

Exploring student perceptions towards innovation in relation to the academic and social context

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PhD Programme in Innovation and Educational
Intervention
April 2021

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Paula Álvarez-Huerta
(Abril 2021)

Esker Onak / Acknowledgements / Agradecimientos

Lehenik eta behin, eskerrak eman nahi dizkiet Jose Ramon Vitoria, Ainara Artetxe, Begoña Pedrosa, eta Jon Altunari ikerketa mundura hurbiltzeko eman zidaten aukeragatik. Beste profil bat eduki arren, ikerketa karrera hasteko aukera eman zenidaten, eta batez ere eskerrak eman behar dizkizuet Maite Garciarekin elkartu eta lan egiteko aukera emateagatik.

Hemen aurkeztutako lana ez litzateke posible izango Iñaki Larrea eta Alex Muela gabe. Behar nuen konfiantza eta autonomia guztia eman didate. Zuekin lan egin ahal izatea pribilegio bat izan da. Mondragon Unibertsitateko Humanitate eta Hezkuntza Zientzien Fakultateari ere eskerrak eman nahi dizkiot PIF programan parte hartzeko aukera emateagatik. Irakatsi eta ikasteko grina duten pertsoez inguratuta nire ikerketa profila garatzen lagundu dit.

Probilegiatua izan naiz ere, Indiana Unibertsitateko, Alexander McCormick, Angela Miller eta Allison BrckaLorenz bidean ezagutu ditudalako. Eskerrik asko hirurei.

Eskerrak eman nahi dizkiot Julia Barnesi ere, ingelesarekin laguntzeagatik. Halaber, Oxel Azkarateri eskerrak eman nahi dizkiot etengabeko animoengatik, eta Ana Carpinterori, bere laguntza eta ekarpenengatik, berak uste baino askoz ere baliotsuagoak izan direlako niretzat. Eskerrak baita PIF eta HUHEZIKo gainerako langileei ere, beti ere nire ikerketa lana beren ekarpenekin aberasteko prest izateagatik. Eskerrik asko, nola ez, ikerketa honetan parte hartu duten ikasle guztiei.

Denbora tarte honetan, Mondragon Unibertsitateak zein balio dituen eta bere eginkizuna gizarte honetan zein den ulertu dut, eta bertako jendeak aldaketak lortzeko duen gaitasunaz jabetu naiz.

Azkenik, eskerrik asko nire ingurukoei, hemengoei eta hangoei, errezagoa eta alaiagoa egiteagatik bide hau; maitasunez betetzeagatik: Eren, Lena, Luka, eskerrik asko.

A mis padres y a Irene, gracias por estar siempre ahí.

LABURPENA

Berrikuntza da ideia berriak gauzatzeko eta horiek besteentzako balio bihurtzeko gaitasuna. Gero eta konplexuagoa eta aldakorragoa den errealitateari arrakastaz egokitzeko eta aurre egiteko beharrezkoa den gaitasun esanguratsuenetakoa ere bada berrikuntza.

Pentsamolde berritzailea uler daiteke sortzeko, ideia berriak gauzatzeko eta zailtasunak eta oztopoak gainditu eta prozesuan irauteko gaitasunarekin lotutako pertzepzio multzo bezala. Kontzeptualizazio horretatik abiatuta, eta lau azterlanen bidez, doktorego-tesi honen helburu nagusia da ezagutza berria eskaintzea jakintza arlo ezberdinetako unibertsitate-ikasleen pentsamolde berritzaileari buruz.

Lehen azterlanean ($N = 1,741$), zeharkako diseinu baten bidez, aztertzen dira lehen mailako unibertsitate-ikasleen pertzepzioak berrikuntzarekin lotutako hainbat aldagairi dagokionez. Bigarren azterlanean ($N = 759$), ikasleek beren hezkuntza-testuinguruan duten inplikazioaren eta pertzepzio sortzaileen arteko erlazioa aztertzen da zeharkako diseinu baten bidez. Hirugarren azterlanean ($N = 1,380$), pandemiaren ondoriozko konfinamenduak hezkuntza-maila desberdinetako ikasleen pertseberantzian eta pertzepzio sortzailean izandako balizko eragina aztertzen da, baliokideak ez diren taldeen diseinu kuasi-esperimentalaren bidez. Azkenik, laugarren azterlanean ($N = 2,369$), proposatzen da unibertsitateko ikasleen pentsamolde berritzailea aztertzeke eredu bat.

Emaitzek aditzera ematen dute desberdintasunak daudela ikasleek berritzeko duten gaitasunari buruzko pertzepzioetan, hala generoaren arabera, nola jakintza-arloaren arabera. Pertzepzio horiek aztertzeke eredu berri bat proposatzeaz gain, identifikatu dira unibertsitateko ikasleengan pentsamolde berritzailearen garapenerako praktikak. Bereziki, ikerketa multzo honek azpimarratzen du bermatu behar dela unibertsitateko ikasleen aukera ikaskuntzaren ikuspegi sakonetan murgiltzeko, irakasleekin eta gainerako ikasleekin modu esanguratsuan elkarrekintzak izateko eta eragin handiko praktiketara parte hartzeke.

Horrenbestez, generoaren eta jakintza-arloaren arabera desberdintasunak gainditzeari begira, lan honen ekarpenek laguntza enpirikoa eskaintzen die unibertsitatei bertan esku-hartzeak garatzeko eta berrikuntzaren kultura sustatzeko.

ABSTRACT

Innovation, or the ability to implement new ideas and to transform them into values for others, is a necessary skill to successfully confront an increasingly complex and changing reality.

Innovative mindsets can be defined as the sets of perceptions related to one's ability to create new value, to apply it to both old and new challenges, and to persevere in the process when difficulties arise. From this conceptualisation, and through four studies, the main objective of this doctoral thesis is to provide new insights into the development of a student innovative mindset at higher education institutions.

In the first study ($N = 1,741$), a cross-sectional design is used to analyse first-year university student perceptions in relation to different variables associated with innovation. The relationship between student engagement and creative confidence beliefs is analysed by means of a cross-sectional design in the second study ($N = 759$). To examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on the grit and creative self-efficacy of students ($N = 1,380$), a quasi-experimental design of non-equivalent groups is used in the third study. Lastly, the fourth study ($N = 2,369$), puts forward a new theoretical model to analyse student innovation mindsets.

Results reveal differences across students of different genders and disciplines of study in relation to their confidence in the ability to innovate. In addition to proposing a novel model for analysing such perceptions, practices that can promote the development of an innovative mindset in university students are identified in this doctoral thesis. In particular, this research highlights the importance of ensuring that university students have the opportunity to engage in deep approaches to learning, to interact in a meaningful way with educators and peers, and to participate in high-impact practices.

Ultimately, these findings provide empirical support to develop interventions aimed at overcoming differences across students in relation to their innovative self-perceptions and at fostering a culture of innovation in higher education institutions.

RESUMEN

La innovación, o la capacidad de implementar nuevas ideas y transformarlas en valores para los demás, es una de las competencias más relevantes y necesarias para afrontar y adaptarse con éxito a una realidad cada vez más compleja y cambiante.

La mentalidad innovadora se puede concebir como el conjunto de percepciones relacionadas con la capacidad de crear, de implementar nuevas ideas y de perseverar en el proceso a pesar de las dificultades y los obstáculos. Partiendo de esta conceptualización, y a través de cuatro estudios, el objetivo principal de esta tesis doctoral es aportar nuevo conocimiento relativo al desarrollo de una mentalidad innovadora en el conjunto del alumnado universitario.

En el primer estudio ($N = 1,741$), mediante un diseño transversal, se analizan las percepciones de alumnado universitario de primer curso con respecto a distintas variables asociadas con la innovación. A través de un diseño también transversal, en el segundo estudio ($N = 759$) se examina la relación entre la implicación del alumnado en su contexto educativo y sus percepciones creativas. En el tercer estudio ($N = 1,380$), se examina el potencial impacto del confinamiento provocado por la pandemia en la perseverancia y la percepción creativa de alumnado de diferentes niveles educativos mediante un diseño cuasi-experimental de grupos no equivalentes. Finalmente, en el cuarto estudio ($N = 2,369$), se propone un modelo de análisis de la mentalidad innovadora del alumnado universitario.

Los resultados ponen de manifiesto que existen diferencias en las percepciones del alumnado sobre su capacidad para innovar, tanto en función del género como de la rama de conocimiento. Además de proponer un nuevo modelo de análisis de estas percepciones, se han identificado prácticas que pueden fomentar el desarrollo de una mentalidad innovadora en el alumnado universitario. En particular, esta investigación destaca la importancia de garantizar que el alumnado universitario tenga la oportunidad de involucrarse en enfoques profundos del aprendizaje, de interactuar de modo significativo con el profesorado y el resto del alumnado, y de participar en prácticas de alto impacto.

En definitiva, estos hallazgos aportan apoyo empírico para desarrollar intervenciones dirigidas a superar las diferencias de género y de disciplina de estudio encontradas y fomentar una cultura de la innovación en contextos universitarios.

RESUME

La innovación, o la capacidad d'implementar ideas nuevas y transformales n'elementos de valir pa los demás, ye una de les competencias más relevantes y necesaries pa emprobar y adaptase con éxitu a una realidá cada vez más complexa y cambiante. La mentalidá innovadora pue concibise como'l conxuntu de percepciones relacionaes cola capacidá de crear, implementar ideas nuevas y esforquiñar nun procesu pese a les dificultaes y les torques.

Partiendo d'esta conceptualización y al traviés de cuatro estudios, l'oxetivu primeru d'esta tesis doctoral ye contribuir conocimientu nuevu relativu al desendolcu d'una mentalidá innovadora nel alumnáu d'instituciones d'educación superior.

Nel primer estudiu ($N = 1,741$), pentemedies d'un diseñu tresversal, analícense les percepciones del alumnáu universitariu de primer cursu al rodiu de variables estremaes venceyaes a la innovación. Nel segundu estudiu ($N = 759$) examínase, tamién con un diseñu tresversal, la rellación ente la implicación del alumnáu nel so contestu educativu y les sos percepciones creatives. Nel terceru ($N = 1,380$) analízase'l potencial impactu del confinamientu que provocó la pandemia nel esfotu y la percepción creativa del alumnáu de dellos niveles educativos pentemedies d'un diseñu cuasi-esperimental de grupos non equivalentes. A lo cabero, el cuartu estudiu ($N = 2,369$) propón un modelu d'análisis de la mentalidá innovadora del alumnáu universitariu.

Los resultaos amuesen qu'esisten diferencies nes percepciones del alumnáu sobre la so capacidá d'innovar, tanto en función del so xéneru como del so ámbitu d'estudiu. Amás de proponer un modelu nuevu d'análisis d'estes percepciones, identificáronse práctiques que pueden fomentar el desendolcu d'una mentalidá innovadora nel alumnáu universitariu. Esta investigación destaca sobremanera la importancia de garantizar que l'alumnáu universitariu tenga la oportunidá de s'involucrar n'enfoques profundos del deprendimientu, d'interactuar de manera significativa col profesoráu y el restu del alumnáu y de participar en práctiques de gran impactu.

Estes conclusiones ofrecen asina una base empírica pa desendolcar intervenciones empobinaes a superar les diferencies de xéneru y de disciplina d'estudiu atopaes y fomentar una cultura d'innovación n'ámbitos universitarios.

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CHAPTER 1.
Introduction

1.1 Background

How confident are university students in their ability to create and innovate? What capacity do they have to maintain interest and persevere despite adversity? To what extent do their individual characteristics influence the development of these skills? What role does the educational context play? Do unexpected situations, such as the lockdown caused by the COVID-19 virus, have any influence on these relevant skills for innovation? This research work addresses these questions.

These issues have arisen at a time when developing students' innovation competence is becoming increasingly important in higher education (Ovbiagbonhia et al., 2019). Across Europe, higher education institutions are addressing the development of relevant competences among students in order to ensure their contribution to innovation (European Commission, 2017). The Bologna Process, that informs the creation of the European Education Area, recognises that young people need a broad set of competences to fully develop in today's society (European Commission, 2018). Moreover, according to the Bucharest Communiqué (2012), in order to contribute to the needs of society and the labour market, graduates will have to combine subject-specific knowledge with transversal, multidisciplinary and innovation skills and competences. In this regard, during the 2015 Yerevan Conference, European Ministers highlighted the need to intensify strategies to promote creativity, innovation and entrepreneurship among university students (EHEA, 2015).

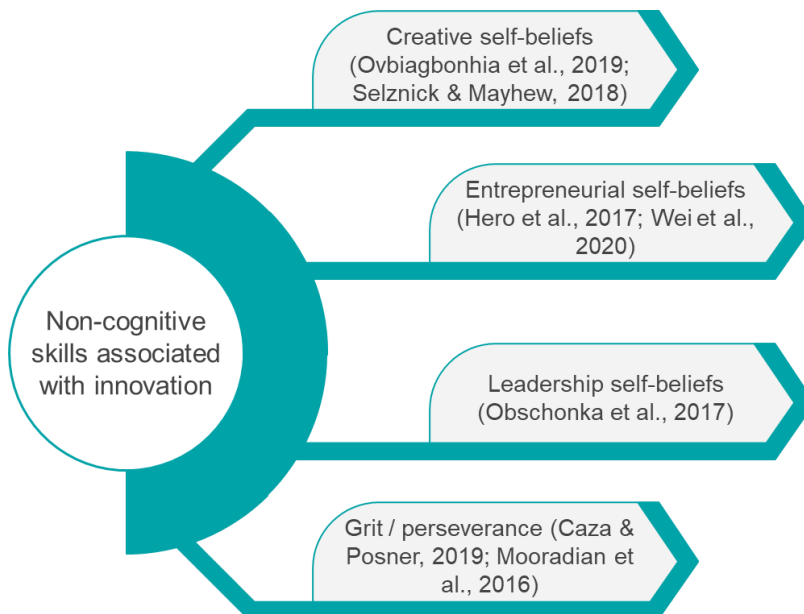
While innovation and creativity are indispensable in the contemporary workplace (Acar et al., 2019), entrepreneurship is widely recognized as an essential engine of economic and social development (Ribeiro-Soriano, 2017; Urbano & Aparicio, 2016). The importance of entrepreneurship has been particularly highlighted in the face of the worldwide COVID-19 pandemic, which has exposed the world to great uncertainty (Etemad, 2020; Maritz et al., 2020). As the European Union indicates (2019), being able to transform opportunities and ideas into values for others is key for lifelong learning and can help young people find fulfilling jobs and become independent, engaged citizens. Furthermore, according to the OECD (2019a), when students involve in creative thinking, create new value and ask questions, they develop self-worth and become more prepared when confronted with uncertainty.

Given its relevance, creativity, innovation and entrepreneurship have been jointly framed as a mega-competence to promote among university students (Edwards-Schachter et al., 2015). Nowadays, as a means towards coping with a rapid pace of change and obsolescence of knowledge, strengthening these skills among students is at the core of education agendas, and depends to a large extent on the development of non-cognitive competences for all students (Edwards-Schachter et al., 2015; OECD, 2019b; Selznick & Mayhew, 2018).

Self-beliefs concerning creativity, entrepreneurship, leadership and perseverance can be grouped under the term non-cognitive skills. Also often referred to as socioemotional skills (Chernyshenko et al., 2018; Marsh et al., 2018), non-cognitive skills have been defined as “patterns of thought, feelings and behaviour” (Borghans et al., 2008; p.974). These skills are susceptible to change, and educational institutions have been shown to play an important role in their development (Garcia, 2014). In addition to analysing the knowledge acquired by students, it has been indicated that institutions should investigate the degree to which students demonstrate significant behaviours, attitudes and strategies for both academic development and later life (Farrington et al., 2012). Nonetheless, non-cognitive skills are not only important for their own sake, but also indirectly (Garcia, 2014). In particular, considerable research has found evidence of a positive association between specific non-cognitive attributes and student academic success (Bowman et al., 2019).

According to the research literature (Farrington et al., 2012), student self-beliefs are, together with perseverance, sense of belonging and learning strategies, among the non-cognitive factors that mostly influence academic development. In shaping innovative behaviours, student self-perceptions also play a significant role and determine whether students will express or suppress those sorts of actions (Edwards-Schachter et al., 2015). In that sense, and as indicated in Figure 1, self-beliefs concerning creativity, entrepreneurship, leadership and perseverance are among the most significant non-cognitive variables with respect to innovation (Caza & Posner, 2019; European Union, 2019; Hero et al., 2017; Mooradian et al., 2016; Obschonka et al., 2017; Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018; Wei et al., 2020). According to Dweck (2008), the self-perceptions that people hold about themselves shape their mindsets. In order to examine overall students' perceptions in relation to innovation, the concept of innovative mindset is particularly relevant. In this research, innovative mindset is defined as “*the set of beliefs related to one's ability to create new value, to apply it to both old and new challenges, and to persevere in the process when difficulties arise*”.

Figure 1. Non cognitive variables associated with innovation



Despite the important role played by self-perceptions and mindsets in influencing the choice of tasks to be undertaken, and the level of effort and persistence put into them (Bandura, 1997), there is limited research on student self-perceptions in relation to their innovation abilities (Edwards-Schachter et al., 2015; Ovbiagbonhia et al., 2019). Notwithstanding being a priority for public-policy makers, educators and researchers, and calls for the analysis of student innovation capabilities (Edwards-Schachter et al., 2015; Keinänen & Kairisto-Mertanen, 2019; Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018; Tsang, 2019), this is one of a number of research gaps that remain largely unaddressed in the field.

On the one hand, the need to analyse innovation competences in students enrolled in different university disciplines has been emphasized (Teixeira & Forte, 2017; Tsang, 2019). The scarcity of this kind of studies outside the field of business could stem from a limited understanding of what entrepreneurship and innovation mean; while entrepreneurship is generally associated with starting or owning a business (Gainesini et al., 2018), the prevalent view of innovation is associated with enterprise and technology (Linton, 2018). As yet under-researched, these narrow understandings could be affecting innovation competence development among students of different university disciplines. However, the concept of entrepreneurship encompasses not only the creation or management of new ventures, but also engaging in self-employment and in entrepreneurial behaviours (Szaban & Skrzek-Lubasińska, 2018), moreover, the

many types of innovation that contribute to social progress relate to a variety of technological and non-technological areas (Linton, 2018).

On the other hand, despite gender segregation in professional fields related to entrepreneurship and innovation (Alsos et al., 2013; OECD/European Union, 2019), there is a shortage of studies analysing the relationships between study discipline, gender and innovation competence. The analysis of these interrelationships could have important practical implications when it comes to closing the gender gap in innovation and entrepreneurship, by tapping the creativity, innovation and perseverance skills of all students. Overall, to address these issues, it is imperative to have theoretically grounded and empirically validated instruments to analyse innovation in educational contexts (Hero et al., 2017; Newman et al., 2018; Selznick & Mayhew, 2018; Tsang, 2019).

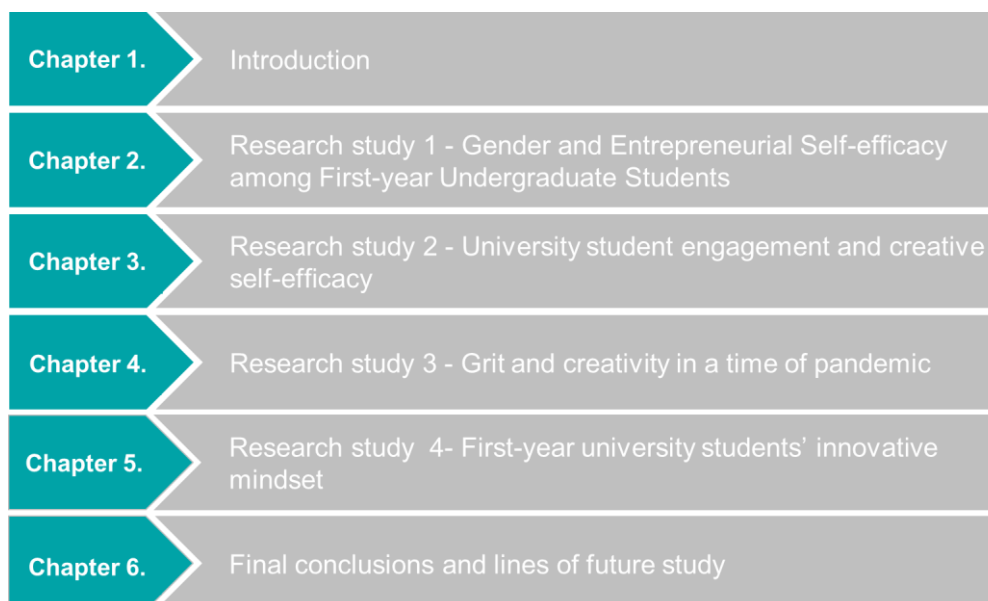
Additionally, the contextual dimensions of research must be acknowledged not only with regards to conceptual or spatial positions, but also in terms of its time frame (Huberman & Miles, 1994; Yilmaz, 2013). One of the data collections carried out within this research coincided with the lockdown decreed in Spain due to the COVID-19 pandemic. Undoubtedly, this lockdown exposed students to an unprecedented situation in which they had to face not only the insecurity caused by the pandemic, but also a new educational scenario characterised by online interaction. In this sense, it seems relevant to examine whether such an unexpected situation is capable of influencing student innovation perceptions.

In summary, the aim of this thesis is to provide new insights into aspects and particularities relating to the development of a student innovative mindset at higher education institutions, and to contribute to filling some of the gaps detected in the extant literature. Preparing graduates for the workplace is presently a serious challenge for higher learning institutions, as society moves towards being more dynamic and unpredictable (Killingberg et al., 2020). According to OECD (2019), structural changes are expected in the labour market, bringing with them the incessant appearance of non-standard jobs. It has been suggested that entrepreneurial, creative and innovative thinking and behaviour might help future generations not only to deal with these societal changes (Newman et al., 2018) but also to feel more empowered and prepared to shape these future changes (OECD, 2019b).

1.2 Dissertation structure

The present PhD dissertation comprises four studies in which different research questions related to the general objective of promoting university student innovative mindsets are explored. This dissertation has been structured according to such studies, as indicated in Figure 2. The structure is such that each chapter is arranged around four main sections, introduction, methods, results, and discussion, and can be read independently of any of the other chapters. Nonetheless, in order to avoid repetitions, the first and last sections focus on contextualising the research studies and delving into common aspects. Accordingly, the structure of this PhD dissertation is as follows: in the remaining part of this chapter, an introduction is made to the theoretical bases and the methods that support the different research studies undertaken, and to the context in which this research was carried out. In the following chapter, gender differences in student perceptions towards their ability to come up with new ideas and products are explored. We analyse the relationship between university student engagement and student perceptions towards creativity in the third chapter. The fourth chapter goes on to examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on student self-beliefs concerning creativity and perseverance or grit. In the fifth section of this document, a novel theoretical model to analyse student innovative mindsets is proposed. The final section is dedicated to discussing the overall conclusions from the studies, and to indicating potential lines of future research.

Figure 2. Dissertation structure



1.3 Theoretical basis

1.3.1 Innovation in higher education

Creating new value implies innovating to shape the future, by means of developing new knowledge, insights, ideas, strategies and solutions, and applying them to current challenges (OECD, 2019b). According to the OECD Learning Compass 2030, creating new value is one of the transformative competences that educational institutions should be promoting, together with taking responsibility and reconciling tensions and dilemmas. Encouraging this transformative competence among students relies on developing student competence for innovation (Alsos et al., 2013; Hero et al., 2017; OECD, 2019b), an issue which is becoming increasingly relevant in higher education (Ovbiagbonhia et al., 2019). As stated by the European Commission (2020b), higher education institutions should be centres for regional development and innovation. Nonetheless, as institutions may not be contributing as much as they should concerning innovation development, an innovation gap has been detected in the European higher education context (Hero et al., 2017). It has been suggested that higher education institutions may not be fulfilling demands for developing innovation skills across students (Keinänen & Kairisto-Mertanen, 2019), and a greater understanding of innovation in the higher education context is required (Tierney & Lanford, 2016). While innovation has become sought after, and a ubiquitous term, certain barriers may be leading higher education institutions to find innovation elusive.

On the one hand, innovation is frequently portrayed as intrinsically technological (Linton, 2018) and, hence, as an outcome to be measured in economic terms; therefore, it is not easily measurable in educational contexts (Hero et al., 2017; Selznick & Mayhew, 2018). However, as Hero et al. (2017) argue, innovation can result in any kind of novel product, process or service. Moreover, in an educational context, it can also be the result of a pedagogical process. On the other hand, and in relation to the aforementioned interpretation of innovation, there are few methods for assessing student innovation competences (Keinänen & Kairisto-Mertanen, 2019; Selznick & Mayhew, 2018; Tsang, 2019). According to Hero et al. (2017), this lack of reliable assessments for innovation-related learning outcomes may well have had an impact on how educational contexts can influence innovation.

Overall, assessment of student learning outcomes is essential to support effective learning processes that promote competence development. One of the objectives of

the Bologna process, which seeks to bring more cohesion to higher education systems across Europe, is the development of specific competences to promote social and professional growth for all students. Accordingly, significant reforms in the structure of university degrees and the development of quality assurance systems have been put in place (Blázquez et al., 2018). Within this proposal, a competence is defined as a set of knowledge, skills and attitudes that can be learned and developed, and which is required for one to function effectively in a given context (Mulder et al., 2009). Based on this definition of competence, Hero et al., (2017) define innovation competence as a collection of personal characteristics, knowledge, skills and attitudes that are connected to creating specific novelties and implementing them.

In relation to this, it is widely accepted that self-perceptions play a significant role in shaping the development of competences (Bandura, 1997; Marsh et al., 2016). According to social cognitive theory, self-perception beliefs play a very influential role in motivation and goal attainment (Bandura, 1997). These self-efficacy beliefs have been defined as the degree to which a person has confidence in their ability to perform a task successfully in a given context (Bandura, 1997). In relation to career development, social cognitive career theory (Lent et al., 1994; Lent & Brown, 2019) highlights the central role that self-beliefs play in occupational development. When faced with an academic or professional challenge, the level of efficacy influences the decision as to confronting the challenge, the level of motivation, preparation and perseverance with which the challenge will be tackled and, therefore, its level of achievement (Bandura et al., 2001).

According to Dweck (2008), a mindset is the set of self-perceptions that people hold about themselves. The mindset, an output of our personal histories, guides the collection and interpretation of new information and shapes our attitudes towards a situation (Gupta & Govindarajan, 2002). In addition, the mindset that we hold about our competences can foster strategies that can, in turn, support or impair the expression of said competence (Dweck & Molden, 2017). The concept of mindset, with a relatively long history in cognitive psychology (Gollwitzer, 1990; Gupta & Govindarajan, 2002), can provide a more integrated approach towards an understanding of innovation, as it focuses on valuing innovation for its development potential, rather than considering that some personality traits define who is an innovative person (Selznick & Mayhew, 2018).

Furthermore, as mindsets can be shaped through different experiences (Bosman & Fernhaber, 2017), this approach may be especially useful in the higher education context as it implies that, as a result of the university experience, students may be able

to develop a more innovative profile. This, in turn, will compel higher education institutions to generate strategies that promote the development of an innovative mindset across students.

Innovation as a mindset has been predominantly addressed in organisational contexts (Kahn, 2018; Kuczmariski, 1996; Man, 2001). In such contexts, an innovation mindset has been defined as one where the individual members of an organisation assimilate innovation, which leads to the development of a supportive and productive organisational culture (Kahn, 2018). In education, the innovation mindset concept has not been explored in significant detail. As the understanding and definitions of innovation vary significantly from one context to another (Dziallas & Blind, 2019), it is important to seek clarification. In this study, innovation mindset is defined as '*the set of beliefs related to one's ability to create new value, to apply it to both old and new challenges, and to persevere in the process when difficulties arise*'. This definition recognises the important role played by self-perceptions in influencing an individual's behaviour (Bandura, 1997). Moreover, it incorporates a person's beliefs about their creativity, entrepreneurial skills and perseverance; according to numerous experts, beliefs about these characteristics play a significant role in innovation (Caza & Posner, 2019; European Union, 2019; Hero et al., 2017; Mooradian et al., 2016; Obschonka et al., 2017; Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018; Wei et al., 2020).

