Analysis of Entrepreneurship Competencies' development among students

The assessment of entrepreneurship compentencies' using the EntreComp framework among students for Delft Centre for Entrepreneurship

By

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TU Delft

“Analysis of Entrepreneurship Competencies' development among students”

An MSc. thesis on the assessment of entrepreneurship compentencies’ using the EntreComp among students for Delft Centre for Entrepreneurship

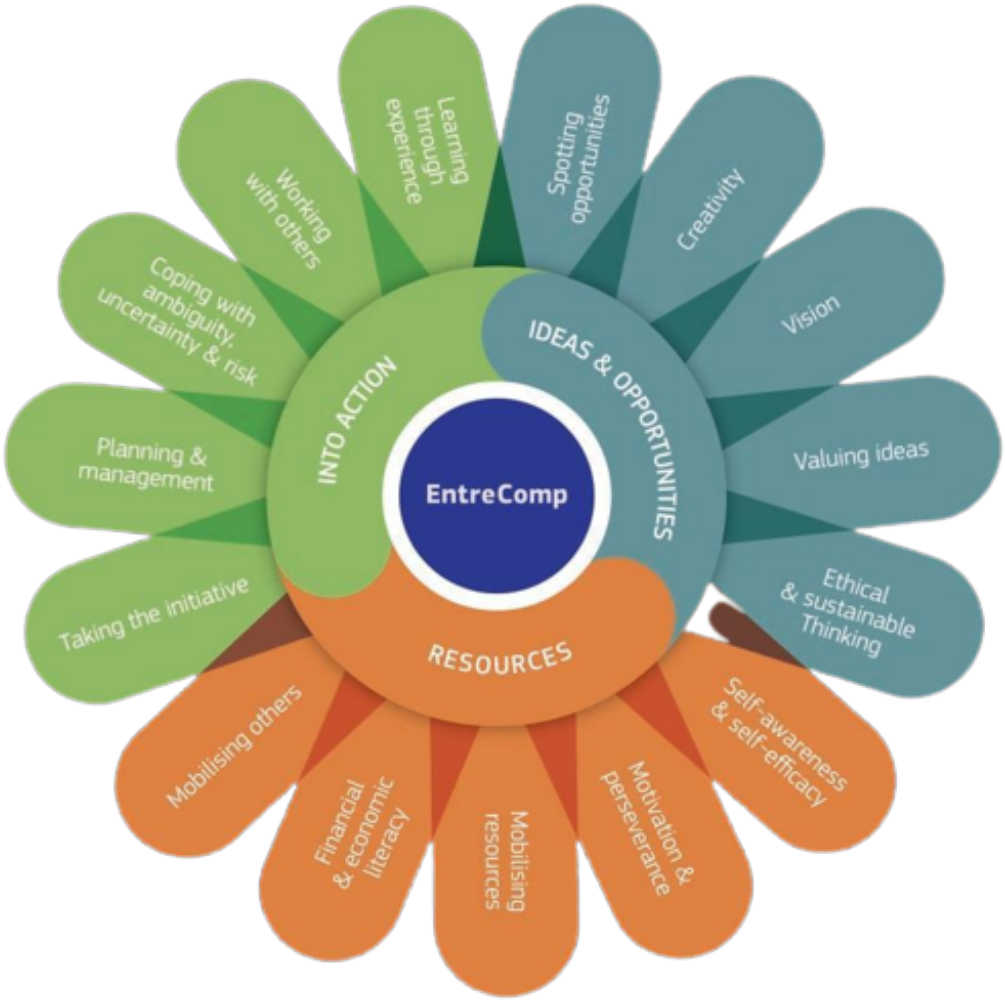

Figure 1: EntreComp framework (Bacigalupo et al., 2016)

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Preface

Before you lie the master thesis “Analysis of Entrepreneurship Competencies' development among students”, a research conducted over February 2023 to July 2023 on behalf of Delft Centre for Entrepreneurship. This master thesis has been written to complete the criteria for graduation of the MSc. Program Complex Systems Engineering and Management at Delft University of Technology.

As first, I would like to thank the whole graduation committee for their patience, flexibility, enthusiasm and help over the past four months. Starting with the first supervisor of this research project, Ellen van Andel (MSc.), who played a key role in setting up the research and her guidance for me within the DCE section. From our first meeting at in late January, I knew I could count on her support and expertise. In addition, she connected me to the other graduation committee members and was continuously available throughout the research process, even when she was in Africa for one of her projects in low- and middle-income countries. I warmly recommend to readers of this report to check out one of Ellen's projects.

Next, I would like to thank Dr. Ing. Victor Scholten who as chair of this project and director of DCE provided crucial high-level insights on important bottleneck moments in the research process. Victor helped me with vital information for the data-analysis, which really pushed me forward on a though moment. As last, I want to thank Dr. Ben Wagner, which I first met in my first master’s year and as second supervisor understood my perspective as CoSEM student. Despite his very tight and hectic schedule, he was from the beginning always very excited and interested in my research plans and progress. I want to thank him for his involvement and his views as member of the organization and governance section at the faculty of TPM.

Lastly, I want to thank my family for their continuous support in my five study years at TU Delft. Next, I want to thank my study friends Yassir, Mustafa, Jeroen, Emre, David, Dennis and Teun of which most of them I met in my first year at the faculty of TPM in 2018. We’ve done many projects and courses together over the past five years, and I’m very glad to see how we grew as individuals over these years. I’m very excited to see where everyone will end up and I’m sure everyone will make a fantastic career as engineers. Also, I want to thank Nick, Taoufik and Lukas. They were important persons for me besides my study.

Mitchell Looij
Delft, June 2023

Executive Summary

The EntreComp framework has emerged as a comprehensive and influential reference model for fostering entrepreneurial competences. Developed by the European Commission's Joint Research Centre, EntreComp provides a common language and framework for understanding and developing entrepreneurship-related knowledge, skills, and attitudes. This master thesis aims to explore the application and effectiveness of the EntreComp framework in assessing students' self-assessment of entrepreneurship competencies. This is done for the problem owner, Delft Centre for Entrepreneurship.

Problem focus and importance
Presently, there are numerous research available on the use of EntreComp to assess entrepreneurship competencies in various contexts, such as businesses, schools and universities. What's more, the amount of research and use of EntreComp sees an increasing importance over the last couple years. However, in literature it seems the Netherlands currently lacks a national policy for entrepreneurship education. Additionally, it seems there is no national model for entrepreneurship education in the Netherlands. As last, Delft Centre for Entrepreneurship lacked a proper analysis so far on their education related to the EntreComp framework. Therefore, this research focusing on solving the problem to bridge the gap between the use of EntreComp of education at Delft Centre for Entrepreneurship and the forming of educational strategies based on data coupled to EntreComp. Consequently, the following research question was central to this study:

"How can the EntreComp framework be used to assess entrepreneurship competences among students following the Delft Centre for Entrepreneurship education programmes?".

Therefore, the main objective of this study is to analyse the use of the EntreComp framework for the DCE 2022/2023 survey results, and the effectiveness of entrepreneurship education programmes in assessing entrepreneurship competences among students. Therewith, in the analyses we could identify key entrepreneurship competences and provide recommendations for improving DCE education and future research in this area.

