The pedagogical element of assuring a common goal in students' group work (section D.2) is central to foster cross-disciplinary interaction; the shared objective permits a sense of belonging to learning community where members contribute with diverse expertise. This may represent the re-configuration of communities, not framed by disciplinary cultures (which identify students in early stages of the interaction) but based on a common domain of interest (the innovation challenges). In these cases, the sense of belonging to these communities framed around innovation problems permits, and requires, the recognition of both, students' similarities (shared project) and differences (disciplinary expertise).

Yet fewer data elements show that the sense of community also seems to be enhanced by recognising similarities as human beings, beyond shared academic goals. An educator illustrates

this, explaining a class discussion after an introductory game whereby students were asked to tell the small multidisciplinary class something about themselves, what they liked, disliked and their fears:

> "What they say is, how incredible how similar we are... As I say, "I am a potato, you are squash, but we are in a soup. And I have a little taste of meat, I have a little taste of squash, I have a little taste of corn, but I am a potato and from the potato I am giving different things" (CL.5.lecturer).

'Cazuela', a typical Chilean dish, serves as analogy for what may be aimed as interdisciplinary learning, in the sense of contributing from each perspective yet with an integrated goal and learning from each other. The participation in a learning community and the sense of belonging to it is emphasised as a learning dynamic.

Despite appreciating diversity to achieve certain aims, however, the data suggests that effective communication is, in the views of participants, simpler when disciplinary perspectives are perceived as similar. The next case illustrates:

> "I also realise that… these different specialisations aren't necessarily so pronounced and our contributions are quite similar to both the student project group and in class… there's no miscommunication, we always understand each other when we talk, and I think, I realise that it's not so difficult to understand engineering people, and that for them it's not difficult to understand us" (NL.COL.10.student).

Such fluid cross-disciplinary communication is exceptional in the data. Yet it exemplifies that even in successful appraisals of cross-disciplinary communication, the underlying assumption is that disciplinary distance hampers communication. A central pattern in the data tells that: "the challenge is that they can communicate with each other" (CL.EXP.7.lecturer).

Communication across disciplines may have an interdisciplinary nature; i.e., involving common goals, meaning negotiating, conflict resolution and shared understanding (Greef et al., 2017). Several stages of interdisciplinary communication are identified in the data. This non-linear process is likely experienced differently by Minors' students. Arguably, the process may be 'successful' in terms of reaching the integration of different perspectives or not. Multiple socio-emotional skills are involved, overall favouring innovation by permitting such contestation and integration of viewpoints. The key phases emerging from the empirical analysis are the following:

- **Resistance to openness**. The shift from resisting different others and their opinions to being open and appreciating such diversity is critical. “Before I did not accept the opinion of others much, or it was more difficult for me to teamwork, or I always listened only to my ideas. And then with the [Minor] and the modules, I suddenly realised that “this kid sees something that I don’t see”” (CL.ALL-R.11.student). This process may occur quickly at an early stage of the academic period or not, as discussed before.
- **Openness, vulnerability and empowerment**. Then, a process of initiating meaningful collaboration occurs. Learners overcome fears to expose oneself, feeling reassured to share their views ‘safely’. The previously quoted student continues her narrative:

> “When I saw that people gave opinion on things that, I don't know, seemed silly, I said “I can also say something silly”, OK and the other one said “but you're right, let's do this”. Then, viewpoints of different fields were mixed. And there you allowed yourself to manage better, you accepted the ideas of others, you were more willing to give your opinion, another environment was generated, and I liked it a lot” (CL.ALL-R.11.student).

This stage requires self-management skills, to self-direct oneself towards facing challenges and to overcome preconceived barriers for collaboration.

- **Group interdependency.** Relatedly, as aimed by some educators, students see the need and benefit of collaborating and mutually supporting each other because they achieve better results and enhance their learning. As discussed in section D.1, some educators encourage students to shape by themselves their cross-disciplinary collaboration. Others, attempt to assure the students’ sense of group interdependence; e.g., a lecturer’s approach is to “force them to work in a group, that they feel part of a group and feel the dependence of the group, that is, that you alone will not be able to do it” (CL.EXP.6.lecturer).
- **Understanding others and others’ disciplines**. Cross-disciplinary collaboration entails “to get accustomed to, maybe strange ideas or strange habits of group mates” (NL.COL.4.lecturer), and as experienced by students “gives me a lot of knowledge, it gives me a lot of insight into what other degrees do” (CL.EXP.10.student). It is hard to assess the depth of interdisciplinary understanding experienced by individuals but the data evidences students’ transformation into increased appreciation of others’ disciplinary perspectives.
- **Divergence, discussion and reconciliation of differences**. Conflicts and opposition of approaches appear in cross-disciplinary interactions. Handling these differences is a learning process which may be hard because of the multiple disciplinary perspectives and the required

communication skills. The discussions "during the project are really diverse" (NL.COL.7.external-collaborator) and differences in opinion "are resolved by also understanding how the other works" (CL.EXP.9.student). This requires, as emphasised by participants, to question one's paradigms: "You are forced to think differently. And your assumptions, your base assumptions are also different… then you have all these ideas and all of it, and everything has to fit together into one idea" (NL.COL.6.student). Such 'fitting together' is represented in the next phase.

- **Integration of perspectives for better results (in limited time)**. "When we face a problem there are so many different points of view that converge on something and make it work much better than it could be if I had worked alone on that" (CL.ALL-R.11.student). This exemplifies possible interdisciplinary understanding, entailing the integration of perspectives. As said, with the data it is difficult to differentiate between integration (interdiscipline) and juxtaposition (multidiscipline). This may be to some extent assessed through students' task distribution. The following approach is likely multidisciplinary: "We sometimes divided the parts of the work, then, the one who had the most ability to do something, did it. Then that way, that is, one learns, I feel that I learned by watching or when I asked a classmate directly or seeing how they did some things" (CL.ALL-R.10.student). This possibly permits learning new knowledge rather than integrating it into novel solutions. A similar approach is "reaching a consensus on that and not getting into an argument, in a direct confrontation… It is a matter of time, because in general one left work for the last two days or the last day, so there was no time to argue" (CL.EXP.13.student). It seems, therefore, that time pressure in educational activities plays a double function: it may accelerate processes such as openness -as discussed earlier- but it may also limit the debate and integration of ideas.

These phases may be experienced in different orders or concurrently, partially or fully, and with varied degrees of depth. These collective learning processes are distinguished for analytical purposes acknowledging their entanglement. Overall, when experienced deeply, they likely represent transformative learning (Taylor and Cranton, 2012) whereby learners confront their beliefs and assumptions, becoming more flexible and open, integrating new perspectives and transforming their plans for action. These transformative processes are further discussed in Chapter 9.

Overall, relationship skills, and notably cross-disciplinary communication, are central skills developed in multidisciplinary learning settings with pedagogical approaches leveraging these learning opportunities. Difficulties to relate and collaborate with others derive from epistemological and cultural disciplinary differences, prejudice about different others, fears of being judged and

exposed, and from feeling different (more or less capable in some areas). The data shows experiences of interdisciplinary understanding in the sense of integrating different perspectives, yet it is inconclusive on its extent of occurrence. The thematic analysis evidences, however, that students across cases enhanced their collaboration and communication skills by interacting with peers from different disciplinary backgrounds.

5. Responsible decision-making: learners can develop respect and professional commitment in cross-disciplinary settings

The sense of responsibility in multidisciplinary learning contexts manifests in Minors Innovation in various ways. The ability to properly deliver on innovation projects showing professionalism and group collaboration denotes a responsible approach. The capacity to respect, resolve conflicts and allow others' contribution by accepting their different expertise are critical skills too. These elements relate to aspects discussed earlier, as SESI of different dimensions are interrelated and manifested into responsible decision-making processes.

The contribution of different disciplinary perspectives in the development of better innovation solutions is agreed by participants. An external collaborator explains:

> "So you get a lot of in group discussion. And I think the outcome of that is that you have a well-balanced decision about how you go… So, I think more, more opinions and more different background result in a better outcome, in the end" (NL.COL.7.external-collaborator).

Yet the sense of responsibility in creating innovations in cross-disciplinary contexts goes beyond innovation outcomes and possible accountability to problem-holders. It involves one's sense of professional performance, individually and notably collectively in multidisciplinary groups. On some aspects of group work, a student comments: "That was awesome because you'd see that each time you're getting to an innovation process, everybody would chip in, and everybody will know that there's more than just your own perspectives. So, nobody would say, "We're gonna do it this way", and that's it" (NL.COL.6.student). This reflects openness and respect towards others' different approaches. As discussed earlier, the drivers for the development and exercise of such skills vary, as does their presence in the data across cases. To different extents, these skills are acknowledged as supporting responsibility in innovation projects and their embedded decision-making processes.

Concluding, socio-emotional skills favouring innovation associated to self-awareness, self-management, social awareness, relationship skills and responsible decision-making are developed by students in processes facilitated by cross-disciplinary pedagogies. The platform of multidisciplinary classes permits this, although the forms in which students and educators engage with such disciplinary diversity varies. Central skills evidenced in the data are the capacities to collaborate and communicate across disciplinary boundaries. These processes require multiple other skills, such as openness, respect for diversity, self-confidence and self-regulation. It can be concluded that cross-disciplinary pedagogical approaches strongly contribute to SESI, in multiple ways.

G. Conclusions on cross-disciplinary education

The critical role of cross-disciplinary education in the development of socio-emotional skills favouring innovative behaviours strongly emerged from the empirical analysis. Students, lecturers, managers, authorities and external collaborators agreed on the relevance of cross-discipline. This addresses a first aspect of the second research question on how SESI are pedagogically facilitated in the four Minors Innovation. Minors are offered to all undergraduate students of the corresponding universities[17] and students with different disciplinary backgrounds participate in the programmes, offering a baseline for cross-disciplinary interactions. The platform that multidisciplinary classes offer differs from active pedagogies leveraging on this potential, and further, from students' learning experiences. Pedagogies show intentionality on the development of certain competencies or understanding. However, the pedagogical decisions and approaches analysed that benefited SESI may, or not, be intended towards their development. Students' learning, while shaped and favoured by pedagogical approaches, is not assured by these.

Minors Innovation educators encourage students' interaction across disciplinary boundaries alluding to its benefits for innovation results and for innovation skills. Educators highlight the importance of different disciplinary perspectives in developing innovations (focus on the resulting solution) and in fostering innovation skills for real-world professional practice which tends to be cross-disciplinary (focus on the learner).

Educators promote cross-disciplinary work through various mechanisms largely framed in innovation-oriented PjBL. The innovation projects and their in-progress innovation solutions represent boundary objects, permitting the communication of different perspectives and the

[17] Except from students having the Minors' modules in their main curricula.

construction of meaningful approaches for those across boundaries. The data highlights three themes related to pedagogical practices shaping students' development of SESI. The criteria and ways of forming PjBL student groups affects students' self-directedness in their learning process and the disciplinary mix of project groups, which in turn shapes the degree of cross-disciplinary interaction. Sharing a common goal, a central PjBL aspect driving collaboration, is emphasised to different extents by participants, acknowledging that the group work aims determine the required integration of disciplinary perspectives and entailed challenges in such process. These approaches support learning in crossing disciplinary boundaries, by establishing and transforming interactions between learners manifesting different, and possibly conflicting, disciplinary cultures and epistemologies. These boundary-crossing practices in diversity enrich innovation processes. They also nurture the development of SESI.

Multiple SESI are developed in learning contexts facilitated by cross-disciplinary activities. A central set of abilities relate to self-awareness and social awareness regarding disciplinary epistemologies. Learners' increased consciousness of how they and their peers conceive knowledge and approach innovation challenges enables them to relate to different others. Self-directedness is key in overcoming fears to express different opinions, as an expert and as a novice, in contexts where disciplinary expertise is more varied than in mono-disciplinary classrooms. A key relationship skill developed is communication, notably of an interdisciplinary nature, which means that participants can understand others' perspectives and integrate them. This is central for creativity and innovation.

It can be argued then, that in these innovation-oriented cross-disciplinary activities, epistemic practices facilitate SESI. Epistemic practices represent "collective strategies for exploring, assessing, critically examining and justifying knowledge claims" allowing learners to handle complexity (Nerland and Hasu, 2020, p. 6). Some actions of shared epistemic agency mapped by Damşa et al. (2010) when analysing collaborative object-oriented activities include, for example, identifying a lack of knowledge, sharing information, discussing misunderstandings and reframing problems. All of these are epistemic actions in the sense that relate to knowledge and knowing (Damşa et al., 2010), while as evidenced in this thesis, support the development of socio-emotional skills. This illustrates the practical inseparability of emotional and cognitive learning processes (Krathwohl et al., 1964). It also exemplifies concrete activities framed in cross-disciplinary and project-based education that promote SESI.

These learning processes though may be hindered by institutional arrangements, by educators' challenges in educating disciplinary diverse groups of students and by students' distinct disciplinary cultures, which represents a central learning potential but is also perceived as a hurdle. Inasmuch it is overcome, learning seems boosted in the Minors Innovation.

SESI development across disciplinary boundaries share certain processes with learning through community engagement, another SESI-favouring process of crossing boundaries between universities and the wider society. I analyse cross-disciplinary education and community engagement separately for conceptual purposes. Yet in practice, these pedagogical approaches are intertwined, to different degrees, in the four Minors Innovation. Their connection has also been conceptualised in the interdisciplinary learning literature, emphasising the importance of authentic problems. Woods (2007), for example, analyses interdisciplinary programmes involving "collaborations between students from differing subject areas in pooling their disciplinary knowledge in addressing complex and significant, real world problems" (2007, p. 854). Working in real problems facilitates transdisciplinary learning, in which perspectives from academia and from society are integrated (Greef et al., 2017). Still, while desirable, authentic problems is not a defining feature of interdisciplinary learning. In Minors Innovation, despite not necessarily having an explicit interdisciplinary pedagogical approach, participants narrate cross-disciplinary learning experiences based on innovation-oriented PjBL activities. These are largely real-world problems entailing varied degrees of collaboration with real-world partners. Therefore, the four Minors Innovation provide a cross-disciplinary platform, which does not necessarily entail interdisciplinary learning in the sense of the integration of disciplinary perspectives. Cross-disciplinary educational activities centre to varied degrees on real-world problem involving community engagement collaborations. This latter component of these entwined activities is discussed in the following chapter.

Chapter 8. Crossing boundaries between the university and the broader society: findings on community engagement and the development of socio-emotional skills for innovation

Community engagement, i.e. collaborations between universities and the wider society, emerged from the data as a pedagogical practice critically facilitating the development of socio-emotional skills for innovation in the Minors Innovation. Crossing the organisational boundaries between university IE programmes and the wider society appears to offer important learning opportunities which rely on 'real-world' innovation processes experienced by students. These innovation processes are framed in real-world innovation challenges, i.e. problems or opportunities requiring novel solutions. In the Minors, students engage in different capacities and forms with members of the broader community that are affected by, or work on, these innovation challenges. This learning opportunity at the boundaries between the university and the wider community entwines with cross-disciplinary boundary-crossing and innovation PjBL activities and according to participants, strongly contributes to SESI development. Given the preponderance of community engagement in the data as a SESI-conducive practice, I dedicate this chapter to this pedagogical approach, being a second part of the answer (following on cross-disciplinary education, discussed in Chapter 7) to my second research question on how SESI are pedagogically facilitated by educators in Minors Innovation.

The relationship between universities and the broader society was one of the many aspects that came up more strongly than anticipated during the data collection. Its presence in the Minors Innovation and its modules, and the forms and extent to which it could support SESI were unknown. The thematic analysis highlighted community engagement as a key pedagogical approach, contributing to SESI in its capacity to provide real problems and real contexts where students can experience innovation processes. Findings show that the participants across the four cases agree in the value and desirability of experiencing learning processes based or supported in community engagement. Findings also evidence that community engagement practices in the Minors profoundly contribute to SESI development in all five socio-emotional dimensions. However, the advancement of community engagement practices varies between cases. Both Dutch programmes, Collaborator and Networker, show significant development of community engagement. On the contrary, the Chilean cases are less active: at All-rounder students experience some forms of collaboration with the broader community while at Explorer it is limited. That is, the practice varies in intensity and manifestations. Yet, the benefits of community engagement are perceived

transversally across cases and by different types of participants. Even those participants whose engagement with the broader community is limited, appreciate the notion and seek further participation.

Findings suggest that the main driver for including community engagement in the Minors is to teach innovation better, in terms of students' preparedness to engage in innovation processes. Educators value community engagement as pedagogical means for students to experience real-world innovation processes, when an experiential learning approach guides the educational design. Identifying societal problems, understanding users' needs and testing possible solutions are some innovation phases experienced through community engagement. Yet, educators also value the close observation and comprehension of societal problems as tools to encourage students' agency, social awareness and active citizenship, beyond innovation purposes. Only limitedly, however, collaboration with persons and institutions external to the university is sought instrumentally and formally to foster specific SESI. Educators emphasise, nevertheless, skills such as empathy, resilience and wider social awareness as desirable learning outcomes of community engagement activities. Overall, the data confirms that community engagement is used to provide a real-world context for innovation experiences, fostering various SESI through these authentic learning settings.

Community engagement takes multiple forms in Minors Innovation. Formal and informal alliances, with individuals and communities, with public or private institutions, at local, national and international levels, in partnerships led by academics or by students, with or without reporting and accountability mechanisms to partners, are all modalities of community engagement practiced in the Minors. For example, individual students at All-rounder self-organised the delivery of short innovation workshops for school children in Chile. A group of students from Networker collaborated with a local botanical garden in the Netherlands and created a start-up based on the project. A group at Collaborator helped a cleaning company improve innovation processes. A cohort of students from Collaborator worked with several municipalities diagnosing and addressing local problems through delimited projects, while students at All-rounder collaborated with a municipality more loosely in need-finding processes through one-off interviews with people in public places. The type of counterpart, type of problem, collaboration agreements and distribution of responsibility – between the university and the community partner, and within the university, between students, lecturers and others- shape students' learning experience and the potential development of SESI.

Community engagement for learning in Minors, however, implies multiple challenges for different types of participants. These collaborations entail negotiating aims, managing expectations about

the joint activities, and agreeing the dedication, timings and funding. From the University side, lecturers mainly perform these tasks. They do so while guiding students and helping them to overcome fears and resistances to community engagement. Moreover, as discussed in Chapter 5, lectures are subject to students' evaluations of the modules and so pedagogically innovating through incorporating community engagement activities entails certain risk for lecturers in academic careers. Thus, developing community engagement educational activities entails significant responsibility for lecturers. Students experience learning processes that differ from practices in their mainstream degrees, which may also be challenging. External collaborators, depending on the type of community engagement, face their own problems in the implementation of these collaborations. These obstacles seem to diminish the intensity of community engagement. The data suggests that the gap between the confirmed appreciation and execution of this practice derives from the mentioned practical arrangements required for successful collaborations and from the challenges embedded in boundary-crossing processes; i.e., encountering different cultures and epistemologies.

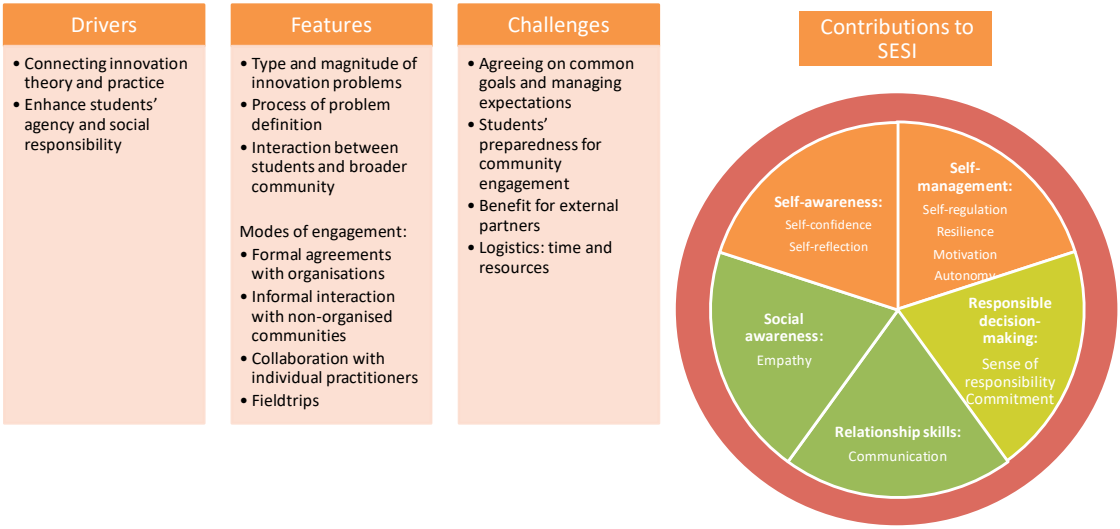
Encountering differences, as challenging as it can be, represents the central learning opportunity of community engagement in the Minors Innovation and coincides with processes in cross-disciplinary education. However, the different 'cultures' that students encounter in community engagement appear to be less distinguishable or recognisable than disciplinary 'cultures'. From a situated learning perspective (Lave and Wenger, 1991), the communities shaped around innovation projects in which students participate tend to be less clearly defined in terms of the members' identities and expected perspectives than in cross-disciplinary learning. In other words, the range of community partners with whom students interact, may be perceived as 'different' by students (e.g., regarding their professional status, socio-economic situation, geographical location, occupation, etc.), but the characterisation of their cultural distance is less clearly defined. This implies that the (re-) establishment of interactions across boundaries in community engagement requires understanding others whose 'cultures' may be unfamiliar to students.

This community engagement boundary-crossing practice stimulates the development of multiple SESI in the five dimensions of socio-emotional learning. Community engagement promotes students' awareness of their potential as innovators and their responsibility and capacity to work in real relevant issues. Students also boost their self-confidence, motivation, understanding of society, responsibility, value for diversity, capacity to work with different people and tolerance. They become active social agents through experiential learning processes. Experiencing real-world innovation processes enhances students' ability to engage (responsibly) in innovation ecosystems.