1.3.2 Research variables

Self-beliefs encompass a set of perceptions about the self which lead many of our decisions and actions (Rouault & Fleming, 2020), and which have been analysed under different theoretical perspectives. The humanistic movement, by means of stressing the opportunity of self-actualization and reaching one's full potential, sparked an interest in self-processes and their influences in our behaviours (Pajares, 2002). Self-beliefs, likewise, draw from sociocognitive psychological perspectives. The social cognitive theory considers human functioning as a reciprocal interaction between individual behaviours, internal personal factors and contextual events (Bandura, 1986, 1997). Within Bandura's social cognitive perspective, individual regulatory processes influence self-directed changes in behaviours through different self-beliefs, which include self-concept and self-efficacy (Bandura, 1997). Today, research on self-beliefs is widely dominated by these two self-beliefs. Self-efficacy is the degree to which a person has confidence in his or her ability to perform a task successfully in a given context

(Bandura, 1997; Bowman et al., 2019). While sharing many similarities (Pedrero & Manzi, 2020), self-concept has been defined as the global set of thoughts and feelings an individual holds about their self (Rosenberg, 1979).

With regards to perceptions associated with innovation, self-beliefs regarding creativity, entrepreneurship, leadership and grit are among the most cited (European Union, 2019; Gainesini et al., 2018; Hero et al., 2017; Karimi et al., 2016; Obschonka et al., 2017; Ovbiagbonhia et al., 2019; Zampetakis et al., 2011). Although there are different perspectives regarding the relationship between creativity and innovation (Pratt & Jeffcutt, 2009; Rank et al., 2004), it is generally asserted that creativity is the first step in the innovation process, with innovation usually being portrayed as the implementation of an idea (Amabile, 1996). In addition, innovation is not a simple and linear process (Sarooghi et al., 2015) and, thus, it requires considerable grit and entrepreneurial and leadership skills (Ovbiagbonhia et al., 2019). It is for this reason that self-perceptions in relation to creativity, entrepreneurship, leadership, and grit may have an important impact during the creating and implementing stage of a new or significantly product, process, or service, i.e. an innovation process (Dziallas & Blind, 2019; Farmer & Tierney, 2017; Fuller et al., 2018; Mooradian et al., 2016; Zhao et al., 2005).

Historically, creativity has been defined in many different ways (Glăveanu, 2018). Nowadays one of the most accepted definitions refers to creativity as a process leading to the production of both original and useful novelties (Grigorenko, 2019; Kaufman & Sternberg, 2010; Mumford, 2003; Runco & Jaeger, 2012). Creativity is also emphasised as a distinctive feature of innovative behaviour (Hamidi et al., 2008), due to its role in the identification of opportunities (Ko & Butler, 2007) and in driving innovation within an organisation (Ip et al., 2018). In addition to this, the importance of creativity in confronting contemporary social challenges has been specifically acknowledged (Caballero García et al., 2019; Daly et al., 2016), which has led to it being considered as an essential component of education (Snyder et al., 2019). Despite this, creativity learning has been declared an issue for contemporary education (Grigorenko, 2019), and the need for more practical and empirical research to understand the influence of different learning environments on the creative development of students has been expressed (Marquis et al., 2017).

In relation to this, growing evidence suggests that creative self-beliefs play a central role in different aspects of the creative process (Anderson & Haney, 2020). The confidence shown by students in their creative abilities has attracted significant

research in recent years (Redifer et al., 2021). As a result, it has been asserted that students' creative self-perceptions influence their creative development (Beghetto, 2006; Karwowski & Lebuda, 2018; Royston & Reiter-Palmon, 2019).

According to Karwowski et al. (2019), creative self-perceptions include both creative self-efficacy, a person's confidence in their capacity for creative work, in a specific context, at a particular level of performance (Tierney & Farmer, 2002), and creative self-concept, a more holistic perception about the ability to perform creatively (Beghetto & Karwowski, 2017). The rationale behind both creative self-beliefs is that those individuals with a higher confidence in their creative skills are more likely to engage in creative tasks and persevere when difficulties arise (Beghetto & Karwowski, 2017). In relation to this, it has been indicated that a higher creative self-efficacy is positively associated with greater levels of self-motivation (Tierney & Farmer, 2002). The existing body of research suggests that creative self-efficacy plays a central role in the actual development of creative action (Farmer & Tierney, 2017).

Overall, findings in different contexts, including education, indicate that creative self-perceptions are an important precursor to creative effort and performance (Mathisen & Bronnick, 2009). In education contexts, higher levels of creative self-efficacy have been related, not only to greater creative performance, but also to greater confidence in academic skills and greater educational projection (Beghetto, 2006; Robbins & Kegley, 2010; Tierney & Farmer, 2004). Furthermore, it has been found that those showing high creative self-beliefs are better prepared to address the challenges associated with innovation (Newman et al., 2018).

The relationship between entrepreneurship and innovation has been extensively studied and it is recognised that both terms are intertwined, with innovation leading to the development of new business model, and entrepreneurship conducting to incremental and radical innovations (Pradhan et al., 2020). As a result of the key role that entrepreneurial activity plays in innovation and economic growth, and the potential of social and sustainable entrepreneurship to solve social challenges (Bazan et al., 2020), there is an increasing interest in understanding what leads people to pursue entrepreneurial careers (Nabi et al., 2015; Newman et al., 2018). Of particular interest is the examination of the confidence students show in their entrepreneurial abilities (Mauer et al., 2017; Newman et al., 2018; Nowiński et al., 2019). Entrepreneurial self-efficacy draws from social cognitive theory and refers to an individual's confidence in their competence to perform entrepreneurial tasks and roles (Chen et al., 1998). The relationship between entrepreneurial self-efficacy and the entrepreneurial career has been analysed and clear patterns emerge; those with higher confidence in their ability

to perform entrepreneurial tasks and roles have a greater tendency to pursue entrepreneurial careers (Newman et al., 2018). Other research shows there is a relationship between high entrepreneurial self-efficacy and behaviours related to entrepreneurship (Dempsey & Jennings, 2014; Hmieleski & Corbett, 2007). Moreover, Wei et al. (2020) found that high entrepreneurial self-efficacy has a positive influence on innovation behaviour.

Leadership has not been as extensively studied as creativity or entrepreneurship in relation to innovative processes, but the literature review carried out by Hughes et al. (2018) found enough evidence to assert that leadership is a relevant variable in creativity and innovation. Moreover, several studies (Fuller et al., 2018; Obschonka et al., 2017) have highlighted the importance of analysing leadership as a precursor to innovative behaviours.

As an over-researched topic (Gandolfi et al., 2017), there are numerous definitions of leadership. Nevertheless, leadership is generally viewed as a social process through which one person exerts influence over others in order to guide, structure, and facilitate goals achievement and interactions (Yukl, 2006). According to Huszczko and Endres (2017), leaders need a high level of self-awareness. Leadership self-efficacy has been defined as an individual's confidence in their ability to lead others (Dwyer, 2019), and is considered one of the key variables regulating leader functioning (McCormick, 2001). There is evidence that a high leadership self-efficacy results in better performance and in more interest and effort toward becoming a better leader (Huszczko & Endres, 2017). Furthermore, leadership efficacy has been positively associated with transformational leadership (Carleton et al., 2018; Chan, 2020). This leadership style refers to a process that encourage individuals to commit to a shared vision within an organisation, by challenging them to innovate and develop their own leadership potential (Bass & Riggio, 2006). At present, transformational leadership receives the most attention in leadership research, and is considered to have a very important role to play in educational contexts (Anderson, 2017).

Another self-regulatory process that has recently generated attention in the field of entrepreneurship and innovation is grit (Arco-Tirado et al., 2018; Butz et al., 2018; Nambisan & Baron, 2013; Salisu et al., 2020). According to Duckworth et al. (2007), grit can be defined as the capacity to work toward challenges, maintaining effort and interest over years despite adversity and they have identified perseverance of effort and consistency of interest as two components of grit. Perseverance of effort refers to an individual's capacity to work towards long-term goals (Duckworth et al., 2007), whilst consistency of interest is the degree to which a person is able to maintain the interest

required to achieve such goals despite adversity (Duckworth et al., 2007; Salisu et al., 2020). Recent research involving university students suggests that perseverance of effort overlaps with self-control and conscientiousness, whereas consistency of interest is more closely associated with cognitive self-regulation, effort regulation, and behavioural engagement (Muenks et al., 2017).

Grit as an aggregated factor has been associated with several variables, mainly academic performance (Christopoulou et al., 2018). It has also been associated with greater academic engagement (Hodge et al., 2018), the development of more effective learning strategies (Weisskirch, 2018), goal setting (Muenks et al., 2017), and the pursuit and attainment of postgraduate training (Palisoc et al., 2017). Moreover, according to Kannangara et al. (2018) and Goodman et al. (2017), those with high levels of grit show significantly higher levels of self-control and mental well-being, in addition to having a growth-oriented mindset and a greater ability to overcome stressful life difficulties. Given its positive association with emotional stability, it is considered that grit may buffer the impact of negative life events (Blalock et al., 2015).

Despite being a relatively recent construct, grit has also received some criticism, related mainly to the fact that an emphasis on individual grit may obscure social, economic, and racial justice variables (Anderson et al., 2016). However, accumulating evidence suggests that grit is a highly relevant construct in educational contexts (Christopoulou et al., 2018; Credé, 2018; Fernández-Martín et al., 2020). In innovation contexts, the influence of grit has not been so extensively studied. Nonetheless, potential relationships between grit and entrepreneurial and innovative behaviours are beginning to be analysed. As an example, the investigations carried out by Nambisan and Baron (2013) and by Mooradian et al. (2016) suggest that grit plays a central role in entrepreneurial development. Moreover, recent research suggests a positive influence of grit on innovating behaviours. Caza and Posner (2019) collected data from an international sample of more than 3,000 leaders and found that those individuals showing higher levels of grit reported more frequent innovating behaviours. Similarly, Suendarti et al. (2020) found that grit had a positive direct effect on the innovative behaviour of educators.

A further variable to contemplate when examining students' self-beliefs in relation to their ability to be creative, entrepreneurial, to lead or persevere is the discipline of study in which they are enrolled. Social cognitive career theory is one of the most influential theoretical models used to analyse educational and occupational choices. According to this theory, self-beliefs, together with other contextual factors, shape career and

educational choices, as we tend to select careers where we feel competent and avoid those in which we do not (Bandura, 1997; Lent & Brown, 2019). In a recent meta-analysis (Sheu et al., 2018), it was found that self-efficacy beliefs and outcome expectations explained a great proportion of the variance in student interest to choose a STEM (science, technology, engineering and mathematics) major. Therefore, depending on the degree to which students perceive creativity, entrepreneurship, leadership or grit as essential skills in their degrees, one might expect to find differences in their self-beliefs.

In relation to this, it has been indicated that innovation is commonly associated with the technical sciences as opposed to the arts, humanities and social sciences (Linton, 2018). Moreover, despite the great potential for innovation across the different fields of study (Teixeira & Forte, 2017), it has been observed that studies on entrepreneurship and innovation carried out in higher education contexts either focus on business or technical disciplines or overlook the degree in which students are enrolled (Teixeira & Forte, 2017; Tsang, 2019). The growing promotion of STEM education (Blackburn, 2017), together with this limited understanding of innovation may have an impact on student self-beliefs regarding their ability to innovate and makes it particularly pertinent to analyse student field of study in this research.

1.3.3 Higher education impact

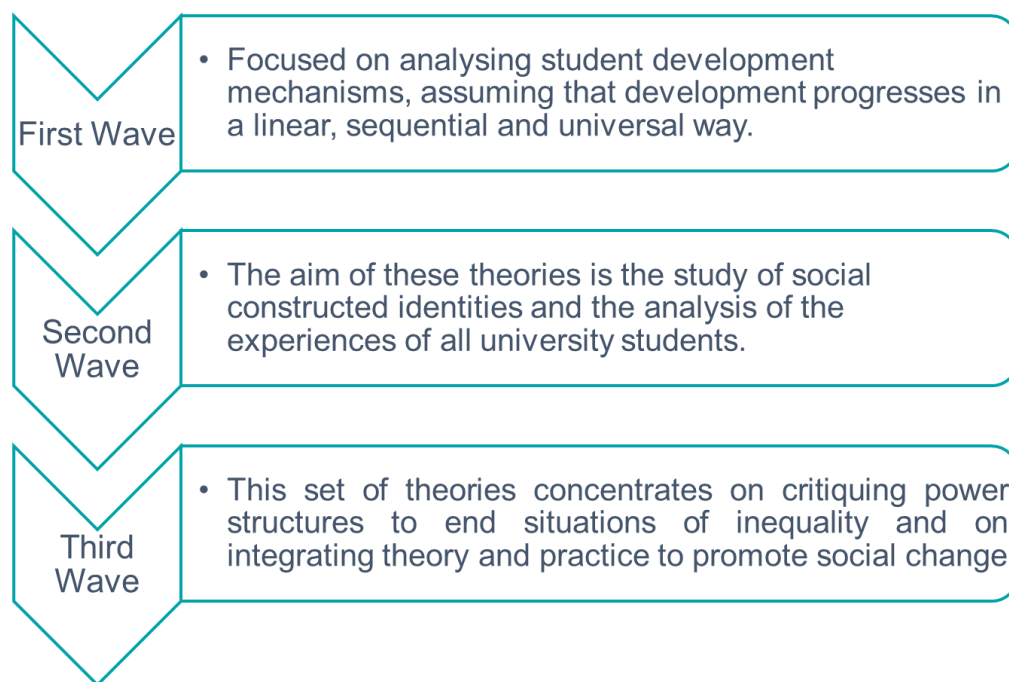
To promote innovation at an institutional level, the study of both student perceptions and the capacity of learning environments to impact on the innovative self-beliefs of students is necessary (Ovbiagbonhia et al., 2019).

The analysis of the impact of higher education learning environments on students is attracting significant research interest. This is reflected in the number of studies published on this area (Tight, 2018). A search for articles in the ERIC database on the impact of higher education returns 8,168 articles in the year 2020, and in the last five years almost 40,000 articles were published on this topic. This line of research focuses on the identification and analysis of relationships between the university experience and student development (Pascarella, 2006). With this objective, and grouped under the term “student development research”, different models and theories have been developed to describe critical factors and interactions that influence student change (Ozaki, 2016). Student development as a field of study was described by Rodgers (1990) as the set of theories and research related to student development in post-

secondary education. More recently, Patton et al. (2016, p.6) defined student development as “*the collection of theories related to college students that explain how they grow and develop holistically, with increased complexity, while enrolled in a postsecondary educational environment*”.

These theories have evolved from models that interpreted student development as a sequential and universal process to more integrative models that seek to understand the university experiences of those students belonging to minority groups (Jones, 2019). Subsequently, critical and post-structural perspectives have been incorporated into the analysis of student development. The aim of these approaches is to explicit inequality structures in order to pursue social transformation. Jones and Stewart (2016) put forward a division into waves of the theories that have been developed to understand student development in higher education contexts, represented in the following figure.

Figure 3. Evolution of student development theories (adapted from Jones et al., 2016)



The increasing complexity of these theories highlights the difficulty of analysing the development of university students. However, this line of research is necessary to gain an understanding of how to stimulate student cognitive and non-cognitive growth (Lori et al., 2016). Specifically, it can help design higher education contexts that encourage positive growth in all students. Indeed, the role of context is one of the fundamental elements of those theories that analyse student development (Jones, 2019). Within such models, Astin's (1984) engagement theory is particularly relevant. According to

this theory, learning is directly proportional to the quality and quantity of personal engagement; increased engagement stimulates cognitive complexity, which leads to learning and development. Similarly, there is evidence of a positive association between student involvement and non-cognitive development (Gutman & Schoon, 2013). From this perspective, the university experience ought to offer academic and non-academic opportunities to get involved with other people and ideas; nonetheless, the student needs to be able to capitalise on such experiences (Pascarella & Terenzini, 2005).

The concept of engagement has been present in the academic literature for more than sixty years, with its meaning evolving over time (Feldman & Newcomb, 1969; Tight, 2019). Presently, it is widely accepted that student engagement is a particularly influential factor in the development and learning of university students (Kahu & Nelson, 2018; Trowler, 2010). According to a recent definition that tries to embrace the different dimensions of the term, student engagement is “*the energy and effort that students employ within their learning community, observable via any number of behavioural, cognitive or affective indicators across a continuum.*” (Bond et al., 2020, p.3)

Nonetheless, engagement is a complex and controversial concept, studied from different approaches and multiple theories (Kahu, 2013; Payne, 2019; Trowler & Trowler, 2010). According to Azevedo (2015), engagement is one of the least accurately used and overgeneralized constructs found in the educational field. In fact, part of this misperception may be due to different contextual interpretations. The concept of engagement has its historical roots in a body of work based on research primarily from North America and Australia, and in large-scale annual national surveys. At European level, however, the idea of engagement has been approached from other perspectives, predominantly focusing on the study of learning approaches (Trowler, 2010). Furthermore, there has been some overlap between the term of engagement and that of motivation (Skinner, 2016). Nonetheless, nowadays motivation is understood as the individual differences and psychological processes behind a given behaviour (Zepke, 2014), and engagement is generally portrayed as the external manifestations of motivation in behavioural, emotional, and cognitive terms (Fredricks et al., 2019).

Several literature reviews have been published on student engagement, and researchers have sought to address the multidimensionality of the term, as reflected in Table 1. Nonetheless, one of the most widely used categorisation in the literature is

that of Kahu (2013), according to which, four approaches to engagement can be observed. The behavioural perspective focuses on the effective practice of teaching; the psychological perspective understands engagement as an internal individual process; the sociocultural perspective assigns a critical role to the sociocultural context, and the holistic perspective aims at bonding the rest of the perspectives.

Table 1. Engagement dimensions, according to different literature reviews (Vuori, 2014; p.513)

Kahu (2013)	Leach & Zepke (2011)	Trowler (2010)	Wimpenny & Savin-Baden (2013)	Bond & Bendelier (2019)
Behavioural dimension	Motivation and agency	Student individual learning	Inter-relational engagement	Behavioural
Psychological dimension	Transactional engagement (with educators)	Structure and process	Engagement as autonomy	Affective / Emotional
Socio-cultural dimension	Transactional engagement (with students)	Identity	Emotional engagement	Cognitive
Holistic dimension	Institutional support Active citizenship		Engagement as connection or disjunction	

The behavioural approach to engagement highlights the importance of both student actions and institutional practice, and it is the most widely researched perspective of engagement in higher education literature (Tight, 2019). This approach is based on Kuh's (2009) definition of engagement as being the time and effort students devote to activities that are empirically linked to the desired outcomes of higher education, and what institutions do to induce students to participate in such activities. According to this approach, learning environment plays a key role in creating opportunities for students to engage in meaningful and transformative educational experiences, both inside and outside the classroom (Patton et al., 2016). One of the main limitations expressed towards the behavioural perspective of engagement is that, by focusing only on elements that the institution can control, a wide range of other explanatory variables

are excluded, such as student motivation, expectations, and emotions (Kahu, 2013). However, it is broadly recognised that the behavioural approach to engagement provides a practical lens from which to manage the significant challenges current higher education institutions face (Coates & McCormick, 2014).

In addition, it has been noted that this conceptualisation of engagement has substantial strengths, such as its ability to address numerous critical factors that affect learning and teaching (Zepke, 2018), to promote student development through their sense of belonging (Thomas, 2012), or to consider students as co-producers of knowledge rather than as consumers (Nygaard et al., 2013). The study of university student development from a practical perspective of engagement seems particularly relevant at a moment when the need for empirical research to promote the innovative, creative and entrepreneurial potential of students has been expressly indicated (Nowiński et al., 2019; Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018). In relation to which, it has been argued that student engagement and self-efficacy are intertwined constructs (Gist & Mitchell, 1992; Llorens et al., 2007; Schunk & Mullen, 2012). Although we are unaware of any studies that have explicitly examined the relationship between student engagement and innovation confidence beliefs, there is recent evidence that certain educational contexts can promote student general self-efficacy beliefs (Van Dinther et al., 2010) and specific creative confidence beliefs (Anderson & Haney, 2020). Furthermore, Bowden et al. (2019) found that behavioural engagement determined self-efficacy and self-esteem among university students.

The National Survey of Student Engagement (NSSE), a project managed by Indiana University, is the best known example of the behavioural approach to engagement. This survey is based on Kuh's (2009) definition of engagement as being the time and effort students devote to activities that are empirically linked to the desired outcomes of higher education, and what institutions do to induce students to participate in such activities. The NSSE project was created with the intention of concentrating on those educational contexts and practices that research has associated with student learning and development over decades (Kuh, 2010). Accordingly, it assesses student engagement in relation to approaches to learning, to collaborative learning with peers, to interactions with faculty, and to the campus environment (Kuh, 2010).

When it comes to learning strategies, NSSE captures not only how much students engage in analysing course materials or in quantitative reasoning, but also to which extent they engage in higher order learning and reflective and integrative learning. Higher order learning refers to the extent to which the work proposed to students

emphasises cognitive tasks such as application, synthesis or evaluation. The block of questions related to reflective and integrative learning assesses the extent to which student learning is connected to their personal experiences and understandings. It also captures the extent to which students analyse topics from different perspectives. Compared to superficial learning approaches, more associated with content memorization, when students engage in deep learning approaches they aim to understand and to critically reflect on what they are learning (Asikainen & Gijbels, 2017). It is currently considered that a deep approach to learning should be prioritized in order for university students to develop quality learning (García Martín, 2011). Furthermore, in a sample of more than 8,000 students participating in the 2010 National Survey of Student Engagement, Miller and Dumford (2016) found significant positive relationships between deep approaches to learning and student creative processes.

Collaborative learning and discussions with diverse others constitute the learning with peers section of NSSE. According to Loes et al. (2018), interdependent work with peers in achieving shared educational goals stimulate student intellectual growth. There is, indeed, abundant evidence on the positive influence of collaborative learning on several learning outcomes. Learning with peers has been positively associated with student development in the following areas, among others: critical thinking skills development (Schamber & Mahoney, 2006), academic achievement and better psychological adjustment (Johnson et al., 2000) and openness to diversity (Loes et al., 2018). To assess collaborative learning NSSE asks students how often they involve in meaningful interactions with peers, like working on team projects or preparation for exams. How often they involve in discussions with people from different races or ethnicities, economic backgrounds, religious beliefs or political views is assessed to analyse to which extent students interact with and learn from others who have different life experiences.

NSSE also looks at the extent to which students interact significantly with the teaching staff. The more often students meaningfully interact with educators, the greater their personal and academic growth, particularly in the following areas: satisfaction college and retention (Pascarella & Terenzini, 2005), student learning, and academic achievement (Kim & Sax, 2009). In a sample of 5,169 university students across 10 campuses, Kim & Lundberg (2016) found that student-faculty interaction is positively associated to greater engagement, and students' cognitive skills development. According to Kuh (2003), meaningful interactions with faculty are characterised by

discussing intellectual issues and future career plans, while discussing personal problems or informally socialising do not seem to influence student development.

Quality of interactions and a supportive environment are considered campus environment engagement indicators. NSSE assesses to which extent students involve in positive formal and informal interactions. In addition, it assesses to which extent the campus environment promote student wellbeing, opportunities to be socially involved and academic and non-academic support. In their review of nearly 2,500 studies dealing with how college affects students, Pascarella and Terenzini (2005) found that supportive higher education contexts improved student academic competence. With a dataset that included 3,796 non-first generation and 1,844 first-generation university students, Wright (2017) observed that while supportive campus environments are critical for all students, they are particularly essential for first-generation students.

NSSE is one of the most widely used tools for measuring engagement in higher education. In 2020, 484,242 students responded to NSSE, and approximately 6 million students have completed the survey since 2000. In terms of structure, in addition to collecting information on the above mentioned engagement indicators, students report on sociodemographic characteristics and estimate their growth, both educational and personal, in areas of general knowledge: intellectual, communication skills, personal, social and ethical development and professional preparation (Kuh, 2009).

The NSSE also explores students' participation in what are known as high-impact practices, namely learning communities, service learning, research projects, internships, and study abroad. According to Kuh (2008), these practices are beneficial because they require commitment on the part of students and oblige them to communicate with both peers and faculty about meaningful topics. High-impact practices encourage the interaction of students with diverse ideas and people of different backgrounds, while providing them with regular assessments of their work and allowing them to apply their knowledge in different contexts (Kilgo et al., 2015). Research has found that students who participate in one or more of these practices report gains in terms of personal growth and socially responsible leadership (Kilgo et al., 2015). Furthermore, the benefit of participating in these practices is positive for the entire student population, but evidence suggests that students belonging to minority groups tend to benefit more from participating in this type of educational activities (Kuh, 2008).

Accordingly, it is important to acknowledge that the impact of higher education experiences may not be the same for everyone as each student brings their own

circumstances. Student biological, psychological and emotional characteristics, together with life experiences, condition the influence of the university context on their development. Consequently, the present investigation is not limited to specific students or study disciplines and aims to focus on the entire student population, acknowledging that anyone is capable of participating in innovation processes (Keinänen & Kairisto-Mertanen, 2019). According to Alsos et al. (2013), more research is particularly required on the relationship between the educational experiences of women and their innovative development.

1.3.4 Gender analysis in research

Addressing a gender perspective in research is vital, as gender is one of the main categories on which inequalities are based (Sanz, 2016). The incorporation of a gender perspective in research implies that gender is considered a key analytical and explanatory variable in the investigation (European Commission, 2011). Gender conceptualises the cultural construction of what it implies to be masculine or feminine and cannot be determined (Howes, 2002). This conceptualisation moves away from a simplistic association of gender with sex that marginalises people who deviate from a supposed “normality” (Brotman & Moore, 2008; Scantlebury et al., 2007).

Within the framework of this research, adopting a gender perspective is mandatory, as innovation, together with technology and entrepreneurship, is an area commonly characterised by either gender-blindness or male dominance (Ranga & Etzkowitz, 2010). In this regard, the innovation literature has been criticised for rarely adopting gender perspectives in innovation studies (Nählinder et al., 2015), particularly as gendered constructions of innovation continue to be reproduced in different ways and in different domains (Alsos et al., 2013). This may have an effect on the professional development of the different genders. According to the recent Report of the Global Entrepreneurship Monitor (GEM, 2019), there is a deficit of gender equality in the early stages of the entrepreneurial process in Europe, as women, along with other minorities, are significantly less likely than men to embark upon an entrepreneurial career (OECD/European Union, 2019).

Indeed, entrepreneurship and innovation are frequently portrayed as male stereotyped activities (Ahl, 2006; Alsos et al, 2013; Ranga & Etzkowitz, 2010). These gendered conceptualisations have been associated with the gender bias that presupposes that

women do not possess the skills to develop an entrepreneurial career (Alsos et al., 2013; Hmieleski & Sheppard, 2018; Lackeus, 2015). Gender stereotypes internalised by children and adolescents may contribute to the development of certain gender identities that can help perpetuate professional career discrimination (Alon & DiPrete, 2017; Bian et al.; 2017). It has been established that self-efficacy beliefs influence gender differences in interest in academic careers (Eccles et al., 1983; Lent et al., 1994, 2017; Lent & Brown, 2008). Research has consistently shown the predictive nature of students' self-efficacy beliefs in career entry behaviours, such as university degree choices and academic performance (Hackett, 1995; Lent & Brown, 2019). Researchers have demonstrated that women, in general, show lower self-efficacy than men for male-dominated STEM careers (Hackett, 1995; Tellhed et al., 2017), an argument that contributes to explain the persistence of horizontal gender segregation within academic disciplines of study (Alon & DiPrete, 2017).

Several studies (Dempsey & Jennings, 2014; Díaz-García & Jiménez-Moreno, 2010; Wilson et al., 2009) have indicated that women show, in general, less confidence in their entrepreneurial abilities and this, in turn, has been associated with a lower development of entrepreneurial intentions. This pattern has also been confirmed in the university context (Díaz-García & Jiménez-Moreno, 2015; Gatewood et al., 2002; Nowiński et al., 2019), although other studies have found no differences (Conway Dato-on & Mueller, 2008; Zhao et al., 2005). According to Newman et al. (2018), these inconclusive results may be associated with not analysing gender as a socially constructed concept.

Research has also reported gender differences concerning self-confidence in creative abilities. No systematic differences were found between genders in terms of creative potential and, when differences have been found, these have been suggestive of better creative capacities among women (Baer & Kaufman, 2008). Nevertheless, several studies have shown that men tend to report greater creative efficacy than women (Karwowski, 2011; Zhou et al., 2012), although other studies have found no divergences (Gibbs, 2014; Zhang & Zhou, 2014). In their review of creative self-efficacy studies, Farmer and Tierney (2017) suggest that the inconsistency of these results may be due to the different contexts in which these investigations were carried out.

Leadership self-efficacy has not been so extensively analysed from a gender perspective (Hannah et al., 2008; Paglis, 2010). Studies that have adopted a gender perspective on leadership, show mixed results. Huszczo and Endres (2017) and Singer (1991) did not find any differences relating to feelings of confidence in the leadership

skills of men and women, whereas other studies did find significantly higher levels of leadership self-efficacy among men (Bobbio & Manganeli, 2009; McCormick et al., 2002).