Research approach
The problem was approached in three phases. As first, a literature review is conducted to create a theoretical framework of the EntreComp research. Next, the methodologies chapter is used to form the approach on analysing the available data related to EntreComp. As last, the results chapter is used to communicate the analysis outcomes to DCE.

Main research findings
Firstly, the literature review focused on entrepreneurship education, focusing more broadly on European policies on entrepreneurship education and various definitions on EE. Thereafter, there is taken a specific look at EntreComp, focusing on its complexities, challenges and usage. Finally, the focus was on the usage of the EntreComp framework in research papers.

The output of the research mainly concentrates on relations between the variables in the EntreComp DCE dataset, and therefore to provide recommendations for DCE on their research and education in this area. Two datasets for the minor program's technology-based entrepreneurship and international entrepreneurship and development were analysed. To analyse the data in chapter 5, there was looked at the descriptive of both datasets.

If looked at mean values, the mean value for competence 9, "financial and economic literacy", is in both datasets the lowest. This means that the student groups don't assess their selves very high in these EntreComp abilities at the start of the minor programmes, scoring 3.64 for TBE and 3.83 for IED on average on a 7-point Likert-scale. In addition, the highest scores were seen on competences 6 and 7, *"self-awareness and self-efficacy"* and *"motivation & perseverance"*, scoring for all four entries higher than 5.5. Therefore, it's recommended to focus more on awareness on the competence "financial and economic literacy" within DCE education.

Three hypotheses were found significant using a t-test: the relation between self-employed parents and valuing ideas (TBE), creativity on gender, and self-employed parents on uncertainty, ambiguity and risk (IED). All the other hypotheses were found insignificant, meaning there was no difference observed between the two researched groups.

Therefore, it's recommended to emphasize the creativity competence under males, as the difference is significant with females for both programs. For TBE it's recommended to focus on the competence of valuing ideas under students without self-employed parents, as there is a significant difference as well. As last, for IED it's seen that people with self-employed parents differ significantly on the competence uncertainty, ambiguity and risk, meaning handling uncertainty under these groups can be emphasized.

As last, Cronbach's alpha is used to test the internal validity of the dataset. Only one factor scores lower than 0.6 meaning, there is poor internal consistency within the competence. This is the case for competence 4 "valuing ideas" for the TBE dataset, with a Cronbach's alpha of 0.523. Furthermore, 2 factors score between 0.6 and 0.7, namely "spotting opportunities" (0.694) in the TBE dataset and "valuing ideas" (0.682) for the IED dataset. The rest of all Cronbach alpha score are all above 0.7, meaning great internal consistency.

Therefore, it's recommended to revise the question around "valuing ideas", by increasing the number of items in the scale. By adding more items, a greater variation in the construct being measured can be captured, potentially increasing the overall reliability. It is important, however, to ensure that the additional items are conceptually relevant and effectively measure the construct of interest.

Chapter six of the master thesis presents a comprehensive discussion of the research findings, limitations, and recommendations for future research in entrepreneurship education. It highlights the need to expand the sample beyond DCE, consider other frameworks alongside EntreComp, explore additional variables influencing entrepreneurial behaviour (to form new hypotheses), and improve survey design. The chapter suggests alternative statistical approaches and the importance of examining growth over time to understand the development of entrepreneurship competencies among students.

The research is relevant to DCE and entrepreneurship education in general, because of the proven need of researching the use of EntreComp among students. The research demonstrates the lack of a nationwide EE policy, and DCE had not analysed their survey data in full detail as well. Therefore, this research contributes to entrepreneurship education in the Netherlands and gives a demonstration of possible ways to improve educational programmes for DCE.

Keywords: EntreComp, Delft Centre for Entrepreneurship, Entrepreneurship, Education.

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List of Abbreviations

CoSEM. Complex Systems Engineering, and Management…….
DCE. Delft Centre for Entrepreneurship…….
EC. EntreComp……..……...
EntreComp. European Entrepreneurship Competence Framework…….
EE. Entrepreneurship Education……..
EI. Entrepreneurship Intention…….
HEI. Higher-education institute…….
IED. Internernational Entrepreneurship and Development……..…….
RFD. Research Flow Diagram……
RPL. Recognition of prior learning…….
SDG. Sustainable Development Goals……
SOI. System-of-interest. ……..
STEM. Science, Technology, Engineering, Mathematics…….
TBE. Technology Based Entrepreneurship……

1. Introduction

This research explores and assesses the effectiveness of the EntreComp on students following education programmes at Delft Centre for Entrepreneurship (DCE). At first, this chapter introduces the research problem. Thereafter, the societal relevance and problem statement will be discussed. Then, the following main- and sub-questions are discussed together with the research flow diagram. As last, the report structure is presented.

1.1. Problem description

Entrepreneurship education programmes have become increasingly popular in recent years, as more and more universities are recognizing the need to prepare their students to become entrepreneurs (Gibcus et al., 2012). However, the effectiveness of such programmes in developing students' entrepreneurship competences is still a matter of debate. It turns out that it is sometimes difficult to gain insight into the current state of entrepreneurship education, since entrepreneurship education is "not yet a standard practice in national monitors, in evaluations and documentation" in the Netherlands (Baggen et al., 2018).

At the same time, in recent years, more and more research is conducted towards entrepreneurship education. This resulted into the development of several standardized frameworks and competence models, such as the EntreComp framework (Bacigalupo, et al., 2016) and the Lackeus' framework on entrepreneurial competencies for the OECD (Lackeus, 2015). What's more, Lilleväli and Täks (2017) identified different competence models for "conceptualizing the systematic process of entrepreneurship competence development". So far, they identified several different competence models, such as the UK, USA and Danish competence models for entrepreneurship education.

However, the Netherlands still lacks a qualitative evaluation methodology in entrepreneurship education (Baggen et al., 2018). A problem also identified by Delft Centre of Entrepreneurship, where the focus is on technology-based entrepreneurship education. DCE offers three Bachelor minor programmes worth 30 ECTS Credits, and a large variety of different entrepreneurial Master courses from the Think-Act-Start set. As of now, DCE identifies difficulties to assess the EntreComp framework and therewith the development of entrepreneurship competences among students over the recent years.

Within this field, it is very interesting for DCE to research the effects of the EntreComp and other frameworks on its education. The current lack of standardization within TU Delft on measuring technology-based entrepreneurship competencies leaves room for new and refreshing insights for its education programmes.

Without an effective framework to assess these programmes, it is difficult to determine whether they are providing students with the right skills and knowledge to succeed as entrepreneurs. In addition, existing competence frameworks haven't been studied and tested in detail within DCE. Therefore, the purpose of this research is to tackle DCE's knowledge gap and problem on how to properly assess and test the (developed) entrepreneurial competencies among their students.

1.2. Scientific relevance

From an academic perspective, recent papers mainly focus on global standardization of entrepreneurship competencies, mostly using rating scales. There is one concrete example of research by van der Valk (n.d.), in which he analysed survey answers from minor students of DCE. The data originated from academic years 2011 to 2013, and students could answer the questions using a 5-point Likert scale.

What's more, Blenker et al. (2014) researched different methods in entrepreneurship education research. It emerged that literature uses primarily descriptive forms of analysis. It's considered as a serious limitation towards entrepreneurship research, and the research mentioned the need for more refined forms of data analysis for more in-depth investigations for entrepreneurship education research.