The latter aligns with the key purpose of community engagement in the Minors as expressed by participants: to provide a real-world platform to experience innovation processes.

This chapter analyses the ways in which community engagement pedagogically contributes to the development of SESI in Minors Innovation students. Findings are organised in four aspects: aims driving the inclusion of community engagement practices in the Minors; meaningful features of community engagement for the development of SESI; challenges perceived by participants; and the benefits of this practices for students in terms of SESI development. The next figure summarises these findings.

Figure 8. Summary of findings on community engagement and the development of SESI



Source: Author's.

A. Drivers of community engagement in innovation education

The data suggests that educators use community engagement practices to promote students' involvement in real-world innovation processes that support learning experiences. While community engagement may certainly be used in other programmes, this section centres on the rationale for these activities from the perspective of educators in Minors Innovation. Within the range of community engagement activities discussed by participants, two key patterns emerge on the reasons for including them as pedagogical strategies in the Minors. One focuses on bridging innovation theory and practice to boost students' learning. The other stresses the relevance of societal comprehension beyond its direct impact on innovation. That is, community engagement is

perceived as means to both, connect students with real-world innovation practices and to promote students' agency, citizenship, sense of purpose and social responsibility.

The rationales behind the inclusion of community engagement in Minors Innovation are analysed mostly from the perspective of university educators (including lecturers, programme managers -which in two cases are also lecturers-, central administration authorities, innovation unit authorities and external collaborators), rather than from the viewpoint of community partners, although some external collaborators interviewed acted as community partners. The two central aims are analysed next.

1. Connecting theory and practice: experience sustains learning

A central driver to develop community engagement activities in the Minors is to foster students' practical application of knowledge. In the views of educators, "the value of having these works with real entities, [is] it makes tangible what you learn in theory with practice"(CL.ALL-R.13.external-collaborator), because it "is different learning as theoretical knowledge from learning by doing" (CL.ALL-R.1.innovation-unit-authority). This rationale agrees with perspectives from the PjBL literature: "learning is maximized if the context for learning resembles the real-life context in which the to-be-learned material will be used" (Thomas, 2000, p. 8). The sense of authenticity then is an implied PjBL feature highlighted by Minors Innovation educators as a central driver for community engagement activities.

Learning in practice is important for preparing students for work, particularly in innovation, which is inherently dynamic, applied and multi-faceted:

> "I believe that society, as in macro terms, gives the base to reality. Because in the end it's useless to theorise, if later the student goes out to the market and continues to think about the book. That is, the changing, the dynamic, the adaptability that goes hand in hand with innovation, entrepreneurship, it's forced somehow by society" (CL.EXP.6.lecturer).

Connecting theory and practice is especially important given the Minors' innovation orientation. This connection helps to understand complex innovation theories, which are "extremely abstract; you can't see it, you can't smell it, especially the systems are big… And that's also the goal of the group work to make it land" (NL.NET.4.lecturer). Bridging theory and practice also permits experiencing abilities: "This is about application, this is about entrepreneurs that are actually doing it… it's much more experiential… much longer remains with them, I mean, I hope for years

(NL.NET.3.lecturer&programme-manager). This expected long-lasting learning is partly explained because "you remember things differently than when you're on a non-theoretical level or in practice-based" (NL.COL.3.lecturer&programme-manager[18]). Collaborating with external partners for students' practical experiences is thus conceived as a pedagogical approach that supports better and more sustainable learning.

Students share this view, perceiving the benefit of learning in practice. They value experiencing and practicing their competencies in real-world contexts; for example: "One of the ones [courses] who gave us the most work, but at the same time the most reality, was Social Innovation, because in Social Innovation they asked us to go to the field, talk with people, give them a proposal, so, not only the theory, but we also put it a little more into practice" (CL.EXP.11.student). Another student emphasises the importance of learning in practice to be prepared for work: "theory is beautiful in all, but once you actually get to work in real life, theory is only theory. So, you need to implement your rational skills, your social skills, which you developed in your life, just by being alive" (NL.COL.6.student). This process of 'learning by doing' (Wenger, 1998) is promoted by collaborating with real-world community partners. Overall, students coincide with educators on the benefits of integrating theory and practice through community engagement, notably in skills' development, enhanced understanding and thus, increased preparedness for engaging in innovation.

2. Enhancing students' agency and social responsibility

Community engagement is also regarded as a tool to promote students' capacity and interest for actively engaging in society as citizens and innovators. Despite various innovation conceptual underpinning, educators seem to coincide in the relevance of community engagement learning activities as means to support students' awareness and motivation to exercise their social agency. An institutional authority comments:

> "I believe that what one drives through this is, the empowerment of the student... basically to serve society... I have to understand society as a whole, and understand what are the requirements that society demands of me to attend them… [Industrial challenges] greatly stimulate them [students] to be creative and gives them awareness, I believe, that this baggage of competences that they are acquiring, it is not necessarily… to be able to develop a personal entrepreneurship, but they are 21st century competences that are necessary to be able to carry forward also traditional institutions. Through micro-entrepreneurship,

[18] Quote by assistant of programme manager/lecturer.

through internal incubation processes, they as change agents will be able to be very active and instrumental in the development of these solutions because I think it gives them that vision" (CL.ALL-R.2.central-administration-authority).

This rationale coincides with the university third mission aim of societal progress (Hardwick, 2013), focusing here on learning rather than on knowledge valorisation. According to some educators, community engagement especially supports learners' awareness and social agency when it implies expanding their usual contexts:

> "For me it is also like a topic of social agent… I do not send him ['the student'] to any context, I send him it to a context of more social complexity let's say. So that it is also an opportunity, not only to empathise, but also to empathise with something that in theory is a little different from them… It is to know something different, not through a text, but through having seen it, having understood it... As the contact between human beings, to talk…" (CL.ALL-R.6.lecturer).

The lecturer furthers that despite initial trouble, students finally appreciate learning through interactions across intentionally sought socio-cultural boundaries.

This educational aim of enhancing students' social agency be developing certain abilities interrelates with the aim of integrating theory and practice because both contribute "to solve problems, societal problems, and important—not theoretical problems" (NL.COL.2.central-administration-authority). Moreover, through exercising one's expertise, agency in society is unleashed, as an entrepreneur-educator explains:

> "Sometimes I felt you learned things, but you didn't know what you were going to apply it to. Then when you get closer to the real world, and then when you see that your work adds value to someone else, it is much more rewarding and motivating and finally helps you find and keep looking for your purpose" (CL.ALL-R.13.external-collaborator).

Within these rationales, educators emphasise specific skills relevant for, and developed through, community engagement. For example, the previous participant explains that the satisfaction gained from contributing to others' lives supports self-confidence, which in turn diminishes the tension of transiting from university student to professional life. Therefore, a cycle appears between working in practice, self-confidence, self-reflection on one's purposes and self-direction towards them. Educators also seek to foster persistence, resilience and the ability to manage uncertainty, e.g.: "I

think that context motivates, but the context also gives, provides ambiguity to the students. So, it also provides the arena, the atmosphere where students need to be resilient" (NL.COL.1.innovation-unit-authority). Empathy is a central innovation skill sought through with community engagement, which as discussed in Chapter 6, supports need-finding innovation process. Community engagement also permits understanding real-world innovators or entrepreneurs:

> "We really try to really let them crawl into the skin of an entrepreneur… That process takes weeks before they actually can make that transition from "I'm a student and I'm learning about entrepreneurship" to "I'm becoming entrepreneurial/ an entrepreneur". And some take that marvellously, and some still don't really get it at the end of the road" (NL.NET.3.lecturer&programme-manager).

Hence, developing empathy not only with problem-holders, but with real-world innovators and entrepreneurs, gives students the opportunity of exploring their identities as such.

Therefore, community engagement supports, according to educators, the educational aims of integrating innovation theory and practice, and enhancing students' agency in society. Several socio-emotional skills are also expected to be developed through interactions with the wider community. These aims generally agree with students' learning experiences of developing SESI, discussed in section E.

The data evidences that educators deem community engagement instrumental for learning purposes; the impact on the community is mentioned rather as a motivator for learners than an aim in itself. Thus, Yamamura and Koth's claim (2018) to equally balance learning and community impact in community engagement activities is not explicitly sought by Minors Innovation educators. Further, Morphew et al (2018) distinguish university community engagement activities (beyond learning) between 'service to society' and 'social efficiency'; the former referring to students' role in "building future democratic societies and welfare states", and the latter relating to the "economic and instrumental" aspects of the university-broader society relationship (2018, p. 1082). As emerged in this thesis, through community engagement educators seek to prepare students for 'serving society' by being active responsible innovative agents. But the immediate or direct objective is to enhance learning. Therefore, community engagement for the pure legitimate goal of improving learning opportunities, beyond the important longer-term impact on society, appears centrally in the data, yet not so in the incipient literature on learning-oriented community engagement. Nevertheless, the project outcome feature of PjBL activities takes sometimes in

participants' views a preponderant position in educational activities, without necessarily implying that educators' aims shift from promoting learning to serving society.

B. Key aspects of community engagement

Community engagement is a pedagogical approach for learning. In Minors Innovation, as emerged from the data, the key educational objectives are to bridge theory and practice and to enhance students' sense of agency. Community engagement promotes the development of SESI in students, albeit usually unintentionally or as secondary learning objectives. The activities developed are varied. The thematic analysis suggests multiple forms of community engagement in Minors Innovation. The most important modalities observed in the data are:

- **Formal collaboration with organisations, both public and private, for profit and non-for-profit for addressing "innovation challenges"**. Institutions include university spin-offs and start-ups. These alliances are usually contextualised in PjBL activities, where student groups tackle innovation challenges. Lecturers and/or students previously agree the collaboration and its conditions with their counterparts. Alliances with municipalities for working on local problems or with private companies for the development of new products are examples of these formal partnerships for 'innovation PjBL'.
- **Engagement with non-organised communities experiencing a shared problem**. In cases, students identify problems faced by communities through 'need-finding processes'. These collaborations have no binding commitments and are often one-off unplanned interactions. Interviews are the main form of contact. For example, students go to a square and explore residents' needs, enhancing their understanding of social problematics to be addressed innovatively.
- **Collaboration with individual practitioners, innovators and entrepreneurs** that act as role models. They offer students first-hand experience, know-how, and lessons from practice. Practitioners collaborate as guest lecturers, judges in contests or mentors.
- **Fieldtrips to innovation landmarks.** These may be science parks, incubators and companies. The real setting offers students an authentic grasp of innovation processes. For example, students at All-rounder visited an innovative private company and students at Networker explored a circular economy hub.

The manifestation of community engagement activities depends on at least three aspects: the type of problems addressed, the process for defining them and the interaction that students have with the community. These are discussed next.

1. Type and magnitude of problems addressed

Students in the Minors largely work on projects tackling innovation problems. These can be small-scale relatively simple problems or large-scale complex issues. Problems may be experienced at different levels: locally, nationally or globally, agreeing with the diversity of community engagement activities described by Jacob et al (2015). The challenges may require different levels of technical expertise, delimiting the extent to which students are able to provide solutions on their own.

Lecturers have different views on the desired levels of problems and closeness to partners. One perspective is that problems should be local and accessible to students. An external collaborator criticises approaches with "those problems of Harvard emblematic cases. So I always preferred to take a person who started with a bakery, to the father of a student who has a shoe store, more specific things and close to the student" (CL.EXP.14.external-collaborator). This approach, however, may set questions on the innovations' scalability. A related argument favouring local problems is to facilitate the communication with partners. A different approach is to work on global problems with local partners, as a group of Collaborator students did with the port authorities in Rotterdam to work on the problem of plastic in the oceans. In other cases, students worked with international partners, which does not mean that problems are global. For example, students at Networker helped an American company developing applications for children and seeking to do business in Europe.

Beyond geographical and scale features of partners and problems, Minors Innovation lecturers reflected on the relevance of problems to society, which may be judged differently by educators, learners and community partners. A lecturer explains how the pedagogical decision of going 'out into the world' can enhance students' awareness of, and motivation to engage in, important problems.

> "Originally, we did this on campus... so all the problems were: that it was very far to get to the classroom from the underground… that the food in the casinos was bad... I would say "hey you are like in-house, I need you to see more real needs". And that was when we sent them out and that brought about a tremendous change, because again, it opened their

> minds to the fact that there were countless things in which you can interact or you can develop innovative solutions" (CL.ALL-R.4.lecturer).

Therefore, one aspect is the physical and cultural distance from the problem and problem-holder as perceived by students, and another, the significance of the problem addressed. As discussed in section E, a key element in students' learning process is their sense of usefulness through their 'real-world' work, which could be considered an indicator of 'relevance' of the problem; in this case relevance for learning rather than relevance for the broader society – although both seem to be connected.

2. Process of framing innovation problems

Lecturers, students and/or problem-holders altogether define the scope of problems addressed by students. This affects the skills required and exercised by students. It also determines the expectations of problem-holders about solutions. Data suggests that managing these expectations is difficult in community engagement.

From an innovation perspective, problem-framing is an initial phase crucial for designing good solutions. Students develop the skills to understand and characterise problems as they define the problems to work on. The next quotation illustrates the importance of this phase as experienced by Minors students when collaborating with municipalities:

> "Every city had a different problem, so Amsterdam was mostly about elderly people… By analysing the rhythm of movement… they found out there were actually drug dealers in old people's home… that's the reason why everyone felt so unsafe there…it immediately became a police case… Then they made this great idea about traffic lights… traffic light is too short on green because is geared towards traffic jam in every morning, but old people only leave the house after ten, so you can change traffic lights after ten. So you don't find things like this if you don't really engage with the people who do it" (NL.COL.5.lecturer).

Thus, students may enhance their social awareness by engaging with the community for problem-framing. This does not occur, however, in all examples narrated by participants. Where lecturers define the problems, students seem to miss part of this experience, although it strengthens learning opportunities in the problem-solving phases.

Problem definition encompasses assessing their complexity, which according to some educators is critical for students' learning. A professor explains that working on complex problems "requires

then that you're able to have conversations and meaningful dialogue and collaboration with people from completely different disciplines and with possibly also with different perspectives and different foregrounds and highlight different values" (NL.COL.9.lecturer). Pedagogically, this can be facilitated "by choosing of course this kind of paradigm cases where it comes really, all comes together and you cannot even start to think about an adequate solution if you leave out certain aspects or dimensions" (NL.COL.9.lecturer).

Consequently, students benefit from framing the problems themselves, enhancing their social awareness and self-directedness. Lecturers' choice, however, may encourage other learning aspects, such as skills for collaboration across disciplinary and cultural boundaries.

3. Interaction between students and the broader community

The extent to which students interact with persons outside the formal university boundaries for exploring innovation problems and designing solutions varies across cases. In cases, students simply know a user or problem exists, somewhere in the world. In others, they communicate directly with problem-holders and visit them in their context, having the opportunity to observe the challenges in situ. Some interactions last only for initial problem-definition processes while others maintain throughout projects' development, including the stages of re-framing problems, and exploring, designing and testing solutions. Minors students exemplified these varied degrees of interaction in activities, ranging from only hearing talks from practitioners or doing few one-off interviews, to jointly developing projects with partners during an academic term.

Depending on the depth of interaction, community engagement activities may be regarded as transdisciplinary ones, in the sense of synthesising academic based and non-academic based knowledge (Greef et al., 2017). While tacit and practical knowledge about innovation problems was sought, exchanged and co-created between Minors students and community partners -especially in the need-finding and problem characterisation phases- the collaboration around real-world problems was rarely deemed by participants a knowledge-creation process. This may relate with perceived distinctions between this type of non-codified knowledge drawing on practical know-how and science-technology conceptualisations of research (Jensen et al., 2007), which follow more structured procedures. That is, generating practical knowledge that allows innovation experimentation was generally not explicitly considered a research activity.

From a curricular design perspective, Collaborator shows the most systemic community engagement approach of the four cases. The student project module, which is mandatory to all

Minor students, involves learning to diagnose, analyse, design, implement and evaluate a real-life innovation case. These PjBL activities are developed in partnership with problem-holders from companies, NGOs or public agencies. While the frequency of interaction between students and community partners varies between student groups, this pedagogical element is pivotal in students' educational experience, and specifically in SESI development.

Interacting with real-world partners is novel for some students and common for others. In general, students in the Dutch cases are familiar with these collaborations, expressing for example, that "for me it wasn't special" (NL.NET.9.student). In the Chilean cases, community engagement is less common, and students tend to wish for more interaction. However, the meaning of connecting with the broader society varies. For example, a student did not consider as a qualified community engagement experience his conduction of short surveys to people in the street; he would like more contact because "I feel it is another view that can nourish you a lot, in the end the more stimulus the better" (CL.ALL-R.8.student). The type of interaction between students and community partners, and notably students' feeling of newness of the realities they explore, shape their learning and development of SESI.

As explained in Chapter 7, experiential pedagogical approaches are used differently across the Minors' modules, being community engagement a common pedagogical practice in the experiential cases. Some lecturers interviewed did not use community engagement since their focus was more on concepts and theories, yet they respected the approach. Only one participant, an external collaborator working as lecturer, was dismissive about community engagement as a pertinent educational practice for undergraduate students explaining that the class was too large, and students were under-prepared given their age, maturity and lack of practical work. Other lecturers expressed more nuanced concerns about the students' preparedness and reliability for responding to problem-holders (see section C.2). Therefore, community engagement occurs to various degrees in the Minors' modules, from absent to being a central pedagogical element.

Overall, within the diversity of community engagement activities in the Minors Innovation, key aspects shaping students' experiences are the type of problems being worked with the community, the process of defining them, and the duration, depth and novelty in the interaction between students and community partners. These aspects condition students' development of SESI.

C. Challenges in the implementation of community engagement

The implementation of community engagement activities in the Minors Innovation is restricted, nevertheless, by personal and institutional differences in cultures, aims and timings between university and community partners. Yet precisely some of these differences are resources for innovative solutions and for learning, including the development of SESI. In other words, these cultural differences represent boundaries that hinder collaboration and when interactions across these boundaries are (re)established, learning potentials (and innovation ideas) emerge.

Data suggests that implementing community engagement is difficult notably when activities are formalised, entailing sustained collaboration, e.g., during a study term. Shorter-term collaborations, e.g., for guest speakers or one-off interviews, are easier to implement. However, learning opportunities likely depend too on the activities' magnitude.

This section focuses on the challenges for intense and continued collaborations. Four central challenges emerge from the data: agreeing on common goals and managing expectations, students' preparedness for community engagement, finding benefits for external partners and logistics.

1. Agreeing on common goals and managing expectations

As educational institutions, universities -and specifically Minors Innovation educators- seek community engagement as learning opportunities for students. Community partners may be willing to help in the learning process. Yet they may also have other agendas, like solving their own problems presented as innovation challenges. Tensions arise around the common goal guiding collaboration. Is the focus of educational activities on the project or the learner? (Detmer, 2017).

From the university perspective, keeping learning as the core purpose while managing expectations from external partners about projects' results is difficult: "some students groups do amazing stuff but you cannot give the commitment of a good outcome because learning is the primary outcome they need to focus on" (NL.COL.1.innovation-unit-authority). That is, projects may not achieve the expected results, implying frustration for students, lecturers and/or partners. Moreover, when negotiating aims, positions of power arise, illustrated in these quotations: "we ask them a favour" (NL.COL.3.lecturer&programme-manager), referring to community partners, and "[students] told me they're doing the job for free" (CL.EXP.6.lecturer). It is thus expected that external partners dedicate time to guide students, explain the context and jointly characterise problems. But given the learning focus and students' limited experience, commitments on results delivered by students

are managed cautiously. Therefore, educators generally feel that universities are indebted to their community partners while some students find it unfair that they are not paid for real work. On the other hand, in less formalised collaboration, some community members are sceptical about students' 'free help', as illustrated by a student: "it was hard, because they didn't understand that "university kids came to be interested in us"" (CL.EXP.9.student). Consequently, deciding the collaborations' objectives and modalities is complicated in the Minors because of the participants' distinct expectations.

The different timings between university educational processes and organisations such as companies also represent a cultural boundary to be crossed. An external collaborator from a company explains:

> "The company world is going faster than the students. So, in the end, we had already some solution selected when they [students] presented a solution. I think that if you understand it, you can also use it, like, giving them cases that are not so much in your scope currently, but more in the future" (NL.COL.8.external-collaborator).

Therefore, if differences are assumed, adequate strategies for coordinating timings may be developed.

The challenge of finding models that satisfy students, lecturers and community partners is intensified by inter-institutional coordination. In Collaborator, the three participant universities have diverse expertise and each leverages on networks with different types of organisations. While enriching the landscape for community engagement, this leads to various approaches for the collaborative agreements, problem definition and students' assignments. This requires further coordination between educators with different cultures and community engagement practices.

The characterisation of the problems to be tackled is central in community engagement. At Collaborator, there is a specific phase where students assess, confirm or adapt the problem previously defined by the counterpart; i.e. problem framing is a standard innovation process developed by students in this programme. However, academic and practice-based perspectives on problems may differ, as illustrated next:

> "Scientists created the Ivory Tower… get in touch with the reality and with people in reality. But on the other hand, they have to keep distance. So, the problem, as perceived by the stakeholder, maybe is not the real problem. So sometimes they [students] have to come up

with something that goes in another direction than the stakeholder thinks it is" (NL.COL.4.lecturer).

The quotation reflects the challenge of working with boundary objects -in this case innovation problems- about which participants at either side of the boundary have partial jurisdictions (Star and Griesemer, 1989). Establishing interactions across the 'ivory tower' with the 'real-world' may lead to question preconceptions and change perspectives. This somehow complicated process of bridging the science-practice gap through community engagement emerges as beneficial for students, aligned with the educational aim of connecting theory and practice.