Regarding grit, Jaeger et al., (2010) found higher levels of grit among first-year university women. Similar patterns of differences were reported by Kannangara et al. (2018), who found a positive association between grit and higher levels of self-control and mental well-being. Sigmundsson et al. (2020) found no significant gender differences in grit, but different associations between grit, mindset and passion based on gender. Cross's (2014) study examined the relationship between grit, academic achievement, and gender; results showed that there was a significant and positive relationship between grit and academic achievement for women, but not for men. In the same time frame, other studies have not found significant gender differences in grit (Flanagan & Einarson, 2017; Park et al., 2020; Stellmacher et al., 2020; Warren & Hale, 2020). As an example, Hodge et al. (2018) measured grit, engagement and academic productivity among 395 Australian university students, and found no gender differences. Nonetheless, in their conclusions they argue that the overall inconclusive results found in the literature may be due to the existence of underlying variables that diverge between the different studies.

In relation to student engagement in higher education, recent studies suggest that gender, race, and ethnicity play an important role in student engagement (Gaias et al., 2020; Pascarella & Terenzini, 2005), reason why the need to incorporate these demographic variables into the study of the impact of higher education has been advocated (Mayhew et al., 2016).

In the view of these evidences that point to gendered patterns of engagement and self-concept affecting student development, further analysis of the conditional effects of gender is deemed necessary.

1.4 Research objectives and hypotheses

The aim of this thesis is to provide new insights into aspects and particularities relating to the development of a student innovative mindset at higher education institutions, and to contribute to filling some of the gaps detected in the extant literature. The first aim of this research was to explore first-year student perceptions about their ability to generate new ideas and create products. Particularly, we aimed to explore gender

differences in student self-perceptions, doing so by means of a mediation and moderation analysis.

The need for more empirical research to understand the influence of different learning environments on the creative development of students had been previously argued (Elisondo et al., 2008; Marquis et al., 2017). This need is particularly visible in the Spanish context, where, despite considering creativity as a key competence (Álvarez-Santullano & De Prada Creo, 2018), university students have the perception that creativity is one of the skills they least develop during their degrees (Gómez et al., 2018). In relation to this, Miller and Dumford (2016) indicate the need to study the relationship between student engagement and creative development. Hence, a second objective of the present research has been to examine the relationship between a student's creative self-efficacy and degree of engagement with the educational context. The examination of gender differences in the relationship between student engagement and creative self-efficacy was also deemed pertinent.

Thirdly, the lockdown measures imposed in Spain as a result of the COVID-19 pandemic coincided with the present studies. Besides being related to entrepreneurship and innovation (Caza & Posner, 2019; Newman et al., 2018), grit and creative confidence self-beliefs are also known to be associated with the ability of showing resilience in the face of adverse life events (Matthews et al., 2019; Orkibi & Ram-Vlasov, 2018). Consequently, the third objective of this investigation has been to examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on student grit and creative self-beliefs. We also tested for gender differences in the variables analysed within this topic.

Lastly, the need to improve the innovative skills of university students is commonly asserted (Mayhew et al., 2016; OECD, 2019b; Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018; Tsang, 2019), and the need to develop the required tools to measure innovation in educational context has been argued (Tsang, 2019). The fourth objective of this research was to put forward a novel theoretical model based on creative self-efficacy, entrepreneurial self-efficacy and grit so as to analyse and understand the development of student innovative mindsets in higher education institutions.

The overall aim of the research studies included in this thesis is to build a better understanding of the personal and contextual influences that encourage higher education students to engage in innovation. In order to do so, these are the specific research objectives of this thesis:

1. To analyse the relationship between gender and university student perceptions about their ability to generate new ideas and create products. Hypotheses were as follows:
 - Creative self-efficacy and leadership self-efficacy are expected to predict entrepreneurial self-efficacy of first-year university students.
 - Men are expected to exhibit higher entrepreneurial self-efficacy, creative self-efficacy and leadership self-efficacy than women.
 - Students enrolled in technical disciplines are expected to show higher entrepreneurial self-efficacy, creative self-efficacy and leadership self-efficacy than students enrolled in social sciences degrees.
 - The relationship between gender and entrepreneurial self-efficacy is expected to be partially explained by the mediation effect of creative self-efficacy and leadership self-efficacy.
 - A moderating effect of the field of study in the relationship between gender and entrepreneurial self-efficacy is expected.

2. To examine the relationship between student perceptions regarding their ability to produce creative outcomes, and the degree of student engagement with their educational context. Specifically we expected to find:
 - A positive relationship between student engagement and creative self-efficacy.
 - Among first-year students, collaborative learning, reflective and integrative learning, and higher-order learning to be more closely related to creative self-efficacy. In final-year students, to observe a greater influence of student-faculty interaction and high-impact practices, as these types of experiences become more relevant towards the end of a degree program.
 - Differences in the relationship between engagement and creative self-efficacy depending on the gender and field of study.

3. To examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on student perceptions towards creativity and grit.
 - We predicted that students would show an increase in perseverance of effort, consistency of interest, and creative self-efficacy following the experience of lockdown.

4. To propose a novel theoretical model based on creative self-efficacy, entrepreneurial self-efficacy and grit so as to analyse and understand the development of student innovative mindsets in higher education institutions.

Hypotheses were as follows:

- It was expected that students enrolled in technical disciplines would show higher values in the variables associated with innovative mindsets.
- It was expected that women would show higher perseverance of effort scores than men would. In contrast, men were expected to show higher creative self-efficacy and entrepreneurial self-efficacy.

1.5 Context

1.5.1. European Education system

Within the European Union, each country establishes its own education system. Nevertheless, common guidelines are followed. In all countries, the full-time compulsory education/training period includes at least primary and lower secondary education, although countries may vary in terms of organisational models (European Commission/EACEA/Eurydice, 2020). With regards to tertiary education, each European country has its own individual higher education system, but they are all part of the European Higher Education Area (EHEA). In the EHEA, 48 countries cooperate to achieve a quality higher education, comparable and compatible, throughout Europe. Member countries of the EHEA follow the directives of the so-called Bologna Process to achieve these goals. As part of the Bologna Process, countries within the EHEA have implemented systems with three cycles of higher education qualifications: Bachelor's degrees, Master's degrees, and Doctoral degrees. An essential part of the EHEA is The European credit transfer and accumulation system (ECTS), according to which one year of full-time academic study corresponds to 60 ECTS credits. The system is designed to promote student mobility and make national systems more compatible (European Commission, 2018). Another main feature of the EHEA, with around 38 million students currently enrolled (European Commission, 2020a), is the emphasis on promoting student competences to support their social and professional development (European Commission, 2017).

1.5.1.1 Spanish education system

The Spanish education system, in line with European guidelines, follows a methodological approach based on key competences and learning outcomes. As regards the structure, in Spain, educational competences are shared between the General State Administration and the authorities of the autonomous communities. Central education administrations execute the general guidelines of the Government on education policy and regulates the basic elements or aspects of the system, while regional education authorities develop the State regulations and have executive and administrative competences for managing the education system in their own territory (OECD, 2018). Educational institutions have pedagogical, organisational and managerial autonomy for their resources.

Educational institutions are organised around the different stages that characterise the Spanish Educational system. In Spain, preschool education is optional, basic education is compulsory and it is divided, in turn, into two stages. Primary education is provided in primary school, and is usually studied between the ages of 6 and 12. After successfully completing primary education all students progress to lower secondary level where they follow the same general common core curriculum. At the end of this stage, students receive the Lower Compulsory Secondary Education Certificate, which allows them to have access to upper secondary education. Upper secondary education takes place in secondary schools. It lasts two academic years, and offers two possibilities: baccalaureate, and intermediate vocational training. The latter is also offered in vocational training integrated institutions. Higher education institutions include not only universities but also various professional studies.

1.5.1.1.1 Spanish higher education system

The Spanish higher education system has undergone profound changes, particularly because of the modifications introduced after the publication of Organic Law 6/2001 on Universities (LOU). This regulation included a series of measures to enable appropriate modifications to adapt the Spanish university system to the European Higher Education Area. Subsequently, by means of Royal Decree 1125/2003, the European credit system and the qualification system were validated throughout the country. Harmonization of higher education systems within the framework of the European higher education area was further strengthened with the organic Law 4/2007 (LOMLOU). These regulations respond to the aspiration of the European university

community to establish common key values such as freedom of expression, academic freedom or free movement of students and staff. Reforms also aim to enhance the autonomy of the universities, while increasing the demand for accountability. The European Union promotes these reforms in order to support the modernisation of European universities and to turn them into active agents for the transformation of Europe into an economy fully integrated in the knowledge society.

Nowadays, the Spanish University carries out the public service of higher education through research, teaching and study in accordance with current legislation (Organic Law 6/2001, of 21 December, on universities). The specific functions of the University are the following:

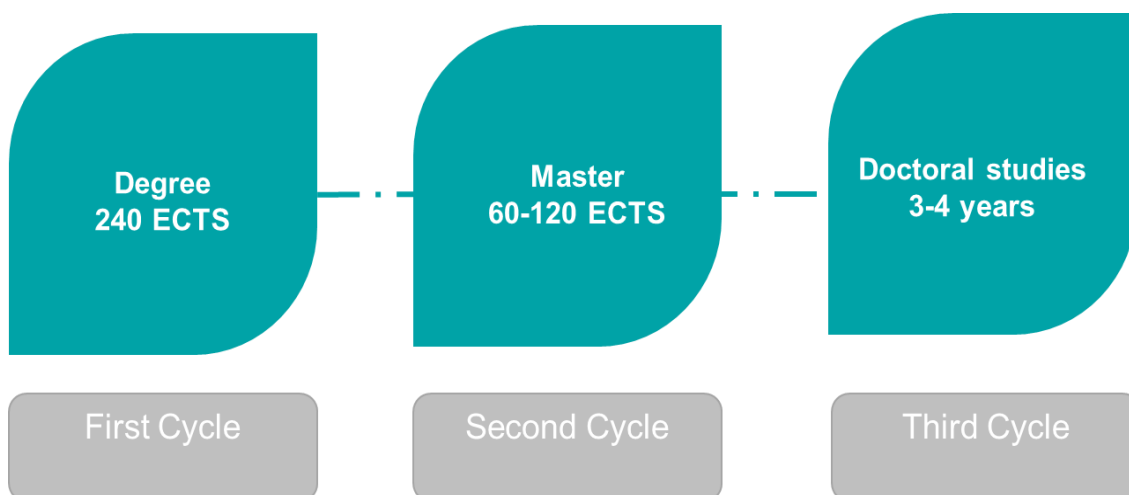
- a) The creation, development, transmission and criticism of science, technology and culture.
- b) The preparation for the exercise of professional activities that require the application of scientific knowledge and methods and for artistic creation.
- c) The dissemination, appreciation and transfer of knowledge at the service of culture, quality of life, and economic development.
- d) The dissemination of knowledge and culture through university extension and lifelong learning.

The Spanish universities, through its different functions, are a basic pillar of the Spanish Strategy for Science, Technology and Innovation (Ministerio de Ciencia e Innovación, 2021). This strategy seeks to restore economic growth after the impact of the pandemic declared by COVID-19 and consolidate Spain as a country of knowledge and innovation. To meet these challenges, it is acknowledged that students will need to acquire relevant competences during their university experience (European Commission, 2019).

Programmes of higher education in Spain and in the European Higher Education Area are offered at three levels – undergraduate, graduate and doctoral studies. Undergraduate degree studies, lead to the award of a degree, and are organised in the following areas: Arts and Humanities, Sciences, Health Sciences, Social Sciences and Law, Engineering and Architecture. These studies require a total of 240 credits for obtaining a grade degree and have an average duration of three or four academic years. Graduate studies leading to the award of a Masters degree require between 60 and 120 credits and usually consist of one to two academic years of study. They also require the public defence of a thesis. Postgraduate studies lead to the award of a

Doctoral degree and require a Master's degree. Besides these official degrees, each university offers a wide range of unofficial specific qualifications. These degrees, with an average duration of one or two years, require a prior graduate or postgraduate degree.

Figure 4. Spanish Higher Education structure following European Higher Education Area guidelines



In the 2018-2019 academic year, the Spanish university system comprised 83 universities, 50 public and 33 private (MCIU, 2020). In the same academic year, 2,920 undergraduate degrees were offered, with 1,293,697 students enrolled. The number of Master's degrees in the 2018-2019 academic year was 3,567, with 214,528 students enrolled, and a total of 1,137 doctoral degrees were taught, in which 86,619 students were enrolled (MCIU, 2020).

1.5.1.2 Basque Autonomous Community education system

Organic Law derived from article 27 of the Constitution regulates the basic aspects of the Spanish educational system. This law is applicable to the Basque Educational System without prejudice to the faculties derived from the Statute of Autonomy in relation to both general and special education. HEZIBERRI 2020 is the Department of Education's framework of the Basque pedagogical educational model, in which the main lines of the pedagogical educational model are indicated: promoting multilingualism and the use of the Basque language, integrating information and communication technologies, and fostering a competence-based educational approach. The framework is the result of gathering the European educational

objectives, the educational policy of the Basque Government, and previous outcomes of the Basque educational system (Eusko Jauriaritza, 2015).

The structure of the Basque educational system overlaps with the structure of the Spanish educational system, being divided into primary, secondary and higher education.

1.5.1.2.1 Basque higher education system

The Basque Parliament ratified in 2004 the Law 3/2004 of the Basque higher education system, which is built upon the principles of service to society, university autonomy and democratic functioning, and determines the scope, basic contents and general objectives of the Basque University. The objectives of the Basque university system are:

- a) The creation, development, transmission, dissemination and criticism of science, humanities, techniques, arts and culture.
- b) The intellectual, scientific, humanistic, technical, and professional training of the students, as well as the contribution to the permanent training of people throughout their lives.
- c) To contribute to social cohesion, through the consolidation and growth of the Basque intellectual, humanistic, artistic, cultural, technical and scientific heritage.
- d) To educate for freedom of democratic thought and expression and the right to political equality regardless of people's ideology.
- e) To incorporate the Basque language into all areas of knowledge, thus contributing to the normalisation of its use.
- f) To connect the Basque university system with the labour system
- g) To contribute to the reduction of social and cultural inequalities.
- h) To contribute to international exchange and cooperation.

The Basque university system is made up of three universities: University of the Basque Country, University of Deusto and Mondragon Unibertsitatea. Campuses are spread over the three Historical Territories (Gipuzkoa, Bizkaia and Araba), and with a total of 34 Faculties, Schools and Affiliated Centres, the Basque university system mobilises a community of almost 56,000 students and more than 9,000 professionals.

1.5.1.2.1.1 Mondragon Unibertsitatea

Mondragon Unibertsitatea (MU) is one of the three universities that make up the Basque university system. Established in 1997 and officially recognised by Law 4/1997 of May 30, Mondragon Unibertsitatea was created from the association of three educational cooperatives: Mondragon Goi Eskola Politeknikoa “Jose M^a Arizmendiarieta” S.Coop, ETEO S.Coop. (currently MU Enpresagintza S.Coop.), and HUHEZI S. Coop. (MU, 2019). It currently has four Faculties and seven campuses or headquarters:

- Faculty of Engineering, in Arrasate-Mondragon, Bilbo and Goierri.
- Faculty of Business, in Oñati, Bilbo and Bidasoa.
- Faculty of Humanities and Educational Sciences, in Eskoriatza, Aretxabaleta and Bilbo.
- Faculty of Gastronomic Sciences, in Donostia.

During the 2019-20 academic year, Mondragon Unibertsitatea offered 16 undergraduate degrees in six areas of knowledge: engineering, business management, entrepreneurship, communication, education and gastronomy. Spread over its ten campuses, the student population enrolled during the 2019-20 academic year in official Mondragon Unibertsitatea degrees was that of 5,512 (Mondragon Unibertsitatea, 2021).

The mission of Mondragon Unibertsitatea is to transform society through the comprehensive training of people and the generation and transfer of knowledge. Every four years, Mondragon Unibertsitatea carries out a process of strategic reflection aimed at improving the quality of university training, research and transfer activities. The strategic plan 2021-2024, includes the following main strategic priorities:

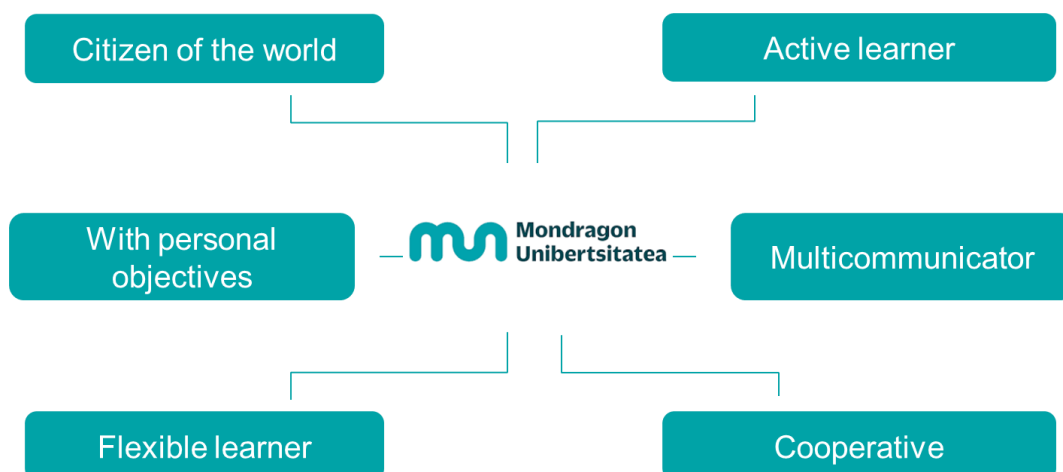
- To strengthen student personalised and differential learning experiences.
- To reinforce the character of a global university, open to the world through territorial expansion and international openness.
- To promote digital transformation.
- To increase its socio-economic impact by contributing to business transformation and entrepreneurship.
- To promote specialisation and excellence in Research and Transfer.
- To actively and transversally promote Sustainable Human Development.

- To continue its commitment to be an interesting cooperative university project, which promotes growth and sustainable development.

MU's strategic lines are actively supported by educational practices developed in accordance with the MENDEBERRI (“new century”, in Basque) framework. The MENDEBERRI project began in the 2001-2002 academic year and, following UNESCO guidelines for 21st century learning, guided the revision of MU's educational paradigm. A trilingual (Basque, Spanish, English) educational model characterised by development of competences, practical pedagogies, and intensive management of new information and communication technologies was proposed. In subsequent years, MU has continued developing educational innovation processes in relation to digitalisation, student mobility and internationalisation, and particularly in relation to recognising the responsibility of education in achieving sustainable human and social development (García Martín et al., 2017).

MENDEBERRI 2025 is now focused on the personal, social and professional training of students, so that they are able to cope with future personal and professional challenges. Consequently, six axes have been identified as objectives to be achieved by Mondragon Unibertsitatea graduates, as represented in Figure 5.

Figure 5. Objectives of MENDEBERRI 2025 educational model



These objectives are associated with the development of specific student competences, and aligned with the educational context demarcated in the MENDEBERRI framework according to the socio-constructivist paradigm.

1.5.2 Time frame

The data collections corresponding to this research were carried out during the academic years 2018-2019, 2019-2020 and 2020-2021. This is a context characterised by rapidly evolving data-driven technologies, globalisation, and transnational global crisis. Innovation is deemed to play a critical role in mitigating and responding to such challenges. It can also help societies navigate through uncertainty, another characteristic of present times, particularly after the emergence of COVID-19.

On March 14, 2020, the Spanish Government declared the state of alarm to deal with the health situation caused by the SARS-CoV-2 coronavirus. This exceptional situation lasted 98 days, and during the first 48 days freedom of movement was severely restricted. To date, considering the elevated socio-economic implications of the health crisis, Spain is one of the worst-hit countries by the COVID-19 pandemic (Eurostat, 2020; MAPFRE Economics, 2020). Among the measures implemented during the state of alarm, all on-site educational activity was suspended. The suspension forced the educational community to adapt to an online teaching and learning scenario.

Recent studies have documented psychological distress in the general population as a result of the emergence of COVID-19 outbreak (Passavanti et al., 2021; Rajkumar, 2020; Serafini et al., 2020; Wang et al., 2020). In the student population, the studies carried out in China by Zhou et al. (2020) and in the United States by Browning et al. (2021) revealed a high psychological impact associated with the quarantine among high school and undergraduate students. In Spain, Marques et al. (2021) indicate that the COVID-19 pandemic is having a significant impact on the psychological health of university students.

Accordingly, further study of the psychological distress associated with the lockdown is a priority; however, the assessment of other variables, not related to the mental health of the students, but involved in managing stressful situations is also pertinent and necessary to address the educational challenges caused by the COVID-19 crisis. Students have had to deal with the psychological impact of the pandemic, in terms of confusion and anxiety due to the exposure to the disease, and the social distancing measures imposed. Furthermore, they have had to adapt to a teaching and learning scenario characterized by teaching time reduction, disconnection from institution and shift to digital environments (Castillo & Velasco, 2020).

From a positive and alternative perspective to recent studies on the psychological impact of the pandemic, it was deemed relevant to analyse the impact of the lockdown

on student development with regard to student perceptions towards creativity and grit; variables associated not only with innovation, but also with the management of stressful and uncertain social circumstances. The examination of this question provides relevant information regarding the contextual influences on the innovative development of university students, one of the main objectives of this research.

1.6 Methods

A quantitative research methodology was selected in order to respond to the research objectives of this doctoral thesis. From this perspective, it is assumed that the reality is unique and tangible, that knowledge can be based on empirical observation, and that researchers remain impartial and objective throughout the research process (Fontes de Gracia et al., 2013).

Specifically, a quasi-experimental design was utilised in the different studies that structure this doctoral thesis. This research strategy aims to promote the study of problems of social and professional relevance that cannot be transferred to the laboratory, but which can be studied under controlled conditions. Interest in the study of real events and the control limitations that characterise such situations prompted the systematisation of quasi-experiments. The quasi-experimental design shares many of its essential characteristics with the experimental design, such as the specific intervention of the independent variable, whose effects on the dependent variable we want to study. In quasi-experimental research, the main limitation is that participants are not randomly assigned. As a result, initial equivalence of the groups is not assured. Therefore, when comparing groups, differences cannot be directly attributed to the manipulation of the independent variable. The use of this methodological strategy entails that results ought to be cautiously analysed and interpreted with regard to causal relationships inferences. Quasi-experimental designs may be further classified according to whether they are longitudinal or cross-sectional. While in longitudinal designs, differences among variables or in the frequency or nature of events are explored at different points in time, cross-sectional designs are used to analyse relationships between variables, groups and events at one point in time.

In the field of higher education impact, it is considered that it is essential and feasible to carry out such research designs (Pascarella, 2006). Despite the aforementioned control deficiencies, quasi-experimental designs have acquired a major role in applied

research in recent decades, particularly in educational contexts. Nonetheless, in applying this methodology, an attempt has been made to identify and control possible threats to internal validity. In this regard, the need for meticulous research designs that include relevant variables of the student profile and the university context, together with complex multivariate statistical analyses has been indicated (Astin, 1970; Astin & Antonio, 2012).

This dissertation comprises four studies in which different research questions are explored. In the first study, a cross-sectional design was used to explore gender differences in entrepreneurial self-efficacy in first-year university students and to identify moderators and mediators of the observed relationship. The same research design was used in the second study regarding university student engagement and creative self-efficacy. To examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on the grit and creative self-efficacy of students at different educational levels, a non-equivalent groups quasi-experimental design was used. In the last study, a cross-sectional design was used in order to develop a novel model for analysing university student innovative mindsets.

Participants

Almost all the students participating in this investigation were enrolled in Mondragon Unibertsitatea. Nevertheless, in order to make the sample more representative, data collection was also extended to other territories. These additional data collections were carried out at Florida Universitària (Valencian Community). This institution is ascribed to the University of Valencia and to Valencia's Polytechnic University and offers university degrees in the following areas: education, tourism, ICT, engineering and business. In addition, it offers training cycles, private face-to-face and semi-face-to-face, and official and own postgraduate programs. Currently, more than 200 professionals work on Florida Universitària and more than 3,700 people study there each year. Moreover, in order to expand the sample and improve the generalisation of the results, high school and vocational training students also participated in the study about the impact of the lockdown measures on students' grit and creative self-efficacy.

Data was collected in a period of three academic years, 2018-19; 2019-20 and 2020-21. A detailed classification of the participants according to research study and academic year is provided in Table 2.

Table 2. Summary of participants

Participants				
	N	Age	Institutions	Academic year
1st study	1,741 792 women 949 men	17 to 27 years <i>Mage</i> = 18.76 <i>SD</i> = 1.82	Mondragon Unibertsitatea Florida Universitària	2018-2019 2019-2020
2nd study	759 400 women 359 men	17 to 43 years <i>Mage</i> = 20.82 <i>SD</i> = 2.66	Mondragon Unibertsitatea Florida Universitària	2018-2019
3rd study	1,380 810 women 570 men	15 to 51 years <i>Mage</i> = 18.34 <i>SD</i> = 4.37	High school <i>N</i> = 853 Vocational training <i>N</i> = 243 Mondragon Unibertsitatea <i>N</i> = 284	2019-2020
4th study	2,369 1,187 women 1,182 men	17 to 46 years <i>Mage</i> = 18.48 <i>SD</i> = 1.90	Mondragon University Florida Unibertsitatea	2018-2019 2019-2020 2020-2021

Instruments

In order to respond to the research objectives of this doctoral thesis, and after an extensive bibliographic review, the following instruments were chosen for use in the different studies included in this thesis:

Entrepreneurial Self-Efficacy. The entrepreneurial self-efficacy instrument developed by Zhao et al. (2005) measures self-efficacy in relation to specific entrepreneurial tasks. Respondents are asked to indicate on a 5-point Likert scale how confident they are (1 = no confidence; 5 = complete confidence) in their ability to identify business opportunities, create new products, think creatively and commercialise an idea or new development. A couple of minutes are needed to answer the items. Zhao et al. (2005) reported a strong relationship between their measure and that developed by Chen et al. (1998), and a weaker relationship to measures of general self-efficacy (Newman et al., 2018). This scale has been used in different studies showing good psychometric properties, Bullough et al. (2014) reported a Cronbach's alpha of .817.

Creative Self-Efficacy Instrument (Tierney & Farmer, 2002). The Creative Self-Efficacy Instrument comprises three items, each rated on a 7-point Likert-type scale (1 = Totally disagree; 7 = Totally agree), and it takes around two minutes to complete. The instrument has been widely used in the educational field and shows good psychometric properties (Puente-Díaz, 2016). This scale shows discriminant and convergent validity in relation to other related constructs such as job self-efficacy (Tierney & Farmer, 2002), creative role identity (Tierney & Farmer, 2011) and intrinsic motivation (Zhou et al., 2012). Across more than 40 samples, this instrument have a median Cronbach alpha of 0.83, suggesting an adequate degree of reliability for this short scale (Farmer & Tierney, 2017).

Leadership Self-Efficacy. This was assessed using three items developed originally by Singer (1991) and employed subsequently in studies by Paglis & Green (2002) and Bobbio and Manganelli (2009), showing positive correlations with other measures of leadership self-efficacy. The first item asks, “*If you were in a leadership position, how effective do you think you would be as a leader?*”, and it is rated on a scale from 1= not effective to 7 = very effective. Respondents are then asked “*To what extent do you think your capacities would fit the requirements of a leadership position?*” and “*To what extent do you think it would be easy for you to succeed in a leadership role?*”, in both cases giving a rating from 1 (= not at all) to 7 (= very much). A couple of minutes are required to complete the items. According to Bobbio and Manganelli (2009), this scale shows acceptable psychometric properties; in their study, reliability was found to be .85.

Grit-S Scale (Grit-S, Spanish adaptation by Arco-Tirado et al., 2018; original scale by Duckworth & Quinn, 2009). The Short Grit Scale (Grit-S) assesses the capacity to work strenuously toward challenges, maintaining interest and effort over years in order to achieve long-term goals. It has two subscales, Consistency of Interest and Perseverance of Effort, both of which comprise four items that respondents rate using a 5-point Likert-type scale (from 1 = “Not like me at all” to 5 = “Very much like me”). The scale takes approximately five minutes to complete. It shows good psychometric properties, including internal consistency, test-retest stability, and convergent and discriminant validity (Duckworth & Quinn, 2009). Arco-Tirado et al. (2018), which validated the Spanish version of the scale, found that the internal consistency of the subscales was low but that the internal consistency of the full scale was adequate supporting the use of the scale in research. Furthermore, the Grit-S scale has been extensively used in educational contexts in recent years (Christopoulou et al., 2018).