What's more, Margherita et al. (2016) researched the promotion self-assessment of the entrepreneurial competence among students in Europe, also based on the EntreComp framework. It was concluded that still consensus need to be reached "on how many questions can be asked to ensure an adequate response".

Furthermore, the relative newness of the EntreComp model presents an opportunity for original research that explores its effectiveness in a specific educational context. By examining the EntreComp framework's applicability and proposing recommendations for improvement, this research contributes to enhancing the assessment practices at DCE and potentially informs similar institutions seeking to assess entrepreneurship competencies.

In more detail, Raţiu et al. (2023) have done a bibliometric review and reviewed research trends around EntreComp. The concluded that the analysis shows a lack of a common understanding and practice in using EntreComp, indicating the need for support and direction in effectively promoting the learning process. In addition, they recommended that the development of policies and best practices for implementing EntreComp in various educational programs and contexts can be the subject of future research. This research is also discussed in more detail in chapter 3.3.4.

Overall, this research focusses on how to improve the assessment of entrepreneurship competencies for Delft Centre for Entrepreneurship in a specific educational context. The current state-of-art literature leaves room for refined research methods on this topic, and with the EntreComp model being a relative new phenomenon, means there is still room to perform such research.

1.3. Societal relevance

Entrepreneurship education in general is crucial for the economic growth of a country and plays a vital role in achieving sustainable development (Rashid, 2019). The research project's focus on improving the assessment methods of the development of entrepreneurship competences for DCE is crucial in enhancing entrepreneurship education and promoting sustainable development within countries.

One of the main societal benefits of this research is its potential to contribute to the development of better entrepreneurship education programmes. By improving the assessment methods of the development of entrepreneurship competences, this research can provide insights into the most effective approaches to developing the skills and knowledge needed to succeed as an entrepreneur.

Already back in 2005, Van Der Hoeven and Rutte (2005) emphasized as Dutch government valorisation of research as a task of the universities, and the need of stimulation of entrepreneurship within education.

Another significant societal benefit of this research is its potential to contribute to the creation of more sustainable and innovative businesses (Lüdeke-Freund, 2019). Entrepreneurship is a vital driver of innovation and economic growth, and sustainable entrepreneurship is essential for achieving sustainable development.

What's more, entrepreneurship education is critical for the economic growth of a country, and it plays a vital role in achieving the Sustainable Development Goals (ILO, 2017). The research project's focus on enhancing entrepreneurship education by improving the assessment methods of the development of entrepreneurship competences aligns with several of the SDGs, particularly those related to education (SDG 4), economic growth (SDG 8), and innovation (SDG 9). The relation between these SDGs and this research are highlighted within the following table:

Sustainable Development Goals	
	There should be equal access to technical and higher education. Moreover, there should be an increase in the number of people with relevant skills. DCE forms an important actor for providing high quality entrepreneurship education, on a technical university for both engineering as well as non-engineering students. Moreover, DCE contributes to this SDG with development relevant skills for decent work under students.
	This SDG focusses on enterprise development and therewith economic growth. Moreover, there is the coupled target towards promoting development-oriented policies supporting entrepreneurship, creativity and innovation. DCE contributes both to the promotion of entrepreneurship among students, as well as the encouragement of being creative and innovative. In the education programmes, students are motivated to come up with new business ideas.
	There should be an increase to small-scale enterprises, to develop countries and an integration the value chains and markets. Furthermore, scientific research should be encouraged and an upgrade in technological capabilities. As an university, TU Delft and DCE both contribute to science and practical innovations within a variety of sectors.

Table 1: coupled sustainable development goals

1.4. Research questions, problem statement and objective

This chapter focusses on setting out the main- and sub-research questions, that are to be answered in this research. In addition, the problem statement and research objective are formulated.

1.4.1. Problem statement

The problem statement is based on the effectiveness of entrepreneurship education programmes in developing students' entrepreneurship competences needs to be assessed, in which the EntreComp framework can be used to identify key competences and provide recommendations for improving education and future research in this area.

1.4.2. Main research question

"How can the EntreComp framework be used to assess entrepreneurship competences among students following the Delft Centre for Entrepreneurship education programmes?"

The main research question focuses on examining how the EntreComp framework can be utilized to assess entrepreneurship competences among students following the Delft Centre for Entrepreneurship (DCE) education programs. The EntreComp framework serves as a reference model for understanding and assessing entrepreneurship competences, providing a comprehensive framework that encompasses the knowledge, skills, and attitudes necessary for entrepreneurial success.

This research question seeks to explore the practical implementation of the EntreComp framework within the specific context of DCE's education programs. By investigating the application of the framework, the study aims to evaluate its effectiveness in assessing the entrepreneurship competences of students and identify potential areas for improvement. The main research question can be divided into the following sub-questions:

1.4.3. Sub-question 1

1. *What is the EntreComp framework and how does it measure the entrepreneurship competencies?*

This sub-question aims to provide a comprehensive understanding of the EntreComp framework. It involves exploring the components, dimensions, and indicators of the framework to gain insights into how it measures entrepreneurship competencies. The goal is to establish a solid foundation of knowledge about EntreComp as the assessment tool. This is done in chapter three, in the literature review.

1.4.4. Sub-question 2

2. *How effective is the EntreComp framework on assessing the entrepreneurship competences among students for Delft Centre for Entrepreneurship?*

This sub-question focuses on evaluating the effectiveness of the EntreComp framework specifically for assessing entrepreneurship competences among students in the context of Delft Centre for Entrepreneurship. It involves gathering empirical evidence through data analysis to assess the alignment between the framework and the competences being evaluated.

1.4.5. Sub-question 3

3. *What are recommendations to improve the development of entrepreneurship competences among students for Delft Centre for Entrepreneurship?*

This sub-question aims to provide practical recommendations based on the findings of the research. It involves identifying potential areas of improvement in the development of entrepreneurship competences among students at Delft Centre for Entrepreneurship. The recommendations could include modifications to the curriculum, teaching methods, assessment strategies, or other relevant aspects to enhance the effectiveness and impact of entrepreneurship education.

1.4.6. Research objective

The objective of this study is to analyse the EntreComp framework, its survey results, and the effectiveness of entrepreneurship education programmes in developing entrepreneurship competences among students, and to identify key competences and provide recommendations for improving education and future research in this area.

1.5. Research flow diagram

Figure 2 shows the relation between research input, the research itself and the desired output for the research.