Concluding, establishing common collaboration goals, defining innovation problems for students to work on, and managing expectations from universities and community partners, especially in formalised collaborations, are key community engagement challenges acknowledged by Minor Innovation participants. These represent boundary practices, which as theorists have suggested, permit learning inasmuch the interactions (and their limitations) are identified, assessed and transformed (Akkerman and Bakker, 2011a). In the process of agreeing goals, such boundary-crossing learning exceeds the scope of university students and includes educators and community partners.

2. Students' preparedness for community engagement

Some lecturers are critical about students' preparedness for community engagement. Especially they care about students' sense of responsibility, technical capacities and commitment. This is exemplified through two quotations:

> "There is a kind of feeling that perhaps they [students] are too early in the study to really already go out and apply all these theories about social and technological innovation in real life and to already match all the expertise and structures that are in-place in a company or with a city council" (NL.COL.3.lecturer&programme-manager).

> "Students' maturity is not always suitable. So, for example, they [students] did not always come to the meeting with the client or they arrived late, so in the end, you lose favour with your relationships, with your friends" (CL.EXP.6.lecturer).

Lecturers lead the agreements for sustained collaborations largely through their personal contacts; thus, students' unreadiness risks lecturers' credibility with their networks. Consequently, finding appropriate community partners interested in sharing problems with students, a central condition

for community engagement to occur, is hampered by concerns about students' performance, limiting educators and partners' willingness to collaborate.

The question about students' preparedness is to some extent shared by students themselves:

> "It was demanding, because it was stressful to think that a module that is supposed to be simple, required to have meetings, go to super-distant places, go to the field, arrange interviews, go to towns, etc., to understand what are we talking about and then doing research, being able to propose solutions, having meetings to propose them. Then, that was too demanding, but at the same time it was also very useful" (CL.EXP.11.student).

This reaffirms that students' expectations about the Minors being 'easy' programmes (Chapter 5) are inconsistent with the required time dedication. However, these expectations may be based on ideas about experiential-inductive pedagogies compared to deductive teaching. Still, both students and lecturers question students' preparedness for community engagement, representing a learning opportunity, as discussed in section D.

3. Benefit for external partners

Opinions about the perceived benefits by external partners vary. Several educators think that the community partners like to collaborate, but they do not benefit from the projects' results, e.g.:

> "Anyone from my module has never… one of these companies came up and say, "Well, this was terrific and we learnt so much of that". No. It's much more that they give a kind of space to play for the students" (NL.COL.3.lecturer&programme-manager).

Other educators observe that partners may benefit: "they found very very useful this course, but not because they could gain a profit out of it but because they could have, share ideas they were not thinking on" (NL.NET.5.lecturer). Intellectual property has not been an issue of debate with community partners because projects' results have not reached that level of novelty and complexity. Another element is the contact with prospect employees, as explained by a community engagement partner: "to get in contact with students and… possibly, students that will be hired in the future" (NL.COL.8.external-collaborator). Therefore, the perceived benefits for partners vary and tend not to be in the form of outstanding solutions to their problems. Rather, community partners benefit from acquiring new perspectives to analyse issues and establishing contact with potential future employees. This entangles with the difficulties discussed above of establishing common goals and students' preparedness to engage responsibly.

These perspectives, however, reflect mainly university participants' views; only few external collaborators acting as community engagement partners were interviewed. Further research focusing on partners' perspectives could shed light on their experiences.

4. Logistics: time and resources

Logistics also hinder community engagement activities. Finding partners, agreeing on the conditions, coordinating meetings, fulfilling university administrative procedures, among other tasks is time consuming, especially for academics, but also for community partners, university managers and students. A lecturer illustrates: "we always attract a new entrepreneur to work as a life case, so we're putting a lot of effort and time in reshaping and renegotiating the courses" (NL.NET.3.lecturer&programme-manager). Funding, e.g., for students to visit partners, is another practical challenge mentioned, albeit less than the others, affecting the operation of community engagement activities.

Therefore, project-based community engagement is challenged by several interrelated aspects. These largely derive from cultural differences between universities and the wider society. Agreeing on common goals with community partners willing to collaborate regardless of uncertain results and certain demands, defining adequate problems for students' capacities and managing logistics, are all important and difficult aspects to develop this boundary practice. Despite these challenges, community engagement is sought and practiced in the Minors Innovation, with varied intensities across the four cases. These activities show multiple benefits for SESI development.

D. Contributions of community engagement to the development of socio-emotional skills for innovation

Despite these obstacles, community engagement is pedagogically valued by Minors Innovation educators and students. The benefits of this boundary practice specifically for the development of SESI derive strongly from the real context, i.e., the authenticity of problems, community partners and their cultural settings. Learning processes contributing to SESI are discussed next, organised in the five CASEL categories: self-awareness, self-management, social awareness, relationship skills and responsible decision-making. The analysis is based primarily on the perception of students, and secondarily, of educators.

1. Self-awareness: learners can increase their self-reflection and self-confidence by crossing academic boundaries

Experiential learning in authentic settings creates a bridge between students' academic education and their professional practice. This founds part of the relevance of PjBL (Prince and Felder, 2006). Students have real-world opportunities to apply what they have learned and deepen such learning. In becoming professionals, students develop self-awareness skills. Realising their capacities through practical work boosts their professional self-esteem and self-confidence. The sense of usefulness in community engagement activities is central. Work and seeing different realities also promote self-reflection, about their life purposes, careers, own capacities and skills to develop. In a way, these authentic work experiences represent disorienting dilemmas, conceptualised in transformative learning theory as triggering self-reflection about existing frames of reference (Mezirow, 1991).

Experiencing diverse real-world situations boost learners' self-confidence, as illustrated: "Through working with a lot of different people, and putting myself in a lot of different situations you develop far more confidence in new situations basically" (NL.NET.10.student); "[the Minor] has increased my confidence in that I feel that I can really add something to a company now" (NL.COL.12.student). Students care about their future work life and having practical experiences supports their sense of preparedness and self-confidence. Further, some students discuss how they experienced a new professional identity taking professional responsibilities: "All of the sudden, you are an expert in your field. It's really weird because nobody was ever used to that" (NL.COL.6.student). In this sense, the real-world context, projects and community partners are central mediators in learners' development of their professional identity.

Expanding the range of experiences and contexts help students to question their purpose, professional goals and aims in life. For example, a Social Innovation module marked a student's self-reflection process:

> "It was my methodology, so it was like there where I assumed many things, like my basis of what I am doing now, of what interests me most, like helping people and how to carry it out, was like more in that module" (CL.EXP.9.student).

As evidenced by the data, thus, working in real contexts helps self-reflection and consequently, motivation, being the latter connected to the dimension of self-management.

2. Self-management: through community engagement learners develop motivation, autonomy, self-regulation and resilience

Students boost their capacity to self-regulate their emotions, thoughts and behaviours by working in real-world contexts. Through learning experiences in Minors Innovation, learners expressed their enhanced sense of discipline and resilience, self-motivation and autonomy. They also self-direct – to varied extents- their learning experiences.

Reality motivates students. Authentic work situations stimulate students' commitment:

> "It's just more interesting to have a real case, because otherwise you are not likely to work hard for it. So, of course it's special if they come here and there's also somebody that really values your ideas and your work later on" (NL.NET.9.student).

Paired with self-motivation, community engagement may boost students' enthusiasm through the external recognition of students' work too.

Project-based community engagement activities also promote self-directed learning. The areas of autonomy and responsibility for students include the participation in the definition of innovation problems to work on, the relationship with, and accountability to, external stakeholders and the presentation of results. These responsibilities are partly individual and partly collective, shared with classmates. Students have varied preferences on the lecturing style and the freedom offered to direct their own learning. Some explain that making choices increases their motivation because they can focus on their interests, as narrated by a student:

> "The exact way of what they expected from us and what the final report… was determined by the company and/or academic supervisors... So, I think there's a lot less freedom in the courses themselves but in the project, there is a lot… I think that [freedom] gives room to do something that I'm really into, and that I'm also motivated for because I've noticed sometimes when I have to do an assignment or a presentation on a topic that I'm not really interested in, then my motivation also decreases for that" (NL.COL.12.student).

Students' self-directedness in their learning processes is shaped by educators' pedagogical decisions and by students' agency. Interacting with community partners, students can direct their experiences and reflect upon them:

> "It was a vulnerable school… you had to be super attentive to them [school students] and motivate them somehow, and face the frustration that I believe those teachers face daily… one needs to learn how to deal with that and learn from them – how not the let go by emotions and move on, manage frustration" (CL.ALL-R.12.student).

As illustrated, self-management skills such as self-direction and motivation enhanced through work in real-world settings, interrelate with skills in other dimensions, including empathy, a social awareness ability.

3. Social awareness: empathy is exercised in innovation processes with the wider community

Social awareness is a central dimension of socio-emotional skills developed through community engagement by broadening the range of social interactions and contexts where students participate. This facilitates innovation behaviours given that innovation processes are based on observing and understanding problems, and on reframing them through different perspectives.

Empathy is a social awareness skill essential to innovation processes. Students affirm the development of empathy and other social awareness skills, such as value of diversity, through participating in different contexts and interacting with different others. Yet, perspectives about empathy intertwine empathy as a skill and the empathy process as an innovation phase to methodically explore and understand problem-holders' needs (see Chapter 6.C.6). For example, a student considers that: "empathy I would say is when one goes to the field and talk to people, [sees] what problem there is" (CL.ALL-R.9.student). Empathy, in both terms and highlighting its value for innovation is, as the data suggests, intentionally promoted and developed in the Minors Innovation.

As a trainable skill, developing empathy entails becoming sensitive to perceiving things. From a boundary-crossing perspective, it relates to identifying cultural differences and being open to understand, accept and incorporate those perspectives. A lecturer highlights sensitisation as a key socio-emotional skill required to see different perspectives and thus to act ethically:

> "I think the most important one is sensitisation, to make people more sensitive. One of the things that they learn, that we teach about is value-sensitive design… the most important gain or benefit from this whole exercise is that… they are becoming aware… that things are connected" (NL.COL.9.lecturer).

In that sense, empathy and sensitisation require a systemic perspective. This is facilitated by observing the diversity and complexity of real-world situations.

Community engagement helps too in developing social awareness about real-world innovation (and entrepreneurship) processes. In the next illustrative quotation, a student explains how he became more conscious through a project-based collaboration with an entrepreneur: “It is not as easy as people thinks: a good idea occurred to you, there is financing and that’s it, as if it was created from nothing. No, it's really like blood, sweat and tears and getting it on” (CL.ALL-R.12.student). Understanding how the real-world operates is a key benefit that students acknowledge. Talking about his appreciation of guest speakers, a student emphasises:

> “More than the knowledge itself, like the stories they tell you and like the fact that these lecturers are related in the environment, I think that is what motivates me the most, for example, to take these modules, to know what is happening and what they are doing” (CL.EXP.13.student).

Thus, connecting to real-life situations support students’ social awareness and the capacity to better understand diverse social contexts. This is required to tackle ethically and innovatively complex problems that have multiple relevant dimensions.

4. Relationship skills: communication is strongly developed in community engagement

Students express that through engaging with the broader community they learned to better relate with different people. By taking roles alike their usual ones, learners needed to expand their relationship skills. Notably, they developed communication skills and awareness on communication.

For example, by interacting with people from a company in a Communication module, a student developed new perspectives towards communication in work:

> “I had never seen communication, until that course, as something relevant… on how I generated a bond or could also de-generate it… Then I realised that communication like opens many doors if one knows how to communicate, is like I don’t know, a magic wand… I said if in the future I wanted to create a company, I already know that communication is something essential” (CL.ALL-R.11.student).

Especially in the cases in Chile, students emphasised the importance and often lack of skills to communicate with different others. In these cases, students' interlocutors tended to be unknown people that they approached for short conversations or surveys, communities more vulnerable than them, and peer students from different disciplines. The following quotation illustrates the centrality of developing communication skills for some students, and the reliance on lecturers to acquire appropriate techniques: "I had no idea how to approach people, I talked to the lecturer and she taught me that there are forms and forms, and one has to be very careful with what one says" (CL.EXP.9.student). Thus, basic abilities serving not only innovation purposes, but life in general, may be underdeveloped by undergraduate students.

Some students reflected and self-assessed their improved relationship skills. The next quotation illustrates the perceived benefit of participating in the Minor in terms of skills exercised in a PjBL experience, where the student was the only in her project group enrolled in the Minor (in some cases, modules are open to students beyond the Minors):

> "I have never gone to a construction site... You go, you do an interview, you locate yourself, you have everything planned, that planning never realises... I realised that I had many skills for that versus them [non-Minor students] and there I realised clearly: the [Minor] when going to the field to solve problems and things like that, focuses on that style [of learning activities]... It's like I can lead a conversation with my interviewee well, I can capture the things that I found interesting and deepen them, in short, all the interviews we did were super fruitful" (CL.ALL-R.9.student).

Overall, community engagement offers students the opportunity to interact with people from different backgrounds, crossing cultural boundaries. In this process, they develop communication, and more broadly, relationship skills benefiting innovative behaviours.

5. Responsible decision-making: learners manifest enhanced sense of commitment and responsibility in community engagement activities

Work in real contexts encourages responsible decision-making because students' tasks become more meaningful when they affect real-world people. Students' sense of responsibility is boosted by witnessing and understanding broader realities, reflecting upon their roles in society and interacting and collaborating with others. That is, responsibility relates to the skills discussed in the four previous dimensions: self-awareness, self-management, social awareness and relationship skills. These skills are exercised by students when experiencing various innovation phases that

require responsible decision-making: problem identification, characterisation and analysis, evaluation of solutions considering ethical aspects and deciding their adoption. Crossing the cultural boundaries of university through experiential IE, thus, enables students to increase their sense of responsible decision-making, associated to various socio-emotional skills.

Responsibility is, unlike other SESI, explicitly promoted by educators in the Minors. Notably, the Collaborator programme considers responsibility at its core, manifested in its curricular design and academic staff. In other programmes, students' capacity to contribute responsibly to society is aimed by educators particularly through the design of PjBL community engagement activities. As discussed, these require interaction with, in situ visits to, and reports about the wider community and the challenges experienced. These pedagogical approaches foster students' responsibility, as a skill in practice. A student highlights the benefit of this interaction:

> "But most useful is the student project group because we are working in a company, we have very regular contact with them and we're actually responsible for an innovation project… We are working on improving the environmental print, so we're advising the environmental department of the company on a certain aspect of the environment impact, and we're looking into combining all the different people working there and having some kind of collaboration on this one and convincing them that it's needed and useful" (NL.COL.10.student).

This illustrates students' responsibility for projects, their integration of approaches to propose solutions, and the accountability to third parties. This type of activity, however, varies across cases. In cases of limited community engagement, students expect – partly based on classmates' experiences – their skills development. The following quotation show students' ideas that collaborations with people beyond the university enhance their commitment and consequently, personal growth:

> "There are other courses that I have not taken, but there are courses where you commit to a community to carry out a project, to develop it. And that is a lot richer personally and apart there you do acquire a commitment with all the people whom you are promising that you are going to solve a problem" (CL.ALL-R.9.student).

The student weighs the value of face-to-face collaboration with real-world partners. This is a key pattern observed in the data. However, some data elements question whether learners need to connect physically with real contexts, or if an emotional yet not physical connection has similar

effects on students' learning processes. In the next quotation, a professor explains how evoking real-life situations through pedagogical material can play a similar role in learning processes:

> "I think good ethics education doesn't necessarily need to bring you in contact with real people because good ethics education conjurers up or appeals to your imagination in such a vivid and evokes that in such a lively way, that it's almost as if you were talking to the people… For example, I have taught an ethics course to mechanical engineers here and maritime engineers-shipbuilders. And so, what we did is instead of starting with theories, ethical theories, what I did was just analyse maritime disasters, but in full detail. So also using video material that people were just rescued by the Navy or you know so people in the cold water, the stories of the people. So that really kind of brought… how important their work is, the safety and cannot compromise on safety… And of course it is, it would be better -but it's very time consuming- to bring in the real people" (NL.COL.9.lecturer).

The authenticity of the situation or case, and the possibility of connecting emotionally with the people involved, therefore, seems to be the key, despite being non-contemporaneous and not entailing a bi-directional communication. This seems consistent with previous research findings that 'cognitive realism' is more important than 'physical realism' in students' real-world learning experiences (Roach et al., 2018). In the Minors case, an essential emerging aspect is that learners still have the possibility of acting upon the situation because the case is presented as a lesson for their future professional performance.

In the same direction, a student narrates a situation whereby, albeit not having face-to-face interaction with the problem-holders who were physically and possibly culturally distant, a central value of the learning experience was the possibility to contribute to a real problem.

> "It's nice to have an actual place to apply our knowledge to, right? That's what it was. Yeah, the feeling that you're really working on something real, to get more motivation. I think. Yes, it was a real place you could visit. But for another course we worked on faecal sludge management, well, poop basically, in Dar Es Salaam in Tanzania, and that was very far away of course. And we were only writing our reports on it so it wasn't very applied, but again, I did feel like we were actually applying our knowledge to something that existed, that was real" (NL.NET.10.student).

Therefore, the thematic analysis suggests that direct interaction with real-world problems, organisations and people supports students' sense of responsibility, commitment and motivation.

This represents a cultural boundary-crossing process through which students develop skills in establishing interactions with different others. Nevertheless, in cases without direct interaction but with in-depth presentation or work on problems, and with opportunities for students to act upon them, learners may also enhance these skills. Consequently, two elements facilitating the development of responsibility and other SESI are: the authenticity of problems and problem-holders, and chances to enact agency applying skills in society.

Therefore, community engagement is a pedagogical approach used in the Minors Innovation to various extents but valued consistently across cases and types of participants. It is a learning resource fundamentally given its boundary-crossing nature; students can experience and develop multiple skills favouring innovation in the process of knowing, understanding and interacting with persons beyond the university boundaries. Key SESI developed, in the views of students themselves, include self-reflection, self-confidence, motivation and sense of purpose, self-direction, empathy, communication, and responsibility.

E. Conclusions on community engagement

This chapter analysed community engagement as a key pedagogical practice for the development of SESI in Minors Innovation students. This approach emerged across cases as critically promoting SESI, despite varied degrees of experimentation with community engagement in the Minors analysed. In community engagement, boundaries between academia and other societal groups are crossed. Educators incorporate community engagement activities with two main aims: to allow students to experience innovation concepts in practice and to enhance students' agency. They also aim to promote certain skills such as empathy, responsibility, and generally, social awareness. Students' narratives tend to confirm the development of this kind of skills, despite the multiple challenges that students, educators and community partners face. Community engagement takes multiple forms. The specific activities, their duration and associated responsibilities taken by students, educators and community partners shape learners' development of SESI.

Real-world problems, places and people emerge as a central element in participants' community engagement experiences favouring the development of SESI. The power of authentic situations in promoting learning relates to three features. First, the data suggests that problems that are current and unsolved, and therefore might benefit from learners' potential contribution, motivate students. Real old problems already solved, as in study cases, do not have the same effect. Students' perception of their own impact, usefulness and agency enhances their learning, as the data reveals. Authentic learning experiences with space for students' contribution has also been discussed in the

PjBL literature as a motivational dynamic (e.g., Prince and Felder, 2006), seemingly, however, without centring the discussion on community engagement relationships and their entailed potentials to develop socio-emotional skills. Second, Minors Innovation students develop SESI such as empathy, commitment and responsibility by connecting with persons experiencing genuine relevant challenges. That is, interacting with real counterparts that may benefit from students' work encourages further the development of several socio-emotional skills. Third, through community engagement activities learners experience a sense of otherness. Students benefit, despite difficulties and fears, from interacting with persons that are different from themselves and from their known environments. Students learn and apply skills such as openness and communication. Otherness may be experienced in multiple forms and students' experiences of otherness depends on the amplitude of their regular interactions with different others. Encountering such differences in unfamiliar settings is a central feature of boundary-crossing (Suchman, 1993), which in this case study is observed too, when crossing disciplinary boundaries. Thus, real-world problems, opportunities to be agentic and useful, and otherness are emerging features of community engagement favouring the development of SESI in the Minors Innovation.

The development of these community engagement activities entails multiple logistical and educational challenges, and educators play a key role in permitting these collaborations. This means, as concluded in other studies, that educators in Minors Innovation re-shape the boundaries between universities and their external environment. Huisman and Fumasoli (2014) found, regarding university institutional conditions and contract relations with external partners, various motivations for both, internal stakeholders – including academics – and external ones to develop boundary work, leading to boundary contracting and expansion. In the case of the Minors studied, it emerges too that educators significantly set the foundations for boundary work with external partners, by negotiating collaborative activities directly with them or by stimulating students to do so. In cases where students were responsible for establishing collaborations, educators set guidelines. Educators, thus, play the role of boundary broker, who connect communities to facilitate new meaning (Wenger, 1998). These boundaries and their surrounding activities, on a micro-level (collaboration with specific partners in a course) may be volatile since the sustainability of these alliances vary and generally require institutional commitment. On a more systemic level, though, HEIs continuous collaboration with their environment in educational (innovation-related) endeavours, even if specific partnerships are not sustained over time, may increase the porosity of universities to engage externally. Enabling institutional policies, including logistics and rewarding conditions for academics to innovate pedagogically, may increase the breadth and benefit of this type of boundary work.

F. Conclusions on boundary-crossing pedagogical practices promoting the development of socio-emotional skills for innovation

The second research question of this thesis aimed at understanding how universities pedagogically facilitate the development of SESI in Minors Innovation students. The data suggests that within a variety of approaches, experiential, inductive and project-based pedagogical approaches promote SESI. In this context, two pedagogical practices are preponderant in the facilitation of SESI, as discussed by different types of participants: cross-disciplinary education and community engagement. These approaches were respectively analysed in Chapters 7 and 8.