National Survey of Student Engagement (NSSE; Kuh, 2010; Zilvinskis et al., 2017). Items used with permission from *The College Student Report*, National Survey of Student Engagement, Copyright 2001-18. The Trustees of Indiana University. The NSSE examines various dimensions of student engagement. For the present study we focused on those which appeared, a priori, to be relevant both to our educational context and to the proposed theoretical framework, namely higher-order learning (4 items), collaborative learning (4 items), student-faculty interaction (4 items), reflective and integrative learning (7 items), and participation in high-impact practices (5 items). With the exception of high-impact practices, item scores are converted to a 60-point scale, with higher scores indicating greater engagement on the corresponding indicator. For high-impact practices, students must indicate whether they have yet to decide, do not plan to, are planning to or have already participated in a given practice. Around ten minutes are required to complete the questionnaire. Cronbach's alphas for the different engagement indicators range from .76 to .88 (NSSE, 2021) and according to Pascarella et al. (2010) there is enough evidence to suggest that the engagement dimensions analyse student participation in practices that predict relevant learning outcomes.

Following the process of translation-back translation commonly used in research, the above scales were translated independently from English into Basque and Spanish, to be later translated into English by two bilingual people and reviewed by the research team (Brislin, 1980). In the case of grit, we used the Spanish adaptation by Arco-Tirado et al., 2018 of the Grit –S scale developed by Duckworth and Quinn (2009), which was translated into Basque likewise following the process of translation-back translation.

A summary of research designs, participants, and instruments employed in the different studies that comprise this dissertation can be found in Figure 6.

Figure 6. Summary of research designs, instruments and participants

	Aim of the study	Research design	Participants	Instruments employed
Research study 1 : Gender and Entrepreneurial Self-efficacy among First-year Undergraduate Students	To explore gender differences in entrepreneurial self-efficacy and to identify moderators and mediators of the observed relationship	Cross-sectional study (survey)	First-year undergraduate students	<ul style="list-style-type: none"> ESE (Zhao et al. , 2005). CSE (Tierney & Farmer, 2002). LSE (Singer, 1991; adapted by Paglis & Green (2002) and Bobbio and Manganelli (2009).
Research study 2: University student engagement and creative self-efficacy	To examine the relationship between student engagement and creative self-efficacy in undergraduates	Cross-sectional study (survey)	First and fourth-year undergraduate students	<ul style="list-style-type: none"> CSE (Tierney & Farmer, 2002). NSSE (Kuh, 2010; Zilvinskis et al., 2017).
Research study 3: Grit and creativity in a time of pandemic	To examine whether the academic challenges posed by the lockdown had an impact on the grit and creative self-efficacy of students	Non-equivalent groups quasi-experimental design (survey)	Secondary school students Vocational training students University students	<ul style="list-style-type: none"> CSE (Tierney & Farmer, 2002). Grit-S Scale (Spanish adaptation by Arco-Tirado et al., 2018; original scale by Duckworth & Quinn, 2009).
Research study 4: First-year university students' innovative mindset:	To develop an instrument that measures students' innovation mindset in higher education contexts	Cross-sectional study (survey)	First-year undergraduate students	<ul style="list-style-type: none"> ESE (Zhao et al. , 2005). CSE (Tierney & Farmer, 2002). Grit-S Scale (Spanish adaptation by Arco-Tirado et al., 2018; original scale by Duckworth & Quinn, 2009).

Procedure

The procedure is explained in detail in the methods section of each of the studies that structure this thesis. Nonetheless, some general comments are made below on the common procedures followed.

The samples were generated through convenience sampling, which involves non-random selection of sampling units. In order to maximise statistical power for detecting effects of reasonable magnitude optimum, sample size was determined using G*Power (Faul et al., 2007).

In each of the studies, an online questionnaire was developed with the different instruments required to answer the research questions. Demographic questions related to field of study, gender (binary or non-binary) and age were also included. Questionnaires were then presented to students in the form of an online questionnaire, which they could access and complete via their personal laptop or smartphone. Students completed the questionnaire during class-time. For the study analysing whether the lockdown had an impact on student grit and creative self-efficacy, students completed the grit and creative self-efficacy scales at two time-points, before the lockdown (January-February 2020) and 15 days after major lockdown restrictions were lifted (June 2020).

The research team explained to students the nature of the study, and how to access the questionnaire. It was made clear to them that participation was voluntary and that all data would remain confidential in accordance with current Spanish legislation, to this effect all participants signed informed consent (electronically) prior to any data collection.

Data Analysis

All data analysis were conducted using either SPSS software (version 26.0) or MPLUS software version 7.4 (Muthen & Muthen, 2016). After conducting descriptive analysis, specific analysis were performed depending on the research questions guiding each of the individual studies:

Research study 1 – Gender and entrepreneurial self-efficacy among first-year undergraduate students

The statistical analysis involved four steps. First, we performed descriptive and bivariate correlation (Pearson) analyses for all variables of interest. We then conducted a linear regression analysis to examine the effect of creative self-efficacy and

leadership self-efficacy on entrepreneurial self-efficacy. Next, linear regression was again used to analyse the effect of gender and field of study on creative self-efficacy, leadership self-efficacy, and entrepreneurial self-efficacy. Finally, we developed a moderated mediation model to test the possible mediator effect of creative self-efficacy and leadership self-efficacy on the relationship between gender and entrepreneurial self-efficacy, and to examine whether this relationship was moderated by field of study. The model was tested using maximum likelihood estimation and 10000 bootstrapping samples at 95% confidence intervals. All data analysis were performed using MPLUS version 7.4 (Muthen & Muthen, 2016).

Research study 2 – Student engagement and creative self-efficacy in higher education

To determine the relationship between student creative self-efficacy and engagement, we conducted both a descriptive and bivariate correlation analysis, computing means and standard deviations and Pearson coefficients, respectively. We then performed a linear regression analysis to examine the relationship between student engagement and creative self-efficacy. Finally, we carried out a series of multiple linear regression analyses to explore the relationship between the different dimensions of engagement and creative self-efficacy, both in the sample as a whole and by academic year. In all cases, we tested the assumptions regarding linearity, absence of collinearity, independence, normality, and homogeneity of variance. All analyses were carried out using SPSS 26.0.

Research study 3 - Grit and creativity in a time of pandemic

In order to explore whether the experience of fully online learning during lockdown had an impact on the two criterion variables, we compared the post-test scores (June 2020) of students at each of the three educational levels (high school, vocational training, and university) with those obtained by each of these groups at pre-test (February 2020). After checking that the assumptions for the use of parametric tests were fulfilled, we used the Student's t test to examine whether there were significant differences between the means on each variable. The effect size associated with any observed differences was estimated by calculating Cohen's d. All analyses were performed using SPSS 26.0.

Research study 4 - First-year university students' innovative mindset

In order to explore university student's creative self-efficacy, entrepreneurial self-efficacy and grit, a descriptive analysis of the variables was conducted, after which a multivariate analysis of variance (MANOVA) was carried out in order to examine

whether students' gender and discipline of study influenced creative self-efficacy, entrepreneurial self-efficacy, and perseverance of effort and consistency of interest. To calculate the effect size associated with mean differences, Hedges g statistic was used. Finally, with regard to innovative mindset, Student's t was used to examine differences across genders and disciplines of study; the size of the effect was calculated by Cohen's d . All data analysis were performed using SPSS software (version 26.0).

1.7 Ethical considerations

Concerning ethical issues, it is important to note that this research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

In relation to the participants, the research team described the nature of the study to the students, and sought to provide sufficient information about the research objectives to allow students to understand the implications of participation and to reach a fully informed, considered and freely given decision about their participation. It was made clear to students that participation was voluntary, that they could stop participating at any time, and that all data would remain confidential in accordance with current Spanish legislation to this effect. Participants were not compensated in any manner, and all data collected as part of the study were kept confidential. No potentially identifiable human images or data is presented in this study.

Regarding the questionnaire used in the research, tests were carried out to analyse the suitability of its use in the university population, and it was verified that no offensive, discriminatory or unacceptable language was used. In addition, being aware that repetitive use of particular language can reinforce harmful stereotypes and strengthen prejudices of different kinds, an attempt has been made to follow a non-sexist language throughout this document. Furthermore, by means of analysing collected data for gender differences, the necessity of addressing gender issues in research is acknowledged.

Works of other authors has been acknowledged with the use of APA referencing system throughout this dissertation. Likewise, it has been an objective to reach the highest level of objectivity in discussions and analyses throughout the research.

All these standards have been followed in each of the studies presented in this manuscript. Finally, this investigation was reviewed and approved by Research Ethics Committee of Mondragon Unibertsitatea.

CHAPTER 2.
Gender and entrepreneurial self-efficacy
among first-year undergraduate
students: The roles of creative self-
efficacy, leadership self-efficacy and
discipline of study

Abstract

The aim of the study was to explore gender differences in entrepreneurial self-efficacy among first-year undergraduates and to identify moderators and mediators of the observed relationship. Participants were 1,741 first-year students (792 female, 949 male) from two Spanish universities ($M_{age} = 18.76$, $SD = 1.82$). They were enrolled in degree programmes in two broad fields: technical and social sciences. Using a cross-sectional design, we obtained measures of creative self-efficacy, leadership self-efficacy and entrepreneurial self-efficacy. Results showed that both leadership self-efficacy and creative self-efficacy predicted entrepreneurial self-efficacy, although creative self-efficacy was the variable that contributed most to the expected change in entrepreneurial self-efficacy. There were also differences in entrepreneurial self-efficacy and creative self-efficacy according to gender and field of study, with students enrolled in a technical field and male students in general scoring higher. Mediation–moderation analysis showed that creative self-efficacy mediated the relationship between gender and entrepreneurial self-efficacy, and also that the field of study buffered the effect of gender on entrepreneurial self-efficacy. Our results suggest that reinforcing the creative self-efficacy of women could possibly help to close the gender gap in entrepreneurial self-efficacy. It might also be useful to design specific training initiatives for undergraduates enrolled in social sciences, the aim of which would be to foster an entrepreneurial culture and help them to recognise their potential role as entrepreneurs.

Keywords: gender, entrepreneurship, self-efficacy, leadership, creativity, field of study

2.1 Introduction

Entrepreneurial competence is regarded as one of the key factors underpinning self-realization, employability, citizen participation and social inclusion (European Union, 2019), and it has been linked to socioeconomic growth (Ahmed et al., 2020; Nowiński et al. 2019). Accordingly, there is growing interest in the study of variables that may influence the development of this competence (Newman et al., 2018), especially among young adults who are embarking upon higher education and who will therefore form the next generation of professionals with the potential to drive and develop transformational projects (Gieure et al., 2019; Newman et al., 2018; Obschonka et al., 2017).

The aim of the present study was to examine the possible mediator effect of creative self-efficacy and leadership self-efficacy on the relationship between gender and entrepreneurial self-efficacy in first-year undergraduates, and to test whether this relationship was moderated by the field of study. Understanding more about these relationships would help in designing specific training initiatives aimed at improving students' entrepreneurial competence.

Entrepreneurial self-efficacy in university students

Entrepreneurial competence is one of the basic meta-skills that young people need to develop in order to succeed in modern society (Halberstadt et al., 2019). It is important to note that this competence goes beyond the ability to create innovative organizations. As the European Union points out (2019), entrepreneurship also implies the development of other skills such as creativity and the sense of initiative, skills that play a key role in a person's professional development (Lans et al., 2014) and which are crucial to fostering an entrepreneurial culture (Edwards-Schachter et al., 2015). The importance of these skills is further underlined by the impact that technology is having on our ways of working (OECD, 2019a), a tendency that has been heightened during the COVID-19 pandemic (Giones et al., 2020). As several authors have pointed out (Obschonka et al., 2017; Newman et al., 2018), entrepreneurial competence could help future generations to manage these social changes. Similarly, the OECD (2019b) considers that fostering entrepreneurial behaviors among students can help them not only to be better prepared when confronted with uncertainty but also to develop a greater sense of self-worth.

Given the implications that entrepreneurial competence has for a person's future performance at work and as a member of society, there is considerable interest in how it might be developed within the educational setting, especially within higher education (Bazan et al., 2020; Nowiński et al., 2019). One aspect that has been highlighted in this respect is the need to promote students' non-cognitive skills (Higgins et al., 2019) that is to say, ways of thinking, feeling and behaving that go beyond the raw ability to process information (Borghans et al., 2008). These skills are malleable and may be developed through both formal and informal learning experiences (Goldberg et al., 2019; Gutman & Schoon, 2013). Importantly, non-cognitive skills have been shown to predict entrepreneurial behaviour (Sorgner, 2015) and they are of lifelong relevance in a wide range of areas related to personal and social functioning (OECD, 2017). In the academic context, they may guide a person's career strategies and decisions towards entrepreneurship (Sorgner, 2015).

Self-perceptions are an important non-cognitive skill to consider, as they are precursors to motivation and academic performance (Peixoto & Almeida, 2010). Of particular relevance in this respect is perceived self-efficacy, that is to say, the degree to which a person has confidence in his or her ability to perform a task successfully in a given context (Bandura, 1997; Bowman et al., 2019). Entrepreneurial self-efficacy refers specifically to a person's confidence about his or her ability to perform the various tasks and roles relevant to entrepreneurship (Chen et al., 1998; Hsu et al., 2019; Newman et al., 2018; Zhao et al., 2005). Research has found that people with higher entrepreneurial self-efficacy show stronger entrepreneurial intentions and are more confident in their ability to develop viable business ventures (Hsu et al., 2019; Newman et al., 2018; Zhao et al., 2005). This pattern of relationships has also been observed among university students (Sequeira et al., 2007; Díaz-García & Jiménez-Moreno, 2010; Austin & Nauta, 2016; Geenen et al., 2016; Lanero et al., 2016), where studies have specifically found that self-efficacy promotes an entrepreneurial mindset (Wardana et al., 2020) and mediates the impact of entrepreneurial education on intentions (Nowiński et al., 2019). A close relationship between high entrepreneurial self-efficacy and social entrepreneurial intent has also been reported in college students (Bacq & Alt, 2018; Barton et al., 2018).

Creativity, leadership and entrepreneurship

Several authors have highlighted the importance of creativity and leadership as precursors to entrepreneurship in adult life (Obschonka et al., 2010, 2011, 2017; Ramsay et al., 2017). More specifically, creativity has been considered a key factor in

the development of entrepreneurial competence, due to its role in the identification of possible business opportunities (Ko & Butler, 2007), and in driving organization innovation (Ip et al., 2018). In this context, the notion of creative self-efficacy, defined as a person's beliefs regarding their ability to produce creative outcomes (Tierney & Farmer, 2002), has become a topic of increasing interest among researchers (Karwowski & Lebuda, 2018; Tierney & Farmer, 2002). This relatively recent line of research has revealed associations between creative self-efficacy and creative development at both the individual (Hsu et al., 2011; Robbins & Kegley, 2010; Tierney & Farmer, 2004) and team level (Shin & Eom, 2014; Shin & Zhou, 2007). Importantly, this relationship has been observed in different contexts, including education (Mathisen & Bronnick, 2009; Robbins & Kegley, 2010), where there is empirical evidence of differences in perceived creativity across students from different degree programs (Miller & Smith, 2017). Overall, studies have found that individuals high in creative self-efficacy are more likely to explore cognitively the idea of becoming an entrepreneur (Fuller et al., 2018).

In addition to creativity, research has also highlighted the importance of leadership as a precursor to entrepreneurial activity (Fuller et al., 2018; Obschonka et al., 2017; Redmond et al., 2017). As for leadership self-efficacy, this has been identified as one of the key variables regulating leader functioning in a dynamic entrepreneurial environment (McCormick, 2001). Leadership self-efficacy refers to a person's confidence in his or her ability to lead others (Dwyer, 2019), and in general, higher leadership self-efficacy has been linked to better leader performance and to more interest and effort toward becoming a better leader (Huszczko & Endres, 2017). Although it has been suggested that this type of self-efficacy is influenced by contextual factors (McCormick et al., 2002), only a limited number of studies have specifically examined this (Dwyer, 2019). However, there is evidence that leadership self-efficacy among undergraduates differs according to their cultural background and field of study (Mitchell & Daugherty, 2019; Nguyen, 2016), with variations being particularly reported across different degree programs (Komives & Sowcik, 2020). These findings suggest that students' conceptualisation of leadership may differ depending on their disciplinary area of study.

In light of the above, and given that during the transition to adulthood, leadership and creativity are among the factors that predict entrepreneurial intentions (Fuller et al., 2018; Obschonka et al., 2017), it is of interest to analyse how confidence in one's creative and leadership abilities may shape a person's entrepreneurial self-efficacy.

Self-efficacy, entrepreneurship and gender

There is currently a clear gender gap when it comes to entrepreneurial activity (Wieland et al., 2019), and within the European Union women are less likely than men to embark upon an entrepreneurial career (OECD/European Union, 2019). Research in this field has found that lower entrepreneurial self-efficacy is associated with less propensity towards entrepreneurship, and vice-versa (Newman et al., 2018), and hence it has been hypothesised that women engage in fewer entrepreneurial activities because they have less entrepreneurial self-efficacy than men (Kickul et al., 2008).

Entrepreneurship has also been associated with the so-called 'hard sciences' (natural science or physics), as opposed to the 'soft sciences' (social sciences) (Pilegaard et al., 2010; Rafiei et al., 2019). Given that perceived self-efficacy plays a decisive role in career choice (Thébaud, 2010; Palmer et al., 2017), this association may also be reflected in different levels of self-efficacy among students from different fields of study. In this regard, it is important to note that when it comes to higher education, women are under-represented in STEM subjects, that is, science, technology, engineering and mathematics (Kanny et al., 2014; Wegemer & Eccles, 2019). It has been argued that this is partly a consequence of the negative impact that gender stereotypes have on women's self-perceptions of their ability to follow certain career paths (Tellhed et al., 2017). Interestingly, studies conducted in what have traditionally been regarded as male subject areas, such as engineering, have found that women students in these fields score higher on self-efficacy than do their female counterparts from other degree programs (Gurski & Hammrich, 2017; Sax & Newhouse, 2019). Accordingly, one would also expect to find greater entrepreneurial self-efficacy among women who enroll in science, mathematics or engineering degrees, in comparison with their peers studying within the social sciences. If this proved to be the case, it would suggest that the field of study has a moderator effect on the relationship between gender and entrepreneurial self-efficacy.

2.2 The present study

Fostering the kinds of self-efficacy required for entrepreneurial competence is clearly an important task for higher education systems (Mayhew et al., 2016; Vázquez-Burgete et al., 2012). Given that this competence has been associated with more skilled and more successful professionals, as well as with higher life satisfaction, it is important we understand more about the variables that underpin its development. Despite, however, its importance for young people and their future, there have been few initiatives within

universities aimed at promoting entrepreneurial competence among students, especially in those subject areas that have not traditionally been linked to entrepreneurship, that is to say, social sciences, law and humanities. In our view, this is due in part to an insufficient understanding within higher education of the variables that may lead to greater entrepreneurial competence.

It should also be noted that although women tend to show lower entrepreneurial self-efficacy than men, this issue has not been widely studied in the higher education context, and little attention has been paid to the potential moderator effect of the kind of degree programme being followed. Neither is it clear which variables mediate the relationship between gender and entrepreneurial self-efficacy.

In light of the above, the aim of the present study was to examine the possible mediator effect of creative self-efficacy and leadership self-efficacy on the relationship between gender and entrepreneurial self-efficacy in students, and to test whether this relationship was moderated by the field of study.

The specific study hypotheses were as follows:

- Creative self-efficacy and leadership self-efficacy will both predict entrepreneurial self-efficacy among first-year undergraduates.
- Male students will score higher than their female peers on entrepreneurial self-efficacy, creative self-efficacy, and leadership self-efficacy.
- Students enrolled in a technical field (engineering and architecture) will score higher than their peers from the social sciences on entrepreneurial self-efficacy, creative self-efficacy, and leadership self-efficacy.
- The relationship between gender and entrepreneurial self-efficacy will be partially explained by the mediation effect of creative self-efficacy and leadership self-efficacy.
- The field of study will have a moderator effect on the relationship between gender and entrepreneurial self-efficacy.

2.3 Materials and Methods

Participants

Participants were 1,741 first-year students (792 women, 949 men) from two universities in northern Spain. They were aged between 17 and 27 years (mean = 18.76, $SD = 1.82$) and were enrolled in degree programmes in either a technical field (engineering and architecture, $N = 683$) or the humanities (social sciences and law, $N = 1,058$).

Measures

Entrepreneurial Self-Efficacy. This was assessed using four items developed by Zhao et al. (2005) to measure self-efficacy in relation to specific entrepreneurial tasks. It Respondents are asked to indicate on a 5-point Likert scale how confident they are (1 = no confidence; 5 = complete confidence) in their ability to identify business opportunities, create new products, think creatively and commercialise an idea or new development (e.g., “How confident are you in your present readiness for successfully identifying new business opportunities?”) A couple of minutes are needed to answer the items. In the present sample, MacDonald’s ω coefficient of reliability was .68.

Creative Self-Efficacy. This was measured using the three-item instrument developed by Tierney and Farmer (2002) to assess employees’ perceived capacity for creative work. Each item (e.g., “I have confidence in my ability to solve problems creatively”) is rated on a 7-point Likert scale ranging from 1 (Totally disagree) to 7 (Totally agree). The instrument, which takes around two minutes to complete, has been widely used in educational settings and it has shown good psychometric properties (Hass et al., 2016; Robbins & Kegley, 2010). Internal consistency in the present sample was .65 (MacDonald’s ω).

Leadership Self-Efficacy. This was assessed using three items developed originally by Singer (1991) and employed subsequently in studies by Paglis and Green (2002) and Bobbio and Manganelli (2009), showing positive correlations with other measures of leadership self-efficacy. The first item asks, “*If you were in a leadership position, how effective do you think you would be as a leader?*”, and it is rated on a scale from 1= not effective to 7 = very effective. Respondents are then asked, “*To what extent do you think your capacities would fit the requirements of a leadership position?*” and “*To what extent do you think it would be easy for you to succeed in a leadership role?*” in both cases giving a rating from 1 (= not at all) to 7 (= very much). A couple of minutes are

required to complete the items. Internal consistency in the present sample was .88 (MacDonald's ω).

Procedure

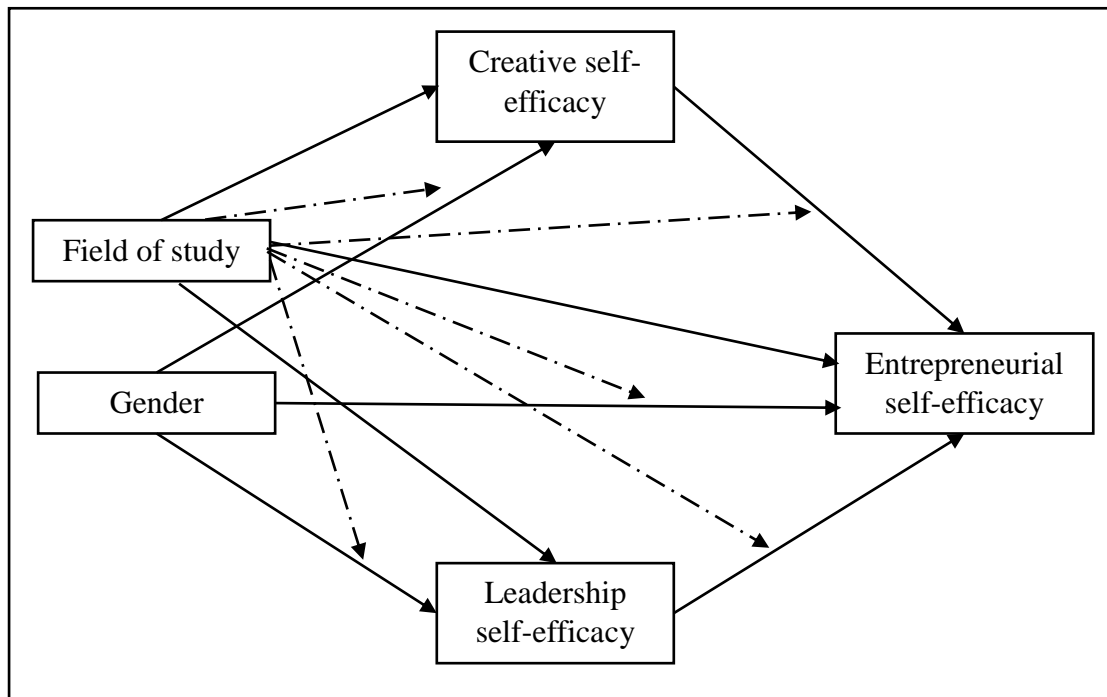
In order to maximise statistical power for detecting effects of reasonable magnitude we first determined the optimum sample size using G*Power (Faul et al., 2007). The calculation indicated that for linear bivariate regression: two groups, with a difference between slopes of 0.015 and power of 95%, a minimum sample of 1,446 participants (723 men and 723 women) would be needed. We then used convenience sampling to recruit students from the aforementioned two universities during the 2018-2019 and 2019-2020 academic years. This approach means that the study design is cross-sectional.

The three instruments described above were presented to students in the form of an online questionnaire, which they could access and complete via their personal laptop or smartphone. The research team explained to students the nature of the study and how to access the questionnaire. It was made clear to them that participation was voluntary and that all data would remain confidential in accordance with current Spanish legislation to this effect.

Data analysis

The statistical analysis involved four steps. First, we performed descriptive and bivariate correlation (Pearson) analyses for all variables of interest. We then conducted a linear regression analysis to examine the effect of creative self-efficacy and leadership self-efficacy on entrepreneurial self-efficacy. Next, linear regression was again used to analyse the effect of gender and field of study on creative self-efficacy, leadership self-efficacy, and entrepreneurial self-efficacy. Finally, we developed a moderated mediation model to test the possible mediator effect of creative self-efficacy and leadership self-efficacy on the relationship between gender and entrepreneurial self-efficacy, and to examine whether this relationship was moderated by field of study. The model was tested using maximum likelihood estimation and 10000 bootstrapping samples at 95% confidence intervals. All data analyses were performed using Mplus 7.4 (Muthén et al., 2016). The conceptual framework of the moderated mediation model is shown in Figure 7.

Figure 7. Conceptual framework of the moderated mediation model.



2.4 Results

Descriptive and bivariate correlation analysis

Table 3 shows the results of the descriptive analysis.

Table 3. Descriptive statistics for the total sample and by gender.

Variables	Total <i>N</i> = 1,741	Women <i>N</i> = 792	Men <i>N</i> = 949
Age, <i>M</i> (<i>SD</i>)	18.76 (1.82)	18.44 (1.60)	19.03 (1.94)
Entrepreneurial self-efficacy (ESE), <i>M</i> (<i>SD</i>)	14.46 (2.38)	14.21 (2.46)	14.67 (2.29)
Creative self-efficacy (CSE), <i>M</i> (<i>SD</i>)	15.45 (2.04)	15.21 (1.98)	15.65 (2.06)
Leadership self-efficacy (LSE), <i>M</i> (<i>SD</i>)	15.07 (2.97)	15.02 (2.96)	15.10 (2.99)

Field of study, % (N)			
Social sciences and law	60.77 (1,058)	74.37 (598)	25.63 (203)
Engineering and architecture	39.23 (683)	49.42 (469)	50.58 (480)

Bivariate correlation analysis

In the bivariate correlation analysis, entrepreneurial self-efficacy showed positive and significant correlations of moderate magnitude with both creative self-efficacy ($r = .50$; $p < .01$) and leadership self-efficacy ($r = .33$; $p < .01$). The analysis also revealed a positive and significant correlation of moderate magnitude between creative self-efficacy and leadership self-efficacy ($r = .35$; $p < .01$).

Linear regression analysis

In order to test whether creative self-efficacy and leadership self-efficacy predicted entrepreneurial self-efficacy, we performed a multiple linear regression analysis. The linear model obtained after testing the assumptions of linearity, non-collinearity, independence, normality and homoscedasticity explained 28% of the variance in entrepreneurial self-efficacy. The results showed that both creative self-efficacy ($\beta = .443$, $z = 22.278$, $p < .0001$) and leadership self-efficacy ($\beta = .170$, $z = 7.881$, $p < .0001$) predicted entrepreneurial self-efficacy, thus confirming, as expected, that the higher the creative self-efficacy and leadership self-efficacy, the higher the entrepreneurial self-efficacy. The standardised regression coefficients indicated that creative self-efficacy was the variable that contributed most to the expected change in entrepreneurial self-efficacy. Accordingly, creative self-efficacy accounted for more of the overall fit (17.14%) than did leadership self-efficacy, which had a minimal impact in terms of reducing prediction errors (0.25%).