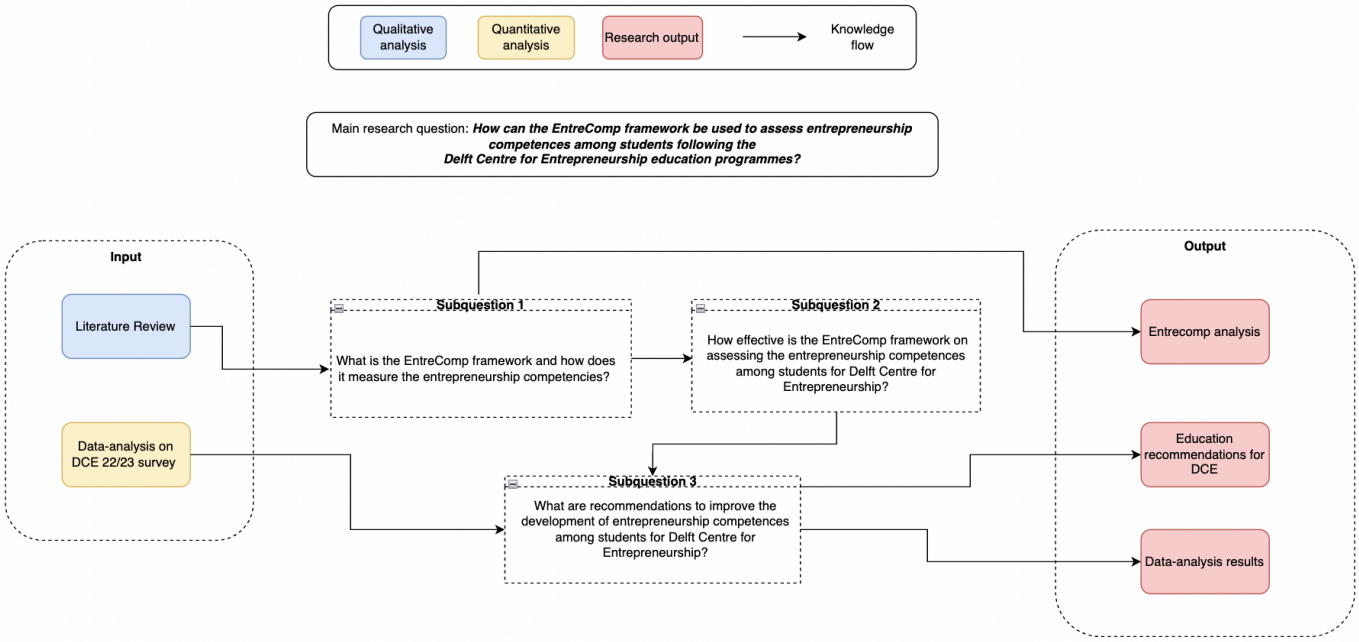

Figure 2: Research flow diagram

The literature review is answered with sub-question 1. Therefore, literature is researched on the EntreComp framework, as well as other entrepreneurship competences and frameworks that can be compared to get a good understanding of the current related research. The concrete output will form the EntreComp analysis. Next, there is chapter 4 methodologies, which answers sub-question 2. There, via other research, the forming of hypotheses, and choice of statistical analysis technique, the basis for chapter 5 will be shaped. As last, sub-question 3 will have the data-analysis results as output, as well as the education recommendations that will be formed for Delft Centre for entrepreneurship.

1.6. Structure of this report

Figure 3 shows the steps and structure of the research methodology as carried out:

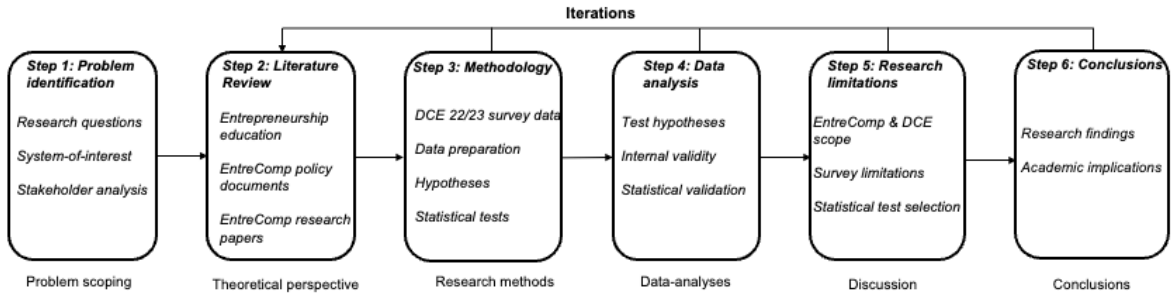

Figure 3: research methodology flowchart

Chapter 2 describe the problem identification. Therefore, a stakeholder analysis will be performed, together with the scoping and stating of the problems as identified. Chapter 3 discusses all selected and relevant literature around entrepreneurship education, competences and assessment. From there, the foundation is formed around the current state-of-art for Delft Centre for Entrepreneurship around these topics. Hypothesis could be formed on the research questions, as well as research output as start for the next chapter. Chapter 4 discusses the methodologies and possible (new) ways of experimental design to improve the assessment methods for DCE. Chapter 5 discusses the results from

the analysis, based on literature, data analysis and consulting. Chapter 6 discusses the limitations of the research and provides scientific recommendations. Finally, chapter 7 draws the conclusions by answering the research questions.

2. Problem identification

In chapter 2, the problem to be addressed in the research was identified and outlined. This chapter serves as a continuation of that process, by scoping down the situation and clarifying the research approach through a stakeholder analysis. The stakeholder analysis aims to identify and analyse the stakeholders involved in the system-of-interest, which refers to the specific context and environment in which the research is being conducted. By doing so, the chapter provides a better understanding of the key actors, relationships, and interests that are relevant to the research problem. Furthermore, this chapter presents the design approach that will be used in the research, based on the stakeholder analysis. The design approach describes the overall methodology and research framework that will be applied to address the research problem.

2.1. Stakeholder analysis

Part 2.1 identifies involved stakeholders, as highlighted in table 2. In their research towards contextual stakeholder identification, Salado and Nilchiani (2013) emphasized that past research has focused on the process of finding stakeholders by adopting stakeholder-centric techniques like **brainstorming**. What's more, they identified that a proper identification of stakeholder is the first step in tying the system of interest together and ultimately correctly defining the problem of concern. This method is predicated on the idea of listing entities that are connected to the system and then examining their interconnections to determine their relative relevance to the system (Bryson, 2004).

Stakeholder	Description (of interest and role in system)	Interest	Role
Stakeholders which play a role in Entrepreneurship education and a possible participatory system for the mission are identified.			
Delft Centre for Entrepreneurship (problem owner)	***DCE focuses on technology-based entrepreneurship and embraces various research approaches, methods and teaching techniques (DCE, n.d.).***	Improving entrepreneurship education	Direct
DCE Students	***Follow education at DCE, to improve entrepreneurial knowledge and competencies***	Improving entrepreneurial knowledge	Direct
Rijksdienst voor Ondernemend Nederland (O2lab)	***O2lab is an initiative of the RVO and the Ministry of Economic Affairs and Climate Policy, and wants to strengthen and embed the entrepreneurial spirit in education (RVO, 2023).***	Collaborate to strengthen entrepreneurial spirit	Indirect
European Commission (EntreComp, JRC)	***To provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle (Bacigalupo et al., 2020).***	Policy making	Direct
TU Delft	***TU Delft is working on solving global challenges for new generations of society train responsible engineers and push the boundaries of engineering sciences (TU Delft, 2023).***	Research benefits Awareness	Indirect
OECD	***OECD is here to promote policies that will improve the economic and social well-being of people around the world (OECD, 2023).***	Policy making	Indirect

Table 2: Identified stakeholders

2.2. System-of-interest

This part aims to clearly define the system-of-interest (SOI) for the identified problem. Wasson (2005) defines the SOI as follows: *"The system consisting of a MISSION SYSTEM and its SUPPORT SYSTEM(s) assigned to perform a specific organizational mission and accomplish performance-based objective(s) within a specified time frame".* In addition, the International Council on Systems Engineering (INCOSE) defines the SOI as *"The system whose life cycle is under consideration"* (Kinder, 2012). In this case, the SOI is sketched to clearly define what is considered and what not.