The four cases, Collaborator and Networker in the Netherlands, and Explorer and All-rounder in Chile, show a variety of pedagogical approaches to innovation education. Most teaching-learning methodologies supporting SESI, as discussed by different types of participants, are socio-constructivist in nature. That is, students steer their meaning-making processes in dialogue and mutual transformation with their learning environment. This involves other students (from the same or other areas), lecturers who tend to adopt facilitator roles, and different types of collaborators in educational activities, including problem-holders or providers. The educational activities boosting SESI are largely organised as innovation-oriented projects, where students work in groups conducting innovation processes. The Minors Innovation studied also include courses and activities based on lectures and textbooks, but as discussed with participants, these pedagogical approaches did not substantially promote SESI. Therefore, the analysis focused on experiential teaching-learning practices.

The analysis of the pedagogical practices supporting SESI draws on boundary-crossing theory as the data evidences that SESI development is promoted by learners' interactions across boundaries. That is, boundary-crossing mediates horizontal development as learners engage with varied expertise (Griffiths and Guile 2003). Innovation challenges, and their in-construction solutions, represent boundary objects. These are used by participants across organisational boundaries, i.e., between universities and the broader community, and across disciplines, to jointly create meaning. These collaborations represent boundary practices in which students and other persons involved meet, (re)establishing interactions across socio-cultural differences (Akkerman and Bakker, 2011a). Two boundary practices distinctively emerging from the data as supporting SESI, cross-disciplinary learning and community engagement, were discussed in detail. In crossing boundaries, learners may experience disorienting dilemmas, as they question and potentially transform their assumptions (Mezirow, 1991) through the interaction with different others. Assisted by educators

-who experience their own challenges as mediators in students' learning and as pedagogical innovators- students develop multiple socio-emotional skills for innovation.

Skills in the five dimensions of socio-emotional learning, i.e., self-awareness, self-regulation, social awareness, relationship skills and responsible decision-making (Durlak, 2015), are developed, supported by community engagement and cross-disciplinary practices. SESI are significantly developed by participating in learning communities formed with other students and members of the broader society participating in community engagement activities. They experience various forms of learning as social participation: by belonging to the community, by 'doing' the practice of the community, by reshaping one's identity participating in the community and by giving other meaning to experiences (Wenger, 1998).

An overarching conclusion that integrates these interrelated dimensions is the enhancement of learners' agency. There are numerous signs that students become more aware, responsible, motivated and engaged in their learning trajectories, and with their lives more generally. The evidence suggests that through active, authentic, collaborative, and across-boundaries learning activities learners become more agentic. Minors Innovation learners co-construct their ecologies of resources for learning, which as Damşa et al. (2019) have discussed centring on digital resources, can and in this case "transcend institutional, disciplinary, social and cultural boundaries and can enable extended learning spaces that are less time–space–place bound" (p. 2076). An overarching challenge for educators then, as discussed in Chapters 7 and 8, is to facilitate 'learning spaces' which can be partly preconfigured yet are shaped by learners (Damşa et al., 2019), and in this case, by peers from other disciplines, community partners and resources such as innovation challenges.

Findings also emphasise the collective process of developing SESI. Most skills developed are based on the interaction with others. Yet, the data is inconclusive on students' intentionality to support their peers' learning; i.e., collective learning occurs facilitated by these experiential activities, but students do not consistently and consciously seek to contribute to others' learning experiences. Key findings about SESI development in these boundary practices include:

- Boundary-crossing experiences encourage students to self-reflect about their own assumptions, motivations and professional purposes. In crossing disciplinary boundaries, learners reflect too about their disciplinary expertise in multidisciplinary contexts, and about their perception of disciplinary others and vice-versa. In crossing institutional boundaries and working in authentic settings, students question and redefine their desired contribution to society. By exercising skills in practical settings, students become more self-confident.

- Practice motivates students. Innovation PjBL activities such as choosing and framing innovation projects, forming student groups, organising tasks and delivering results, are all learning opportunities permitting degrees of self-direction depending on educators' pedagogical choices.
- Empathy is a central skill promoted and developed in Minors. Being socially aware boosts innovation by rightly identifying needs. It also facilitates interactions across disciplinary and organisational boundaries, enhancing the novelty of innovation solutions.
- Communication facilitates interactions across boundaries and is an important relationship skill developed by Minors' students. Cross-disciplinary educational activities and community engagement expose students to various situations where they expand their capacity to communicate with different others.
- Responsibility is promoted differently across cases as an innovation value. Both boundary-crossing practices offer opportunities for students to boost their individual and collective responsibility. In the case of community engagement, having authentic counterparts increases students' commitment and willingness to work hard to fulfil the agreements, showing the importance of students' sense of usefulness in contributing to tackle societal challenges.
- Socio-emotional skills favouring innovation were in cases acknowledged as important for life, beyond innovation. Participants also recognised transformational processes, in which profound perspectives (towards themselves, different others, work and societal problems, for example) were questioned and changed.

Overall, entwined with the development of SESI, learners seemed to become more aware of their potentials as active agents in their learning processes and in society. While the implementation of certain pedagogical practices promotes students' development of SESI, this does not assure learners' learning process. Also, learning may occur through situations not designed intendedly as pedagogical means. The actual occurrence of learning processes is difficult to analyse. Learning entails simultaneous internal (psychological) and external (social) interactions (Illeris 2002). Moreover, transformational learning may be triggered by single discrete events or by long-term experiences (Cranton, 2016). Given the innumerable possible configurations that these features may take, learning experiences are unique. Nevertheless, the data shows patterns in SESI learning processes in the four Minors Innovation, discussed in the following chapter.

Chapter 9. Learning catalysts: facilitators that enhance and deepen learning

Socio-emotional skills for innovation are developed by students in the Minors Innovation through varied learning processes stimulated by active and inductive pedagogical approaches. Notably, findings evidence that experiential innovation education using PjBL and two boundary-crossing practices, community engagement and cross-disciplinary learning, enhance SESI. In this context, and exploring the essence of learning processes that trigger, enhance and deepen learning as experienced by Minors' students, the new notion of learning catalysts emerged.

A proposed notion arising from the data is 'learning catalysts', those facilitating conditions of learning processes that promote substantial (important) and sustainable (enduring) development of socio-emotional skills for innovation. Catalysts represent patterns in the data, within diverse and unique learning experiences. Catalysts catalyse when experienced: the term 'catalyst' refers to this 'in-action' role; 'catalysing', perhaps, denoting the process, may be more precise. While features of pedagogical design may favour learning catalysts, these are not pedagogical tools per se. They are features of the learning process, as experienced by learners. The significance and sustainability of learning is considered through students' and other participants' experiences, notably manifested in transformative learning, characterised by the critical questioning of assumptions, profound shift in perspectives and consequent taken or planned actions.

The notion of 'learning catalysts' contributes to responding to the second research question on the mechanisms used by HEIs to promote SESI. Catalysts evidence aspects that support learning, rather than teaching, but these are intrinsically related, especially in formal education. The notion of learning catalysts emerges in the context of experiential IE analysing the development of SESI. The analysis of catalysts, therefore, has practical pedagogical implications for the promotion of SESI in this type of context. Other catalysts may be identified in these and other settings, and the catalysts discussed here may be applicable to other situations. The analysis of these possibilities, however, require further research.

This chapter proposes the notion of learning catalyst and discusses three catalysts arising in the context of experiential IE, largely based on projects and relying on community engagement and cross-disciplinary pedagogical approaches. The learning catalysts identified are *authenticity of the learning experience*, *relation with otherness* and *protected autonomy*. The following sections first conceptually examine the notion of learning catalysts, and then, analyse the three learning catalysts

identified in Minors Innovation, discussing their characteristics, manifestations and contributions to the development of SESI. The chapter concludes with reflections for research and practice.

A. Conceptual proposition: learning catalysts

I propose that learning catalysts spark, accelerate and deepen learning, supporting its endurance. In experiencing catalysts, learners enhance the significance and sustainability of learning, observed through participants' reflections on perspective transformation and consequences in their planned and executed actions. Learning catalysts have been identified in the context of experiential IE, founded in experiencing innovation processes such as need-finding, problem reframing, designing solutions with integrated perspectives, testing and implementing, and in constructivist inductive educational approaches. Project-based learning, cross-disciplinary learning and community engagement shape experiential IE in Minors Innovation. Different mixes of constructivist and innovation-oriented pedagogical approaches, practiced in varied teaching-learning contexts and experienced by unique human beings in particular periods of time, lead to innumerable and unrepeatable learning processes. Within such diversity and uniqueness of experiences, patterns in essential aspects of the learning process of SESI are identified.

Three learning catalysts emerged: a*uthenticity of learning experience, relation to otherness* and *protected autonomy.* Resolving real problems and encountering real-world users support the development of multiple socio-emotional skills. Students expand their social awareness, practicing empathy, perspective taking, respect and active listening. They also become more motivated, perseverant and responsible for their work, exercising agency as innovators-learners. Developing a sense of usefulness by contributing to society strongly stimulates students' learning, developing relevant skills for working towards better innovation outcomes. *Authenticity of learning experiences*, therefore, catalyses learning in the context of Minors.

Relation with otherness may boost SESI too. As discussed, creativity and innovation are enriched when different views are contested and integrated (Csikszentmihalyi, 2010); therefore, innovation processes experienced in IE also benefit from diverse perspectives. The Minors offer students the possibility of collaborating with different others: students and lecturers from other disciplines (and in some cases, other universities and countries), external collaborators to the university and innovation problem-holders with, sometimes, distant realities from those of students. In facing otherness, students initially tend to experience resistance or difficulty with understanding and accepting the other. Through pedagogical conditions, particularly under time pressure, students manifest -to varied extents- transformations in their perspectives towards otherness. They

experience and develop relationship skills such as openness, communication and conflict resolution. In cases, students reframe their understanding of and their attitude towards others, shifting from rejection to embracing and valuing otherness. These skills are valuable for innovative behaviours and beyond.

A third catalyst is learning experiences involving *protected autonomy*; that is, situations in which students are free and encouraged to self-direct their learning process, holding responsibility for their decisions and actions, while being guided, supported and contained by the lecturer/facilitator. Such balance seems to favour students' proactivity, ownership for their work and willingness to manage risks. Yet preferences vary among students in terms of desired balance between having freedom to make decisions and receiving support from educators. Experiencing protected autonomy is directly related with PjBL approaches in the Minors. In PjBL activities in the Minors, students work in groups on specific innovation problems, generally in multidisciplinary groups and often collaborating with partners external to the university. Managed as projects, PjBL activities entail organising tasks, timeframes and results. These settings offer students opportunities to exercise autonomy -individually and in groups-, making decisions and self-directing their learning processes.

The three learning catalysts arose from the data through thematic analysis across the four cases. I searched for patterns that supported learning experiences beyond structured pedagogical methods. In exploring the second research question on pedagogical approaches that supported the development of SESI, experiential and PjBL arose as primary approaches used in the Minors. These, entwined with the boundary-crossing practices of cross-discipline and community engagement facilitated SESI. Yet the data about learners' learning experiences suggested more specific factors that accelerated or deepened learning processes. Authenticity, expressed primarily as 'real-world' problems and people, stood out. Otherness, manifested in notions of cultural distance leading to interaction challenges and opportunities, arose as a second pattern in the four cases. Protected autonomy, derived from an appreciated balance (by students and educators) in learning settings that allows learners to experience freely yet feeling protected. The commonality of these elements was their potentiality to boost learning, in terms of the perceived importance and rootedness of learning. Learning catalysts are thus metaphorically proposed in this thesis to suggest the learning power of these three features.

Authenticity of the learning experience, relation with otherness and protected autonomy intrinsically connect with boundary-crossing pedagogical approaches discussed in Chapters 7 and

8. Authenticity relates to real-world innovation problems worked in community engagement collaborative activities and to cross-disciplinary project-based work, common in professional life. Otherness is inherent in boundary-crossing processes; encountering different others determines boundary-crossing (Suchman, 1993) and substantiates the challenge and value of boundary-crossing (Akkerman and Bakker, 2011a; Guile, 2011; Star and Griesemer, 1989). Otherness is experienced in working across disciplines and in community engagement. Protected autonomy arguably crosses boundaries in one's own development–the essence of learning. The catalyst allows learners to grow in their learning by being able to safely move the boundaries of their own understanding or abilities. In this sense, protected autonomy echoes attributes of Vygotsky's Zone of Proximal Development (1978): an appropriate gap between actual and potential development together with guidance from more proficient persons facilitate learning. As observed in Minors Innovation, the three learning catalysts are inter-connected, build on each other and may be experienced simultaneously. While it is feasible to identify learning dynamics catalysed by these elements, it is unfeasible to separate their contribution to learning processes completely.

As a socially constructed process, learning is mediated by many practices, including boundary-crossing (Griffiths and Guile 2003). While mediating artefacts in learning processes may include other students, community partners, educators and innovation problems, arguably catalysts mediate in processes through which these artefacts mediate. For example, community partners are mediators in learning and the underlying authenticity they bring mediates their contribution to learning processes. Or, students from other disciplines also mediate learners' processes, in which the relation with that 'other' further enhances classmates' mediator roles. Similarly, educators mediate learning, being the guidance-freedom balance experienced by the learner a mediation element in the educator-learner relationship. Perhaps learning catalysts may be proposed as mediators of mediators.

Learning catalysts relate to pedagogies as learning catalysts may define certain pedagogical methods stimulating specific learning objectives. For example, authenticity of the learning experience is sought in community engagement, PjBL and other constructivist learning approaches. Relation with otherness is implied in cross-disciplinary learning, although it may be not acknowledged centrally and explicitly in the rationale supporting cross-disciplinary practices. The same logic applies to otherness in community engagement. Protected autonomy is entailed in PjBL approaches, yet the descriptions and benefits grounding PjBL may not assess the balance embedded in this learning catalyst as a feature supporting learning. Other active learning approaches not necessarily framed in projects, and where students hold responsibility for deciding

and guiding aspects of their learning processes also reflect the protected autonomy catalyst. In the Minors, the latter is observed, for example, in cases where students conduct one-off activities with community partners, such as visits to certain communities to identify needs/problems to be resolved innovatively without involving following-up activities with the same communities. Therefore, the proposed learning catalysts emerge from the Minors' experiential teaching-learning contexts which may be characterised as innovation-centred, constructivist, inductive, cross-disciplinary and collaborative, both in terms of the notable work in student groups and in the community engagement dimension. These pedagogies set the foundations for the identified learning catalysts, but differences remain between both notions.

Learning catalysts are meaningful inasmuch they are experienced by learners (with different degrees of awareness). Catalysts relate to pedagogical conditions but characterise learning processes, as hereby suggested. Also, while pedagogies are intentionally designed to promote learning objectives, catalysts may be conceived purposefully or not, potentially contributing to learning unintentionally. For example, some lecturers designed learning activities explicitly intended to visit social contexts distinct from their regular environments to observe different realities. In this case, an element of relation with otherness is embedded in the educational design. Contrarily, the degree of guidance offered by lecturers to students may in cases be set without seeking a balance between support and autonomy, i.e., protected autonomy. However, the data shows that in multiple occasions educators do promote learners' self-directedness by designing pedagogical activities that imply some steering from educators and significant responsibility from learners in their learning process. There are numerous cases where the intendedness of learning catalysts is debatable. For example, when forming study groups for PjBL, a central criterion explained by educators was to mix backgrounds to foster diversity that contributes to innovation. Lecturers either formed the groups (or defined composition criteria) or allow students to decide the groups by themselves. When students decide, a common educational aim was that students experienced the potential benefits and drawbacks of mixing or not, with peers from varied backgrounds. In the case of groups mixed by lecturers, the catalyst of relation with otherness could be experienced, yet the mainstream argument explained by educators is the value of (disciplinary) integration for better innovation results. When educators allowed students to decide, possibly the catalyst protected autonomy may be implied, however, such balance was not mentioned explicitly in these cases. Nevertheless, despite the intentionality of including practices related to learning catalysts, as with pedagogies, learning is not assured.

The relevance of learning catalysts lies in their potential to facilitate important and enduring learning experiences. That is, learners may develop substantial and sustainable learning experiences aided by catalysts. The significance of learning supported by catalysts is observed through students and other participants' appreciations of learning processes. The sustainability character of learning is anchored through learners' self-reflection on their learning experiences, which may lead to shifting attitudes, viewpoints and understandings, and to subsequent actions, taken or planned. This learning is characterised by transformative learning elements: experiencing a dilemma, critically assessing one's assumptions, changing perspectives and acquiring resources for new courses of action (Cranton, 2016). That is, catalysed learning processes may lead learners to experience transformative learning. This transformation refers to revised meaning-making processes guiding future actions based on more open viewpoints (Mezirow, 1991). However, learning catalysts may also support learning processes not necessarily featuring substantial or enduring, transformative-looking qualities. That is, catalysts facilitate yet do not assure substantial and sustainable learning. The empirical analyses of the following sections discuss cases that show indications of transformative learning and others in which the potential transformation is unknown.

The mechanisms through which learning catalysts catalyse learning processes are multiple. A key commonality among the three catalysts is the enhancement of self-reflection. Self-reflection leads to assessing one's assumptions and potentially shifting perspectives prompting different pathways of action. Questioning is central in transforming learning theory and in other self-empowering theories, for example, as examined by Paulo Freire and in Bildung literature. Another process common to the identified learning catalysts is the tension, difficulty or challenge that learners experience prior to the transformation of perspectives. Unfit believes, thoughts or behaviours trigger their questioning, usually feeling discomfort before. From a transformative learning theory perspective, and as anchored by Jack Mezirow in his framework, this uneasiness is framed as a disorienting dilemma (2000). Therefore, learning catalysts may accelerate and deepen learning, but prior to that, learners may experience difficulties because there is a process of reassessing and questioning oneself. After that reflection process, more sustainable learning may occur.

Summarising, the notion of learning catalysts emerged thematically from the data on the development of SESI in Minor Innovation students. Learning catalysts are proposed as facilitating conditions that boost and deepen learning processes, of SESI and beyond. Catalysts relate to features of inductive experiential IE and active cross-boundary pedagogies shaping learning in the Minors, including community engagement and cross-disciplinary learning. Yet learning catalysts differ from pedagogies in that they are not necessarily incorporated intentionally as pedagogical

practices and most importantly, in that they work in catalysing processes experienced by learners. Catalysts may contribute to learning in varied degrees; when substantial, enduring learning may occur. This is manifested in processes that characterise transformative learning, notably in the questioning of assumptions, perspective transformation and change in courses of action. While features describing catalysts may be incorporated in pedagogical designs, this does not assure that learners experience in transformative ways. Three interrelated learning catalysts emanated from the analysis of learning processes: the authenticity of the learning experience, relation with otherness and protected autonomy. These facilitators, identified in undergraduate experiential IE, may be applicable to different contexts, while other catalysts may emerge. Further research is required to explore these aspects. The following sections analyse learning experiences of Minor Innovation students' catalysed by these three elements. Three aspects are explored: the meaning of each catalyst, their manifestation in Minors Innovation and their contribution to the development of SESI and in cases, to experience transformative learning experiences.

B. Learning catalyst 1: Authenticity of learning experience

1. Meaning and relevance of the catalyst: reality motivates

Authentic learning contexts allow students to experience their learning processes more realistically, fostering reflexivity on themselves and their position in society in relation to others. Authenticity in teaching-learning practices has been analysed and promoted in varied settings. Enhanced motivation, collaboration skills and self-directedness are some of the skills developed, as reported in the literature. In the IE context, and specifically in the four Minors studied, the results are consistent with previous research. In relation to SESI, authentic learning opportunities promote more responsible approaches towards students' learning outcomes, as in many cases they may affect others' lives. Moreover, beyond increasing self and social awareness, authentic education in the innovation (and entrepreneurship) landscape, given its hands-on approach, encourages students to develop their own innovation and entrepreneurial endeavours. That is, learners become active agents, realising largely self-driven real-world projects, beyond formal education tasks (the Minor serves in cases as an initial step in students' extra-curricular entrepreneurial activities). Engaging and reflecting upon such experiences orients students on their life purposes and values; what matters to them. Therefore, authenticity represents a door for students' professional development and a connection with the labour market, notably in this case, to self-created endeavours.

Authenticity is presented in Minors Innovation centrally through real problems that a certain community experiences. Yet participants also value the work-like experiences developed in PjBL (with objectives, time restrictions and operational challenges) and cross-disciplinary learning activities (they resemble real-life team working). Regarding real problems, they are local, e.g., an issue in the university campus; national, e.g., mobility difficulties of elderly people in specific known-to-students vulnerable sectors; or global, as the melting of ice reserves. These types of real-world problems provide the basis for innovation processes and usually are incorporated in PjBL pedagogies.

Students search and access information about the problem to engage in the innovation process and, according to the courses' requirements, design possible solutions. In some cases, students interact with problem-providers and/or with problem-holders. For example, in the case of a problem in the university campus, students may speak (possibly using research methods like semi-structured interviews) to other people on campus, exploring their needs. According to the problem framing by lecturers and/or students, it may imply having a clear counterpart, for example, a marketing team in a company or urban planning offices in a municipality. In other cases, the counterpart or the beneficiaries of the potential solution may be less defined groups, such as pre-school children. In the latter case, students may connect with these groups in diverse ways. The extent to which students personally communicate and collaborate with persons outside the formal boundaries of the university in the exploration and design of solutions varies significantly. In some cases, while the problem is non-fictional, students may not interact with its stakeholders; in other more authentic learning experiences, students vividly observe and understand the problem by connecting with the involved parties. The extent to which students are encouraged/allowed to experience the authentic context that provides grounds for the learning process shapes also the type and extent of SESI's development.