We then conducted a new linear regression analysis to examine the effect of gender and field of study on the level of creative self-efficacy, leadership self-efficacy, and entrepreneurial self-efficacy. Results showed a statistically significant association between gender and scores on both entrepreneurial self-efficacy ($\beta = .096$, $z = 4.028$, $p < .0001$) and creative self-efficacy ($\beta = .108$, $z = 4.546$, $p < .0001$), but not with respect to scores on leadership self-efficacy ($\beta = .014$, $z = 0.565$, $p > .05$). More specifically, male students showed greater entrepreneurial self-efficacy and creative self-efficacy than did their female counterparts, but men and women did not differ in terms of leadership self-efficacy.

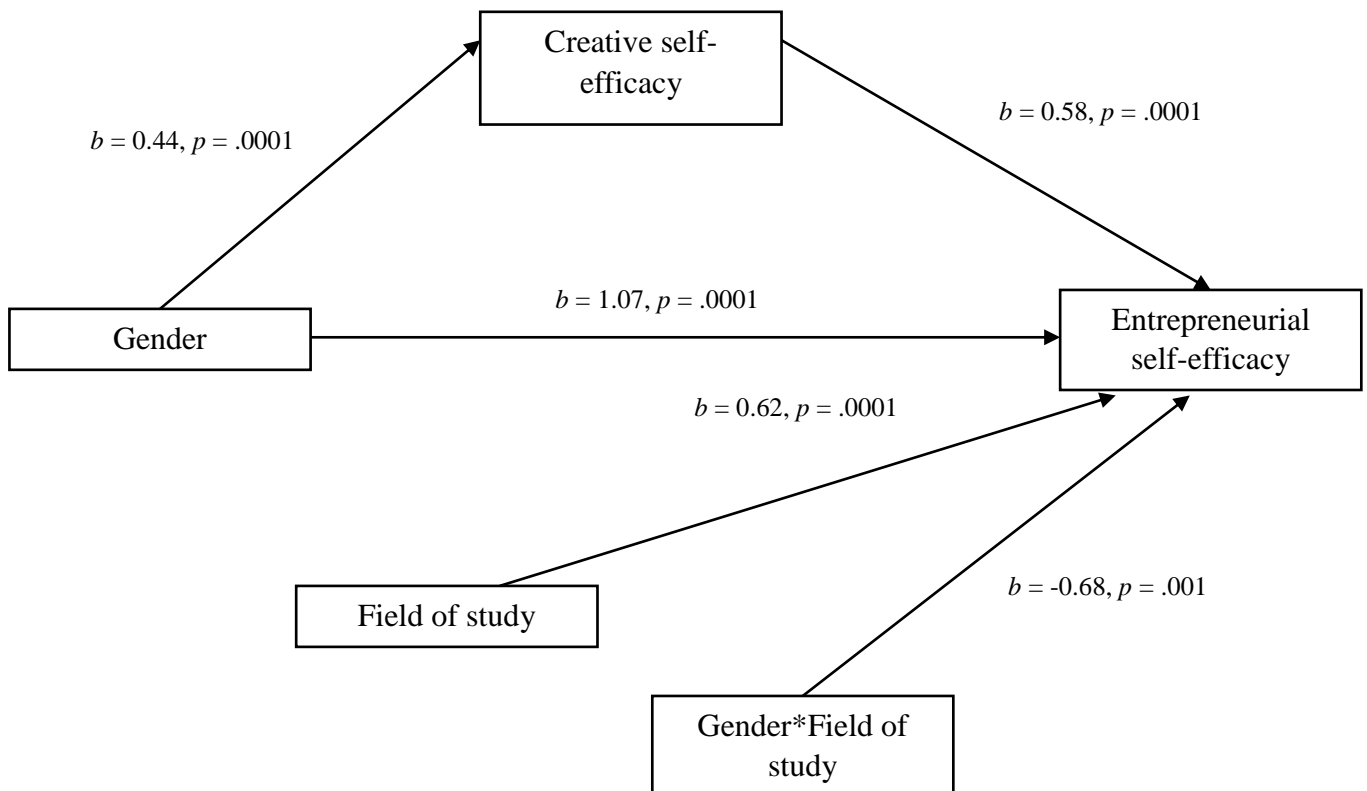
Regarding the field of study, the analysis indicated that this variable was significantly associated with differences in both entrepreneurial self-efficacy ($\beta = .081$, $z = 3.395$, $p < .001$) and creative self-efficacy ($\beta = .061$, $z = 2.548$, $p < .05$), whereas no such effect was observed in relation to leadership self-efficacy ($\beta = .036$, $z = 1.510$, $p > .05$). More specifically, students enrolled in a technical field showed greater entrepreneurial self-efficacy and creative self-efficacy than did their peers from the social sciences, but the two groups did not differ in terms of leadership self-efficacy.

Moderation Mediation analysis

In order to examine the fit of the measurement model derived from the set of instruments used, we performed a confirmatory factor analysis (CFA), using the robust maximum likelihood method for parameter estimation. The proposed model yielded acceptable fit indices: $\chi^2[32] = 402.411$; $p < .001$; CFI = .933; TLI = .905; RMSEA [90% CI] = .082 [.075; .089]; SRMR = 0.053. Measurement invariance by gender was also confirmed.

Regarding mediation effects, it can be seen in Figure 8 that gender had a statistically significant indirect effect on entrepreneurial self-efficacy via creative self-efficacy, $\beta = .25$, 95% CI [0.111; 0.408]. These results indicate that the difference between male and female students in entrepreneurial self-efficacy is partially explained by the higher creative self-efficacy of males. It should be noted that neither the main effect of gender on leadership self-efficacy nor the main effects of field of study on creative self-efficacy and leadership self-efficacy were statistically significant. Neither was there an interaction effect of gender and field of study on creative self-efficacy or leadership self-efficacy. Non-significant results were similarly obtained when analysing possible interaction effects of creative self-efficacy and field of study on entrepreneurial self-efficacy, and of leadership self-efficacy and field of study on entrepreneurial self-efficacy. These effects were therefore eliminated from the final model as they did not improve the overall fit ($\Delta\chi^2 = 7951.371$, $\Delta df = 3$). The resulting model showed a good fit: $\chi^2[2] = 4.405$; $p > .05$; CFI = .966; TLI = .984; RMSEA [90% CI] = .026 [.000; .060]; SRMR = 0.009.

Figure 8. Statistical form of the conditional process model (moderated mediation)



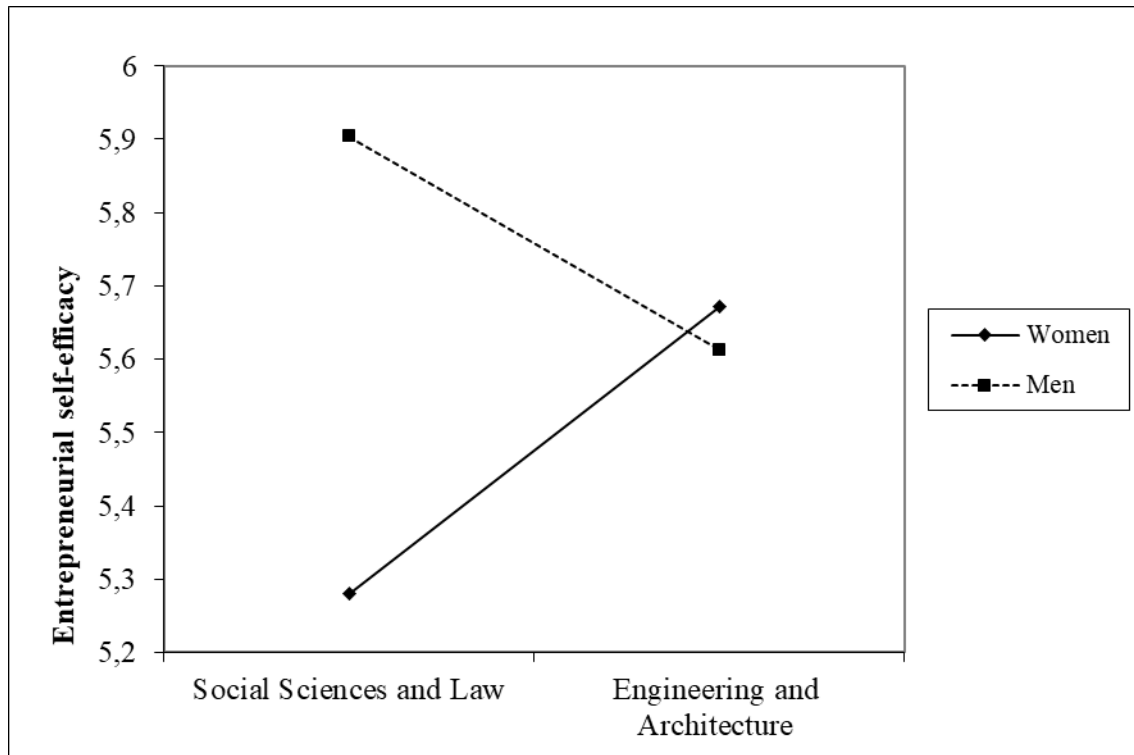
Total effect, $b = 1.33$, 95% CI [0.194, 0.693]

Indirect effect, $b = 0.25$, 95% CI [0.111, 0.408]

Finally, the analysis showed a negative and statistically significant interaction effect of gender and field of study on entrepreneurial self-efficacy ($b = -0.68$, $z = -3.404$, $p < .001$). As can be seen in Figure 9, female students enrolled in engineering and architecture degrees scored higher on entrepreneurial self-efficacy than did their female peers in social sciences and law, whereas the opposite effect was observed

among male students. This indicates that the field of study buffers the effect of gender on entrepreneurial self-efficacy.

Figure 9. Interaction effect of gender and field of study on entrepreneurial self-efficacy.



2.5 Discussion

The aim of this study was to explore gender differences in entrepreneurial self-efficacy among first-year undergraduates and to identify moderators and mediators of the observed relationship. To this end, we began by examining whether creative self-efficacy and leadership self-efficacy predicted entrepreneurial self-efficacy. As expected, the analysis revealed a positive association between these three variables, and more specifically that creative self-efficacy and leadership self-efficacy predicted entrepreneurial self-efficacy. These results are consistent with previous findings (Fuller

et al., 2018; Biraglia & Kadile, 2017; Zampetakis et al., 2011) and highlight the need to address both creative self-efficacy and leadership self-efficacy within training initiatives aimed at promoting the entrepreneurial competence of undergraduates.

Importantly, however, our analysis also showed that of the two variables, it was creative self-efficacy that contributed most to the expected change in entrepreneurial self-efficacy. This finding is in line with previous reports that have emphasized the importance of creative self-efficacy as a driver of innovative behaviour and entrepreneurial confidence, as well as its influence on entrepreneurial decisions and intentions (Fuller et al., 2018; Hsu et al., 2011), suggesting that creative self-efficacy should be considered a key competence of entrepreneurs.

As to why leadership self-efficacy was a less important predictor of entrepreneurial self-efficacy than was creative self-efficacy, the relative contributions of these two variables to perceived entrepreneurial competence have not, to our knowledge, been explored previously in undergraduates. Although there are different interpretations of entrepreneurship within the educational field (Bridge, 2017), it is reasonable to assume that the current generation of students recognise that it goes beyond the ability to create and manage new enterprises, insofar as they are likely to have been exposed to the idea that entrepreneurial competence is founded on creativity, imagination, perseverance, and the ability to work collaboratively so as to transform new ideas into values for others (European Union, 2019). Their conceptualisation of leadership, by contrast, may still be closer to the idea of organisational leadership. An interesting topic for future research would therefore be to explore how students understand leadership within the context of entrepreneurship, and to examine whether other variables, such as perseverance or the ability to work as part of team, are also important in terms of their developing an entrepreneurial mindset.

Regarding gender differences, male students scored higher on creative self-efficacy and entrepreneurial self-efficacy than did their female counterparts, an important finding given that perceived self-efficacy plays a decisive role in career choice (Bandura et al., 2001). Reports published within the European Union have noted that, despite decades of efforts, there continues to be a gender gap in entrepreneurship (OECD/European Union, 2019). Given that the students we surveyed were already beginning their degree studies, our results suggest the need to look again at what is being done to foster women's creative and entrepreneurial skills and self-perceptions prior to university entry.

Differences in creative self-efficacy and entrepreneurial self-efficacy were also observed in relation to the field of study, with students enrolled in a technical field (engineering and architecture) scoring higher than their peers in the social sciences and law. Given, as we have already noted, that perceptions of self-efficacy play a role in career choice (Lent & Brown, 2019), a possible explanation for our results is that social science and law students do not regard creativity and entrepreneurship as being essential to their field. In this regard, it should be noted that research on entrepreneurship suggests that entrepreneurial activity has generally been ignored in non-technical fields of study (Pilegaard et al., 2010), which could have a negative impact on the entrepreneurial vision and attitudes of students (Vázquez-Burgete et al., 2012). In a similar vein, Rafiei et al. (2019) have argued that entrepreneurship has been more readily incorporated into technical disciplines such as engineering, as opposed to the social sciences, this despite the fact that the concept of entrepreneurship has emerged from more socially oriented disciplines such as sociology, psychology and economic and cultural anthropology (Carlsson et al., 2013).

It has also been suggested that social occupations are less attractive to entrepreneurs because of their autonomy, independence and risk propensity (Zhang & Arvey, 2009). However, the emergence of so-called 'social entrepreneurship', which provides opportunities to make a difference in community settings, is considered a promising option in terms of the professional development and job opportunities available to social science graduates (Bazan et al., 2020; Vázquez-Burgete et al., 2012). That said, this is a relatively new field (Barton et al., 2018) and hence it may be too soon to see an effect on the relationship we observed here between lower confidence in entrepreneurial abilities and the choice of a social sciences or law degree. In our view, one of the keys to social transformation involves finding ways of showing the value of entrepreneurship for both personal and professional development, regardless of the specific area of work. Thus, at a practical level, there is a need to design specific training initiatives for undergraduates enrolled in social sciences and law, the aim of which would be to foster an entrepreneurial culture and help them to recognise their potential role as entrepreneurs.

An original contribution of the present study is that we examined whether the field of study had a moderator effect on the relationship between gender and self-efficacy. The analysis revealed that female students enrolled in engineering and architecture degrees had similar scores on entrepreneurial self-efficacy to their male peers, whereas female students in the field of social sciences and law scored lower on this variable. This illustrates how the difference between male and female students in

entrepreneurial self-efficacy depends on the field of study. These findings may partly be explained by the negative impact of gender stereotypes on women's self-perceptions of their ability to follow certain career paths (Tellhed et al., 2017), and in this respect it should be noted that our results are consistent with previous studies showing that women students who enter what have traditionally been regarded as male subject areas score higher on self-efficacy than do their female counterparts from other disciplinary fields (Gurski & Hamrlich, 2017; Sax & Newhouse, 2019). The role of perceived self-efficacy in career choice (Thébaud, 2010; Palmer et al., 2017) could also be relevant here, insofar as female students who enroll in social sciences and law degrees may not perceive entrepreneurial competence to be necessary for their future professional development.

Finally, another objective of this study was to examine the mediating role of creative self-efficacy and leadership self-efficacy in the relationship between gender and entrepreneurial self-efficacy. The results showed that the differences between male and female students in entrepreneurial self-efficacy are partially explained by the higher creative self-efficacy of males. This suggests that reinforcing the creative self-efficacy of women in education might be one way of closing the gender gap in entrepreneurial self-efficacy. Accordingly, initiatives aimed at promoting entrepreneurial competence among women should pay particular attention to this aspect.

Contrary to expectations, we did not observe a mediation effect of leadership self-efficacy. Although some studies have found leadership to be a factor in the choice of an entrepreneurial career (Biraglia & Kadile, 2017; Obschonka et al., 2017; Ramsay et al., 2017), our results suggest that leadership self-efficacy is not a key variable when it comes to explaining differences between male and female undergraduates in entrepreneurial self-efficacy.

2.6 Limitations

The present study has a number of limitations. First, the sample was recruited from just two Spanish universities and hence it is unclear to what extent the results are generalizable. Although we sought to address this limitation by including a considerable number of students from different disciplines, further studies in other knowledge areas, universities and countries are required to confirm the validity of our findings. A related limitation is the fact that our data are derived from two cohorts of first-year undergraduates, and future research would therefore need to gather data from a wider variety of groups. In this respect, a longitudinal design would be useful not only in order

to confirm the validity of the present findings but also to examine how students' perceptions about their entrepreneurial abilities evolve across the course of their university studies. It would also be interesting to explore the contextual factors associated with higher entrepreneurial self-efficacy. Research focused on observing the real entrepreneurial behaviors of undergraduates is likewise important for examining the role of self-efficacy in predicting their actual behavior in non-professional contexts.

2.7 Conclusions

The results of this study show that entrepreneurial self-efficacy is predicted by creative self-efficacy and leadership self-efficacy, and hence both these variables should be addressed by training initiatives aimed at promoting entrepreneurship among undergraduates. However, the greatest emphasis should be placed on creative self-efficacy.

We likewise observed gender differences in self-efficacy and between students from different disciplinary fields. Our analysis also showed that the field of study had a moderator effect on the relationship between gender and self-efficacy. Thus, women enrolled in engineering and architecture degrees differed less from their male peers in entrepreneurial self-efficacy, whereas the gender difference was more marked for female students in social sciences and law. At a practical level, this highlights the need to offer specific training to women and to students enrolled in social sciences and law, the aim of which would be to foster an entrepreneurial culture and help them to recognise their potential role as entrepreneurs.

Finally, the gender differences found in entrepreneurial self-efficacy were partially explained by the higher creative self-efficacy of men. This suggests that reinforcing the creative self-efficacy of women in education could help to close the gender gap in entrepreneurial self-efficacy. Leadership self-efficacy, by contrast, does not appear to be an important variable when it comes to explaining gender differences in entrepreneurial self-efficacy.

CHAPTER 3.
**University student engagement and
creative self-efficacy**

Abstract

The fostering of creativity in higher education has been linked to enhanced professional competences and personal development among students. The main aim of this study was to examine the relationship between student engagement and creative self-efficacy in undergraduates. The sample comprised 759 students (52.70% women) from two Spanish universities, ranging in age from 17 to 43 years ($M = 20.82$, $SD = 2.66$). Students from the first and final year of various degree programs completed the National Survey of Student Engagement and a measure of creative self-efficacy. Results showed a positive relationship between student engagement and creative self-efficacy, as well as differences by gender and academic year with regard to the dimensions of engagement that contributed most to enhanced creativity. The study highlights the importance of ensuring that students in higher education have the opportunity to participate in collaborative learning, meaningful interactions with faculty, higher-order learning, reflective and integrative learning, and high-impact practices. Higher-order learning and reflective and integrative learning appear to be particularly important in the early stages of a degree program, whereas with senior students, greater emphasis should be placed on reflective and integrative learning and high-impact practices.

Keywords: Creative self-efficacy, engagement, high-impact practices, gender

3.1 Introduction

The fostering of creativity in higher education has been linked to enhanced professional competences and personal development among students (Egan et al., 2017). Creativity implies divergent thinking in the analysis of problems and is thus more likely to lead to innovative solutions (Hensley, 2020). It has therefore been considered crucial for tackling socioeconomic challenges such as those derived from the global financial crisis of 2008 (Kümmel & Lindenberger, 2020; Pearson & Sommer, 2011), and for responding to the complex problems associated with the current COVID-19 pandemic (Cohen & Cromwell, 2020). In addition to being important for adapting to novel situations (Caballero García et al., 2019), creativity also shares a mutually dependent

relationship with academic performance (Karwowski et al., 2020). Consequently, and as set out in the Europe 2020 Strategic Framework for Education and Training (European Union, 2014), enhancing creativity and innovation has become a key goal of educational policy in European countries, with attempts being made to implement this across all levels of education and training. However, despite consensus over the obligation to cultivate creativity in higher education (Badger, 2019), there remains considerable room for improvement (Grigorenko, 2019), leading to calls for further research into the factors that influence the fostering of creativity among undergraduates (Marquis et al., 2017; Miller & Dumford, 2015).

The primary aim of the present study was to examine the relationship between students' perceived creativity and their degree of engagement with the learning context. To the best of our knowledge, it is one of the first studies of this kind to be conducted in the Spanish educational context.

Creative self-efficacy

The literature on creativity suggests that students' perception of their creative ability plays an important role with regard to its development (Karwowski & Lebuda, 2018). Measuring self-efficacy, that is, the extent to which people see themselves as capable of achieving certain goals (Bandura, 1997), is thus a useful way of exploring students' beliefs about their own creativity (Tierney & Farmer, 2002).

The notion of creative self-efficacy refers specifically to a person's beliefs regarding their ability to produce creative outcomes (Tierney & Farmer, 2002), and numerous studies have shown that it is associated with creative development in the educational setting (Beghetto, 2006; Farmer & Tierney, 2017). Along with other factors such as planning and perseverance, creative self-efficacy has also been found to predict academic resilience (Cassidy, 2015; Martin & Marsh, 2006) and confidence in one's academic abilities (Beghetto, 2006), leading to calls for interventions aimed at promoting creative self-efficacy among college students (Saleh et al., 2017).

The growing interest in creative self-efficacy is also due to the fact that it can develop over time and, as a concept, it is easy to operationalize (Tierney & Farmer, 2011). Various studies (Van Dinther et al., 2010) have demonstrated that higher education students' self-efficacy can be enhanced through interventions based on social cognitive theory (Bandura, 1997), specifically through four sources of development: experiences of mastery, non-directive experiences, feedback, and emotional and psychological states. However, few such interventions have aimed explicitly to promote students' creative self-efficacy (Tang & Werner, 2017), and the relationship between educational

interventions and the development of creative self-efficacy has not been sufficiently investigated (Farmer & Tierney, 2017). Indeed, only a small number of studies have analysed the impact of educational interventions designed to enhance students' creative self-efficacy (Mathisen & Bronnick, 2009; Robbins & Kegley, 2010; Vally et al., 2019). These studies suggest that training in creative self-efficacy has a positive effect on students' creative abilities and that academic institutions have a key role to play in promoting these skills. In recent years, however, attention has also turned to whether creativity can be related to students being more engaged with the learning process and educational activities (Miller & Dumford, 2016).

Student engagement and self-efficacy

Engagement is a key factor in students' personal and academic development (Bakadorova et al., 2020), and various studies have found a positive association between school engagement and academic performance (Fredricks et al., 2004). Greater engagement has also been linked to lower levels of depression (Li & Lerner, 2011) and higher life satisfaction (Lewis et al., 2011). Although various interventions for promoting student engagement in higher education have been described (Fredricks et al., 2019), it is important to note that engagement is a complex and multifaceted concept, the exact nature of which is subject to debate (Kahu, 2013; Payne, 2019). It is generally agreed, however, that engagement has behavioural, cognitive, and affective dimensions (Kahu, 2013).

One of the most widely recognized approaches to engagement derives from the behavioural conceptualisation, where it refers to students' exposure to and participation in educational practices associated with high levels of personal and academic development (McCormick et al., 2013). A possible limitation of this perspective concerns its ability to capture the construct of engagement in all its complexity (Kahu, 2013). On the other hand, it has been argued that the behavioural approach to engagement can enhance students' learning and motivation through institutional support (Zepke, 2018), as well as boosting their confidence in their ability to achieve goals (Bowden et al., 2019). It also provides a benchmark for the effective management of learning environments in higher education (Coates & McCormick, 2014).

The National Survey of Student Engagement (NSSE), a project managed by the University of Indiana, is a good example of the behavioural approach to engagement. The NSSE assesses student engagement in relation to approaches to learning, collaborative learning with peers, interactions with faculty, and the campus environment

(Kuh, 2010), and it is one of the most widely used tools for measuring engagement in higher education. As regards the areas assessed by the NSSE, Miller and Dumford (2016) found a significant relationship between approaches to learning and students' creative cognitive processes. Following a systematic review of research in the field, Davies et al. (2013) concluded that there is strong evidence that creativity is closely related to opportunities for working collaboratively with peers. A more recent study by del Moral Pérez et al. (2018) supports the idea that a collaborative approach is effective in developing students' creative potential. Research has also found that interactions with faculty characterized by respect and emotional support can have a positive impact on students' creative development (Gajda et al., 2017; Grigorenko, 2019).

The NSSE also explores students' participation in what are known as high-impact practices, namely learning communities, service learning, research projects, internships, and study abroad. According to Kuh (2008), these practices are effective because they require dedication on the part of students and oblige them to communicate with both peers and faculty about meaningful topics. They also expose students to diverse ideas and people of different backgrounds, while providing them with regular assessments of their work and allowing them to apply their knowledge both within and beyond the classroom walls (Kilgo et al., 2015). Research has found that students who participate in one or more of these practices report gains in terms of personal growth and socially responsible leadership (Kilgo et al., 2015).

As regards student engagement and self-efficacy, the literature suggests that the two constructs are interlinked (Majer, 2009; Schunk & Mullen, 2012) and fulfil an important function in relation to students' academic performance (Olivier et al., 2019). According to social cognitive theory, self-efficacy affects motivation and engagement through the setting of goals and self-evaluations of progress (Schunk & Mullen, 2012), with studies reporting higher levels of engagement among students who score higher on self-efficacy (Maricuțoiu & Sulea, 2019; Pajares, 1996). However, although research in the occupational context shows a positive association between employee engagement and creative self-efficacy (Chen, 2016; Orth & Volmer, 2017), the relationship between these variables has not been sufficiently investigated in higher education. Some studies have found that a diversity of social ties, which is characteristic of participation in high-impact practices, produces an environment that is favourable to the development of creativity (Gong et al., 2019). Similarly, it has been suggested that participation in multicultural learning experiences can facilitate the creative process (Maddux et al., 2010). Finally, although we are unaware of any studies that have

explicitly examined student engagement in relation to academic year, research has found that new undergraduates have less experience of deep approaches to learning (Baeten et al., 2010; García Martín, 2016), whereas those in their final year usually report more frequent interaction with faculty (Johnson et al., 2009) and more experience of high-impact practices (Finley & McNair, 2013).

3.2 The present study

As we have seen throughout the introduction, creativity is one of the key variables influencing an individual's academic and professional development and performance, and it is therefore important to foster it during higher education. However, and as noted, there is scope for improvement in this respect, and further practical and empirical research is needed to improve our understanding of how different learning environments influence students' creative development (Marquis et al., 2017). One of the factors that is now considered crucial for students' creative development is the extent to which they engage with learning processes and activities (Miller & Dumford, 2016). However, few studies have focused specifically on a variable that is particularly relevant to the creative process, namely creative self-efficacy.

The main aim of the present study was to examine the relationship between student engagement and creative self-efficacy in undergraduates. To this end, we applied the NSSE and a measure of creative self-efficacy to a sample comprising first-year and final-year students from various degree programs. We were particularly interested in identifying the dimensions of engagement that contributed most to the relationship with creative self-efficacy in students at opposite ends of their degree program.

Overall, we expected to find a positive relationship between student engagement and creative self-efficacy. Among first-year students, we expected that collaborative learning, reflective and integrative learning, and higher-order learning would be more closely related to creative self-efficacy because these variables play a greater role in learning processes and activities during the initial stages of university education. In final-year students, by contrast, we expected to observe a greater influence of student-faculty interaction and high-impact practices, as these types of experiences become more central towards the end of a degree program.

A further objective of our study was to explore possible gender differences, both in the relationship between student engagement and creative self-efficacy overall and more

specifically by academic year. As no previous research has examined this question in depth, we regard our study as exploratory and do not propose an initial hypothesis.

A final goal was to address the need for research in this field beyond the English-speaking world, and, to the best of our knowledge, our study is one of the first of its kind to be conducted in Spain. Although creativity is considered a key competence within the Spanish university system (Álvarez-Santullano & De Prada Creo, 2018), research shows that students in our country view creativity as one of the skills that is least fostered during their degree studies (Gómez et al., 2018), suggesting that faculty are unclear about how best to promote it. The present study may therefore shed light on which aspects of student engagement need to be addressed in order to enhance the creative self-efficacy of Spanish undergraduates. Finally, our use of internationally recognised tools for gathering data means that our results may be compared with those of similar studies in other countries.

3.3. Method

Participants

The sample for this study comprised 759 undergraduates from two universities in northern Spain (Mondragon Unibertsitatea and Florida Universitària). They ranged in age from 17 to 43 years ($M = 20.82$, $SD = 2.66$) and 52.70% ($n = 400$) were women. Students were enrolled in either year 1 ($n = 373$) or year 4 ($n = 386$) of a degree program in a technical field (engineering and architecture) or the humanities (social sciences and law).