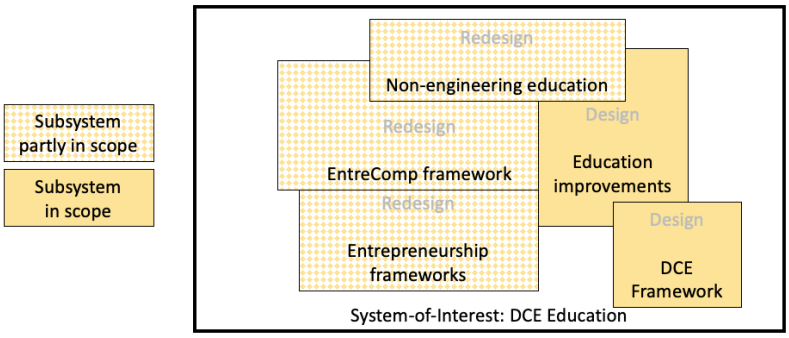

Figure 4: System-of-interest

As can be seen in figure 4, it's clear that non-engineering is partly in scope. This research is focussed on TU Delft a technical engineering university. In addition, for this research the focus is particularly on the EntreComp, as it's considered one of the most important recent frameworks within the entrepreneurship education research field.

Therefore, other entrepreneurship frameworks are subsystems outside the scope. In the end, the focus is on the subsystems in scope looking at the design of education assessment improvements for DCE, as well as creating an outcome framework based on the data-analysis in this research, based on assessments under students for the study years 2022/2023.

2.3. Relevant design approach to CoSEM

This master thesis is linked to the study programme Complex Systems Engineering and Management. A CoSEM engineer does not design the system but designs an intervention that is intended change some processes within the system Educating is often seen as **"**a process of knowledge transfer**"**. You can also think of it as a process of changing the way other people think by changing their mental models. Processes of knowledge transfer are themselves shaped by socio-technical artifacts such as schools, universities, courses, electronic learning environments, etc**.** (Bots, 2021). Therefore, the design of assessment is seen as a socio-technical system.

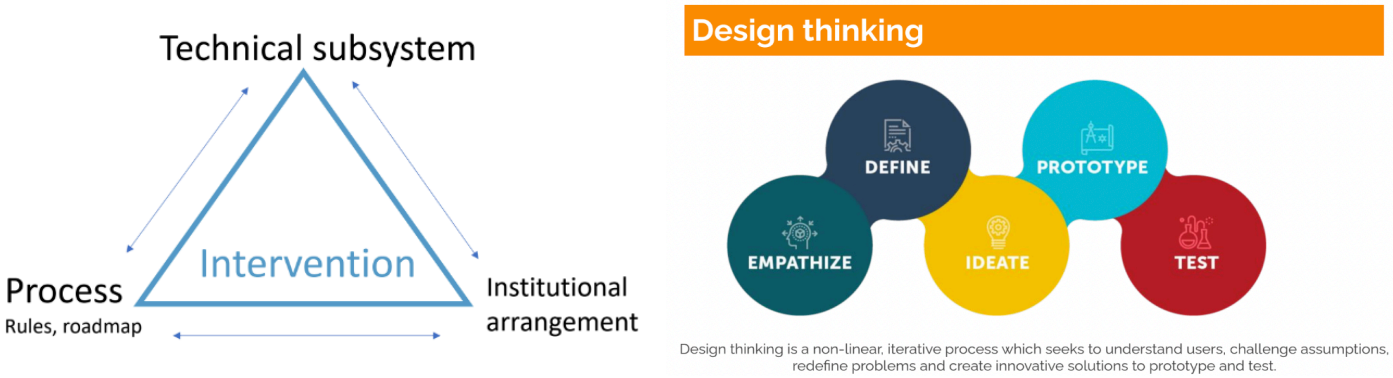

Figure 5: CoSEM design principles (van der Spek, 2022)

CoSEM engineers intend to design an intervention, because of the interaction between three elements: the technical subsystem, the process perspective and institutional arrangements.

The technical perspective involves the identification of the technical tools and resources required to design and implement the assessment methods. This could include digital tools, software programs, and other technological infrastructure required to support the assessment process.

The institutional perspective involves the identification of the stakeholders involved in the assessment process, such as students, teachers, academic institutions, and external organizations. This perspective considers the policies, regulations, and procedures of academic institutions and other external organizations that may impact the assessment process.

The process perspective involves the identification of the processes required to design, implement, and evaluate the assessment methods. This perspective considers the workflows, timelines, and activities required to complete the assessment process, from the initial design phase through to the evaluation and feedback phase.

2.4. Delft Centre for Entrepreneurship's situation

The problem owner in this situation is Delft Centre for Entrepreneurship (DCE). For DCE, two bachelor programmes of 30 EC are focussed on:

1. Technology-based entrepreneurship: *"provides a foundation for students who want to combine their technical knowledge with entrepreneurial skills to create, recognise and exploit new market opportunities. You can analyse markets and estimate technological developments. You can analyse start-up organisations and recognise and, if necessary, exploit opportunities in the market***"**. See appendix H for full information on the flyer.

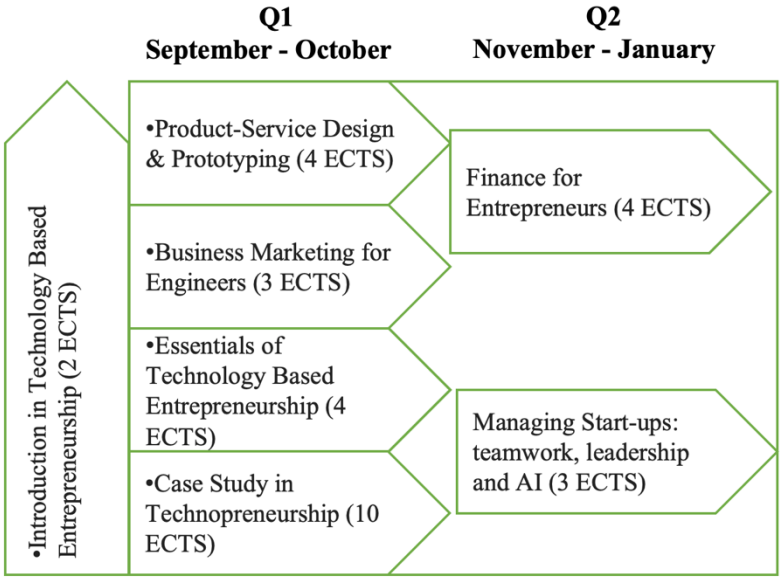

Figure 6: Course overview for Technology-Based Entrepreneurship (DCE – TU Delft, 2023b)

2. International entrepreneurship & development: "allows students abroad to develop technical solutions for complex challenges contributing to socioeconomic development. You will work in multidisciplinary teams to solve a challenge assigned to you by a project provider. Most of these challenges are located within developing and emerging markets and focus on achieving environmental, social or economic pro-poor impact. You will learn how to manage and work on a technology-related project in a different cultural and institutional setting with your team". See appendix H for full information on the flyer.