'Authentic', derived from the Greek 'authentikos', expresses the features of principal and genuine. It can also have a normative moral connotation, which is not applied here. Yet, what is genuine in the context of IE in globally-engaged universities in Chile and the Netherlands? What 'societal reality' do universities want to present to students (in the case of top-down designed innovation challenges) and what realities do students decide to explore in authentic learning experiences (when working in student-defined problems)? Given the substantial collaborative dimension of Minors Innovation and the underlying value of diversity in innovation-related settings, these questions are complex. The four Minors Innovation explored are collaborative in their multidisciplinary dimension, involving students and faculty with different backgrounds, and

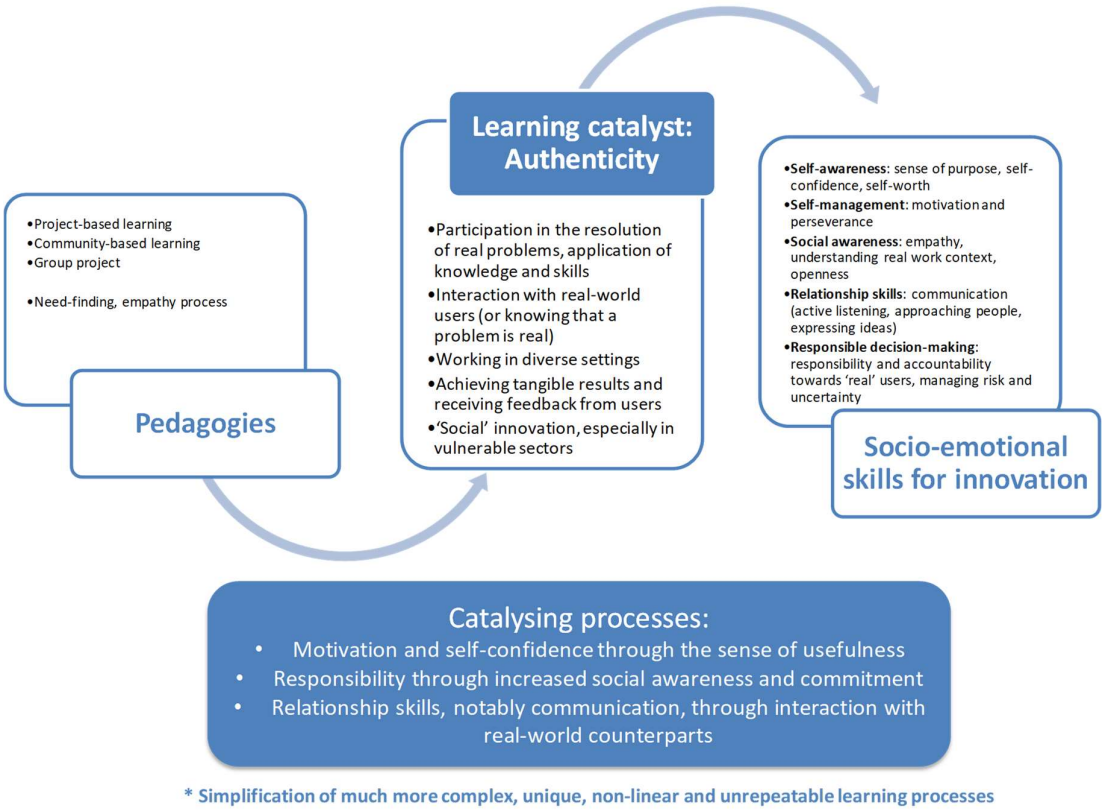
facilitators/ lecturers that include both, full-time university staff and professionals working mostly in non-university settings. The Collaborator case is designed as a collaborative initiative between three universities with diverse disciplinary orientations, and as declared by interviewees, dissimilar values and modus operandi. Beyond the collaborative dimension, Minors Innovation are non-mainstream formal educational activities; as discussed earlier, these are optional pathways for students. While the governance models across the four Minors Innovation vary, generally, there are relatively free and open spaces to explore new teaching-learning methodologies, including the incorporation of genuine problems to be addressed innovatively by students. Different emphases are observed in authentic problems used in the Minors. The explorative qualitative methodology used in this study is not suitable to assess with precision the types of problems considered, which also vary between courses and over time as do the leaders and lecturers of the programmes. However, elements highlighted by participants through semi-structured interviews inform the types of authentic situations pedagogically used. These were analysed in Chapter 8.

Despite variations in the type of 'real world' problems and in conjunction with PjBL and cross-disciplinary education features, students manifest how experiencing authenticity catalyses their learning processes. Especially pertinent to this research, authenticity promotes SESI. In some cases, it fosters transformative learning experiences where students question and shift premises that guide their actions. Illustrative situations are analysed next.

2. Socio-emotional skills enhanced through authenticity of learning experience

Motivation, commitment and responsibility towards society and particularly, problem-holders are strongly catalysed by authenticity. In real-world projects students act more resourcefully, proactively and responsibly. Through connecting with persons and organisations beyond the university context, students shift their perception on their potential impact in the world. In these interactions, learners also develop their communication skills, instrumental to perform necessary tasks in experiential IE settings. The following figure summarises the observed patterns in the relation between this learning catalyst, pedagogical approaches and skills developed.

Figure 9. Learning catalyst 'authenticity of learning experiences': related pedagogies, skills promoted and catalysing processes



Source: author's.

These patterns are strongly visible in three of the four cases. In one case, participants manifested that the interaction with 'real-world' stakeholders was limited in the Minor Innovation context (varying between modules and over time). Still, they value the possibility of doing so: "I would like that people come to present, and some people have come, sometimes they go to courses. I remember… and I found it super fun…" (CL.EXP.10.student). When asked what he gets from that experience, the student continues: "To know how the thing works, how easy, how difficult it is, know what the challenges that they face are because sometimes one sees it so easy… And that people that come to tell their experience, "no, it was hard, I tried the first time and failed, I had to try a second time" (CL.EXP.10.student). The student refers mostly to guest lecturers, a familiar type of interaction with external stakeholders. He also makes references to the value of this activity for understanding how innovation and entrepreneurship work in practice. That is, despite few authentic learning experiences, there is an appreciation of their benefit.

In the other cases, authentic learning experiences are common. Three patterns outstand in the data on SESI development: motivation and self-confidence through the sense of usefulness; responsibility through increased social awareness and commitment; and relationship skills, especially communication. In Chapter 8, when analysing the contributions of community engagement in the development of SESI through authentic learning experiences, several illustrative cases where discussed. Next, the essence of the catalysing process is examined.

In authentic learning experiences, students tend to feel their work is valuable because they can see the (potential) use of their work and its (potential) contribution to 'real-world' people. This sense of usefulness enhances their motivation and self-confidence. As a learning catalyst, authenticity activates their eagerness to create impact in their learning process, and as professionals and citizens, by being active agents. Authenticity triggers an 'innovation spirit' to create change. While directly interacting with problem-holders catalyses learning, simply knowing that an innovation challenge is real, and their work may be applied, increases students' motivation. Yet, authentic experiences not only boost learners' enthusiasm and commitment to work harder before and during the process – usually in the form of PjBL- but it supports students' self-confidence as tangible results are achieved, and possible valuable feedback is received from third parties. As a student expresses, "it's like you can be proud of what you do because you just make an exam, you can pass, but no one is proud of you" (NL.NET.9.student). External recognition then, also plays a role in learners authentic experiences. Of course, as discussed in the previous chapter, multiple challenges are embedded in educational practices that permit authentic learning experiences, and therefore these benefits are not assured and in fact may lead to educational difficulties.

A second pattern in the development of SESI through authentic learning experiences is that increased social awareness and commitment lead to a higher sense of responsibility. A student illustrates: "it was a social topic, [we had to] go to see or go to prototype, to research, to test with the user. There one has to be very responsible because, if the project doesn't move forward it leaves very worried like, those people that remain hopeful. And that also, you don't have to promise, you have to explain that it is for school, for uni, difficult. Like one was to be very responsible I find" (CL.EXP.8.student). It seems that this enhanced responsibility is expressed more vividly in contexts where innovation beneficiaries are from impoverished backgrounds or manifesting serious needs. As students empathise with problem-holders, they expand their social awareness about difficult contexts boosting consequently their sense of responsibility and reliance.

Communication skills are also improved through authentic learning experiences. Unfamiliar contexts and new activities challenge students in their interactions. A lecturer exemplifies: "it was to identify needs and find solutions to different problems that the people from the Municipality were detecting in markets, in the square… My teaching assistants went with them [students] and told me that initially it had been very hard for them, to get close to an unknown and approach him/her and ask" (CL.ALL-R.4.lecturer). The lecturer reports that after receiving guidance from teaching assistants, "they all scattered and each went to ask and enquire" (CL.ALL-R.4.lecturer). Overall, students (seemingly more in the cases in Chile) experience a difficulty in communicating in authentic settings with people from different backgrounds. Through practice, and with the support of educators, they learn and implement communication techniques, which learners tend to value as relevant skills developed in the Minors and applicable in other spheres of life.

3. Illustration of transformative learning: Reliability and proactivity

The enhanced sense of responsibility fostered in authentic learning settings is linked to increased awareness of other professional abilities and attitudes. The following case illustrates a learning experience, possibly transformative, on the importance of being attentive, reliable and open when working in 'real-life' contexts.

> "…it like became apparent that in real life in contrary to our school exercises, in real life you have to actually keep on going even if there's uncertainty, right. You have to reach out in every tiniest move you make if every person you talk to can be the bridge to the next experience" (NL.NET.10.student).

The student continues explaining the experience of networking in a fair where he met representatives of a foreign company: "And there we just talked to random people… to make some connections and everything… that led to that insight that you have to be proactive and assertive to try to improve your situation or the goal you're trying to reach, basically" (NL.NET.10.student).

In this case, the student experienced the dilemma to grow into a professional mindset, understanding dynamics important to real-life experiences, in contrast to what the student perceives are relevant in educational settings. He reflects on this transition, recognising the new attitudes required. Through practical experiences, he exercises the abilities, enacting the learner's transformed perspective.

Authenticity of learning experiences catalyses the development of SESI as learners observed and connect with real-world innovation problems and problem-holders. These interactions foster motivation, empathy, self-confidence and responsibility. In some cases, learning may go beyond specific skills and trigger questioning of assumptions and entailed perspective transformation.

C. Learning catalyst 2: Relation with otherness

1. Meaning and relevance of the catalyst: from rejection to valuing diversity

Otherness is implicitly or explicitly relevant to SESI in many ways, as manifested in conceptual approaches used in this thesis. The diversity embedded in different others is central to creativity and innovation. Boundary-crossing pedagogical practices are an invitation to explore otherness. This partly sustains the pedagogical value for SESI of both boundary-crossing approaches analysed, community engagement and cross-disciplinary learning. In that sense, crossing the boundaries limiting sameness and otherness nurtures SESI in various ways. As a learning catalyst, relation to otherness refers to the vivid experience of learners. It differs from the pedagogic device to which students are exposed. In fact, as proposed earlier, learning catalysts may be devised pedagogically, but reveal their catalysing value only when experienced by learners.

Relation with otherness is a second important catalyst for developing SESI, despite (and greatly, because of) the challenges entailed in relating with different others. Students' social identities comprise multiple dimensions. Features acknowledged by students and other participants as relevant in students' relationships with different others include their disciplinary background, gender, age, nationality, social class, personality and being a university student. Identities are multifaceted, dynamic and contextualised and therefore numerous other characterisations may shape experiences of otherness as catalysing processes. The design of Minors Innovation comprises several elements that facilitate students' exposure to otherness. Students observe, connect and collaborate with persons that may be regarded as different or unfamiliar. This includes, students and lecturers with different disciplinary backgrounds and varied epistemological and cultural bases, and problem-providers or problem-owners for innovation PjBL who may also be regarded as distant others in various ways. This implies that the learning context differs from their regular one. For example, students recognise lecturers' distinct pedagogical methods, related to the innovation subject and to educators' innovativeness in teaching-learning practices. Moreover, as noticed by some students, varied educational spaces (such as specific buildings or areas in the university campus) also represent different learning settings for Minor Innovation students. These elements

shape otherness, as experienced by students. However, these features are not necessarily included in the Minors seeking such diversity.

Exposure and relation to otherness may support SESI development, entailing also difficulties in accepting, relating and valuing different others. Interacting with different others, students' own identity is contested, against others' identities and their self-image. Some pedagogical conditions observed in the Minors promote and require the engagement with others in delimited timeframes. Specifically, innovation-oriented project-based pedagogies demand collaboration and tangible results in usually short periods of time. This pressures students to deal quickly with their possible resistances when working with different others.

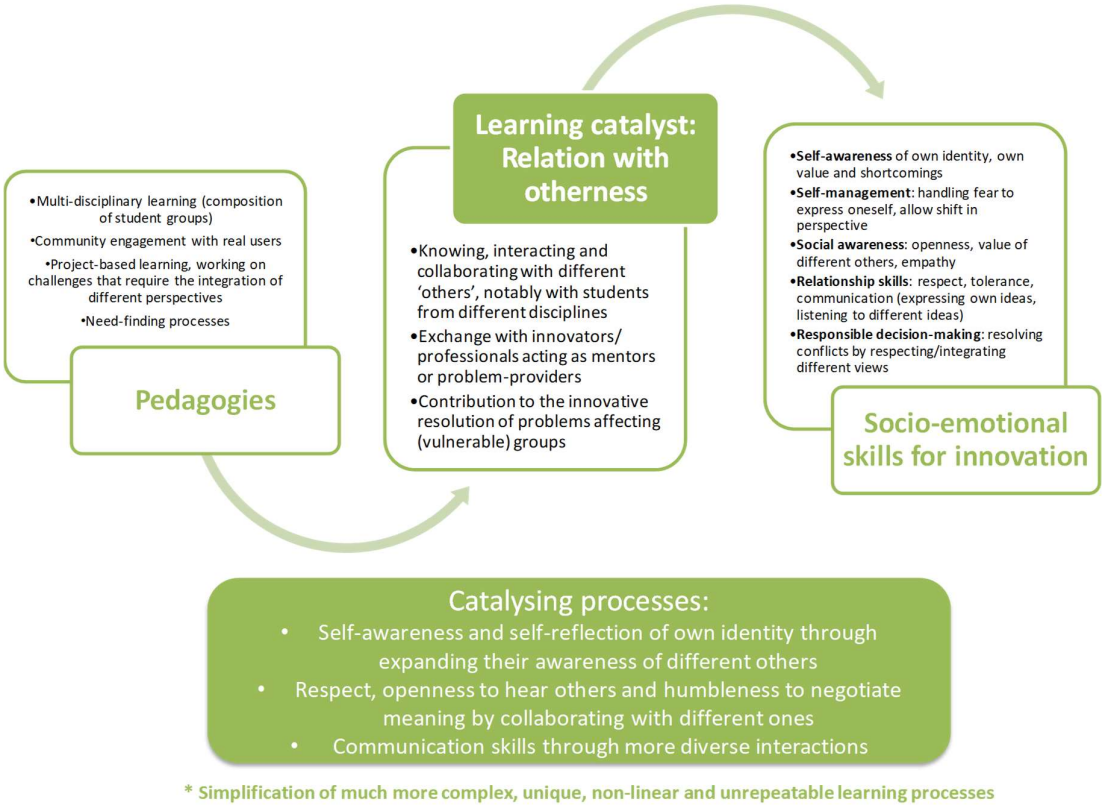
While every learning experience is unique, the data suggests that these teaching-learning conditions, where relating to different others is central, promote the development of certain SESI, such as communication and openness. These support shifts in perspectives towards different others. Some students narrated reflections on their (adjusted desired) roles in the world, manifesting enhanced self-awareness. Students become more socially aware, understanding others' views, others' norms and others' contributions. Through interacting with different others, students further respect diversity and take ample perspectives on the innovation challenges and their social context. Moreover, some students manifested profound shifts in premise perspectives, reframing their understanding of and their attitude towards others, shifting from rejection to appreciation of otherness. That is, with different degrees of depth, some students transform their paradigms on the interaction with different others.

2. Socio-emotional skills enhanced through relationship with otherness

Relating to otherness favours multiple SESI with variations depending on the type of relationship with the other. For example, working with peers from different disciplines supports interdisciplinary communication and self-awareness as students are confronted to their own identity in understanding their contribution to cross-disciplinary work. Collaborating with professionals or innovators participating in educational process as mentors, evaluators or problem-providers help learners to expand their social awareness and to reflect on their professional aspirations. Others who represent vulnerable populations boost empathy and sense of commitment and responsibility towards the corresponding groups, and as citizens and innovators. Different educational practices and epistemological standpoints conveyed by educators that differ from learners' mainstream educational practices incite openness and questioning of assumptions. That is, otherness is manifested in multiple ways and catalyses many SESI. These features of pedagogical practices may

intentionally or unintentionally seek for diversity. However, the encounter with diverse persons and situations is central in nurturing SESI. This may occur from states of discomfort, and participants' preparedness to overcome the unease and develop skills that support their learning experiences is varied. The following diagram summarises pedagogical practices related to the learning catalyst of relating with otherness and key skills developed in each of the socio-emotional learning dimensions.

Figure 10. Learning catalyst 'relation with otherness': related pedagogies, skills promoted and catalysing processes



Source: author's.

Exposure to otherness prompts questions on one's assumptions and viewpoints. Self-reflection appears in the data as a common process experienced by learners when knowing broader realities. In relation to contrasting situations, learners assess their own identities, including their professional-disciplinary identity and their professional-citizen identity. As discussed through illustrative quotations in Chapters 7 and 8, such self-reflection helps students (re)define life and professional purposes and integrate newly adopted perspectives and skills.

Exchanges with different others also encourage shifts in relationships with different others. Associated skills are strongly evidenced from practice in experiential IE. Learning to develop respect, clarity in expressing oneself, openness to hear others, humbleness to negotiate meanings across boundaries and the capacity to create collectively (in this case innovation solutions) are abilities appreciated by participants in their experiences of otherness. In cases, relating with otherness catalyses deep changes, as illustrated next.

3. Illustration of transformative learning: Liberation from 'the right answer'

The learning catalyst of relation with otherness may support perspective transformation regarding different others, and one's thoughts and beliefs. The following quotation illustrates a process of interdisciplinary learning, leading to interdisciplinary communication and to a profound shift on the value of assessing one's assumptions. Discussing about innovation and creativity processes, the student comments:

> "I think it's a collaborative process. I mean, the fact that you're always working [with] people who, per definition, disagree with you. That kind of, makes it a very interesting process because, I mean, even though she was a good friend of mine, she is an architect. So she and I would always disagree on everything… it would never be a smooth process, but that's exactly what you don't want. You don't want it to be a smooth process because, then you realise you're talking the same language and you're taking the same considerations and assumptions, so you're forgetting a lot of things. So I think the most important skill that we learnt is we're able to talk with each other. Even though that might sound very easy, but at first, it was really hard for us to talk at academic level between students because you would have, like, disciplines that are so far apart. And, at the end, we were talking the same language… well, it sounds very revolutionary, but breaking boundaries with your own assumptions… you're being schooled to say that you know the right thing, that your perspective is the right answer, right?... But throughout the processes you realise that every idea is a question mark. And you kind of doubt of your own ideas more because, then you realise that there is more to the subject than just your own perspective. So, I think that is one of the most valuable skills that I learnt" (NL.COL.6.student).

The student alludes to disciplinary tribes (Becher and Trowler, 2001) in recognising his original belief that collaboration among disciplines by default leads to disagreements. The dilemma he faces, then, is how to handle varied disciplinary standpoints -manifested in cross-disciplinary innovation PjBL-

and how to deal with the paradigm of 'one right answer'. He critically assesses the need of developing capacities that allow him and the group to manage different disciplinary views, which is instrumental for achieving the project's objectives. In this critical reflection on interdisciplinary communication premises, the learner develops a new approach towards others' disciplines and towards his new own professional collaborative attitude. He transforms his perspective. 'The right answer' approach is no longer helpful, nor valid. He liberates from this belief, opening to other attitudes. His questioning is consistent with the critique to simple (single) solutions - or solutionism- in the professional practice landscape, which acknowledges that diverse knowledge practices are needed to grow professional communities and to work in information-intense settings (Nerland and Hasu, 2020). The student's paradigm shift is triggered by reflection on the requirements to fulfil the courses' activities; the formal, yet optional educational context (and its assessments) motivates this and other students to question and potentially change perspectives and behaviours. The learner appreciates the importance of this transformation in his approach towards collaborating in diversity. The substantiation of his narrative expresses a long-lasting change of perspective.

Exposure to otherness facilitates the development of multiple SESI, although difficulties tend to be experienced by learners initially. Otherness promotes SESI in the five dimensions of socio-emotional learning, notably in relationship skills and self-awareness. Transformative learning may also be triggered through self-reflection resulting from interactions with different others. In Minors Innovation, the central pedagogical approaches of cross-disciplinary education and community engagement innovation PjBL strongly support the relation to otherness. Otherness, then, is ubiquitous in experiential IE in the cases studied.

D. Learning catalyst 3: Protected autonomy

1. Meaning and relevance of the catalyst: balance between allowing agency and feeling supported

A third catalyst is protected autonomy in teaching-learning practices, that is, experiences in which students are free and encouraged to self-direct their learning process, holding responsibility for their decisions and actions, while being guided, supported and safeguarded by educators. This facilitating condition is present notably in PjBL, where students work in groups resolving an innovation problem, need or challenge. The projects are usually developed in multidisciplinary groups of students and, to different extents across the four cases, in collaboration with partners external to the university. The lecturing or facilitation style determines the form and extent to which

students need to make decisions and to hold responsibility for their actions. Areas of autonomy and responsibility include the formation of project student groups; the definition of the innovation problem that students tackle; the organisation of students' work, including means (e.g., online or face-to-face), timings and modes of group work; the relationship with and accountability to external stakeholders when pertinent; and the presentation of results. The dynamics of exercising autonomy with responsibilities and feeling containment from the learning context vary significantly from case to case, seemingly being the depth and form of collaboration with external stakeholders in real projects an important variable shaping both, autonomy and protection.

Both aspects of the balanced condition of this catalyst, the protected aspect and the autonomy, which embeds responsibilities held by students, are acknowledged by participants as aspects facilitating learning. The possibly sought balance, however, is generally implicit in interviewees' narratives. The promotion of self-direction, autonomy and ownership for their learning is emphasised by several educators, as illustrated in the next quote:

> "I really want students to take ownership of their own learning, and I'm not the one who should tell them what to learn, so I've taken the exam out, for example, because I don't want to evaluate them based on grades… So in the very first day I put them in a circle and… everyone could really say, "Okay. This is why I'm picking this course and what my personal learning objectives are," and I really invited them to take ownership of that… it's not a top-down, one way stream… they can ask their peer, if there's a level of trust and friendship that they feel comfortable with that… and when they don't understand it as a group, they come to me and my co-teacher" (NL.NET.3.lecturer&programme-manager).