Procedure

In order to maximize statistical power for detecting effects of reasonable magnitude, we began by determining the optimum sample size using the G*Power tool (Faul et al., 2007). This indicated that 89 participants would be required for a power of 95%. We thus proceeded to recruit a convenience sample of year 1 and year 4 students from the two aforementioned universities during the 2018-2019 academic year. Data were then collected using the two instruments described below, both of which were hosted online. Potential participants were first informed about the nature of the study, how to access the questionnaire, and the data protection policy, and it was made clear that participation was entirely voluntary. All participants signed informed consent (electronically) prior to any data collection.

Instruments

Creative Self-Efficacy Instrument (Tierney & Farmer, 2002). The Creative Self-Efficacy Instrument comprises three items, each rated on a 7-point Likert-type scale (1 = Totally disagree; 7 = Totally agree), and it takes around two minutes to complete. The instrument has been widely used in the educational field and shows good psychometric properties (Puente-Díaz, 2016). Internal consistency in the present sample was .70 (MacDonald's ω).

National Survey of Student Engagement (NSSE; Kuh, 2010; Zilvinskis et al., 2017). Items used with permission from *The College Student Report*, National Survey of Student Engagement, Copyright 2001-18. The Trustees of Indiana University. The NSSE examines various dimensions of student engagement. For the present study we focused on those which appeared, a priori, to be relevant both to our educational context and to the proposed theoretical framework, namely higher-order learning (4 items), collaborative learning (4 items), student-faculty interaction (4 items), reflective and integrative learning (7 items), and participation in high-impact practices (5 items). With the exception of high-impact practices, item scores are converted to a 60-point scale, with higher scores indicating greater engagement on the corresponding indicator. For high-impact practices, students must indicate whether they have yet to decide, do not plan to, are planning to or have already participated in a given practice. Around ten minutes are required to complete the questionnaire.

In order to confirm a factor structure for the survey tool comprising five first-order dimensions within the higher-order factor of student engagement, we conducted a second-order confirmatory factor analysis (CFA), implementing the Lavaan 0.6-1 package (Rosseel, 2012) in R 4.0.2 (R Core Team, 2020). Model parameters were estimated using the robust maximum likelihood method. The model proposed by the CFA had acceptable fit indices: $\chi^2[247] = 525.113$; $p < .001$; CFI = .921; TLI = .912; GFI = .939; RMSEA [90% CI] = .040 [.036; .045]; SRMR = 0.047. Measurement invariance by gender was also confirmed. All dimensions yielded acceptable coefficients of internal consistency, ranging between .62 and .78. (MacDonald's ω). A total score for student engagement was obtained by summing mean scores on each of the five first-order dimensions.

Data analysis

To determine the relationship between study variables, we began by conducting both a descriptive and bivariate correlation analysis, computing means and standard deviations and Pearson coefficients, respectively. We then performed a linear

regression analysis to examine the relationship between student engagement and creative self-efficacy. Finally, we carried out a series of multiple linear regression analyses to explore the relationship between the different dimensions of engagement and creative self-efficacy, both in the sample as a whole and by academic year. In all cases, we tested the assumptions regarding linearity, absence of collinearity, independence, normality, and homogeneity of variance. All analyses were carried out using SPSS 26.0.

3.4. Results

Descriptive statistics and correlations

Table 4 shows descriptive statistics for the study sample.

Table 4. Mean scores and standard deviations for creative self-efficacy, student engagement, and the five dimensions of engagement by gender and academic year

Variable	Year	Gender	Mean	SD	N
Creative self-efficacy ($M = 15.35$; $SD = 2.56$; $N = 727$)	1	Men	15.60	2.50	183
		Women	14.82	2.00	180
		Total	15.21	2.30	363
	4	Men	15.82	2.76	154
		Women	15.25	2.80	210
		Total	15.49	2.79	364
Student engagement ($M = 648.32$; $SD = 152.69$; $N = 694$)	1	Men	625.80	131.96	174
		Women	614.95	142.56	178
		Total	620.31	137.33	352
	4	Men	669.33	165.43	143
		Women	682.75	160.12	199
		Total	677.14	162.26	342
Collaborative learning ($M = 143.35$; $SD = 40.85$; $N = 759$)	1	Men	140.21	38.10	190
		Women	135.41	42.41	183
		Total	137.85	40.29	373
	4	Men	147.69	38.10	169
		Women	149.40	41.86	217
		Total	148.65	40.73	386

		Men	107.45	47.30	188
	1	Women	98.47	43.39	183
Student-faculty interaction		Total	103.01	45.57	371
($M = 107.81$; $SD = 48.32$; $N =$ _____)		Men	110.41	48.08	167
753)	4	Women	114.04	52.29	215
		Total	112.46	50.46	381
<hr/>					
	1	Men	135.95	41.22	188
Higher-order learning		Women	130.87	43.31	182
($M = 137.65$; $SD = 45.41$; $N =$ _____)		Total	133.45	42.28	370
750)	4	Men	142.28	45.36	166
		Women	141.30	49.99	214
		Total	141.73	47.96	380
<hr/>					
	1	Men	231.11	61.96	180
Reflective and integrative		Women	239.77	62.88	179
learning		Total	235.43	62.49	359
($M = 249.28$; $SD = 70.09$; $N =$ _____)		Men	255.36	75.27	151
722)	4	Women	268.39	73.57	212
		Total	262.97	74.46	363
<hr/>					
	1	Men	12.24	3.01	182
High-impact practices		Women	11.89	2.56	179
($M = 12.31$; $SD = 3.13$; $N =$ _____)		Total	12.07	2.79	361
724)	4	Men	12.83	3.47	154
		Women	12.34	3.35	209
		Total	12.55	3.41	363

Note: The possible score on each of the measures shown in the table is as follows: Creative self-efficacy, range 3-21; Student engagement, range 0-1160; Collaborative learning, range 0-240; Student-faculty interaction, range 0-240; Higher-order learning, range 0-240; Reflective and integrative learning, range 0-420; High-impact practices, range 0-20.

It can be seen in the table above that year 4 students scored higher than their year 1 counterparts on both creative self-efficacy and engagement, as well as on each dimension of the latter. Regarding gender, men students in year 1 had higher mean scores than their female peers on creative self-efficacy, engagement, and all except the 'reflective and integrative learning' dimension. The results for year 4 students were more varied: women scored higher on engagement overall and on the collaborative

learning, student-faculty interaction, and reflective-interactive learning dimensions, whereas men scored higher on creative self-efficacy, higher-order learning, and high-impact practices.

As shown in Table 5, there were positive and statistically significant associations between the different indicators of student engagement. In addition, these indicators yielded positive and significant correlations of moderate magnitude with creative self-efficacy.

Table 5. Pearson correlations between creative self-efficacy and the different dimensions of student engagement

Variable	1	2	3	4	5	6
Creative self-efficacy	--					
Collaborative learning	.24***	--				
Student-faculty interaction	.34***	.36***	--			
Higher-order learning	.36***	.24***	.40***	--		
Reflective and integrative learning	.42***	.31***	.46***	.56***	--	
High-impact practices	.29***	.20***	.33***	.27***	.31***	--

*** $p < .001$.

Effect of student engagement on creative self-efficacy

To examine the relationship between student engagement and creative self-efficacy, we conducted a linear regression analysis, controlling for the effect of gender. The model obtained explained 23.5% of the variance in creative self-efficacy, and the relationship between this variable and student engagement was statistically significant ($\beta = .469$, $t = 14.025$, $p < .001$). The results also showed that creative self-efficacy was predicted by collaborative learning ($\beta = .076$, $t = 2.059$, $p < .05$), student-faculty interaction ($\beta = .104$, $t = 2.578$, $p < .05$), higher-order learning ($\beta = .128$, $t = 3.061$, $p < .005$), reflective and integrative learning ($\beta = .235$, $t = 5.368$, $p < .001$), and high-impact practices ($\beta = .123$, $t = 3.370$, $p < .001$). The highest value of both the standardized regression coefficient and the semi-partial correlation coefficient corresponded to reflective and integrative learning.

We then conducted independent linear regression analyses for men and women students. Among women, we observed statistically significant relationships between

creative self-efficacy and both reflective and integrative learning ($\beta = .343, t = 5.795, p < .001$) and high-impact practices ($\beta = .194, t = 4.109, p < .001$). A significant association between creative self-efficacy and reflective and integrative learning was also observed among men students ($\beta = .190, t = 2.924, p < .005$), in addition to a statistically significant relationship between creative self-efficacy and both student-faculty interaction ($\beta = .181, t = 2.968, p < .005$) and higher-order learning ($\beta = .164, t = 2.687, p < .05$). In terms of relative predictive weight and contribution to overall fit of the model, reflective and integrative learning was the most important variable in both men and women.

Effect of student engagement on creative self-efficacy in year 1 students

To examine the relationship between student engagement and creative self-efficacy in the sub-sample of year 1 students, we conducted a new linear regression analysis, once again controlling for the effect of gender. The results showed that creative self-efficacy was predicted by both higher-order learning ($\beta = .136, t = 2.362, p < .05$) and reflective and integrative learning ($\beta = .191, t = 3.124, p < .005$), although no statistically significant relationship was found with respect to the other indicators of engagement. Reflective and integrative learning was the variable that contributed most to the expected change in creative self-efficacy and to overall model fit.

In the regression analyses by gender, the results for women showed significant associations between creative self-efficacy and both reflective and integrative learning ($\beta = .275, t = 3.056, p < .005$) and high-impact practices ($\beta = .219, t = 2.921, p < .005$). A significant association between creative self-efficacy and reflective and integrative learning was also observed among men students ($\beta = .199, t = 2.361, p < .05$), in addition to a significant relationship between creative self-efficacy and higher-order learning ($\beta = .233, t = 3.020, p < .005$). Among women, the variable of greatest relative importance was reflective and integrative learning, whereas for men students it was higher-order learning.

Effect of student engagement on creative self-efficacy in year 4 students

The relationship between student engagement and creative self-efficacy in the sub-sample of year 4 students was likewise examined through linear regression analysis, controlling for the effect of gender. Here the results showed that creative self-efficacy was predicted by both reflective and integrative learning ($\beta = .274, t = 4.343, p < .001$)

and high-impact practices ($\beta = .148$, $t = 2.874$, $p < .005$). The highest value of both the standardized regression coefficient and the semi-partial correlation coefficient corresponded to reflective and integrative learning.

In the linear regression analyses by gender, the results for women showed significant associations between creative self-efficacy and both reflective and integrative learning ($\beta = .372$, $t = 4.660$, $p < .001$) and high-impact practices ($\beta = .177$, $t = 2.848$, $p < .005$), with reflective and integrative learning having the greatest relative importance. Among men students we only observed a statistically significant association between creative self-efficacy and student-faculty interaction ($\beta = .244$, $t = 2.561$, $p < .05$).

3.5. Discussion

The main aim of this study was to examine the relationship between creative self-efficacy and student engagement among undergraduates. As expected, the results showed a positive association between these two variables. More specifically, we found that creative self-efficacy was predicted by collaborative learning, student-faculty interaction, higher-order learning, reflective and integrative learning, and high-impact practices. These findings have considerable implications for educational policy. The importance of creativity for tackling the challenges that society is currently facing has been widely recognized (Caballero García et al., 2019; Daly et al., 2016). However, although educational institutions have acknowledged their obligation to cultivate students' creative potential (Badger, 2019), activities aimed at achieving this are often lacking in practice (Marquis et al., 2017), a problem that is especially evident in our country, Spain (Gómez et al., 2018). Our findings regarding how creative self-efficacy may be fostered through various dimensions of student engagement therefore provide a platform for implementing activities and practices that promote creativity in the higher education context.

The variable most closely related to creative self-efficacy in our study was reflective and integrative learning, an activity that has been previously linked to students' creative process (Miller, 2018; Miller & Dumford, 2016). Reflective learning refers to the connection between what students learn and the world around them, and to the reconsideration of problems and ideas from diverse perspectives (Campbell & Cabrera, 2014). It is considered that when students engage in personally meaningful learning and are open to learning and knowledge that challenges their preconceived ideas, they

are involved de facto in a creative process (Beghetto & Schreiber, 2017). From a practical point of view, therefore, one of the conclusions to be drawn from the present study is that reflective and integrative learning should be ascribed a key role in educational initiatives aimed at enhancing higher education students' creative self-efficacy.

Another aim of our study was to identify the specific dimensions of engagement that contributed most to the relationship with creative self-efficacy in students at opposite ends of their degree program (year 1 and year 4). Here we found that reflective and integrative learning was the variable most strongly associated with creative self-efficacy in both year 1 and year 4 students, suggesting that this kind of learning experience should be available throughout a degree program. However, there were also some results that were specific to one of the two year groups.

In the sub-sample of year 1 students, we found that creative self-efficacy was predicted not only by reflective and integrative learning but also by higher-order learning, indicating that in the first year of a degree program, deep learning experiences can help to enhance creative self-efficacy. This finding is consistent with our hypothesis, in that students new to higher education generally have less experience of reflective and higher-order learning (García Martín, 2016). Learning environments that encourage cognitive tasks such as understanding, synthesis, analysis, and reappraisal would therefore be expected to have a positive impact on creative self-efficacy.

As regards year 4 students, the results showed that higher levels of creative self-efficacy were associated with both reflective and integrative learning and high-impact practices. In our view, this is due to the particular importance that high-impact practices acquire as students approach the end of their degree program and prepare to embark on a professional career. From an applied point of view, and in line with existing recommendations (Finley & McNair, 2013), we would argue that greater emphasis should be placed on engagement in high-impact practices throughout higher education. If the aim is to enhance creative self-efficacy, then these practices should expose students to diverse ideas and people of different backgrounds, allowing them to apply their knowledge in practice and offering them regular assessments of their work (Garvey et al., 2018; Kilgo et al., 2015). The review by Maddux et al. (2010) also suggests that multicultural learning experiences can make an important contribution here.

A final objective of the present study was to explore possible gender differences in the relationship between creative self-efficacy and student engagement. The results of this

analysis showed that reflective and integrative learning was the variable most closely related to higher levels of creative self-efficacy in both men and women, thus providing further support for the importance of this kind of experience. However, we also observed some gender differences. Specifically, among women in both year 1 and year 4, creative self-efficacy was strongly associated with high-impact practices. Although this finding should be interpreted with caution and requires corroboration in further studies, we speculate that women may, more than men, have personal characteristics that help to explain why high-impact practices are particularly relevant to the development of their creative self-efficacy. Research suggests that women benefit more from intercultural experiences because they are more open to diversity and score lower than men on ethnocentrism (Tompkins et al., 2017). In addition, a stronger relationship between extroversion and creative self-efficacy has been reported in women (Karwowski et al., 2013).

With respect to men, the results for those in year 1 showed a close relationship between creative self-efficacy and higher-order learning. This association between creativity and deep learning experiences is not itself surprising, because all forms of creativity originate in subjective perceptions and interpretations of knowledge (Beghetto & Schreiber, 2017; Kaufman & Beghetto, 2009). What is striking is that the relationship between higher-order learning and creative self-efficacy was only observed among men in year 1. Although further studies are required to shed more light on these gender differences, it may have to do with the fact that, while men and women do not differ in creative ability, they do appear to use different cognitive strategies when performing creative tasks (Abraham, 2016).

A final result to consider is the relationship we observed among men in year 4 between creative self-efficacy and student-faculty interaction, a variable that refers to the joint discussion of meaningful topics or future career plans. This result suggests that interactions of this kind can have a positive impact on students' creative confidence as they approach the end of their studies and prepare to enter the labour market. The fact that this relationship was only observed among men in their final-year may have to do with gender differences in motivation and creativity. Specifically, research suggests that males and females differ in the neurophysiology of reward processing (Volf & Tarasova, 2013), and also that extrinsic motivation plays an important role in men's creative development (Abraham, 2016), which may explain why feedback from faculty has a greater impact on their creative self-efficacy.

3.6. Limitations

This study has a number of limitations. First, participants were recruited from just two Spanish universities, and a larger sample would be required to generalize the results. Further studies are also needed to test the external validity of our findings with respect to those obtained in other countries. In addition, the data obtained here from first- and final-year students would need to be complemented with equivalent data from students in the intermediate years (2 and 3) of a degree program. In this respect, a longitudinal design with a single group of students would provide a more robust test of the results reported here.

3.7. Conclusion

The results of this study show that creative self-efficacy is positively associated with student engagement in higher education. This highlights the importance of ensuring that students have the opportunity to participate in collaborative learning, meaningful interactions with faculty, higher-order learning, reflective and integrative learning, and high-impact practices. Higher-order learning and reflective and integrative learning appear to be particularly important in the early stages of a degree program, whereas with senior students, greater emphasis should be placed on reflective and integrative learning and high-impact practices.



CHAPTER 4.
Grit and creativity in a time of pandemic

Abstract

In Spain, the lockdown imposed as a result of the COVID-19 pandemic meant that all face-to-face education was suspended in favour of online learning. The aim of this study was to examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on the grit and creative self-efficacy of students at different educational levels. Participants were 1,380 students (58.70% women, 41.30% men) enrolled in a total of 18 different centres across three levels of education (high school, $N = 853$; vocational training, $N = 243$; university, $N = 284$). They ranged in age from 15 to 51 years (M age = 18.34, $SD = 4.37$). During January and February 2020, several weeks prior to lockdown, data on grit (Grit-S Scale) and creative self-efficacy (CSE Scale) were gathered as part of a broader research project on teaching and learning competences. For the present study the same two instruments were re-administered 15 days after major lockdown restrictions were lifted (June 2020). Results showed a significant increase in consistency of interest among vocational training and university students following the lockdown learning experience. Contrary to expectations, however, we found no differences in perseverance of effort or creative self-efficacy at any of the three educational levels, although gender differences were observed on some of the variables. These results suggest that consistency of interest, a component of grit, was the primary adaptive strategy developed by students in response to a situation that demanded a high degree of self-regulation, motivation, and independent learning over a prolonged period. This is consistent with previous studies showing that during adversity, grit is important for maintaining the level of interest required to achieve longer-term personal goals and for overcoming challenges along the way.

Keywords: COVID-19, grit, consistency of interest, perseverance of effort, creative self-efficacy, gender

4.1 Introduction

Based on estimates of personal, social, and economic costs, Spain is one of the countries most severely affected by the COVID-19 pandemic (Eurostat, 2020; MAPFRE Economics, 2020). The major lockdown restrictions that were announced by the Spanish government on 15 March 2020 lasted for a total of 98 days, and for 48 of these days, people were largely confined to their homes. One of the measures introduced was the suspension of all face-to-face teaching, and as a result the educational community had to quickly make provision for online learning across all levels.

Although further studies with robust designs are required, the literature on the psychological impact of quarantine, coupled with research already conducted in the context of COVID-19, suggests that the current health crisis and lockdown measures may have serious, wide-ranging, and lasting effects on mental wellbeing (Brooks et al., 2020). With particular respect to the student population, a recent study in China by Zhou et al. (2020) found that around 40% of high-school students experienced symptoms of depression and anxiety during the COVID-19 outbreak, while Cao et al. (2020) reported that 24.9% of Chinese college students were affected by anxiety as a result of the pandemic. In Spain, Odriozola-Gonzalez et al. (2020) found that around 50% of university students experienced moderate to extremely severe levels of anxiety, depression, and stress during the first weeks of the COVID-19 lockdown.

While these findings highlight the importance of research into the psychological impact of lockdown and quarantine, it is also necessary to understand more about the factors that can help students to face the educational challenges resulting from these exceptional circumstances. Indeed, students have had to deal with the psychosocial impact of the COVID-19 outbreak, in terms of social distancing and managing their own feelings of confusion and anxiety and fears about infection (Castillo & Velasco, 2020). They have also had to adapt to a new online learning environment characterized by reduced teaching time and the absence of face-to-face contact and support (Azorín, 2020). In this context, the aim of the present study was to examine two variables that are known to play a role in how people respond to stressful and uncertain situations that require a high degree of self-regulation, namely grit (Matthews et al., 2019) and creativity (Morrell, 2008). This is an important topic of study as it may shed light on the kinds of personal changes that students have had to make in order to cope with the rapid switch to fully online learning during lockdown.

Grit: Perseverance of effort and consistency of interest

Grit has been defined as the capacity to work strenuously toward challenges, maintaining interest and effort over years in order to achieve long-term goals (Duckworth et al., 2007). It is a non-cognitive variable that has shown sufficient validity as a predictor of academic and occupational performance and other indicators of success across the life cycle (Vazsonyi et al., 2019).

In terms of personality theories and models, grit overlaps with the conscientiousness domain of the Big Five taxonomy (Arco-Tirado et al., 2018; Credé, 2018), since it is conceptually related to facets such as industriousness, orderliness, and dependability (Duckworth & Eskreis-Winkler, 2013). Where grit differs, however, is that it is specifically characterised by passion and sustained interest in the pursuit of important long-term goals (Arco-Tirado et al., 2018). Accordingly, grit is considered to be composed of two factors: perseverance of effort and consistency of interest (Fosnacht et al., 2019).

Perseverance of effort refers to an individual's capacity to work towards long-term goals (Duckworth et al., 2007). There is evidence that this factor is a better predictor of academic engagement and achievement than is consistency of interest (Bowman et al., 2015; Credé, 2018; Datu et al., 2016). According to Credé (2018), perseverance of effort is strongly correlated with the personality dimension conscientiousness.

Consistency of interest is the degree to which a person is able to maintain the interest and stamina required to achieve long-term goals despite adversity and challenges along the way (Duckworth et al., 2007; Salisu et al., 2020). Because this factor reflects a personal tendency to perform the same or similar activities over a prolonged period (Duckworth et al., 2007), it has more to do with action and the organisation of behaviour in the long-term (Muenks et al., 2017), and it thus implies planning and a commitment to doing so.

Recent research involving college students suggests that perseverance of effort overlaps with self-control and conscientiousness, whereas consistency of interest is more closely associated with cognitive self-regulation, effort regulation, and behavioural engagement (Muenks et al., 2017). However, these relationships appear to depend on educational level, since among high-school students, perseverance of effort was more strongly correlated with cognitive self-regulation than was consistency of interest (Muenks et al., 2017). Given these differential aspects, it is currently considered more appropriate to explore both perseverance of effort and consistency of interest as predictors of students' academic achievement and psychological wellbeing.

Studies of grit as a single factor have linked it to several positive educational outcomes, primarily academic performance and the attainment of higher levels of education (Christopoulou et al., 2018). It has also been associated with greater academic engagement (Hodge et al., 2018), the development of more effective learning strategies (Weisskirch, 2018), goal setting (Muenks et al., 2017), and the pursuit and attainment of postgraduate training (Palisoc et al., 2017).

Regarding responses to adversity, research has shown that people with higher levels of grit are better able to cope with stressful life events (Goodman et al., 2017). Furthermore, grit has been associated with various indicators of personal wellbeing and fewer psychological symptoms. For example, a close relationship has been reported between grit and life satisfaction, perceived happiness (Singh & Jha, 2008), and the achievement of personal goals (Sheldon et al., 2015). Higher levels of grit have likewise been associated with a stronger sense of belonging (Bowman et al., 2015), self-esteem (Weisskirch, 2018), and a growth mindset, that is to say, the belief that intelligence and skills can be developed over time (Dweck, 1999; Hochanadel & Finamore, 2015). Grit has also been linked to lower levels of brooding and rumination (White et al., 2017), and there is evidence that increased grit is associated with decreased anxiety and depressive symptoms (Sharkey et al., 2018) and less suicidal ideation (Pennings et al., 2015). Similar results have been reported in the student population. Specifically, grittier students were found to have an increased level of self-control, resilience, and a growth mindset, and they were more likely to have a lower level of perceived stress (Kannangara et al., 2018).

Research in the educational field, however, has sought to look beyond health and has found that grit also influences various processes involved in self-regulated learning, including metacognitive and time and study environment management strategies (Goodman et al., 2017; Muenks et al., 2017; Wolters & Hussain, 2015). It has also recently been suggested that high-grit individuals are more effective at self-regulation when performing a stressful cognitive task (Matthews et al., 2019). Likewise, it is considered that it is through processes of self-regulation, such as maintaining a sense of self-efficacy (Muenks et al., 2017) and adapting to task demands (Wolters & Hussain, 2015), that grittier individuals are better able to cope with adversity and tackle obstacles head on.

Creativity and creative self-efficacy

There is currently no clear consensus regarding the precise definition of creativity (Harris & Ammermann, 2016; Lassig, 2020). Nevertheless, it is an ability that is ascribed considerable importance in the entrepreneurial, artistic, and educational fields (Sunavsky & Poppenk, 2020).

In the educational context, particular attention has been paid to students' own perceptions of their creative abilities, what is referred to as creative self-efficacy (Beghetto et al., 2011; Karwowski & Lebuda, 2018), a concept derived from the work of the psychologist Albert Bandura. According to Bandura (1997), an unshakeable sense of efficacy is required to persist with creative endeavours that demand prolonged investment of time and effort and where the outcome is uncertain.

Creative self-efficacy refers to a person's confidence in his or her capacity for creative work (Tierney & Farmer, 2002), and research in this field has provided conceptual and empirical support for the idea that creative self-efficacy is closely related to creative performance (Farmer & Tierney, 2017). Indeed, strong associations between creativity and creative self-efficacy have been reported not only in the educational sphere but also in the industrial and financial sectors and in research and development (Beghetto, 2006; Choi, 2004; Jaussi et al., 2007; Shin & Zhou, 2007; Tierney & Farmer, 2002, 2004). This suggests that it is important to understand the factors that influence students' motivation and effort in relation to creative endeavours.

According to the theory of creative self-efficacy, students' confidence in their creative abilities would influence the ways in which they seek to be creative, the amount of effort they dedicate to tasks, and how much time they are willing to invest in overcoming problems they encounter in the process (Tierney & Farmer, 2002). This has considerable implications for the development of educational environments that aim to foster creativity, especially given the inherently dynamic nature of creative self-efficacy (Mathisen & Bronnick, 2009).

As regards the role of creativity in the face of adversity, research indicates that it can be highly useful for overcoming challenges and adapting to new situations (Caballero García et al., 2019), and it appears that this is because creativity helps the person to modulate negative emotions (Gu et al., 2018). In fact, a relationship has been observed between exposure to adverse life events and self-perceived creativity (Orkibi & Ram-Vlasov, 2018), and this relationship is mediated by the emotion regulation strategies a person uses (Forgeard, 2013). Other studies have found that creativity plays an important role in the effectiveness of cognitive reappraisal of negative emotions (Wu et

al., 2017). Similarly, Forgeard and Elstein (2014) suggest that creative thinking enhances psychological flexibility by allowing the person to generate new cognitive, emotional, and behavioural strategies.

A number of studies (Farmer & Tierney, 2017; Puente-Diaz & Arroyo, 2017) have shown that creative self-efficacy can boost creativity by improving perceived self-competence and encouraging participation in creative endeavours. Furthermore, high self-efficacy is associated with increased motivation and perseverance (Bandura, 1997; Bandura et al., 2001) and with a greater likelihood that negative thoughts cease to affect a person's mood (Ozer & Bandura, 1990), leading to the suggestion that self-efficacy is particularly important in adverse situations (Cassidy, 2015). In this context, it has been argued that self-efficacy influences a person's perception of a difficult situation and the choice of coping strategies (Bodys-Cupak et al., 2016).

In the educational field, creative self-efficacy is considered, along with other factors such as planning and perseverance, to be a predictor of academic resilience and perceived stress (Cassidy, 2015; Martin & Marsh, 2006). This highlights the need for interventions aimed at enhancing students' creative self-efficacy (Saleh et al., 2017).

4.2 The present study

As noted earlier, the lockdown measures imposed in Spain as a result of the COVID-19 pandemic meant that all face-to-face education was suspended in favour of online learning. This raises the question of what new skills or resources students needed to develop in response to these exceptional circumstances. In our opinion, grit and creative self-efficacy are two variables that may have played a role in students' process of adaptation. These two factors are known to be involved in the ability to cope with or show resilience in the face of adverse life events (Matthews et al., 2019; Orkibi & Ram-Vlasov, 2018), and they are also related to academic performance (Beghetto, 2006; Hagger & Hamilton, 2019). Accordingly, our primary aim in this study was to examine whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on the grit and creative self-efficacy of students at three different educational levels: high school, vocational training, and university. We also tested for gender differences in the variables analysed.

Thus, in contrast to the reported negative impact of lockdown on mental wellbeing, and from the perspective of resilience (Matthews et al., 2019), our hypothesis was that the current health crisis and the switch to online learning presented students with an

academic challenge that would lead them to generate new adaptive strategies that include grit and creative self-efficacy. Consequently, we expected that students would show an increase in perseverance of effort, consistency of interest, and creative self-efficacy following the experience of lockdown. However, we also expected that this effect would be more marked among vocational training and university students, whose study programs are more geared toward the achievement of long-term personal and professional goals. Finally, we did not expect to observe gender differences in the variables considered.