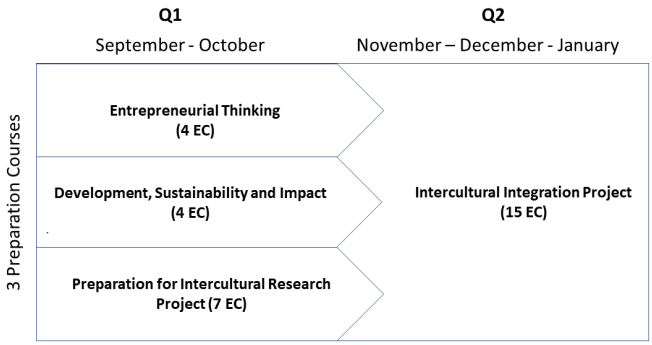

Figure 7: Course overview for the International Entrepreneurship & Development (DCE – TU Delft, 2023a)

2.5. Conclusion problem identification

Chapter 2 of the research identifies and outlines the problem to be addressed, while also scoping down the situation and clarifying the research approach through a stakeholder analysis. The stakeholder analysis aims to identify and analyse the stakeholders involved in the system-of-interest, providing a better understanding of key actors, relationships, and interests relevant to the research problem.

Additionally, the chapter presents the design approach that will be used in the research, based on the stakeholder analysis. The design approach describes the overall methodology and research framework that will be applied to address the research problem. It further defines the system-of-interest for the identified problem, considering what is in scope and what is not. The research focuses on the subsystems within the scope, specifically looking at the design of education assessment improvements for DCE and creating an outcome framework based on data analysis.

The design approach follows the principles of CoSEM and involves the interaction between the technical subsystem, process perspective, and institutional arrangements. The DCE's situation is outlined, with a focus on two bachelor programs: technology-based entrepreneurship and international entrepreneurship & development, providing an overview of the courses offered for each program.

3. Literature review

In chapter 3, a literature review is conducted. This chapter intends to give a thorough overview of how a literature study on entrepreneurship education and EntreComp was conducted. The review was done utilizing scientific databases like Google Scholar and Scopus. The development of entrepreneurial education policy documents was also looked at, on different geographical levels. First, the foundation and method of collecting the literature is presented. Thereafter, there is looked at the development and various definitions on entrepreneurship within education systems, to provide an overview and to form a foundation of what is discussed.

Then, several policy agendas and research are discussed, including entrepreneurship education strategies and following action points for member states within the European Union. In addition, an explanation is given on the EntreComp framework to form a good understanding of the usage. Also, scientific case-study EntreComp research are discussed and presented. Finally, knowledge gaps are presented, including a synthesis of all literature scoped down to the specific DCE situation. This all with the aim to form the starting point for chapter 4, where the methodologies for carrying out the data analysis on DCE EntreComp student survey data is discussed.

3.1. What is entrepreneurship education?

Up to now, a lot of research has been done into entrepreneurship education, with a wide variety of definitions proposed by researchers in literature.

3.1.1. Various entrepreneurship education definitions

Entrepreneurship education is a field that focuses on equipping individuals with the skills and knowledge necessary to start and manage their own businesses. The purpose of entrepreneurship education is to promote entrepreneurship as a means of economic growth and job creation (Maina, 2013). This way of education is designed to encourage the development of entrepreneurial behaviour, skills, and competencies, with the goal of producing successful entrepreneurs. However, there are many different institutes and possible definitions within this field, so it's useful to elaborate on some of those definitions.

Mani (2015) defines entrepreneurship education as "as a collection of formalized teachings that educate anyone interested in business creation". What's more, Peridou et al. (2009) identified entrepreneurship education as it "helping in motivating the entrepreneurial initiatives through enhancing entrepreneurial mindset among the students". In their research towards learning outcomes in entrepreneurship education within higher education settings Wong and Chan (2021) learned that "efforts should be made to understand terms and categories of learning outcomes appropriate for higher education, to enable more effective and efficient teaching and learning".

Over the past years, entrepreneurship education became a more important topic within the education agenda. In fact, the European Commission (2007) including entrepreneurship as one of the eight European Key Competences for the educational systems in member states.

ICF (2015) demonstrated that EE students "are at lower risk of unemployment, they earn more and are more often in leadership positions and are more likely to start their own business". What's more, people starting their own venture having followed EE seemed more ambitious and knowledgeable in the end.

3.1.2. EU-hub outcomes

EU-Hub (2019) checked the pulse of Entrepreneurship Education in Europe via a survey among all member states, also called the entrepreneurship education monitor. Countries were divided in north, south, east and west and respondents included NGOs, ministries and research institutes. What is striking, is that the Netherlands didn't have enough respondents (minimum of 5) to participate in the results of the survey. The survey showed interesting results regarding national strategies on EE. The three alternatives are based on the analysis of Eurydice report (2016), in which "Entrepreneurship Education at School in Europe" was researched, and are as follows:

1. Alternative 1: "*a specific strategy, which focuses exclusively on entrepreneurship education (often developing a common vision across government, reflecting policy priorities for a range of ministries)"*
2. Alternative 2: *"a broader education related strategy incorporating objectives for entrepreneurship education, such as education and training, youth or lifelong learning strategies."*

3. Alternative 3: "*a broader economy related strategy featuring entrepreneurship education, such as entrepreneurship, employment or SME development strategies.*"

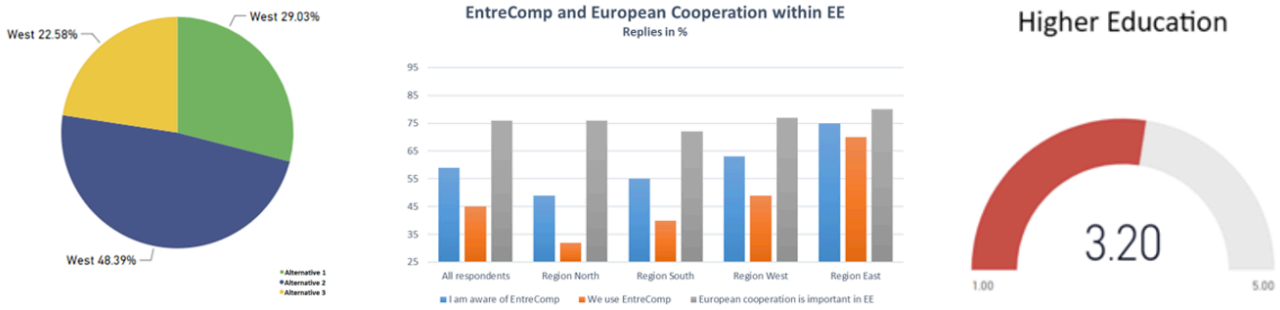

Figure 8: division of national strategies on EE for western countries (left), use of EntreComp (middle) and improvements of entrepreneurship education (right) (EU-hub, 2019)

It was concluded that in general, alternative 2 "the majority of countries seem to move towards a broader education related strategy incorporating objectives for entrepreneurship education, such as education and training, youth or lifelong learning strategies, and moving away from specific EE strategies" was observed. And more specific, for the western countries it was concluded that 48,39% identified alternative 2 as most used national strategy.

What's more, it's remarkable that around 63% of the respondents is aware of the EntreComp framework, while a way lower number, around 47% percent does use the EntreComp framework. This proves there is a lot of improvement seen the absolute difference between awareness and usage of the framework. It's good to see that around 76% of the respondents' value European cooperation in EE. On a scale of 5, an average rating of 3.2 was given for improvement regarding implementation of EE. 77% of respondents agree or strongly agree that improvement is progressing.