The educator outlines multiple aspects of the 'autonomy' and 'protection' components of this catalyst. Centrally, autonomy refers to allowing students to take responsibility and ownership for their learning trajectory, by defining learning aims, working on them and assessing the progress. It also has implications on formal assessment. As the quoted educator proposes, the learning driver shall not be grades, but the satisfaction of learning. Implicitly, the educator aims at an 'ipsative assessment' approach to motivate students, whereby the focus is on learners' self-progress through their learning journey rather than on standardised -and competitive- performance criteria (Hughes, 2014). The protection, or caring dimension, manifests in the educator's willingness to support students as a facilitator and to guide self-reflection.

Furthermore, in group work contexts participants discuss learning with and from peers as representing both, autonomy (from educators) and responsibility (with classmates). On the latter,

however, there are different perspectives on students' preparedness to engage in collective learning settings. Asked if students feel responsible or aware of their peers' learning process, an educator comments: "No, no, no. So you have to build that from… in the courses by making them jointly responsible for the end products… but also giving them increased responsibility for the process" (NL.NET.7.lecturer). Other participants, including students, explain that previous (school) experiences in team-working support their sense of peer-cooperation in learning.

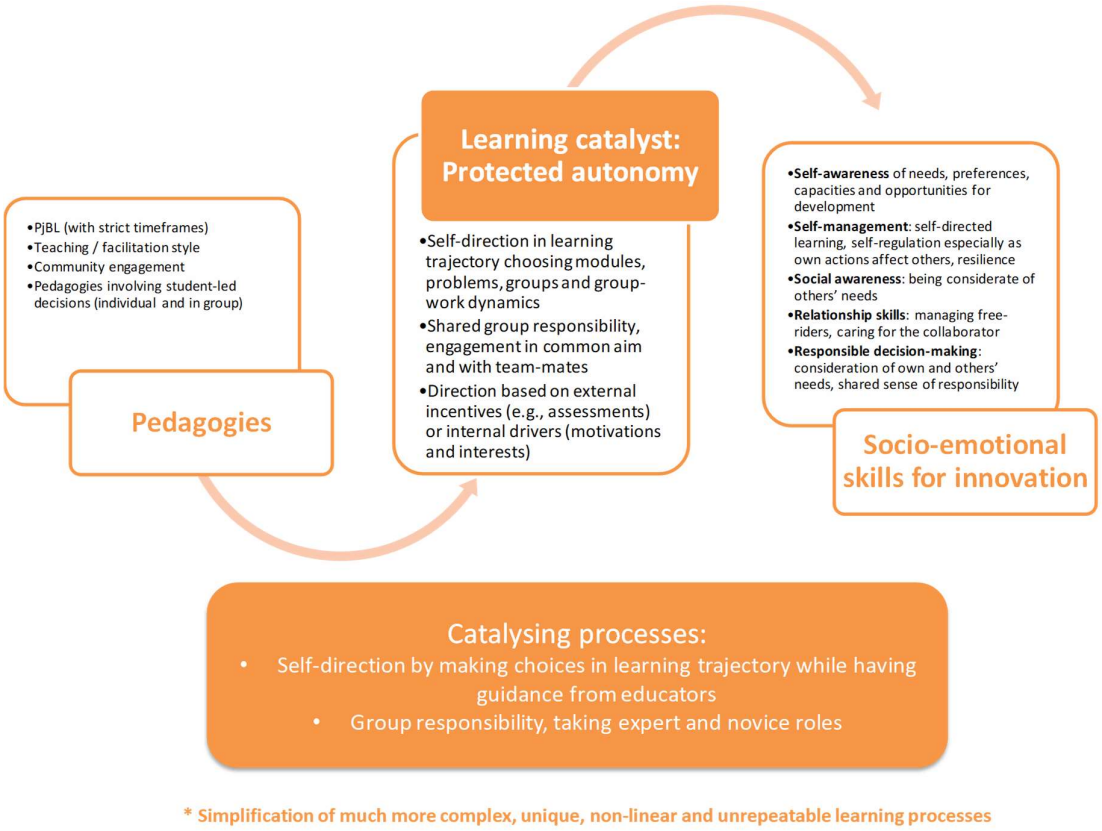
Lecturers, as exemplified in the previous quotations, acknowledge their role in supporting students, related to the 'protected' aspect of the catalyst. This is the feeling of support experienced by students coming from more experienced persons. In cases, though, the 'protected' feature is experienced by students through their identity as university students, vis-à-vis, graduates and professionals. Being a student is interpreted as officially being in a learning phase, with lesser costs than risks compared to professional life.

In the context of this learning catalyst, multiple socio-emotional skills that favour innovation are enhanced. These skills relate to those developed through related cross-boundary pedagogical approaches discussed in Chapters 7 and 8. The following section summarises the relevance of protected autonomy in the development of SESI.

2. Socio-emotional skills enhanced through protected autonomy

The development of SESI facilitated through protected autonomy relates to the five dimensions of socio-emotional learning, yet notably in the areas of self-management, social awareness and responsible decision-making. The following diagram summarises manifestations of this learning catalyst, its relationship with pedagogical approaches and the development of SESI, as analysed in the four Minors Innovation. As with previous catalysts, this simply shows patterns within unique experiences.

Figure 11. Learning catalyst 'protected autonomy': related pedagogies, skills promoted and catalysing processes



Source: author's.

Within the multiplicity of entailed processes, two SESI outstand. One is self-directed learning, which derives directly from the catalyst's description. The other one is group responsibility, strongly present in the Minors through PjBL.

Self-directed learning, the ability to manage one's learning trajectory by setting goals and actions for their accomplishment, is a key SESI boosted through protected autonomy. The equilibrium between receiving guidance from educators and experiencing autonomy to make decisions is illustrated next, by a student explaining why she appreciates this freedom:

> "… because it gives room to dive deeper into the things that I'm interested in, or that my group is interested in… So we chose the one that we think is the most useful for them [innovation results' users] but also that we are interested in… my motivation determines a lot on how much effort I'm willing to put in, and because of that also the end result. So when I'm interested and thus motivated then the outcome is usually also better…

> I think a bit more freedom would be good, but I also think that they shouldn't give us too much freedom because I'm afraid that then people tend to go back into their own field of study too much. What I really like about this Minor is that is so interdisciplinary, and I'm afraid that if you give us too much freedom then we will not use that aspect" (NL.COL.12.student).

Discussing PjBL experiences, the student analyses self-direction related to motivation, dedication, and therefore results. Yet she acknowledges too the collective agency emerging from interdisciplinary work, and the need to be guided by educators in that collaborative process. The catalyst, then, permits students' engagement in their learning process, developing self-regulation skills and relationship skills, when they need to collaborate across disciplines.

Developing shared sense of responsibility is a second essential learning process boosted by protected autonomy in the context of PjBL. The shared responsibility derives from the responsibilities that students hold regarding their own learning process, from the group work component, and from the interaction with external partners, all frequent aspects in experiential IE.

As discussed regarding community engagement learning, responsibility is also strengthened in project's with real-world users or beneficiaries. The shared aspect of responsibility emerges from the group work and is enhanced by the authenticity of the problem tackled. Student's protected autonomy relates to the negotiation of formal responsibilities, agreed between students and/or lecturers with the counterparts.

In interdisciplinary PjBL process, especially when student groups are designed promoting disciplinary diversity, students participating in the Minors often acknowledge being at both sides of a disciplinary knowledge boundary. Expert and novice roles are taken depending on their familiarity with the subject in question. The possible uniqueness of expertise in a study group implies that contributing adequately to the group's tasks has significant consequences in the overall result. Then one aspect of shared responsibility arises from individual 'expert' contributions that altogether shape the group's outcomes.

This relates to PjBL group assessments. One's actions affects others' grades. Therefore, students feel both, the need to manage possible free-riders, and a sense of responsibility for the group. Moreover, in these cases, the protection aspect of the catalyst manifests in peers' relations too. "If we are a team, the team needs to be the most possible connected, so, one needs to take care yes or yes of what does the one next to you and don't leave him aside" (CL.EXP.9.student). Certainly,

this illustrates one side of the coin; other students may be unengaged and try to benefit from their peers' work.

3. Illustration of transformative learning: Self-belief

As with the other catalysts, transformative learning experiences triggered by the catalyst of 'protected autonomy' are observed. The following case illustrates a shift in perspectives and behaviours concerning the student's self-confidence. Centrally, her development was supported by an educator, enabled by her self-reflection and anchored through her action.

> "[The professor] made us write, he made us a series of questions and made us know a lot of the inner part of us. And one is not accustomed to those kinds of modules in which, one looks inwards, judges oneself, see what is right in oneself, what is wrong, how I can reinforce this ability that maybe is not so comfortable. And the teacher was super good, it was, like a psychologist… [It was important] to build a trust that I didn't have before, that also comes a bit from my quest to want to transform what I said before, that I came as very enclosed, like I was not me, so the Certificate [Minor] allowed me to trust…
>
> There were so many challenges for me in the [Minor], of confronting new people, of being in modules that I had no idea about... so, getting out of the comfort allowed me to realise that I was able to develop other types of skills and accomplish satisfactorily… The same fact of giving my opinion, for me it was already such a giant achievement, "well, today I could comment" and the teacher congratulated me… It was already like an achievement that trust, I believe. And also to have other visions regarding life in general, not just the profession" (CL.ALL-R.11.student).

This case denotes a transformative learning process because the student experienced the dilemma of expressing herself in unfamiliar contexts, practiced self-reflection, adopted new perspectives on her capabilities and consequently changed her behaviour. This illustrates learning as becoming (Wenger, 1998). In that sense, the reflective practice was a challenging process of enhancing self-awareness, learning and change (Hughes, 2009). Also challenging was to participate in a multidisciplinary classroom, being the only student of her study programme. In self-reflection processes aided by pedagogical tools proposed by the lecturer, she *re-cognised* herself and her potentialities. The classes served as arena for practicing and developing her communication and self-confidence skills, leading overall to a transformation in perspective about herself. The learner acknowledges her achievement in trusting herself and participating in the challenging context. This

case evidences the importance of this catalyst. The balance between the educator's support and the space for exercising her agency is key.

In conclusion, the learning catalyst of protected autonomy relates to pedagogical design aspects that shape students' opportunities to direct their learning experiences, defining the extent and type of responsibilities they hold. Teaching and facilitation styles are central in students' feeling of support from educators. Participants in this study show varied preferences in their desired balances between assistance and autonomy. Overall, the catalyst contributes to the development of multiple SESI and to some learning experiences regarded as transformative. The essence of these contributions is that students feel safe and confident to be agentic.

E. Reflections on theory and practice

Learning catalysts are proposed as conceptual tools to characterise their facilitation role in learning processes where students develop SESI. The term 'catalyst' indicates that these facilitating conditions trigger, accelerate and promote the sustainability of learning processes. In the cases studied, three catalysts emerged, characterising the essence of students' learning: the authenticity of learning processes, relation with otherness and protected autonomy. These catalysts potentially support learning significance and endurance, notably as learners enhance their awareness and shift perspectives that seem long-lasting and relevant for learners themselves. These processes represent key patterns observed in the data, within the uniqueness and diversity of learning experiences and mechanisms through which these catalysts contribute.

The proposed learning catalysts focus on the learning experience, integrating socio-emotional skills for innovation (as learning outcomes) and pedagogies (as teaching practices). In bridging pedagogical approaches and skills, the teaching-learning context is central. The context in this study is experiential innovation education embedding boundary-crossing practices like cross-disciplinary education and community engagement, framed frequently in innovation-oriented PjBL. The latter means that students collectively execute innovation processes such as need-finding, problem reframing, exploring solutions, designing, testing and iterating. Teaching-learning in the Minors (in their experiential components/modules) is largely conceived as constructivist and inductive, exercising learners their agency notably through self-directed learning processes. In this context, learning catalysts emerge, being directly related with pedagogical practices, yet differing from these. While pedagogies are intentionally conducted generally by educators (with varied results), catalysts are experienced by learners, being the learning experience intentionally driven by catalysts or not.

The relation between specific pedagogical practices and learning catalysts is multiple. The authenticity of learning experience is strongly based on community engagement, a pedagogical approach that allows students to interact with 'real-world' problems and problem-holders. Yet this catalyst also relates to project management tasks present in PjBL, such as goal-setting, time-management and distribution of responsibilities. These practices largely reflect professional work and, in that sense, provide an authentic character. Cross-disciplinary group work offers authentic features too, for similar reasons: professional practice usually requires interactions in disciplinary diversity, acknowledged by educators and learners. The relation between the catalyst of relating with otherness and pedagogical approaches in the Minors is also multiple. Students connect with different others through both analysed boundary-crossing pedagogies: community engagement and cross-disciplinary learning. Protected autonomy, finally, directly connects with PjBL and entailed group and individual responsibilities. However, educators' facilitation and lecturing style plays a key role too. Overall, then, while there is a close connection between the pedagogies observed in experiential IE and learning catalysts, their relation is not one-to-one but manifold.

The identification of learning catalysts, therefore, is contextualised in the Minors. Further research may shed light on the pertinence and validity of the notion of learning catalysts, the emergence of other catalysts in different settings, and the applicability of the three proposed catalysts as facilitators that enhance and sustain learning in other contexts. Beyond these queries, however, what seems clear is that elements characterising learning catalysts may be purposefully incorporated in educational designs, being likely but uncertain -as with teaching and learning generally- that learners will actually experience degrees of activation, acceleration, deepening and endurance of their learning processes.

Cases where the latter occurs are characterised by processes discussed in transformative learning theory. Experiencing a disorienting dilemma, critically questioning one's assumptions, exploring different viewpoints and behaviours, and eventually profoundly shifting perspectives that conduce to adjusted actions reflect transformative learning processes, through which learning catalysts foster significant and sustainable learning. Reframing, i.e., the re-characterisation of problematics in new structures, is critical in these catalysed and transformative processes. Reframing is also essential in innovation processes as different understandings of innovation challenges permit devising novel solutions. In that sense, learning catalysts may promote personal innovation processes, which in this case study are framed in product, service or design -oriented innovation processes.

Chapter 10. Conclusions

This thesis examined socio-emotional skills that contribute to innovative behaviours and their facilitation in undergraduate innovation education programmes. The findings evidence that innovative behaviours require multiple socio-emotional skills, which can be developed by students partaking in Minors Innovation. The findings also identify cross-disciplinary education and community engagement as central pedagogical practices promoting the development of socio-emotional skills for innovation. These pedagogical approaches, respectively discussed in the thesis as disciplinary and organisational boundary-crossing practices, are largely developed framed in project-based group work. These pedagogies favour agentic and collaborative learning experiences, which are in some cases, transformational. That is, some learners profoundly shift their perspectives on themselves, others and societal issues. The proposed notion of 'learning catalysts' illustrates these transformative learning experiences, in which learners substantially and sustainably develop SESI.

The relevance of socio-emotional skills for innovation emerged in my exploration of the literature on innovation skills with a socio-emotional lens and was deepened and analysed empirically. Socio-emotional skills are only implicitly recognised in the literature on innovation skills, although skills deemed socio-emotional are acknowledged as complementing technical and cognitive skills in innovation processes. Socio-emotional skills for innovation, SESI, are thus important as studied by experts, but are not characterised nor framed as socio-emotional. As this study suggests, the limited jargon and frameworks recognising the socio-emotional nature of some skills for innovation constrain the practice of university IE, having implications for the specification of learning objectives, appropriate pedagogies, learning processes, and more broadly, institutional strategies to develop IE.

In other areas, however, the concepts of socio-emotional skills and socio-emotional learning are significantly developed and rapidly growing. Reflection about the importance and pedagogical strategies to promote socio-emotional skills proliferate mostly in school-level education, and less in HE, where it focuses on students' health and wellbeing (Conley, 2015), rather than on learning objectives including innovation-related ones. This knowledge has different foundations from the one nurturing innovation thought. While socio-emotional skills emanate mostly from social psychology applied to school education, innovation skills derive largely from research in economics and business in different contexts, including HE. In this thesis, I have bridged this conceptual and practical gap between innovation skills and socio-emotional skills.

I have intended to deepen our understanding of the notion of SESI and their development in undergraduate university programmes, framed in the roles of HE, and particularly universities, *in* society. In collaboration with multiple societal actors, universities engage in knowledge and innovation-based societies. In this thesis, I have taken the view that innovation is a collective creative skills-based process, and that it benefits from the interaction between persons with different perspectives and cultures (Csikszentmihalyi, 2010; Welz, 2003). It then has the potential to enhance economic development, social wellbeing and environmental sustainability. A central mechanism through which universities contribute to society is by purposefully co-creating knowledge and innovations with and for society. Another fundamental role is educating for responsible engagement in innovation ecosystems. University programmes centred on understanding these complex and dynamic systems, and on developing skills to participate in innovation processes are globally expanding. Therefore, owing to the lack of scholarship on the socio-emotional component of skills for innovation and their pedagogical promotion in university innovation-oriented programmes, exploring the skills required in innovation is fundamental to promote IE in HE.

Two research questions guided this study, namely, what socio-emotional skills contribute to innovative behaviours and how they support such behaviours, from the perspective of participants in undergraduate innovation education programmes; and how SESI are pedagogically facilitated by educators in undergraduate innovation education programmes. These questions aimed to identify and characterise SESI, and to understand teaching-learning processes strengthening their development in university IE programmes.

To do this, I integrated theories about socio-emotional skills, boundary-crossing and learning in HE (Chapter 3). I organised the theoretical framework in two parts. First, I used three learning theories that as a whole see learning as a socially embedded process of transformation encompassing socio-emotional skills: Situated Learning, which conceptualises learning as social participation in collective processes (Lave and Wenger, 1991); Transformative Learning, which emphasises the transformation of perspectives by questioning assumptions (Mezirow, 1991); and Socio-emotional Learning, which centres on the development of socio-emotional skills, integrating cognitive, affective and behavioural domains (Durlak et al, 2015). I used the Systemic Social and Emotional Learning framework developed by CASEL (2016a), to organise the analysis of SESI and their development in its five interrelated dimensions: self-awareness, self-management, social awareness, relationship skills and responsible decision-making. The first four have been analysed amply and seem to converge in the socio-emotional literature. The fifth dimension is central to this

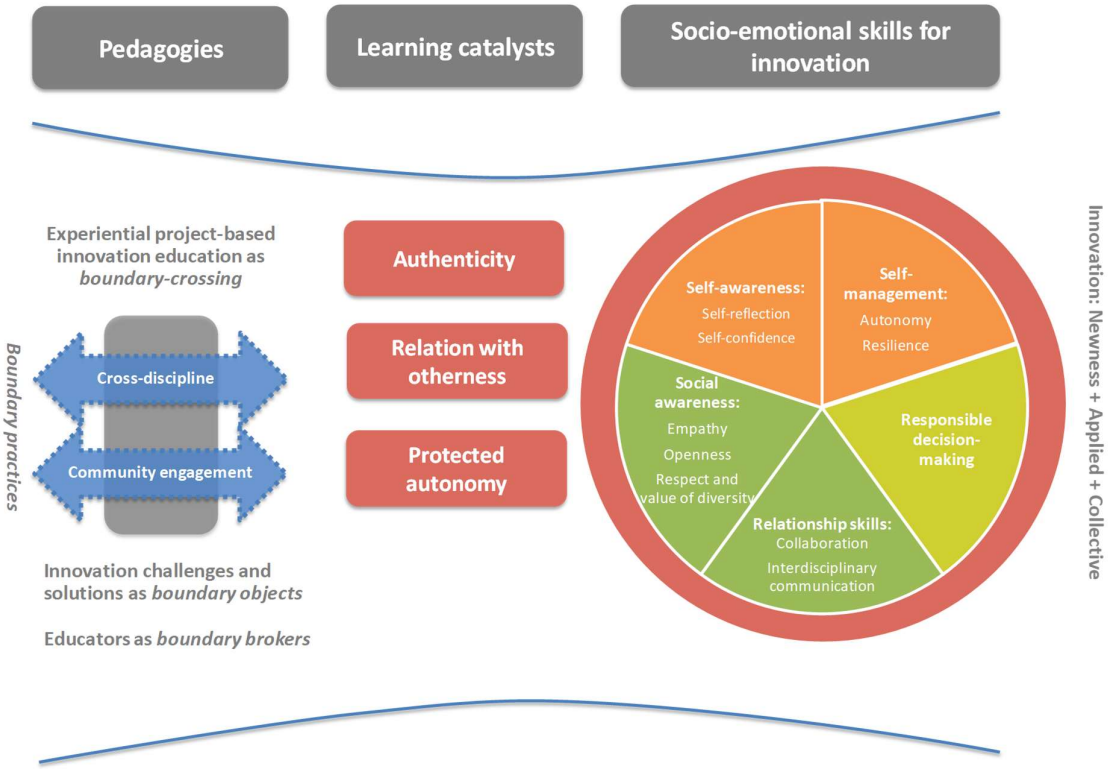
research because the unpredictable effects of innovation can not only be beneficial, but also detrimental (Stilgoe et al., 2013) and thus education for innovation requires reflection and tools to act responsibly.

The second part of my theoretical framework was used to analyse the pedagogical practices favouring SESI, which I observed to be based on group work around projects and on crossing disciplinary and organisational boundaries. Therefore, Project-based Learning and Boundary-crossing theories served to conceptualise two main teaching-learning approaches: community engagement and cross-disciplinary learning, elements which also composed the theoretical framework.