4.3 Materials and Methods

Participants

Participants were 1,380 students (58.70% women, 41.30% men) from across three levels of education (high school, $N = 853$; vocational training, $N = 243$; university, $N = 284$) and enrolled in a total of 18 different centres in the Basque Country (Spain). They ranged in age from 15 to 51 years ($M_{\text{age}} = 18.34$, $SD = 4.37$).

Instruments

Grit-S Scale (Grit-S, Spanish adaptation by Arco-Tirado et al., 2018; original scale by Duckworth & Quinn, 2009). The Short Grit Scale (Grit-S) assesses the capacity to work strenuously toward challenges, maintaining interest and effort over years in order to achieve long-term goals. It has two subscales, Consistency of Interest and Perseverance of Effort, both of which comprise four items that respondents rate using a 5-point Likert-type scale (from 1 = "Not like me at all" to 5 = "Very much like me"). The scale takes approximately five minutes to complete. In the present sample, MacDonald's ω coefficient of reliability was .62 and .72 for the Consistency of Interest and Perseverance of Effort subscales, respectively. These values are similar to those reported for the original scale.

Creative Self-Efficacy (CSE) Scale (Tierney & Farmer, 2002). This instrument measures a person's self-perceived capacity for creative work. It comprises three items that respondents must rate on a 7-point Likert scale ranging from 1 (Totally disagree) to 7 (Totally agree). The instrument, which takes around two minutes to complete, has been widely used in educational settings and it has shown good psychometric properties (Bui & Baruch, 2012; Hass et al., 2016; Robbins & Kegley, 2010; Robinson-Morrall et al., 2013). Internal consistency in the present sample was .72 (MacDonald's ω).

Procedure

This study used a non-equivalent groups quasi-experimental design. During January and February 2020, data on grit (Grit-S Scale) and creative self-efficacy (CSE Scale) were gathered as part of a broader research project on teaching and learning competences among high-school, vocational training, and university students. Shortly afterwards (15 March 2020), the Spanish government declared a state of emergency as a result of the COVID-19 pandemic. For the present study the same two instruments were re-administered 15 days after major lockdown restrictions were lifted (June 2020). Students at both time points completed the two scales via an online platform, subsequent to signing informed consent, which was also obtained digitally. The research team had previously explained the nature of the research and provided a link to the questionnaire, and it was made clear that participation was entirely voluntary and that all data would remain anonymous. The study was conducted in accordance with the guidelines established by the Research Ethics Committee of Mondragon University (Spain).

Data analysis

In order to explore whether the experience of fully online learning during lockdown had an impact on the two criterion variables, we compared the post-test scores (June 2020) of students at each of the three educational levels (high school, vocational training, and university) with those obtained by each of these groups at pre-test (February 2020). After checking that the assumptions for the use of parametric tests were fulfilled, we used the Student's *t* test to examine whether there were significant differences between the means on each variable. The effect size associated with any observed differences was estimated by calculating Cohen's *d*. All analyses were performed using SPSS 26.0.

4.4 Results

Table 6 shows the mean scores (and standard deviations) obtained by students at each of the three educational levels at pre-test and post-test on the measures of grit and creative self-efficacy.

Table 6. Descriptive statistics of grit and creative self-efficacy

Dimension	Educational level	Assessment	Mean	SD	N
Consistency of interest	High school	Pre-test	12.22	2.72	63
		Post-test	12.76	2.80	309
	Vocational training	Pre-test	11.65	2.90	128
		Post-test	13.20	2.69	109
	University	Pre-test	12.34	2.90	127
		Post-test	13.05	2.78	154
Perseverance of effort	High school	Pre-test	13.39	3.31	67
		Post-test	14.04	3.24	317
	Vocational training	Pre-test	13.84	3.33	128
		Post-test	14.04	3.07	108
	University	Pre-test	14.53	2.59	129
		Post-test	14.80	2.38	151
Creative self-efficacy	High school	Pre-test	14.85	2.43	526
		Post-test	15.00	2.82	327
	Vocational training	Pre-test	14.43	2.59	130
		Post-test	14.89	2.74	113
	University	Pre-test	15.82	2.66	129
		Post-test	15.33	2.55	155

Note: The possible score on each of the measures shown in the table is as follows: Creative self-efficacy, range 3-21; Perseverance of effort, range 4-20; Consistency of interest, range 4-20.

The results showed a statistically significant increase in scores on the Consistency of Interest dimension among students in both the vocational training group ($t(235) = -4.252$; $p = .0001$) and the university group ($t(279) = -2.081$; $p = .038$). The effect sizes associated with these differences were moderate ($d = 0.55$) and small ($d = 0.25$), respectively. Although post-test scores on this dimension were also higher among high-school students, the difference was not statistically significant.

With respect to Perseverance of Effort and Creative Self-Efficacy, no significant differences were observed at any of the three educational levels, and the associated effect sizes were very small.

Regarding gender, there was a statistically significant increase (with a moderate effect size) in scores on Consistency of Interest among men students in both the high-school

group ($t(118) = -1.944$; $p = .005$; $d = 0.46$) and the university group ($t(115) = -2.747$; $p = .007$; $d = 0.51$). A significant increase (moderate-to-small effect size) was also observed for Perseverance of Effort among men university students ($t(116) = -1.933$; $p = .005$; $d = 0.36$) and for Creative Self-Efficacy among men high-school students ($t(320) = -2.701$; $p = .007$; $d = 0.32$).

The results for women showed a significant increase in scores on Consistency of Interest in the vocational training group ($t(138) = -4.153$; $p = .0001$), and the associated effect size was large ($d = 0.72$). However, no statistically significant differences were found for women on the other dimensions and educational levels.

4.5 Discussion

The primary aim of this study was to examine whether the academic challenges posed by the switch to fully online learning during the recent COVID-19 lockdown had an impact on the grit and creative self-efficacy of students at three different educational levels: high school, vocational training, and university. The results showed, first, an increase in consistency of interest (one of two components of grit) among vocational training and university students following lockdown. This suggests that the demands of the new learning environment heightened the need for students at higher levels of education to generate greater consistency of interest in their studies. This result is in line with previous studies showing that grit is important for maintaining the level of interest required to achieve personal goals and for overcoming challenges along the way, both in the context of higher education (Kannangara et al., 2018; Wolters & Hussain, 2015) and during adversity or high-stress situations (Matthews et al., 2019).

A possible explanation for why increased consistency of interest was observed among vocational training and university students is that at these higher levels of education, students are working toward longer-term goals along a career path of their own choosing. Furthermore, consistency of interest is a variable that has been associated with the achievement of valuable personal goals (Silvia et al., 2013) and with processes of self-regulation (Muenks et al., 2017). These processes are known to be particularly important for self-directed learning (Delen & Liew, 2016; McClendon et al., 2017), and hence, although the present study is only exploratory, it is plausible to conclude that for higher education students, consistency of interest has been a key factor in helping them to adapt to the demands of the new learning environment, one characterized by an absence of face-to-face contact and which required constant self-regulation on their part.

Contrary to our expectations, we found no differences in perseverance of effort at any of the three educational levels. This result supports the argument that perseverance is a stable personality domain (Schmidt et al., 2020) that is closely related to the Big Five trait of conscientiousness (Credé, 2018; Credé et al., 2017; Roberts et al., 2014). Consequently, we conclude that because perseverance of effort is related to a more stable personality trait, it is less susceptible to change over a short period of time, even under exceptional circumstances such as those experienced by the students in our study.

In this regard, it should be noted that there is currently debate over whether grit is a psychological construct that is susceptible to change, with the question of which kinds of situations may favour or discourage such a change being an additional question of considerable controversy (Fosnacht et al., 2019; Stoffel & Cain, 2018). Our study makes a small contribution to this debate insofar as we found that the experience of a specific stressful situation (i.e., fully online learning during lockdown) was associated with changes in consistency of interest but not in perseverance of effort, a result that supports the idea that grit is partially malleable and is influenced by environmental factors (Alan et al., 2019; Aparicio et al., 2017; Park et al., 2020). This finding also suggests, however, that perseverance of effort, the more stable component of grit that is associated with a personality trait, is not significantly affected by exceptional and demanding situations of an academic nature.

With respect to creative self-efficacy, and again contrary to what we expected, we observed no post-lockdown differences at any of the educational levels considered. In our opinion, this result may be due to factors related to the students' mood during lockdown. Although we did not assess mental wellbeing in our sample, a number of recent studies conducted in the context of the COVID-19 outbreak have documented the negative psychological impact of lockdown on students of different ages (Odriozola-Gonzalez et al., 2020; Zhou et al., 2020). Given that social cognitive theory (Bandura, 1997) considers affective states to be one of the four sources of self-efficacy and that creative self-efficacy has been shown to be associated with positive mood states (Puate-Diaz & Arroyo, 2017), a plausible explanation for our finding is that during lockdown the students experienced high levels of distress, in the form of stress and symptoms of anxiety and/or depression (Odriozola-Gonzalez et al., 2020), and this prevented any growth in their creative self-efficacy.

Finally, and in relation to gender, the results revealed a number of differences in the responses of men and women. Specifically, men showed a moderate increase in

consistency of interest and, to a lesser extent, in perseverance of effort and creative self-efficacy, whereas among women we observed a large increase in consistency of interest. Thus, although these data should be interpreted with caution, it appears that the strategy used by women in adapting to learning under lockdown was strongly focused on enhancing their consistency of interest, whereas men students made less intense changes across all three domains (i.e., consistency of interest, perseverance of effort, and creative self-efficacy).

It is important to note that these changes were not observed at all three educational levels. Thus, in men, consistency of interest only increased at the high-school and university levels, perseverance of effort was only higher in the university group, and creative self-efficacy only increased among high-school students. As for women, the students who showed a significant increase in scores on consistency of interest were those in the vocational training group.

A gendered analysis of differences across educational levels therefore indicates that the major resource used by men high-school and university students in facing the academic challenges posed during lockdown was enhanced consistency of interest. As already mentioned, consistency of interest has been linked to self-regulation processes in learning, and various studies conducted in standard learning environments at both university (Pérez et al., 2017) and high-school level (Cadime et al., 2017) have found that female students show higher levels of autonomy and self-regulation and lower levels of procrastination than do their male counterparts (Ziegler & Opdenakker, 2018). In this respect, our results indicate that, in general, men opted to enhance different metacognitive resources in order to manage more effectively the lockdown learning environment, one which demanded increased autonomy and self-regulation. The difference, however, was that men high-school students showed an increase in creative self-efficacy, whereas their university-level counterparts showed greater perseverance of effort, a difference that is likely related to the kinds of challenges associated with their respective academic pathways. It is unclear why men vocational training students did not increase their score on any of the variables analysed.

As regards to women, the fact that a change was only observed in one of the domains considered (i.e., consistency of interest) and solely in the vocational training group supports the idea that women's capacity for self-regulation and self-directed learning is, in general, greater than that of men, and accordingly they had less of a need to activate these non-cognitive resources during lockdown learning. As to why an increase in consistency of interest was only observed among women in the vocational training

group, this may be related to the characteristics of this kind of training, although further studies would be needed to confirm this hypothesis.

4.6 Limitations

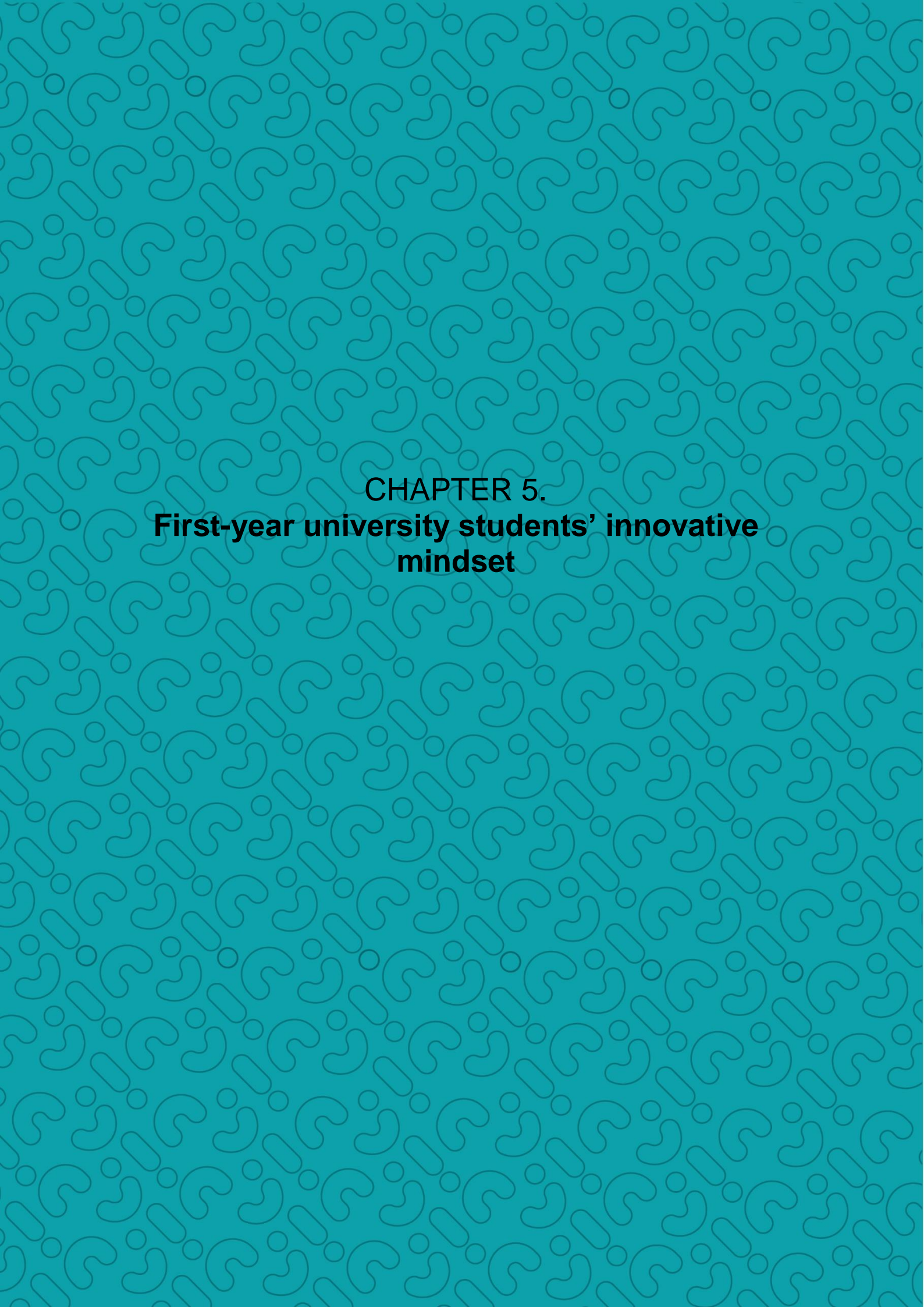
This study has a number of limitations. First, given the impossibility of manipulating the predictor variable (i.e., lockdown) we were obliged to use a non-equivalent groups quasi-experimental design. Obviously, it would have been better to have used a more robust design in which students were randomly selected to form groups of the same size at each of the three educational levels, with each group completing the measures at two time points. Second, the results obtained would have more external validity if they were replicated in larger samples. Finally, grit and creative self-efficacy were measured using self-report instruments, and as such, the responses are susceptible to bias (Dunning et al., 2004). It would therefore be useful to corroborate the results with other sources of data, especially those obtained through qualitative approaches such as in-depth interviews or focus groups with students from different educational levels.

4.7 Conclusion

The results of this study shed some light on the individual resources that students have had to activate in order to meet the demands of fully online learning during the COVID-19 lockdown. While the findings should be treated with caution, not least due to the quasi-experimental design, it appears that consistency of interest, a component of grit, is the primary variable that students have modified in order to adapt to the new learning environment, although this was only the case for students at levels beyond high school.

Overall, our study indicates that a sizeable proportion of students developed specific metacognitive resources in response to an academic challenge that required them to maintain interest and motivation and to work independently over a prolonged period of time. This is an important finding in the context of research on grit as it supports the hypothesis that grit is affected by circumstances and highlights its relevance in situations characterized by high levels of adversity, ambiguity, and complexity (Credé, 2018).

We also observed differential changes in the study variables by gender and educational level. This result points to a topic of interest for future educational research, and with respect to grit, it confirms the need already highlighted in the literature to examine perseverance of effort and consistency of interest separately, since they are conceptually distinct (Bowman et al., 2015; Credé, 2018; Salisu et al., 2020).



CHAPTER 5.
**First-year university students' innovative
mindset**

Abstract

The objective of this research is to examine innovation mindsets among first-year university students. In order to do so, this research proposes a novel model including entrepreneurial self-efficacy, creative self-efficacy, perseverance of effort and consistency of interest. Questionnaires were distributed among 2,369 students. Of these students, 50.11% were women (M age = 18.50, SD = 2.16) and 49.89% were men (M age = 18.33, SD = 2.31). Our findings indicate that engineering and architecture students report a greater propensity towards innovation, particularly with regard to perseverance of effort and consistency of interest. No differences were found across genders. These results suggest that there is a need to promote interventions aimed at enhancing students' innovation mindsets in post-secondary institutions.

Keywords: innovative mindset, self-efficacy, perseverance of effort, consistency of interest

5.1 Introduction

Innovation, often described as a combination of initiative and creative thinking (Tsang, 2019), is considered to be important to social change and economic development (Keinänen et al., 2018; Serdyukov, 2017). In this regard, innovation has been associated with a number of variables, such as creative self-efficacy, entrepreneurial self-efficacy and perseverance. Research has shown that these variables are associated with innovative behaviours in employment contexts (Mooradian et al., 2016; Newman et al., 2018; Wei et al., 2020). Furthermore, this set of variables associated with innovation can be developed through educational interventions (Alan et al., 2019; Burnette et al., 2019; Vally et al., 2019). Accordingly, higher education is deemed to play an important role in the development and promotion of innovative skills (Tsang, 2019).

In contrast, few studies have examined the development of innovative competencies in higher education (Selznick & Mayhew, 2018), mainly because of the difficulty associated with measuring innovative behaviours and attitudes in the educational

context (Tsang, 2019). The dearth of research on the topic of the innovation competences of students who are commencing their university studies is noteworthy. Such studies are necessary in order to improve the innovative skills of students during their university experiences. Therefore, the main goal of this research is to analyse the innovation mindsets of students commencing their university studies.

As previously mentioned, creative and entrepreneurial self-efficacy are significantly associated with innovation. According to cognitive social theory (Bandura, 1997), people's goals, motivations and behaviours are based on their self-efficacy perceptions, which refers to one's confidence in their ability to learn and perform certain tasks (Falco, 2017). In terms of innovation, high levels of creative and entrepreneurial self-efficacy lead to entrepreneurial and innovative behaviour (Newman et al., 2018; Wei et al., 2020).

Creative self-efficacy refers to a person's confidence in their ability to produce creative outcomes (Tierney & Farmer, 2004). Numerous studies have examined this construct (Farmer & Tierney, 2017). For example, in a workplace study, Liu et al. (2016) concluded that creative self-efficacy predicts creativity outcomes in a meta-analysis of 191 samples; such a result also been reported in the field of higher education (Robinson-Morrall et al., 2013). Creative self-efficacy has also been studied from a gender perspective, and although studies have indicated that men tend to show higher levels of creative self-efficacy than women (Karwowski, 2011; Zhou et al., 2012), some studies have found no gender-based differences (Gibbs, 2014; Zhang & Zhou, 2014).

On the other hand, entrepreneurial self-efficacy refers to the confidence that a person shows in their ability to perform various tasks and succeed in entrepreneurial roles (Chen et al., 1998). According to the results of several studies (Markman et al., 2002; Newman et al., 2018; Shahab et al., 2019), there is a link between entrepreneurial self-efficacy and entrepreneurial intentions; this pattern has also been observed among university students (Bacq et al., 2017; Prabhu et al., 2012; Zhang & Cain, 2017). In terms of gender, men tend to report higher levels of entrepreneurial self-efficacy than women do (Díaz-García & Jiménez-Moreno, 2015; Gatewood et al., 2002; Nowiński et al., 2019). However, in several other studies, no differences were found between males and females (Conway Dato-on & Mueller, 2008; Zhao et al., 2005).

Besides creative and entrepreneurial self-efficacy, grit has emerged as an important construct related to innovation. Scholars have defined grit as a tendency to continually maintain interest and effort in pursuing meaningful and challenging personal goals (Duckworth et al., 2007). Grit consists of two dimensions: perseverance of effort and

consistency of interest (Fosnacht et al., 2019). Perseverance of effort has been defined as one's ability to work towards long-term goals (Duckworth et al., 2007). Consistency of interest is the degree to which a person is able to maintain the interest and stamina required to achieve long-term goals despite adversity and challenges along the way (Duckworth et al., 2007; Salisu et al., 2020).

As a concept, grit has recently gained significant popularity in educational fields (Stokas, 2015). Specifically, in relation to academic development, a meta-review of 25 studies (Fernández-Martín et al., 2020) concludes that grit can predict student academic achievement. In terms of gender differences among university students, scholars have reported that women show a higher level of grit than their male peers (Jaeger et al., 2010; Kannangara et al., 2018). However, in other studies, no such differences have been found (Flanagan & Einarson, 2017; Park et al., 2020; Stellmacher et al., 2020; Warren & Hale, 2020).

Creative self-efficacy, entrepreneurial self-efficacy and grit have all been associated with innovation. For instance, Newman et al. (2018) reported a positive association between creative self-efficacy and innovative behaviour. Furthermore, studies have indicated that those with greater creative self-efficacy display innovative attitudes and behaviours due to greater levels of confidence in the knowledge and skills needed to generate and implement ideas (Jiang & Gu, 2017). Moreover, they perceive themselves as more capable of dealing with the uncertainty and challenges that characterise the innovative process (Richter et al., 2012).

In the same vein, a positive association between entrepreneurial self-efficacy and product innovation has been reported (Yu & Chen, 2016). It has also been found that entrepreneurial self-efficacy leads to more innovative behaviours in the workplace (Wei et al., 2020).

Furthermore, grit has been associated with innovation because it relates to one's ability to accept change and challenges and learn from mistakes (Reed & Jeremiah, 2017). In an Austrian study, researchers found that entrepreneurs' perseverance of effort affected venture performance indirectly via innovation success (Mooradian et al., 2016). In an international context, Caza and Posner (2019) reported that those with higher levels of grit showed more frequent leadership and innovation behaviours in both workplace and non-workplace contexts.

Research on the effectiveness of programs to develop students' creative self-efficacy, entrepreneurial self-efficacy and grit has generated interest. Overall, the potential of certain educational programs to develop these variables has been established. Some

studies have shown that educational interventions can improve students' confidence in their creative abilities (Robbins & Kegley, 2010; Vally et al., 2019). In relation to entrepreneurial self-efficacy, it has been shown that growth-mindset interventions have a positive impact on students' entrepreneurial self-efficacy (Burnette et al., 2019). Researchers have also concluded that educational interventions based on the development of a growth-mindset are effective to develop grit among students (Alan et al., 2019). Therefore, a plausible strategy to enhance students' innovative skills could be based on developing their creative self-efficacy, entrepreneurial self-efficacy and grit through specific educational interventions.

These educational interventions should be directed to the whole student population. In this regard, the limited association between innovation and technology (Linton, 2018) may have an impact on the predisposition of students enrolled in different disciplines of study regarding innovation. According to Zeidler (2016), science education research is predominantly focused on STEM-related goals, which is reflected in the educational planning policies of countries such as the United States, the United Kingdom and Finland, as well as the European Union itself, where different initiatives have been developed to promote STEM disciplines. The Basque Government has made it a priority to increase the number of students enrolled in STEM disciplines in the following years (Eusko Jauriaritza, 2019).

Closing the gender gap in STEM subjects is the aim of many of these initiatives (OMCI, 2020). The underrepresentation of women in these disciplines has been associated with lower confidence in their technical skills (Falco & Summers, 2019). However, questions have arisen concerning the omnipresence of STEM education initiatives (Linton, 2018; McComas & Burgin, 2020; Pleasants et al., 2019). Some have argued that political and economic support for these areas of knowledge seems to imply that some disciplines of study are more relevant than others (McComas & Burgin, 2020), which may condition students' career choices (Corrales Serrano et al., 2018).

5.2 The present study

Social and economic development is based on innovation (Serdyukov, 2017). Education is considered to play a critical role in the development of innovation (Keinänen et al., 2018). In this regard, the role of higher institutions is particularly important in fostering innovation skills among future professionals. Consequently, in

order to analyse the innovative development of students, it is necessary to develop theoretical models and empirically validated measures.

Creativity has been defined as the generation of novel and useful ideas (Amabile, 1996). In contrast, innovation differs from creativity as it is based on the actual implementation of ideas (Rosing et al., 2011). In shaping innovative behaviours, student self-perceptions play a significant role as they are determinative of whether a student will express or suppress creativity and innovative behaviours (Edwards-Schachter et al., 2015). In addition, it has been argued that the actual implementation of creative ideas is complex because the process consists of an uncertain path with unfavorable outcomes in many instances (Sarooghi et al., 2015). In this regard, grit is a particularly relevant variable, as scholars have defined it as the capacity of an individual to work strenuously towards a challenging goal while maintaining effort and interest despite failure, adversity and plateaus in progress (Duckworth et al., 2007).

As indicated throughout the introduction to this study, there is theoretical and empirical evidence that establishes the relationship between creative self-efficacy, entrepreneurial self-efficacy, grit and innovative development. Accordingly, we put forward a novel theoretical model to analyse the innovation mindset of university students based on such variables. Innovation as a mindset has been predominantly addressed in organisational contexts. In such contexts, an innovation mindset has been defined as one where the individual members of an organisation assimilate innovation, which leads to the development of a supportive and productive organisational culture (Kahn, 2018). To our knowledge, in education the innovation mindset concept has not been explored in significant detail. As the understanding and definitions of innovation vary significantly from one context to another (Dziallas & Blind, 2019), it is important to seek clarification. In this study, we define an innovation mindset as *'the set of perceptions related to one's ability to create new value, to apply it to both old and new challenges, and to persevere in the process when difficulties arise'*. This definition recognises the important role played by self-perceptions in influencing an individual's behaviour (Bandura, 1997). Moreover, it incorporates a person's beliefs about their creativity, entrepreneurial skills and perseverance; according to numerous experts, beliefs about these characteristics play a significant role in innovation (Caza & Posner, 2019; European Union, 2019; Hero et al., 2017; Mooradian et al., 2016; Obschonka et al., 2017; Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018; Wei et al., 2020).

As innovation is associated almost exclusively with technology nowadays (Linton, 2018), this research is based on the following hypothesis: students enrolled in STEM subjects will show better perceptions in relation to their innovation mindsets than students enrolled in other disciplines of study; this will be reflected in higher scores of creative self-efficacy, entrepreneurial self-efficacy and grit.

Lastly, another aim of this study is to explore gender differences in the innovation mindsets of students. According to the reviewed studies (Farmer & Tierney, 2017; Fernández-Martín et al., 2020; Newman et al., 2018), we predict that women will have higher scores in terms of grit than their male peers. In contrast, we expect that men will show higher levels of creative and entrepreneurial self-efficacy.

5.3 Materials and methods

Participants

The participants in this study were 2,369 students from two universities (Mondragon University and Florida Universitària), who commenced their studies in 2018–2019, 2019–2020 or 2020–2021. Regarding the gender balance of this group of participants, 50.11% were women and 49.89% were men. The average age of the women was 18.50 years old (DT = 2.16) and the average age of the men was 18.83 years old (DT = 2.31). The percentage of students enrolled in engineering and architecture studies was 25.28%, while the percentage of students enrolled in social sciences was 74.72%.

Instruments

Creative Self-Efficacy Scale

The Creative Self-Efficacy Scale, developed by Tierney and Farmer (2002), was used to measure student creative self-efficacy. It consists of three items that respondents must rate on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree); as one example, participants were asked the following question: 'I have confidence in my ability to solve problems creatively'. It has been used in several studies in the higher education context (Bui & Baruch, 2012; Hass et al., 2016; Robbins & Kegley, 2010; Robinson-Morrall et al., 2013) and has shown discriminatory and convergent validity compared to other related constructs (Farmer & Tierney, 2017). In the present sample, Cronbach's alpha is .65.