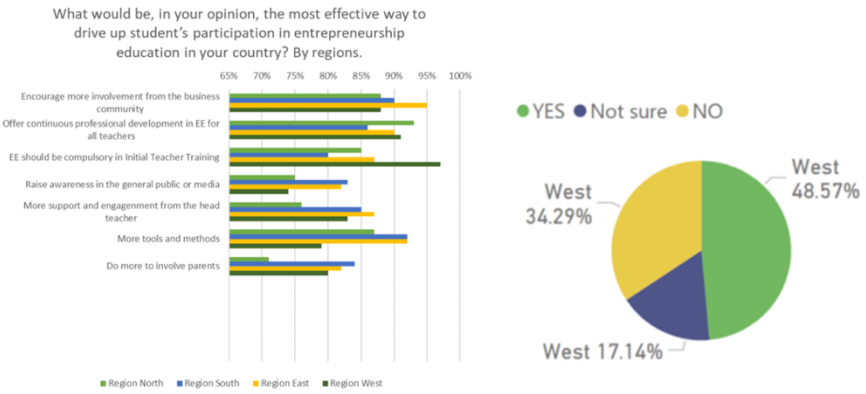

Figure 9: effective ways to drive up student's participation in EE (left) and inclusiveness of practical experiences as part of the curriculum (right) (EU-hub, 2019)

Figure 9 shows the results of effective ways to drive up student's participation and the ratio of practical experiences as part of the curriculum. As spotted, for the western countries it seems that EE should be compulsory in initial teacher training. As second, there should be continuous professional development in EE for all teachers. As last, the education monitor demonstrated that only 48.57% includes practical experiences as part of the curriculum.

3.1.3. European policy's on EE

In 2014, the European Commission (2014) published a policy guidance document to "support improvements in the quality and prevalence of entrepreneurship education across the EU Member States, providing direction for the next steps in the entrepreneurship education policy agenda at EU and national level". The following objectives for entrepreneurship education were identified:

1. "Promoting the development of personal qualities such as creativity, spirit of initiative, risk-taking and responsibility that are relevant to entrepreneurship".
2. "Raising students' awareness of self-employment as a career option (the message being that you can become not only an employee, but also an entrepreneur)".
3. "Providing the business skills that are needed in order to start a new venture".

Appendix B further draws EE strategy phases of development, including EE strategy requirements and different policy requirements as drawn by the thematic working group.

Lilischkis et al. (2021) published a guide to fostering entrepreneurship education commissioned by the European Union. It contained five key actions towards "a digital, green and resilient Europe". Every key action is deepened into three action points on a European, national and local level. In their report, Lilischkis et al. (2021) named that Europe needs people with entrepreneurial competence, i.e., "people with the right knowledge, skills and attitudes to turn ideas into action for the betterment of our society".

In the report, it was recommended that EE should combine experiential learning, competence building and a mind shift among students. Additionally, the report demonstrated that EE becomes increasingly important EU's policy development, being part of EU's "green and digital transitions and the post-COVID-19 economic recovery programmes". Furthermore , it was stated that governments and educational institutions can specifically use EntreComp to create curricula, learning activities, and to promote entrepreneurship as a skill in all areas of education.

Lilischkis et al. (2021) also named key points for the research agenda for EE. They identified that there are still many important questions around EE that require research. Several key research questions were identified, including:
• "How should EE be implemented in initial teacher training and in continuous professional development?"
• "What methods and tools of EE and of measuring students' performance work well in different contexts?"
• "What are the benefits and impacts of entrepreneurship education? How can these benefits and impacts be soundly measured?"
Appendix D details all action points for fostering entrepreneurship education even more.

3.1.4. Effects of entrepreneurship education and ecosystem

This chapter looks at the effects of entrepreneurship education and it's ecosystem, as defined by the European Commission (2014), thematic working group on entrepreneurship education.

Figure 10: potential effects of entrepreneurship in education on society and economy (European Commission, 2014)

Figure 10 shows the potential effects of entrepreneurship in education on society and economy. Aspects such as workforce development, entrepreneurial culture and new business growth are highly rated effects of entrepreneurship education within societies.

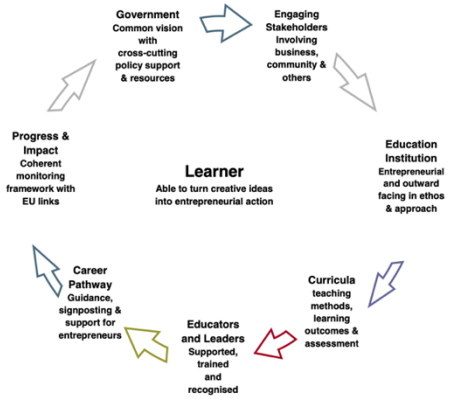

Figure 11: Entrepreneurship Education Ecosystem (European Commission, 2014)

Figure 11 places the learner at the centre and surrounds them with components that influence the larger ecosystem for entrepreneurship education. Together, they situate the educational system in the larger economic and social society, recognizing the importance of entrepreneurial education as a precondition for workforce growth, social well-being, employability, and the establishment of new businesses.

The ecosystem operates on several different scales, and institutional focus is quickly becoming a key factor in the creation of EU-level policy in this area. An institutional strategy is essential if entrepreneurship in education is to become a fundamental and ingrained component of education and training. This indicates both support for entrepreneurship instruction and an entrepreneurial mindset within the educational institution. This does not imply that schools start operating as businesses, but rather that the institution is better equipped to seize opportunities or adapt to change as the entire ecosystem works to foster entrepreneurship (European Commission, 2014).

Three action points were named by the thematic working group:

1. "This Action supports mobilities for learners and staff, to undertake a learning and/or professional experience in another country, and entrepreneurship education is relevant to the anticipated outcomes of these mobilities" (European Commission, 2014).
2. "Cooperation for Innovation and the Exchange of Good Practices. There are three areas of relevance in this Action including transnational Strategic Partnerships, Knowledge Alliances and Sector Skills Alliances" (European Commission, 2014).
3. "Support for Policy Reforms includes opportunities for Prospective Initiatives linked to entrepreneurship education, with Forward Looking Cooperation Projects to try out new policy approaches or Policy Experimentations to pilot up-scaled versions of proven methodologies" (European Commission, 2014).