The methodology used was an explorative cross-country multiple case study (Chapter 4). The analytical procedures permitted the exploration of patterns across-cases (Yin 2011), examining possible contextual variations. The unit of inquiry was Minors Innovation: undergraduate optional credited programmes offered to students of multiple disciplines, consisting of four to six courses aiming to develop understanding about, and abilities for, innovation. Four cases were studied in universities actively involved in innovation education: two in Chile and two in the Netherlands. A total of 57 semi-structured interviews were the main data source: 52 with participants in the Minors and five with national-level policy makers and experts. In the interest of reaching a comprehensive perspective on the skills and their development, and to later triangulate the data, I interviewed a range of participants: students, lecturers, programme managers (two of whom were also educators), central administration authorities, innovation authorities and external collaborators. The data was analysed thematically and iteratively, using deductive and inductive approaches. The main deductive analytical process was the mapping of SESI framed in CASEL's five-dimension socio-emotional framework. This permitted an organisation of skills for innovation based on a pre-existent and widely used typology of socio-emotional learning.

The findings shed light on socio-emotional skills for innovation, pedagogical strategies promoting SESI, and learning catalysts – a conceptual proposition (see Figure 12). I discuss the main findings of the thesis, organised in seven themes, followed by some reflections on the contribution to the theory and implications for policy and practice.

Figure 12. Summary of key findings and concepts of the thesis



Source: author's.

A. Key findings

1. Innovation skills and socio-emotional skills in university innovation education: a necessary yet underdeveloped conceptual encounter

Exploring the meaning of 'socio-emotional' and related abilities, and the types of skills that foster innovative behaviours, clearly reveals how socio-emotional skills play an important role in the palette of skills that boost innovation. Skills for innovation are analysed in the literature using varied typologies and characterisations. However, while implicit discussions in the innovation literature seem to be prolific, it is difficult to find explicit references to the socio-emotional nature of some of the skills. The four cases presented in this thesis reflect a similar landscape. The participants valued skills that may be labelled as socio-emotional and recognised this characterisation as relevant, but rarely used them. In other words, both the literature and the participants highlight the importance of socio-emotional skills in innovation processes, yet conceptualisations, jargon and frameworks that support the analysis and education of SESI are limited. The socio-emotional component of

innovation skills is therefore invisibilised, which reflects the disconnection between knowledge on innovation skills and on socio-emotional learning. There is then significant potential for research: the integrated analysis of empirical data and literature on skills that favour innovation include an important component that can be denominated socio-emotional (Chapters 2 and 6).

2. Ten skills strongly contribute to innovative behaviours, conveying individual and collective agency in context-dependent innovation processes

The analysis of socio-emotional skills favouring innovation (research question 1) permitted the identification of specific skills playing a central role as voiced by the participants. However, the range of skills discussed as valuable and pertinent for innovation is vast. This is partly because of the multiple comprehensions and manifestations of innovation. Innovation may take many forms depending on the type of innovation, the specific processes entailed, the characteristics of innovation challenges, participants involved, among other aspects. The four Minors Innovation and the perspectives of 57 interviewees show this diversity. Consequently, it is not surprising that the skills that are relevant for innovation are likewise heterogenous. In a potential scenario of limitless innovation contexts and processes, any socio-emotional skill could somehow contribute to innovative behaviours.

Nine specific and one broad socio-emotional skills fundamental for innovation were identified through thematic analysis in this study. Self-reflection, self-confidence, autonomy, resilience, empathy, openness, respect and value of diversity, collaboration, interdisciplinary communication and responsible decision-making are essential for innovation. These SESI contribute to innovation in multiple ways. The analysis was organised around the five CASEL dimensions (Chapter 6).

The first dimension, self-awareness, is the capacity to recognise one's thoughts, feelings and behaviours; it supports innovation by understanding and positioning oneself, with strengths and weaknesses in specific innovation contexts. This socio-emotional dimension displays two specific skills as critical for innovation: self-reflection and self-confidence. Self-reflection denotes the capacity to have inner conversations (Archer, 2012), which as discussed by the participants is fundamental to identify one's purposes, and which in turn fosters motivation and commitment to direct and persist in uncertain innovation processes. Self-confidence means being self-assured, and supports individuals in taking actions and managing risks present in innovation. Awareness of oneself is a foundation for other dimensions of SESI because it also helps be aware of others and conduct oneself.

The second dimension, self-management, comprises autonomy and resilience. Autonomy is compatible with interdependence (Bandura, 2018), which is a known feature of innovation work deeming innovation a 'team-sport' (Kelley and Littman, 2008). Autonomy manifests in proactivity, goal-setting and self-directed learning, which are useful when innovating. Resilience, the capacity to adapt in adversity, is central given the uncertainty, risk and potential failure involved in innovation. Innovators need to exercise resilience in multiple stages, but more centrally when novel proposals are exhibited and assessed.

Thirdly, social awareness is the capacity to understand, appreciate and respect others. Empathy, openness, and respect and value of diversity are central skills favouring innovation. In empathising, sensitivity towards others is expressed, which permits openness towards different others. The term 'empathy', as voiced by the participants, represents a socio-emotional skill and an initial stage of innovation whereby users' needs are identified through 'empathising'. This means observing, connecting and assessing innovation requirements, usually onsite and interacting with potential users. Openness permits 'seeing' these needs and 'seeing' potential solutions by reframing the problem. In 'seeing' others, respect and valuing diversity becomes central. Innovation and the preceding creativity phase are enhanced by diversity. Varied perspectives allow to characterise problems and devise solutions innovatively.

Valuing diversity emerges when people with different perspectives interact. The fourth dimension of relationship skills denotes the ability to establish and maintain healthy relationships (CASEL, 2016a). Collaboration and interdisciplinary communication are considered important skills for innovation by the participants. Collaboration builds on other skills, such as openness, flexibility and respect, and requires a common goal to work collectively. Interdisciplinary communication also fosters innovation based on diversity when different disciplinary perspectives are integrated to tackle an innovation problem. Yet, distinct disciplinary expertise, epistemologies and cultures may be difficult to handle. Interdisciplinary communication encompasses abilities to negotiate meaning, resolve differences and develop a shared understanding, hence comprehending one's own discipline is critical (Greef et al., 2017). Other aspects of communication (e.g. active listening) and of relationship skills (e.g. networking) were also acknowledged by the participants as instrumental for innovation.

Likewise, the fifth socio-emotional dimension, responsible decision-making, entails cognitive, affective and behavioural competencies (Durlak 2015). In the analysis of SESI, an overarching responsible decision-making skill was discussed. This involves making ethical choices and seeking

the wellbeing of oneself and others (Conley, 2015), while acknowledging the risk and unpredictability encompassed in innovation. In seeking ethical choices, it is necessary to reflect on one's value pattern, observe others, and consider as many values contested in decisions as possible (NL.COL.9.lecturer). Making responsible decisions in innovation, therefore, requires the integration of multiple other SESI.

The ten socio-emotional skills interrelate and nurture each other. Their individual characterisation serves analytical purposes; in practice, these are developed and expressed conjointly. Overall, the set of skills reflect and require the enacted individual and collective agency of those involved in innovation processes.

The relevance given to these skills was present in all four cases and the patterns emerging embed the contextual characteristics of these Minors Innovation programmes. Therefore, while these skills may support innovation in other contexts, this possibility has to be further explored.

3. National and institutional conditions shape innovation education

As a situated social practice (Lave and Wenger, 1991), IE and its institutional and national settings are mutually (re)shaped. The conceptualisation of 'innovation' varies within and between cases, likely affecting the approaches taken towards SESI. Social responsibility, citizenship and business creation aspects of innovation are entangled. At the programme-institutional level, only the case centred on responsible innovation clearly reflects this aspect of innovation in line with the participants' perceptions of SESI, highlighting responsibility and ethics. Elsewhere, the diverse views about innovation did not generally mean different conceptualisations of SESI. At the national-level, the long-standing Dutch IE, which is connected to knowledge valorisation policies and promoted by Economy and Education-oriented governmental agencies, frames institutional practices and the jargon around innovation (and entrepreneurship) education. In Chile, IE is judged by experts and policymakers as heterogenous – as its HE system – and mechanistic, i.e. adopting teaching-learning approaches instrumentally. In both countries, in common with the relevant literature, the participants recognised the importance of socio-emotional skills in innovation, but their terminology and characterisation are inconsistent, hindering the practice of IE.

The optional character of Minors Innovation appeared to shape the educators and students' experience. While optionality allows the students to choose and self-direct their learning paths, it also generates expectations about Minors' lesser academic demand ('easier') than mainstream programmes. Furthermore, optionality is associated with loose managerial structures (observed in

three cases), affecting the programmes' delivery. Optionality, thus, influences teaching-learning processes.

The thematic analysis revealed that some educators in Minors Innovation experience difficulties to exercise academic freedom for pedagogical innovation. This affected their engagement in pedagogical approaches facilitating SESI. While some academics claimed they had the freedom to design and deliver modules, others expressed limitations associated to institutional evaluations, including assessments of students to lecturers. The educators risked their reputation in pedagogical innovation, enhanced by innovation's inherent uncertain results. The data on this aspect varied across cases, requiring further examination. These national, institutional and programme-level conditions affect pedagogical practices supporting SESI.

4. Boundary-crossing pedagogical practices centrally contribute to the development of socio-emotional skills for innovation

Experiential innovation education can be regarded as a *boundary-crossing* process. As the data suggests, the bridging of two boundaries critically promotes SESI in the Minors Innovation: between academia and the broader society, and between disciplines. Boundaries, i.e., socio-cultural differences disrupting actions and interactions across them, are resources for learning, fundamentally by inciting the critical assessment of assumptions and by permitting the identification, coordination and transformation (or new establishment) of boundary practices (Akkerman and Bakker, 2011b). These processes reflect the principles of several socio-emotional skills and promote their development (Chapters 7 and 8).

The second research question focused on the pedagogical practices supporting the development of SESI in the four Minors Innovation studied. Constructivist pedagogies that promote inductive meaning-making processes with collaborative teaching-learning approaches (Prince and Felder, 2006) were identified by participants as relevant for the development of SESI. One of the approaches identified was project-based learning, which involved the Minors' students in innovation challenges – *boundary objects*. These were sometimes co-defined with external collaborators and tackled in multidisciplinary groups. This practice overlapped with experiencing innovation processes. From identifying needs (problems to be solved innovatively), to characterising and re-framing them by integrating varied perspectives, exploring and designing possible solutions, testing them and iterating their construction, and in some cases, offering the solutions to users, all these strategies form part of experiential IE, a term I used in this thesis to denote this range of practices.

Crossing disciplinary boundaries emerged as a central pedagogical tool in the development of SESI. This was framed as an internal to the university boundary-crossing process (Chapter 7). Pedagogical decisions shaped the form and intensity of potential cross-disciplinary learning. The collaboration with partners beyond universities, termed as community engagement (for learning), emerged from the data as a second pedagogical practice critically promoting SESI, in this case crossing organisational boundaries (Chapter 8). Public, private or mixed organisations and individuals were on 'the other side'. This set of pedagogical approaches, including PjBL, experiential IE, community engagement and cross-disciplinary teaching-learning, all combined in varied ways in the cases studied. Overall, these boundary-crossing practices benefited students' horizontal development, that is, the capacity to interact and negotiate meaning across varied forms of expertise (Griffiths and Guile 2003).

However, learning across boundaries entailed multiple challenges. These included tension in the contestation of epistemological approaches when working on innovation challenges, professional identity dilemmas when interacting with different others, and difficulty in establishing common aims and achievement criteria when working in diverse (disciplinary) groups. Pedagogically and organisationally, further difficulties were observed for the educators. Whilst the educators in the Minors were generally keen to innovate in teaching-learning practices, this implied risks and costs for them as *boundary brokers*, particularly in terms of students' assessment of the lecturers' work, which is part of the mainstream academic evaluation frameworks that permit (or hinder) academic progression. This issue was different in the four cases, and varied between lecturers with predominant academic careers and part-time educators. Academic freedom to innovate pedagogically was therefore contested. Also, despite a longing for communities of practice where innovation educators could share and learn together, in the Minors, this was mostly absent. While there were some initiatives beyond the Minors, high academic burden and the implicit difficulties for defining a common domain of interest (gap rooted in different understandings on the purpose of, and means for, innovation education), constrained the development of communities of practice. In other words, the co-creation and continuous transformation of experiential education as a boundary-crossing practice, stimulated the development of SESI while revealing multiple challenges in the learning process and in the contextual educational conditions for their facilitation.

5. Cross-disciplinary learning promotes self-reflection, questioning assumptions and perspective shifts

The findings suggest that cross-disciplinary education strongly supports SESI development in Minors Innovation. This occurs through experiencing innovation processes organised in projects. Undergraduate students from all or most of the disciplines in the respective institutions may partake in Minors. Courses have students from different disciplines (with varied degrees of mix). This entails a teaching and learning possibility that was used by both educators and learners to different degrees. The degree of disciplinary combination in the analysis and resolution of innovation problems can be labelled as multi or interdisciplinary work, representing a juxtaposition and integration of disciplinary knowledge, becoming transdisciplinary when combined with non-academic knowledge (Greef et al., 2017). These different manifestations apply to the work that Minor Innovation students do, being difficult, however, to distinguish the degree of knowledge integration with the adopted research methodology.

Regarding the development of SESI, the data showed patterns evidencing the value and challenge of this boundary-crossing pedagogy (Chapter 7). The students' disciplinary identities were well rooted despite being at the undergraduate level; i.e., a sense of belonging to 'academic tribes' (Becher and Trowler, 2001) was already developed. In (re)establishing interactions across academic or disciplinary boundaries, the learners negotiate meaning and co-create boundary practices that allow them to fulfil the common goal manifested as an innovation outcome. Through the interaction with different others that hold unfamiliar or at least distinct epistemological standpoints, technical knowledge, and working cultures (such as time management), the students feel their assumptions are challenged. These beliefs relate to their own disciplinary identity and expertise, as well as others' identities and expertise, i.e., questioning their own perspectives through self-reflection sometimes triggered by collaboration and communication problems is a difficult, yet fruitful starting point for developing the capacity to work with others. Another dynamic promoting SESI experienced by the learners is being the 'expert' or the 'novice'. When drawing upon specific technical knowledge, students may feel as the expert if it refers to their area of expertise, holding responsibility for teaching or helping others, and for performing certain tasks. In the opposite scenario, they may need to ask for help, learn from others, and need to act collaboratively.

Overall, in cross-disciplinary learning experiences, the students develop SESI in the five dimensions: self-awareness, particularly in terms of their disciplinary identity and collaborative approach; self-management, by overcoming fears to express opinions in diverse contexts where these may be

questioned and in conducting their behaviours towards collaborative attitudes like flexibility and humbleness; social awareness, opening to understand different 'disciplinary others'; relationship skills, particularly through interdisciplinary communication, active listening and expressing themselves in contexts where negotiating meaning and compromising standpoints may be necessary; and responsible decision-making, experiencing both collective responsibility as groups in charge of certain activities, and individual responsibility in autonomous roles.

Cross-disciplinary education entails challenges for learners and educators. Developing relations with others creates difficulties for students. For the educators, teaching in diversity requires creativity and dedication to design activities, and to choose innovation problems that foster the cross-disciplinary potential, allowing everyone involved to learn. As discussed by the participants, this requires more time, effort and, to some extent, different capacities than mono-disciplinary approaches.

6. Community engagement supports the development of SESI by enhancing motivation, purpose and responsibility

Collaboration with the broader community, beyond the university's increasingly porous boundaries, critically promotes SESI, as acknowledged by all types of participants (i.e., students, educators and managers) across the four cases. Experiencing real-world innovation processes is a central benefit and the main aim by the educators in relation to the integration of theory and practice. Learners, educators and community partners collaborate in various forms of community engagement in the Minors Innovation. These modalities include formal partnerships with institutions providing innovation challenges; engagement with non-organised communities experiencing shared problems; collaboration with individual practitioners acting as role models, mentors or guest speakers; and fieldtrips to places relevant for innovation. The duration, formality, activities and responsibilities of these partnerships vary. Collaborations occur at different levels, mostly with local partners, in cases with national non-local stakeholders and rarely with global partners[19]. Proximity easing interactions and a variety of pedagogically appropriate innovation problems support the predominant development of local partnerships.

For the development of SESI, face-to-face interactions were critical. By collaborating with persons and organisations that experience, study or tackle innovation problems, learners develop multiple SESI, although this is secondarily sought as a learning objective, or an unintentional result of

[19]According to the data available. I did not seek to analyse the totality of community engagement activities.

learning experiences in Minors. The sense of responsibility is enhanced as learners feel motivated and committed towards authentic counterparts. A sense of purpose, self-confidence, resilience, empathy and communication are some other key skills developed when exercising them in collaboration with real-world partners. Moreover, as highlighted by different types of participants, the learners tend to enact agency in their learning process and as innovators-citizens.

Community engagement encompasses operational challenges, particularly in the coordination of this boundary practice. Educators, students and the variety of community partners potentially involved may expect different results from the collaborations. Thus, defining common aims and regulating expectations is challenging – in the understanding that these community engagement activities are mainly defined as learning activities (not as services or consultancies to society, although they may be shaped as such). Managing resources, time and administrative aspects hinder these boundary-crossing practices too. Although the potential benefits of community engagement for learning were acknowledged across all cases, their occurrence varied, partly because of these organisational challenges. In the two Dutch cases, community engagement was significantly experienced by the participants; in one Chilean case, it seemed to be developed to some extent, and in the other one only to a limited extent.

Therefore, the conclusions emerging from the analysis of university-broader community boundary-crossing pedagogies (Chapter 8) suggest that the collaboration between university and external partners supports the development of SESI, enhancing a sense of agency in learners, despite coordination difficulties. This diagnosis of beneficial, yet challenging community engagement also applies to other university-community boundary-crossing activities (e.g. the valorisation of research results). Successful strategies applied in other settings may inform the design of community engagement activities for learning, which have been studied less than research-related cooperation.

7. Learning catalysts as facilitators of the development of socio-emotional skills for innovation - a conceptual proposition

This thesis explored socio-emotional skills facilitating innovation and their pedagogical promotion. I answered the former through the identification of ten key skills considered relevant for innovation according to Minors Innovation participants. The latter focused on practices involving experiential IE around projects, together with community engagement and cross-disciplinary learning. Exploring the essence of learning experiences narrated by the participants, the data showed patterns in the learners' processes facilitated by certain conditions, which I referred to as 'learning catalysts'. The

metaphor of 'catalyst' denotes the stimulation, acceleration and deepening of learning. Originally, I thought of these as 'learning anchors' in their capacity to ground learning; however, catalyst seemed more appropriate to express their dynamising role. Thus, learning catalysts are proposed as a notion connecting the application of pedagogical practices with the development of skills for innovation. In other words, particular experiences that seem to boost learning processes bridging learning aims and results (Chapter 9).

I identified three learning catalysts in the four cases of Minors Innovation, namely, the authenticity of learning processes, relation with otherness and protected autonomy. Authenticity fosters a range of SESI because the learners become more engaged when working with real contexts, problems and people. Increased motivation, commitment and responsibility are shown in their relationship with others. Experiencing a sense of usefulness by exercising their expertise enhances their self-confidence and stimulates self-reflection on professional life purposes. The likelihood of affecting 'real' others boosts their sense of responsibility. The manifestation of authentic learning contexts in the Minors is varied, and educators and institutions can foster this type of experiences through collaborations with 'real-world' persons and organisations, and through engaging in activities resembling or representing real-world contexts.

The 'relation with otherness' catalyst indicates the exposure and collaboration with people that the students believe to be from distinct social, cultural, and disciplinary backgrounds. Being able to acknowledge, accept, value and collaborate with different others is central in innovation because the integration of multiple perspectives (offered by people with different 'cultures' in its broad sense) is a fundamental source of novel ideas. In relating to otherness, the participants manifest the development of SESI (e.g. such as self-reflection) as their own identity becomes questioned vis-à-vis different others. Self-management allows shifts of perspectives after exposure to broader realities. Openness, value and respect for different others increases through effective interactions at the boundary (e.g., social and disciplinary ones). Communication abilities (e.g. listening and expressing) are improved as learners' mutual understanding requires further clarity. Responsible decision-making is also exercised in resolving likely conflicts, especially within project groups and with external counterparts. These skills (see Chapter 6) promote innovative behaviours. Thus, HEIs and societies aiming to foster innovation can benefit from promoting experiences to learn how to purposefully, peacefully and effectively interact in diversity. In the case of Minors Innovation, the learning opportunities that are enhanced by the relation to otherness catalyst are mainly reached through group work in multidisciplinary teams, through the educators' adoption of unfamiliar

pedagogical means, and through interacting with innovation problem-holders from distinct 'realities' in relation to students.

Protected autonomy represents a balance in which the students can be agentic and self-direct their learning while guided and supported by educators. Although the participating students have different preferences regarding this conceptual balance, the data shows that when experienced, it fosters the learners' autonomy, motivation, (measured) risk-taking and sense of responsibility. Project-based learning activities promote this learning catalyst. In PjBL, some spheres of autonomy include the formation of groups, the definition of innovation problems to solve, group work organisation, the relationship with external partners and the presentation of results. The educators' facilitation style is central in terms of reassurance. There are multiple ways in which educators can foster this feeling of safe self-determination.

While many pedagogical features can be designed to promote learning experiences based on authenticity, relation with others and protected autonomy, I would suggest that learning catalysts are only 'activated' when experienced by learners. In that sense, learning catalysts differ from pedagogical practices as they may or not 'work'. Pedagogical practices can be applied, but the learners may not 'spark' learning processes. Conversely, unintentional situations may trigger the students' learning. Thus, while learning may be promoted, it cannot be assured through learning catalysts.

The catalysing processes analysed in Minors Innovation seem to foster a substantial and sustainable development of SESI. These relevance and endurance aspects were observed through narrated learning experiences of only some of the interviewed students. Their experiences included the critical questioning of assumptions, profound shift in perspectives and consequent actions (taken or planned). These processes, amongst others, characterise transformative learning experiences. In an exploratory way, I analysed only a few learning experiences that may be considered transformative; as such they may illustrate the sustainability feature of learning triggered by catalysts.