Entrepreneurial Self-Efficacy Scale

Entrepreneurial self-efficacy was assessed using a series of items developed by Zhao et al. (2005) to measure self-efficacy in relation to specific entrepreneurial tasks. The tool consists of four items based on a Likert scale with five options. A score of one indicates 'no confidence' and a score of five indicates 'absolute confidence'. An example of one item that participants were to score on the Likert scale is as follows: 'How confident are you in your present readiness for successfully creating new products?' This tool has been used in many studies and has been shown to have appropriate psychometric characteristics (Bullough et al., 2014). In this sample, Cronbach's alpha was .68.

Short Grit Scale

The Short Grit Scale (Grit-S) was used to assess students' capacity to work diligently towards the completion of a challenging goal while maintaining interest and effort (Arco-Tirado et al., 2018; Duckworth & Quinn, 2009). Specifically, the Grit-S scale examines students' perseverance of effort and consistency of interest. Each factor consists of four items that respondents must rate on a 5-point Likert scale ('Not like me at all' = 1, 'Very much like me' = 5). An example of one such item is as follows: 'New ideas and projects sometimes distract me from previous ones'. The Grit-S scale is the most widely used scale to analyse grit in educational contexts (Park et al., 2020; Stellmacher et al., 2020; Warren & Hale, 2020). In the present sample, Cronbach's alpha was .61 and .74, respectively, for perseverance of effort and consistency of interest.

Innovation mindset

In order to validate the factor solution proposed in the theoretical model, a confirmatory factor analysis was performed with the Lavaan package version 0.6–1 (Rosseel, 2012) and implemented in the software R 4.0.2. (R Core Team, 2020). The ML Strong method was used for parameter estimation. The model proposed in the verification factor analysis showed acceptable adjustment indicators ($\chi^2 [84] = 603,626$; $p < .001$; CFI = .914; GFI = .946; RMSEA [CI90%] = .064 [.059; .069]; SRMR = 0.046). To obtain an overall score for the innovation mindset factor, average scores related to creative self-efficacy, entrepreneurial self-efficacy, perseverance of effort and consistency of interest were added.

Procedure

In order to maximise statistical power to detect effects of reasonable magnitude, we first determined the optimum sample size using G*Power (Faul et al., 2007). The calculation indicated that for the power of 95%, a minimum sample of 302 participants was required. Students enrolled at Mondragon Unibertsitatea and Florida Universitària in the 2018–2019, 2019–2020 and 2020–2021 academic years were then selected by convenience-based sampling.

University students filled out the measuring instruments electronically after signing an informed consent form. The research team had previously explained the nature of the research and provided a link to the questionnaire, and it was made clear to participants that participation was entirely voluntary and that all data would remain anonymous. The study was conducted in accordance with the guidelines established by the Research Ethics Committee at Mondragon Unibertsitatea.

Analysis

Before conducting further examinations, we conducted a descriptive analysis of the variables. A multivariate analysis of variance (MANOVA) was then conducted to examine whether students' genders and disciplines of study influenced creative self-efficacy, entrepreneurial self-efficacy, perseverance of effort and consistency of interest. To calculate the effect size associated with mean differences, the Hedges *g* statistic was used. Finally, with regard to the innovation mindset variable, the Student's *t* statistic was used to examine differences across genders and disciplines of study; the size of the effect was calculated using Cohen's *d*. All data analysis were performed using SPSS software (version 26.0).

5.4 Results

Descriptive statistics for the study sample are shown in the following table.

Table 7. Means and standard deviations, by genders, for the measures of creative self-efficacy, entrepreneurial self-efficacy, perseverance of effort, coherence of interest and innovative mindset

Variable	Gender	Mean	SD	N
Creative self-efficacy	Women	15.26	2.10	1,107
	Men	15.57	2.15	1,102
	Total	15.42	2.13	2,209
Entrepreneurial self-efficacy	Women	14.21	2.46	1,097
	Men	14.70	2.34	1,076
	Total	14.46	2.42	2,173
Perseverance of effort	Women	12.78	3.83	749
	Men	12.86	3.14	644
	Total	12.82	3.49	1,393
Consistency of interest	Women	12.66	2.73	747
	Men	12.41	2.74	655
	Total	12.54	2.73	1,402
Innovative mindset	Women	54.89	7.07	720
	Men	55.37	6.43	609
	Total	55.13	6.75	1,329

To examine whether gender and discipline of study affected students' creative self-efficacy, entrepreneurial self-efficacy, perseverance of effort and consistency of interest, a MANOVA was performed. The results indicated that gender had a statistically significant effect on both entrepreneurial self-efficacy ($F[1.1296] = 5.978$; $p = .015$) and consistency of interest ($F[1.1296] = 7.057$; $p = .008$). In contrast, no such effect was found on creative self-efficacy and perseverance of effort. In all cases, the size of the effects associated with these differences in averages was low in magnitude (Hedges g men - women = 0.21, 0.09, 0.10 and 0.01, respectively). Thus, while men reported greater entrepreneurial self-efficacy scores than women, women showed greater consistency of interest than men did. Nonetheless, differences were of small magnitude in both cases.

Concerning participants' innovation mindsets, no statistically significant differences were found between men and women ($t[1327] = -1.280$; $p = 0.201$) and the effect size

corresponding to the difference in averages was small in magnitude (Cohen's $d = 0.07$).

Table 8 shows means and standard deviations, by discipline of study, obtained by students on the measures of creative self-efficacy, entrepreneurial self-efficacy, perseverance, and innovative mindset.

Table 8. Means and standard deviations, by discipline of study, for the measures of creative self-efficacy, entrepreneurial self-efficacy, perseverance of effort, coherence of interest and innovative mindset

Variable	Discipline of study	Mean	SD
Creative self-efficacy	Engineering and architecture	15.48	2.11
	Social sciences	15.37	2.11
	Total	15.43	2.11
Entrepreneurial self-efficacy	Engineering and architecture	14.76	2.35
	Social sciences	14.34	2.40
	Total	14.55	2.38
Perseverance of effort	Engineering and architecture	14.10	2.43
	Social sciences	12.55	3.70
	Total	13.33	2.41
Consistency of interest	Engineering and architecture	13.31	2.72
	Social sciences	12.40	2.75
	Total	12.86	2.74
Innovative mindset	Engineering and architecture	57.33	6.37
	Social sciences	54.63	6.77
	Total	55.98	6.57

Regarding disciplinary fields of study, statistically significant differences were found between the scores of engineering and architecture and social sciences students with regards to perseverance of effort ($F [1, 1296] = 38.174; p = 0.0001$) and consistency of interest ($F [1, 1296] = 28.544; p = 0.0001$). In both cases, the effects associated with these differences were of medium magnitude (Hedges' g for engineering and architecture - social sciences = 0.35 and 0.44, respectively). In contrast, no influence of the students' discipline of study was found on creative and entrepreneurial self-efficacy. According to these results, the size of the effect corresponding to the difference between the means was small in magnitude (Hedges' g for engineering and

architecture - social sciences = 0.08 and 0.11, respectively). Thus, undergraduate university students enrolled in engineering and architecture programs reported higher scores than those enrolled in social and legal sciences in grit-related variables; no such difference was found regarding creative and entrepreneurial self-efficacy.

Finally, statistically significant differences with regard to innovation mindsets were found between students enrolled in engineering and architecture and those enrolled in social sciences ($t [1461] = 5.924$; $p = 0.0001$). The size of the effect corresponding to the difference in means was of medium magnitude (Cohen's $d = 0.40$).

5.5 Discussion

In this study, we proposed a new theoretical model to analyse innovation mindsets among university students by means of the examination of students' creative self-efficacy, entrepreneurial self-efficacy and grit. According to the results, the proposed theoretical model shows characteristics that make it suitable for application in university contexts. Although further analysis is needed to confirm the viability of this model, this study contributes to the field of innovation, as the need for instruments that can be used to analyse and promote innovation in educational contexts has been frequently reiterated (Selznick & Mayhew, 2018; Tsang, 2019).

The results show that engineering and architecture students have a better perception concerning their innovation mindset than those enrolled in social sciences. According to recent research on the perceptions of science and technology (FECYT, 2019), scientists and technological experts seem to be more highly valued than experts in other disciplines, and the social sciences are not generally regarded as scientific in the conventional sense of the term. These perceptions may influence students' motivation to choose a career (Corrales Serrano et al., 2018); the strategies put in place around the world to promote STEM disciplines (Linton, 2018) and the limited association of innovation with technology (Tsang, 2019) could explain these results. Consequently, it is pertinent to highlight the notable role played by all sciences in social development through the dissemination of positive messages regarding their scientific contributions and their ability to generate critical perspectives in the production of knowledge (Hay, 2016).

Specifically, the results revealed that engineering and architecture students significantly reported greater perseverance of effort and consistency of interest. In addition to their association with entrepreneurial and innovative behaviours (Mooradian

et al., 2016; Reed & Jeremiah, 2017), the predictive role of these variables in the academic success of university students has also been emphasised (Fernández-Martín et al., 2020). As an example, perseverance of effort has been associated with lower dropout rates (Bowman et al., 2015). Furthermore, consistency of interest correlates with student motivation, a particularly relevant variable in higher education (Muenks et al., 2017). Hence, our results suggest the need to design educational interventions aimed at promoting grit among social sciences students, as these interventions could influence not only their innovation competences, but also their academic development. According to Alan et al. (2019), grit can be promoted in the educational context through educational interventions that highlight the plasticity of the brain, the role of effort, the reappraisal of failures and the importance of setting goals.

In terms of gender, research has shown that the concept of innovation is highly gendered and that it is generally associated with masculinity (Alsos et al., 2013), which could have an influence on the innovative behaviours across genders. Accordingly, analysing innovation mindsets across genders has been encouraged, particularly in educational contexts (Strohmeier et al., 2017). The results of this research shed rays of hope as they reveal similar innovation mindset scores among first-year university students of different genders.

In contrast, results concerning the individual variables suggest the need to design initiatives to promote women's entrepreneurial self-efficacy, particularly as recent reports show that women are half as likely as men in the European Union to opt for an entrepreneurial career (OECD/European Union, 2019). Further to this point, Nowiński et al.'s (2019) research demonstrates that entrepreneurial education programs at the pre-university level have a significant effect in improving women's confidence in their entrepreneurial skills.

5.6 Limitations

This study has several limitations. First, the research was limited to two universities, and therefore generalisability of the findings might be limited to this context. Additional quantitative and qualitative research is necessary to explore the external validity of the findings with regard to other countries, universities and disciplines. Second, in addition to analysing student gender and disciplines of study, intersectional approaches that contemplate students' sexual orientations, ethnic cultures and socioeconomic variables could address the development of innovation skills across the whole student population. A final limitation is the fact that our data was derived from three cohorts of

first-year undergraduate students, and future research would therefore need to gather data from a wider variety of groups. In this regard, longitudinal designs would be useful to examine how students' innovation mindsets develop in the course of their university studies.

5.7 Conclusions

This study has put forward a new theoretical model to analyse students' innovation mindsets through the measurement of their entrepreneurial self-efficacy, creative self-efficacy and grit. In addition to developing a model aimed at analysing student perceptions towards one of the most demanded traits among employees in the 21st century, this study identified differences in innovation mindset scores among students in different disciplines of study. This has been related to differences in social perceptions about the sciences and their relationship with innovation. Together, these findings provide an opportunity to develop informed and targeted interventions to foster innovation in the university context.

CHAPTER 6.
Discussion

6.1 General Discussion

The purpose of this investigation was to provide new insights into aspects and particularities relating to the development of a student innovative mindset at higher education institutions. Acknowledging that fostering an innovative mindset in university students can help them confront anticipated complex social changes, we examined how undergraduate students perceive themselves with respect to several dimensions associated with innovation. Moreover, the role that individual characteristics and contexts play in the development of such perceptions was also examined.

Throughout this research, differences between genders and disciplines of study have been found across students in relation to their confidence when thinking and acting innovatively and entrepreneurially. It has been found that women, in general, show less confidence in variables associated with their ability to innovate. This lower confidence pattern has also been found across social science students. In addition, it was observed that in complex situations, such as during the lockdown caused by the COVID-19 pandemic, students are able to develop adaptive strategies for maintaining interest and effort to achieve long-term goals. Our findings form a basis on which to understand and shape the encouragement of self-perception across university students in relation to their innovative profile.

Importantly, the results highlight the importance of fostering student creative confidence in order to promote innovation in higher education contexts. There is growing evidence that suggests that creative self-beliefs play a central role in different aspects of the creative process (Anderson & Haney, 2020). The present study further highlights the importance of fostering student creative self-beliefs, showing that student creative self-belief exerts a positive influence on their confidence to perform innovative roles and tasks. This finding has relevant theoretical and practical implications.

From a theoretical perspective, it confirms the relevance of including creative self-confidence variables in future study models of student entrepreneurial competence, as suggested in previous studies (Fuller et al., 2018). At a more practical level, it points to the need for the development of interventions aimed at improving student creative confidence so as to promote an innovative attitude among undergraduates. Nonetheless, although educational institutions highlight the need to develop the creative potential of university students (Badger, 2019), there is a deficit in the

promotion of pedagogical practices that promote such student creative processes in higher education (Marquis et al., 2017). In particular, interventions dedicated to promoting creative self-beliefs in universities are still scarce (Tang & Werner, 2017), and the relationship between educational interventions and the development of students' creative self-efficacy has not been sufficiently investigated (Farmer & Tierney, 2017).

The results of our research indicate that creative perception of university students can be improved by influencing their level of engagement. From the behavioural perspective of student engagement, we find that general practices such as collaborative learning, student-teacher interaction, deep approaches to learning, and high-impact practices predict creative self-efficacy. This set of findings is particularly relevant in the Spanish context, where students indicate that creativity is one of the skills that they least develop during their university experience (Gómez et al., 2018).

Reflective learning refers to the connection between the world around the student and their learning (Campbell & Cabrera, 2014), and can be promoted by different metacognitive activities (Carini et al., 2006). According to our results, a plausible approach to fostering student creative perceptions might emphasize reflective learning across disciplines in the higher education context. Several research studies have suggested approaches for cultivating students' reflective learning and these include student explicit training, through specific activities that aim to develop their metacognitive abilities; collaboration in small groups that allows students to recognise their own learning in relation to others; feedback aimed at guiding students to analyse the learning process they have followed (Daradoumis & Arguedas, 2020).

In relation to student year of study, our results show that among first-year students deep approaches to learning, such as reflective learning, are positively associated to greater creative self-efficacy. Among fourth-year students, it was found that high-impact practices also exerted an important influence on development of a better creative perception.

The influence of high-impact practices on creative self-efficacy is consistent with social cognitive theory, according to which real experiences, vicarious experiences, and social persuasion are sources of confidence beliefs (Bandura, 1997). The high-impact practices evaluated in this research also involve meaningful interaction with different people, practical application of knowledge and continuous feedback (Garvey et al., 2018; Kilgo et al., 2015). This study highlights the importance of ensuring that all higher education students have the opportunity to take part in high-impact practices during

their university experience. Having the opportunity to engage in collaborative learning and in meaningful interactions with faculty, likewise, emerged as important contributors to positive creative self-beliefs.

The development of such conditions is important given the ability of positive creative self-beliefs to predict creative and innovative development and to manage adverse situations (Cassidy, 2015), as creative thinking enhances psychological flexibility by allowing the person to generate new cognitive, emotional, and behavioural strategies (Forgeard & Elstein, 2014). Nevertheless, contrary to what we expected, we did not observe differences in creative self-beliefs after the period of lockdown experienced by the students during the spring of 2020. A possible explanation for this finding is that during lockdown the students experienced high levels of distress (Odriozola-Gonzalez et al., 2020), which could prevent creative self-confidence growth. Social cognitive theory (Bandura, 1997) considers affective states to be one of the four sources of self-confidence and, although we did not assess mental wellbeing in our sample, a number of recent studies conducted in the context of the COVID-19 outbreak have documented the negative psychological impact of lockdown among students (Odriozola-Gonzalez et al., 2020; Zhou et al., 2020).

The research carried out in the context of the COVID-19 lockdown yielded further remarkable results. It was found that university students showed an increase in consistency of interest (one of the two components of grit) following the experience of lockdown. This strategy may have been developed by students in response to a situation that demanded a high degree of self-regulation, motivation, and independent learning over a prolonged period. This suggests that the demands of the new learning environment heightened the need for students at higher education level to generate greater consistency of interest in their studies.

This result confirms the important role that grit plays in the management of uncertain and stressful situations. This finding is in line with other research that has shown that people with higher levels of grit are better able to cope with stressful life events (Goodman et al., 2017), and show decreased anxiety and depressive symptoms (Sharkey et al., 2018). Furthermore, consistency of interest was found to be the contextual factor through which grit can be most influenced. Perseverance of effort, the other component of grit, seems to be more stable and unsusceptible to change by uncertain and demanding situations.

The examination of whether the academic challenges posed by the switch to fully online learning during lockdown had an impact on student grit also generated

interesting results from a gender perspective. Results support the idea that women's capacity for self-regulation and self-directed learning is, in general, greater than that of men, and accordingly they seemed to have had less need to activate these non-cognitive resources during lockdown.

Furthermore, one of the main objectives of this research was to analyse university students' perceptions from a gender perspective. In addition to the aforementioned results concerning grit, several important findings have been reported.

Firstly, differences have been observed between women and men in relation to confidence in their ability to think creatively and to implement new ideas. These differences are relevant when women, along with other minorities, are under-represented in research, innovation and entrepreneurship activities in the majority of countries (Planes-Satorra & Paunov, 2017). The findings of our research suggest that the differences between men and women in entrepreneurial self-efficacy may be partially explained by the higher creative self-beliefs held by men. Hence, reinforcing the creative self-beliefs of women in education could help to close the gender gap in relation to ability to perform tasks and roles relevant to entrepreneurship.

Secondly, with respect to potential strategies aimed at developing creative self-beliefs in higher education contexts, gender differences were found in the relationship between student engagement and creative confidence beliefs. High-impact practices appear to exert greater influence on the creative perception of women. Although more research is needed, these relationships might be explained by previous observations in which women tend to show higher levels of openness to diversity and lower levels of ethnocentrism than men (Tompkins et al., 2017). When interacting with faculty, a positive influence was found only in relation to male belief in their own confidence, which could be associated with the gender differences that have been shown elsewhere with respect to motivation and creativity (Abraham, 2016; Volf & Tarasova, 2013). These findings may provide strategies to improve students' creative and entrepreneurial confidence in degrees in which gender imbalance and low levels of student confidence exist.

Thirdly, the findings of this research highlight the importance of analysing the discipline in which students are enrolled, so as not to obscure gender differences in self-perception. Our analysis revealed that while women enrolled in technical degrees had similar scores on entrepreneurial self-efficacy to their male peers, women enrolled in the field of social sciences and law scored significantly lower on this variable. This illustrates that the discipline of study has a moderator effect on the relationship

between gender and self-efficacy. The present study is one of the first carried out to analyse the influence of discipline of study on entrepreneurial self-efficacy, despite the need for analysing this variable so as to promote entrepreneurship and innovation across disciplines (Teixeira & Forte, 2017). At a practical level, this finding suggests the need to promote specific training initiatives that help women undergraduates enrolled in social sciences recognise their potential to become involved in innovation and entrepreneurial endeavours.

Overall, the discipline of study has emerged as a particularly relevant variable throughout this research. The findings indicate that students enrolled in technical disciplines show higher self-perception scores in relation to innovation than those enrolled in social sciences. This study strengthens the idea that institutions can proactively support the development of their students' creative self-beliefs and that such support is crucial for innovative mindset development. Furthermore, it has been found that fostering students' confidence for creative thinking across domains was possible, and that pedagogical practices based on reflective and integrative learning showed potential to be effective. Taken together, these findings suggest ways for addressing the difference gap found in relation to the discipline of study. In addition, and at a more general level, the need for highlighting the role played by all the sciences in social development has been emphasized. Even though this appears to be a sociocultural issue, stimulating collaboration between different fields and faculties, as suggested by Linton (2018), could serve to acknowledge that the arts, humanities and social sciences are significant contributors to the generation of knowledge through innovation.

Lastly, a theoretical model for the analysis of university students' perceptions concerning their innovative profile is proposed, in response to different calls for instruments to measure innovation in higher education contexts (Ovbiagbonhia et al., 2019; Selznick & Mayhew, 2018; Tsang, 2019). Developing research-based models to analyse university student non-cognitive competences is key to developing competence oriented educational models, in line with demands for evidence-informed policies in education (Pellegrini & Vivanet, 2020). Through the examination of creative self-efficacy, entrepreneurial self-efficacy and grit, the aim of the model is to analyse student innovative mindsets from an educational perspective. Working along these lines could facilitate research projects which analyse the impact of novel educational interventions on the innovative profile of students and which promote innovation in higher education contexts.

The studies detailed in this dissertation have provided some significant new insights into the differences that exist between students of different genders and study disciplines concerning their perceptions towards their capacity to innovate, as well as into the conditions that can foster the development of an innovative mindset. The rapid pace of change in today's society is creating unique challenges for higher education institutions and students alike, requiring them to foster and cultivate innovation skills and cultures in order to adopt new ways of responding to global challenges. If fostering innovation is accepted as a means of social development, it is imperative to find ways to promote it in each and every student.

6.1.1 Implications for practice

The aforementioned findings have a number of practical implications. This research has revealed that fostering student creative confidence, in addition to being a relevant educational objective in itself, may be a plausible strategy to promote an innovative mindset among students.

In relation to this, a positive association has been found between student engagement and creative confidence beliefs. Consequently, institutions can play an active role in promoting practices that promote not only student engagement but also creative self-efficacy. Particularly, the importance has been argued for promoting curricular designs that include collaborative learning, frequent student-teacher interaction, deep learning approaches and high-impact practices.

Furthermore, higher education learning contexts should prioritise reflective and integrative learning in order to promote positive creative self-perceptions among students. As maintained by Asikainen and Gijbels (2017), the widespread perception that students develop deep approaches to learning of their own accord during their university experience is, at least, debateable. Institutions could promote the scholarship of teaching and learning among university lecturers through the implementation of pedagogically based professional development programmes, aimed at making explicit the relevance of creating contexts that promote reflective and integrative learning. In such contexts, students become able to make connections between different modules of study, to relate new and previous knowledge and to link course content with their daily life (Bran, 2010).

Overall, this study strengthens the idea that institutions should make it possible for every student to participate in high-impact activities (Kuh, 2008). There is abundant evidence of the positive effects of participating in high-impact practices, in terms of persistence, satisfaction and engagement (Kilgo et al., 2015). Our results suggest that participating in such practices that promote multiculturalism, collaborative learning, student-faculty interaction, and feedback from educators also lead to creative confidence and innovative mindset development among students. Women and those enrolled in social science studies could particularly benefit from participating in high-impact practices in terms of enhanced confidence in their capacity to assume innovative roles.

Grit, or the ability to cope with or show resilience in the face of adverse life events, came to the forefront unexpectedly in our studies during the lockdown decreed in the wake of the COVID-19 pandemic. Our results indicate that students develop consistency of interest, a dimension of grit, in situations that require a high level of self-regulation. This finding confirms the malleability of a variable associated with student academic development and resilience, and suggests the possibility of designing educational interventions aimed at fostering student grit. Recent evidence indicates that growth-mindset interventions, aimed at understanding intelligence and ability to learn as malleable skills, can be efficient to improve student self-perceptions (Alan et al., 2019; Burnette et al., 2019; Karwowski, 2014). Growth-mindset interventions are generally carried out in pre-university education levels but researchers have started to analyse the potential that these interventions may have in higher education contexts (Brez et al., 2020). Implementation of growth-mindset programmes in higher education contexts would offer interesting possibilities in those disciplines of study where student self-beliefs towards innovation seem to be lower.

Throughout this investigation, the need for designing new approaches to analysing student innovative mindset has been argued, and a novel theoretical model aimed at analysing innovative mindsets in university students has been developed. In a sample of first-year university students, this model has made explicit the need to counteract gender stereotypical competence beliefs and to improve the general perception regarding the relationship between innovation and the social sciences. Overall, this research reinforces the need to confront gender stereotypes as they have an impact on what we expect from ourselves, and, therefore, on our academic and professional aspirations. Interventions aimed at understanding the neuroplasticity of the brain and at understanding how stereotypes may be guiding our behaviours could be particularly useful at different levels of education in order to reflect on the limits that we set on

ourselves. In addition, there is a common tendency to place technical disciplines ahead of humanities and social sciences, not only in terms of social and economic impact but also in terms of personal impact, as the general perception is that STEM degrees offer better professional prospects (Hay, 2016). Nonetheless, in order to address today's multidimensional challenges in a holistic manner, a healthy balance between the different disciplines of study needs to be ensured. It should be made clear that, in order to confront current and future threats, we not only depend on technology, but also on sciences that allow us to analyse challenges in social terms, and hence, to develop an inclusive and multifaceted approach to policy-making. In Spain, most undergraduate study is within a single discipline area, allowing specialisation and deepening in learning. Nonetheless, particularly along the first years of university, multi-disciplinary approaches would promote awareness of the relevance of all disciplines, by giving students different insights into significant issues. Moreover, development and support of collaboration networks between young and senior students, researchers and educators from different disciplines would stress the importance of all sciences and foster joint work between disciplines.

6.2 Limitations and Future Lines of Research

The findings discussed provide a basis for developing relevant non-cognitive skills across university students. Nonetheless, there are limitations in this research that could be addressed in future research.

Concerns have been raised regarding the reliability of one's perceptions, which may be prone to biases and inaccuracies, and, therefore, cause problems when used as indicators of skills (Dunning et al., 2004). Nonetheless, on the National Survey of Student Engagement, Miller (2012) did not find support for the influence of social desirability, and several studies suggest that, in the higher education context, self-reports and actual abilities are related (Anaya, 1999; Hayek et al., 2002; Pike, 1995; Zilvinskis et al., 2017).

In another vein, our conceptualisation of gender recognises its existence on a spectrum and accordingly, when completing the questionnaires, participants were able to self-identify as non-binary. Nonetheless, because the number of students who did not self-identify as male or female was very small, this sub-group could not be considered in

the statistical analysis. Further research with larger samples should be undertaken in order to understand student perceptions towards innovation across gender identities.

In addition, the sample was recruited from Spanish educational centres and hence it is unclear to what extent the results are generalizable to other contexts. Besides, as a convenience sampling strategy was used, samples may not necessarily represent the university population in relation to gender and field of study. Although we sought to address these limitations working with a considerably large sample of students, in order to corroborate our findings and expand our knowledge beyond our own context, the importance of carrying out cross-cultural studies in the future is acknowledged. Throughout the different studies, the relevance of longitudinal designs has also been highlighted, not only to confirm the validity of the present findings but also to examine how students' perceptions about their innovative abilities evolve across the course of their university studies.

We consider that this study makes a significant contribution to the understanding of the influence of educational contexts on student creative confidence beliefs. Nevertheless, the importance of distinguishing between creative self-concept and creative self-efficacy (the latter requiring more specific measurement tools) has been highlighted in the recent literature (Beghetto & Karwowski, 2017; Karwowski et al., 2019). Therefore, the use of recently created measurement instruments such as the Short Scale of Creative Self (Karwowski & Lebuda, 2018) would allow to generate further knowledge exploring other variables that may have an important role in the relationship between students engagement and self-perceptions, such as creative identity. In addition, systematic observations of innovative behaviours among university students would explain the specific routes through which student innovative mindsets influence innovative behaviours in non-professional contexts.

Likewise, the analysis of the relationship between the innovative mindset construct and unconventional career plans is considered relevant for future research, as higher education institutions need to prepare students for a rapidly changing world. The assessment of student innovation mindset and career plans across genders and disciplines of study provides useful insights into the conditions that prepare students for a transition to an uncertain professional context and empower them to shape future changes. In this regard, incorporating a strong ethical dimension and adopting a culture of collaboration and cooperation is fundamental, as innovation should aim towards delivering fair and sustainable outcomes. Accordingly, exploring student cooperative identity in relation to innovative mindset would allow for the identification of additional

variables of relevance in the analysis of student innovative development. Furthermore, future investigations could examine other relevant variables in relation to innovation such as openness to diversity and challenge or disposition to critical thinking.

Future research could also analyse how students' perceptions regarding their innovative mindset evolve throughout their university experience. The combination of results from different sources of data might be useful in this regard, particularly mixed methods merging quantitative approaches with qualitative approaches such as in-depth interviews and focus groups with students. The longitudinal analysis of the impact of educational interventions on student profiles is necessary in order to enrich the university experience. Additionally, analysing the influence of other conceptual approaches to engagement on student non-cognitive development would contribute to the development of more effective educational strategies in relation to innovation.

Finally, intersectional approaches contemplating students' gender identity, ethnic culture and socioeconomic variables could substantially improve our knowledge and provide critical insights on how to nurture innovative self-perceptions across all students.

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