B. Contributions to theory

This thesis contributes to understanding and conceptualising socio-emotional skills favouring innovation, in university education contexts. This area is underdeveloped, as discussed in Chapter 2, limiting innovation education and specifically hindering the awareness, promotion and development of socio-emotional skills. I have approached the enquiries about socio-emotional skills

contributing to innovation and their pedagogical promotion in universities with a multifaceted theoretical framework. This has permitted me to explore new theoretical connections and provide conceptual tools that may be useful for further research and the development of active pedagogies, especially PjBL, in university innovation education. I can identify three main theoretical contributions.

First, I analysed the socio-emotional nature of some skills for innovation through a unified concept, SESI. This approach highlights the socio-emotional character of innovation skills, which were latent in the innovation skills literature (e.g., Sidhu et al., 2016; Watts et al., 2013). I have named, characterised and rationalised the relevance of certain socio-emotional skills for innovative behaviours. This was based on the empirical data, supported by the integration of innovation skills literature and socio-emotional learning literature, a novel conceptual connection. These conceptualisations may contribute to further research about innovation skills and about socio-emotional skills in HE.

Second, I explored the development of SESI deeming learning a social practice entailing transformations in individuals, communities and practices, drawing on Situated (Lave and Wenger, 1991) and Transformative learning theories (Mezirow, 1991). This enabled me to highlight the development of SESI occurring as people interact across socio-cultural boundaries, question paradigms and shift approaches that permit new pathways of action. Evidencing these processes in the data led to the conceptual proposition of learning catalysts. Considering the three learning catalysts identified (authenticity of learning experience, relation with otherness and protected autonomy) from the learners' perspectives rather than as pedagogical practices may support future research by shedding light on the role of catalysts in learning. This contributes to the socio-emotional dimension of transformative learning and social learning theories.

Third, I conceptualised pedagogical practices emerging from the data as critically supporting SESI by integrating concepts on PjBL (e.g., Blumenfeld et al., 1991; Thomas, 2000), boundary-crossing (e.g., Akkerman and Bakker, 2011a; Griffiths and Guile, 2003), cross-disciplinary education (Greef et al., 2017; Spelt et al., 2009) and community engagement (e.g., Jacob et al., 2015; Yamamura and Koth, 2018). This novel integration revealed the entwined nature of PjBL, as an experiential collective inductive pedagogy, with other dynamics promoting learning through the participation in communities where members offer diverse perspectives. This contributes to theorisations of innovation education and of SESI, in multiple ways. I analysed key features, challenges and SESI learning processes occurring at the crossroads of both, PjBL and cross-disciplinary education, and

PjBL and community engagement. By applying a boundary-crossing lens, I emphasised collective learning processes triggered by interactions across disciplinary and more broadly, cultural boundaries. This may help in deepening knowledge about innovation-oriented cross-disciplinary education and in establishing a research area about community engagement for learning. The latter, contrarily to research-related community engagement, is underdeveloped and much necessary.

Thus, drawing on various existing theoretical resources, I analysed the development of SESI in university IE showing the centrality of cross-boundary interaction. These interactions entail dilemmas for learners, who, mediated by boundary objects such as innovation problems and devised solutions, reframe their perspectives. Reframing is central in innovation processes and transformative learning, and these approaches converge in the development of SESI. As analysed throughout the thesis, exercising SESI requires agentic learning in communities. I reinforce the idea that these active learning pedagogies can stimulate agency, claim arguably heightened when it comes to socio-emotional skills including self-awareness and self-direction, social awareness and relationship skills, and the will and ability to be responsible citizens-innovators.

Other specific conceptualisations developed throughout the thesis, for example, the educators' pedagogical freedom for innovativeness (challenged by institutional regulations for accomplishing academic career goals), may be relevant for researching similar educational contexts.

Then, methodologically, the explorative cross-country multiple case study supported openness in exploring these subjects, showing also that, despite the limited number of cases, common patterns in human's interactions across boundaries for the development of SESI emerge. Educational challenges and learning opportunities were revealed by having in-depth conversations with a range of participants, comprising students, lecturers, programme managers, innovation and central administration authorities and external collaborators. Theoretical and data triangulation strengthened the results' validity and potential generalisability. Still, the pertinence of these results for other contexts has to be determined by the readers (Guba and Lincoln 2001).

Overall, I consider this thesis contributes to understanding university innovation education, from the perspective of socio-emotional skills. This underexplored research area may benefit from conceptual explorations such as the aforementioned. Theoretical tools and enriched vocabulary on SESI may enhance its policy and practice.

C. Implications for policy and practice

This thesis contributes to innovation education and the recognition of socio-emotional skills in HE. The conceptual contributions can all inform educational policy and practice in similar settings promoting innovation education and socio-emotional skills in universities, and HE more generally.

Contributions to university innovation education

Recognising the socio-emotional component of innovation skills and identifying specific skills enhancing innovative behaviours may encourage educators to purposefully promote them. The rationale for the contribution of skills to innovation can promote their valorisation by educators and learners. Thus, the identification and characterisation of SESI explored in this thesis may strengthen socio-emotional learning in and beyond innovation education programmes.

Evidencing the importance of two boundary-crossing pedagogical practices, community engagement and cross-disciplinary work, can support practitioners by shedding light on the key conditions, difficulties and benefits of these pedagogical approaches for SESI development. This thesis highlights the relevance of cross-disciplinary education to foster innovation skills. The analysis of this process, and the multiple organisational and teaching-learning challenges, can help practitioners to prepare for engaging in IE. Regarding community engagement, the main implications for educational practice are that developing these collaborations requires willpower to negotiate and implement boundary interactions that benefit all, strengthening consequently universities' societal role in alliance with community partners. Recognising the contribution that these demanding educational activities offer can help students' effective development and personal growth.

Policy recommendations

Institutional and governmental policies aimed at strengthening IE, and specifically at promoting SESI, as derived from the findings, can support educators, students, university managers, community partners and their networks. First, policies can permit and promote pedagogical innovation and support learning communities of innovation educators to enhance this fruitful but demanding social practice. This can be manifested as collaborative platforms and funding to share practices, to learn from each other and to recognise the work of those engaged in innovation education. Second, it is important to raise awareness about the value of socio-emotional skills for innovative behaviours, for product and service innovation, and more broadly, for innovating in life.

Universities and governments can encourage such awareness by promoting research, educational initiatives, and dissemination activities about socio-emotional skills and socio-emotional learning. Third, policies can support student learning in diverse settings, offering chances to interact across socio-cultural boundaries. This includes cross-disciplinary work and collaboration with the wider community, pedagogical approaches that, as analysed in this thesis, can encourage SESI development but challenge the multiple actors involved. Acknowledging the value and difficulties of these pedagogical practices is important for educators, managers and policymakers to facilitate their implementation. Fourth, and more widely, it seems important to communicate the richness that diverse perspectives bring to learning and to innovation. Research findings concluding about this value -including this thesis- can inform policies oriented toward inclusion and diversity in HE. Fifth, policies can strengthen (international) research platforms to further develop innovation education and socio-emotional learning. For example, collaboration with researchers and agencies such as CASEL and EASEL Lab at Harvard University may support the above-mentioned processes of raising awareness, promoting learning in communities of educators and enhancing policy design. Overall, governmental and institutional policies can be instrumental in enhancing the practice of innovation education, socio-emotional learning and their connection. Given the relatively incipient development of these areas in HE, policies are important to stimulate their advancement and understanding.

All in all, this thesis' findings reflect that the development of socio-emotional skills for innovation is an agentic, socially contextualised, challenging and potentially transformative learning process. Especially in the cases conveying substantial transformation of perspectives through three learning catalysts, learners' self-directedness is central. Learners in Minors Innovation shape their learning paths and anchor key lessons, largely through reflexivity, contestation and ensuing actions. They do so with and thanks to others, in experiential (authentic) educational settings that permit multiple types of interactions (with different others), and in (safe) spaces allowing autonomy (and requiring responsibility). In this sense, the development of SESI in Minors Innovation reflects a process of *socially-nested self-formation*, in which learners develop themselves through collective processes (Marginson, 2018). The exercise of the learners' agency, which is facilitated by constructivist and experiential higher education, contributes to the development of skills that favour innovative behaviours and thus boosts the learners' engagement in innovation societies. In this learning process, the students devise *novel* perspectives *implemented* in their lived experience, driving therefore, personal innovation processes.

D. Limitations of the study

The study presented limitations; the main ones and the ways I approached them were the following:

- Lack of previous research studying SESI and their development in university innovation education. This hindered the establishment of a baseline of specific knowledge but offered the opportunity to openly explore the subject. I resorted to extant separated bodies of literature on innovation skills and socio-emotional skills to set a knowledge baseline.
- Reduced number of cases. Considering the time and resources available, I studied four cases in two countries seeking – as explained in Chapter 4 – diversity of data yet not statistical representation. While the chosen methodology and number of cases does not allow for analysing SESI and their development in many different settings, it permitted to explore the phenomena in-depth in the selected cases.
- Different prior understanding of underlying cultural issues in the Netherlands and Chile. Although I had previously conducted research about Dutch HE collaborating with Dutch colleagues, being Chilean, my understanding of the Chilean (university) culture is more profound. This might have limited the identification of implicit issues in the data, although the facts that participants in the Dutch cases were open and that literature on innovation education in the Netherlands was richer than about Chile helped in getting insights on cultural aspects in both countries.
- Some emergent issues had different levels of data across cases. As reported throughout the thesis, some emergent aspects were transversal across cases (e.g., the value of cross-disciplinary education for SESI development) while others showed varied degrees of evidence across cases (e.g., pedagogical freedom to innovate). I acknowledged these differences in data and their implications for the findings.
- Many emerging themes yet limited space for their analysis. My intention was to analyse in-depth key phenomena around both research questions and I thus selected the themes that emerged more strongly from the thematic analysis and that were more relevant for answering the enquiries. Other aspects observed in the data, yet not analysed in detail may be the focus of future research. This includes, for example, learners' experiences in inductive active educational settings compared to traditional deductive classes.

E. Future research

Considering the findings, contributions to theory, methodology, policy and practice, and limitations of this study, further research could enhance our knowledge and the development of SESI in university innovation education. Specifically, future research areas include:

Research areas about socio-emotional skills for innovation:

- Socio-emotional and cognitive skills. In practice, their development is entwined (Krathwohl et al., 1964). How are these considered in innovation education programmes?
- Innovation and entrepreneurship skills. What does the literature on innovation education (e.g., Shavinina, 2013) and entrepreneurship education (e.g., Lans et al., 2017) tell about their relationship?
- Key SESI. How are these identified in other (educational) contexts and with other (mixed) methodologies?

Research areas about the development of SESI in university innovation education:

- Innovation educators. What is required for pedagogical innovation (e.g., Kumpulainen et al., 2019) and how is the educator-learner relationship re-shaped in inductive educational settings?
- Institutional conditions and national-level policies affecting SESI development in university innovation education. What are these conditions in various contexts?
- Cross-disciplinary education and innovation education. What are the conditions and processes of cross-disciplinary education (e.g., Greef et al., 2017) in university innovation education, in other educational settings and/or with other research methodologies?
- Community engagement in innovation education. What is the impact on the community (e.g., Yamamura and Koth 2018) and which are the community partners' perspectives on these collaborations?
- SESI, citizenship and innovation. How does the development of SESI in innovation education programmes contribute to graduates' agency as citizenship and innovators in the medium and long-term?

I truly hope that, as a global community of educators, we stress the importance of socio-emotional learning in higher education further, as it promotes agentic citizens. Innovation education may serve as a platform to fulfil and integrate generally disconnected aims: promote economic and technological development through innovation, and enhance human abilities that allow the development of more respectful, peaceful and compassionate societies. As shown in this thesis, these aims are not only compatible. In fact, innovation needs socio-emotional skills. This is especially important as innovation is expected to solve (or at least prevent) global complex problems that may re-shape the future of humanity.

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Appendixes

Appendix 1. Baseline questions for semi- structured interviews

The core guiding questions used in the semi-structured interviews are presented next.

The conduction of the interview aimed at balancing between offering a suitable framework for the questions with openness for discussion outside that frame. New contributions were sought, avoiding pre-setting core notions. In that sense, according to the interviewees' engagement with key concepts, the time dedicated to setting the frame was modulated.

The conduction intended to use the interviewing time strategically. That is, to explore in-depth key aspects feasible to discuss by certain types of stakeholders or certain persons. Therefore, not all topics were discussed with the same level of priority to all stakeholders.

A. Pre-interview

1. Introduction to the interview and research project.
2. Review information sheet and inform consent.
3. Introduction to key concepts if required by interviewee.

If interviewees required a certain framework for engaging, basic definitions and frameworks on the terms innovation and socio-emotional skills were introduced.

a. Innovation

- Products, processes or behaviours that are new, novel or improved, and also to the capacity for and action of developing them.
- As an action: "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005)

b. Socio-emotional skills:

Related to:

- Self-awareness

- Self-regulation
- Social awareness
- Relationship skills
- Responsible decision making

B. Interviewees background

4. Interviewees' specific relationship/ engagement with the programme.

C. Concept of innovation and skills for innovation.

5. NOTION OF INNOVATION IN THE PROGRAMME/ RESPONSIBLE INNOVATION. How is the concept of 'innovation' defined/considered/operationalized in the programme? What is meant by innovation?

6. SKILLS FOR INNOVATION. What are the implicitly or explicitly expected 'innovation skills outcomes' of the program? What should a student have done or learnt "to become an 'innovator'"? Are they any specific targets or measurable objectives? What indicators (if any) are used to determine the final 'innovation' accomplishments of students?

D. Presence of socio-emotional skills for innovation

7. INCLUSION OF S-E SKILLS FOR INNOVATION IN PROGRAMME. What type of skills, abilities or competencies for innovation are promoted and developed in the minor?

a. SOCIO-EMOTIONAL SKILLS. Depending on the acknowledgment of S-E skills, guide or emphasise these (e.g., "other uses of the term include…"). Focus on creativity and relational skills.

i. *If no mention to creativity and relational skills:*

1. Do you think there are skills related to being creative developed in the programme?
2. Do you think there are skills related to relating with others developed in the programme?

ii. *If mention to creativity and relational skills:*

1. To what extent/ how are these creativity skills considered in the programme?
2. To what extent/ how are these relational skills considered in the programme?

b. FORM OF INCLUDING S-E SKILLS IN CURRICULA. Are these competencies explicitly intentioned as learning outcomes or are they unintended consequence of the pedagogical methods? (i.e., is the development of socio-emotional skills a declared intention or is it a secondary effect of the pedagogies used?)

8. PROCESS FOR IDENTIFYING AND DEFINING SKILLS FOR INNOVATION INCLUDED IN THE PROGRAMME. If any: how were these S-E skills or competences identified and defined as key elements of the programme? Which are considered the most important ones for innovative behaviours?

9. REASONS FOR INCLUDING S-E SKILLS FOR INNOVATION IN MINOR. Why have they been considered in the programme? What is their relevance in the context of a Minor Innovation?

E. General pedagogical approaches

10. METHODOLOGIES. What are the main teaching-learning methodologies used that you consider promote these S-E skills?

a. Specifically, the skills related to creativity, how are these developed?

b. Specifically, the skills related to relationships with others, how are these developed?

11. CHOICE OF PEDAGOGICAL MEHODS. Why were these methods chosen to develop these skills?

12. DEVELOPMENT PROCESS. How do you perceive is the development or strengthening of these S-E skills throughout the programme?

13. ASSESSMENT OF S-E SKILLS. Are these S-E skills assessed in any form?

F. Collaborative teaching-learning methodologies

Depending on the acknowledgment of collaborative methodologies, guide or emphasise these.

14. TEAM-WORK. Are there opportunities for students in the programme for working in teams? Why are these team-work activities important in the programme? How do they foster the development of S-E skills?

15. CROSS-DISCIPLINE. Are there opportunities for students in the programme for collaborating with peers from other disciplines? Why is the cross-disciplinary component important in the programme? How does the cross-disciplinary work foster the development of S-E skills?

16. COLLABORATION WITH COMMUNITY. Are there opportunities for students in the programme for collaborating with persons outside the university? How does that collaboration and interaction promote the development of S-E skills?

G. Student agency

17. ROLE IN OWN AND OTHERS' LEARNING PROCESS. How do students actively participate in their own learning process and in the process of their peers? What degree of responsibility do they have in shaping their learning and specifically the development of S-E skills?

18. BOTTOM-UP/ EXTRA-CURRICULAR INITIATIVES. Besides participating in the minor, do students usually participate in other curricular or extra-curricular activities? How engaged/motivated are they with their innovation skills, and with acquiring knowledge on innovation concepts?

19. PERCEPTION OF GLONACAL LEVELS OF RESPONSIBILITY AS INNOVATION STAKEHOLDERS. To what extent do students develop in the minor a sense of responsibility as innovators? At what levels does that apply (i.e., global, national, local levels)?

H. Institutional collaboration/ community engagement

20. TYPES OF ALLIANCES. What types of networks or partnerships with actors beyond the university are in place in the minor?

21. ALLIANCES AT GLONACAL LEVELS. Depending on answer: Are there also alliances with international stakeholders/ other national actors/ the local community? How do they develop and what role do they take in the minor and specifically in the development of skills? How does the collaboration with these external actors shape the skills that students develop?

22. COLLABORATION AMONG TEACHERS (COMMUNITIES OF PRACTICE). Are there any networks of teachers of innovation, within or beyond the university? How do they take place? To what extent is the subject of skills for innovation present in the discussions?

23. PARTICIPATION OF BROADER COMMUNITY IN INNOVATION SKILLS' DEVELOPMENT (INC. PRACTITIONERS). Are there other actors from the broader community that have a role in the learning process framed in the minor? E.g. partners providing innovation challenges, practitioners guiding or assessing the learning process, or others?

I. Satellite enquiries

24. INSTITUTIONAL CONTEXT. To what extent does the institutional context and university strategy for innovation influences the development of the minor, and specifically, of socio-emotional skills for innovation?

25. NATIONAL CONTEXT. Are there aspects of the national-level policy or context that promotes or limits the development of the minor and specifically, of S-E skills for innovation?

26. INNOVATION RESPONSIBILITY. Is it explicitly promoted in the programme a sense of responsibility for the innovations developed? How?

27. INNOVATION EDUCATION AS A GLOBAL PHENOMENON. In relation to the global networks, if any, how do you perceive that the education for innovation is developing worldwide? (and where is the minor in that scene?)

28. FURTHER ASPECT ON THE DEVELOPMENT OF S-E SKILLS FOR INNOVATION IN THE MINOR?

J. Wrap-up

29. Overall, what do you consider are the most important S-E skills for innovation?

30. Which are the S-E skills relevant for innovation processes mostly developed in the minor?

Appendix 2. Ethical materials: information sheet and consent form

Institute of Education

Information Sheet for Interviewees

Study title: Social and emotional skills for innovation in higher education students. Collaborative pedagogical strategies in minor for innovation programmes

Researcher: Andrea Detmer, PhD student
Contact information: andrea.detmer.15@ucl.ac.uk,
+44 7490699192, +56 9 82212448

You are invited to participate in a study on socio-emotional skills for innovation in higher education. The study is part of my academic doctoral training at the Institute of Education, University College London. This Information Sheet will help you decide if you would like to participate in the study. Please do not hesitate to contact me if you require further information.

What is the purpose of the study?
The study aims to map the main socio-emotional skills that stimulate innovative mind-sets in university students and to analyse empirically how outstanding universities in innovation education develop these skills in students. Socio-emotional skills for innovation include for example: communicating new ideas, team-working, and networking with people from diverse backgrounds. The study considers 'minors in innovation', that is, undergraduate programmes composed of 3 to 6 courses/modules on the subject of innovation. It is expected that the results may contribute to policy making and the design of university programmes in innovation education.

Why am I being invited to take part?
In order to understand how the mentioned skills are promoted in the framework of minors in innovation, several stakeholders will be interviewed: students, professors or lecturers, programme managers, university authorities, external collaborators and policy makers. You are invited as an active participant in the scope of higher education and innovation public policy.

What will be my participation if I choose to take part?
Your participation will consist of a recorded interview. Specifically, we will discuss your perception on the national context of education for innovation and the strategies for the development of certain skills for innovation. This includes pedagogical methods, collaboration between higher education institutions and their environment, and the role that students have in their own and their peers' learning process.

How much time will your participation involve?
The interview will last between 45 and 60 minutes. It is a one-off event.
The time and place of the meeting will be decided according to your convenience.

Will your participation in the project remain confidential?
Yes, your name will not be published if you so request, the information will be anonymised if you so request and it will be used only for research purposes.

How will the results of the research be presented?
The results of this study will be presented as a doctoral thesis at University College London. They will also be shared at conferences and relevant journals.
When I have completed the study, I will produce a summary of the findings, which I will be glad to send you if you are interested.

Thank you very much for taking the time to read this information sheet.

If you would like to participate, please complete the attached consent form and return to me (andrea.detmer.15@ucl.ac.uk or during the interview).

If you have any further questions before you decide whether to take part, please contact me.

Thanks in advance for your contribution.

This project has been reviewed and approved by the UCL IOE Research Ethics Committee

UCL Institute of Education
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Institute of Education

UCL

Social and emotional skills for innovation in higher education students. Collaborative pedagogical strategies in minor for innovation programmes

2017

If you are happy to participate, please complete this consent form and return to Andrea Detmer (andrea.detmer.15@ucl.ac.uk or during the interview)

	Yes	No
I have read and understood the information leaflet about the research	☐	☐
I agree to be interviewed	☐	☐
I am happy for my interview to be audio recorded	☐	☐
I would like the information I provide to be anonymised and that if any of my words are used in reports or presentations these are not attributed to me	☐	☐
I understand that I can withdraw from the project at any time, and that if I choose to do this, any data I have contributed will not be used	☐	☐
I understand that I can contact Andrea Detmer at any time	☐	☐
I understand that the results will be shared in a doctoral thesis, at conferences and in journal articles	☐	☐

Name _____

Signed _____ Date _____

Researcher's name: Andrea Detmer Signed _____

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