3.1.5. Entrepreneurship education in the Netherlands

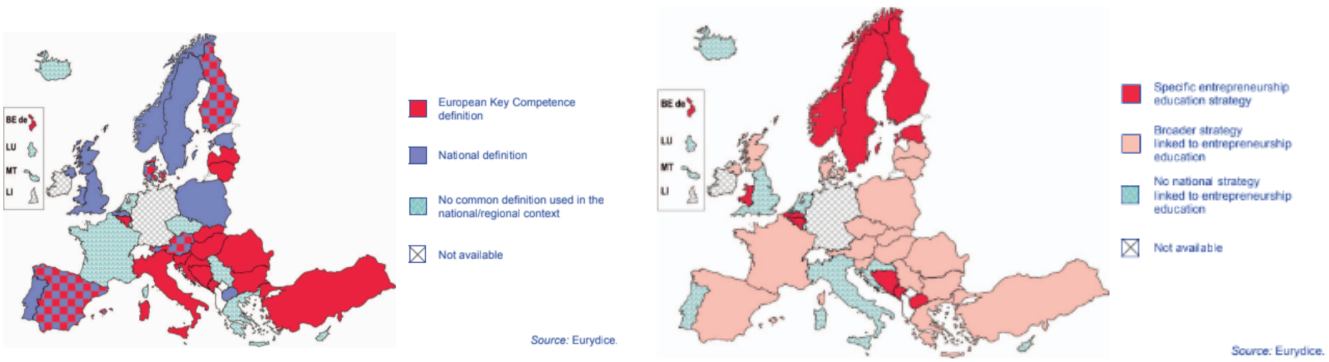

Figure 12: overview of countries with EE definition and EE education strategies (Eurydice, 2016)

In figure 12, two maps show an overview of countries with a specific definition on entrepreneurship education and specific education entrepreneurship strategies. A third of nations adopt their own national definition of entrepreneurship education, whereas around half of nations follow the European definition. There is no widely accepted definition of entrepreneurship education in the national context in over ten nations. Most national definitions of entrepreneurship education have the same thorough understanding as the European Key Competence definition. Its function and goal are reflective of both the broader context of an individual's life and the setting of work and business. Eurydice (2016) concluded that the Netherlands currently lacked a national policy for entrepreneurship education. The Netherlands has a more comprehensive plan for entrepreneurship and innovation, and the need to improve education and training is clearly emphasized. For example, there is a call for stronger collaboration between business and education while connecting to past and present EE initiatives. However, over the past few years, the Netherlands has the O2lab initiative (see table 2) to improve the collaboration between education institution, governments and various industries. What's more, TU Delft has a clear mission statement on entrepreneurship education: "*Integrate Delft Global into TU Delft education programmes and intensify "maker space" education, digital learning and capacity building in target countries. Entrepreneurship: A research and training programme on how to become an entrepreneur in low-resource countries together with Innovation & Impact Centre, Delft Centre for Entrepreneurship, YES!Delft"* (TU Delft, 2023b).

3.2. The EntreComp framework explained

The EntreComp framework is a tool for assessing and developing entrepreneurship competences, designed by a consortium of researchers funded by the European Union. It is considered as a "a common approach to support the development of entrepreneurship as a competence". It was founded and designed by a Joint Research Group, on the initiative of the Directorate-General for Employment, Social Affairs and Inclusion of the European Commission. The objective of the study was to "develop a common conceptual approach, which could support the development of entrepreneurship competence at European level (Margherita et al., 2016).

The framework includes a range of entrepreneurship-related competences that are organized into three main categories: Ideas and Opportunities, Resources, and Into Action. It is designed to be used in entrepreneurship education programs to help students develop their entrepreneurial skills and knowledge. What's more, Margherita et al. (2016) assigned the following definition to the framework:

"The framework describes entrepreneurship as a transversal competence, which can be applied by citizens to all spheres of life from nurturing personal development, to actively participating in society, to (re)entering the job market as an employee or as a self-employed person, and to starting up ventures (cultural, social or commercial)."

Furthermore, Lilischkis et al. (2021) stated that the **ambition** of EntreComp is that stakeholders utilize EntreComp to support policy and practice to create entrepreneurial skills, assess entrepreneurial competences, to assist education programmes, to deliver entrepreneurial skills, design learning programs, and certify skills in any context.

The EntreComp framework comprises 15 competences, which are divided into three main categories. In appendix A, a more elaborated explanation of all competencies is provided:

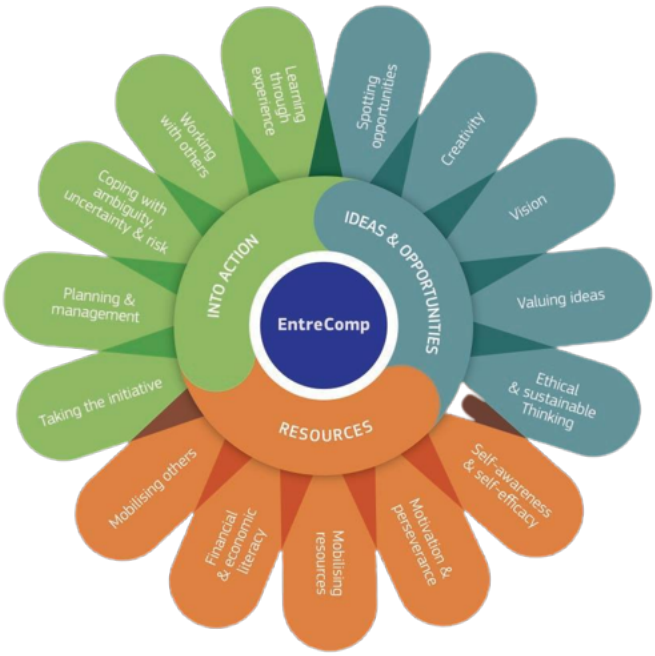

Figure 13: EntreComp framework visualized (Margherita et al., 2016)

The first category, Ideas and Opportunities, includes five competences that relate to the identification and evaluation of business ideas. These competences are Spotting opportunities, Creativity, Vision, Valuing ideas, and Ethical and sustainable thinking.

The second category, Resources, includes five competences that relate to the management and utilization of resources to create and run a successful business. These competences are Self-awareness & self-efficacy, Motivation & perseverance, Mobilizing resources, Financial and economic literacy and Mobilizing others.

The third category, Into Action, includes five competences that relate to the implementation of business ideas and the management of a growing enterprise. These competences are: Taking the initiative, Planning & management, coping with ambiguity, uncertainty & risk, Working with others and Learning through experience.

Each of these competences is further subdivided into more specific skills and knowledge that are necessary for their development. For example, the competence of "Opportunity identification" includes skills such as identifying unmet needs, recognizing trends and patterns, and identifying potential customer segments. In Appendix A, there is an elaborated explanation of EntreComp presented.

The EntreComp framework is designed to be flexible and adaptable to different contexts and settings. It can be used by entrepreneurship educators, business trainers, and policy makers to design and evaluate entrepreneurship education programs, training courses, and policies.

The framework is also supported by a set of guiding principles that underpin its design and use. These principles include the importance of ethical and sustainable entrepreneurship, the need for continuous learning and development, and the recognition of the diversity of entrepreneurship contexts and practices.
The EntreComp framework has been widely adopted and used in entrepreneurship education programs in Europe and beyond. It has also been used by policy makers to design and evaluate entrepreneurship policies and initiatives.

3.2.1. How is EntreComp used

The framework EntreComp, which was introduced in 2016, offers a mechanism for comparing the 15 competencies of the framework with the existing entrepreneurial training and services. Early adopters have utilized the framework as a checklist for creating new training or employability support initiatives as well as to define the abilities required for entrepreneurship education. To support proposals, bids, and policy actions relating to entrepreneurship and employment, EntreComp has been used strategically. The framework has been used as a guide for identifying abilities that may or should be developed to help the development of entrepreneurial skills and mindset, as well as a reference tool for general skills analysis. Additionally, the mapping of current entrepreneurship education and services considering the framework's 15 competences, which prompted the revision of training courses. Most of the cases reviewed focused on all the competence areas, and the cases primarily addressed all of them (McCallum et al., 2018).

3.2.2. Key factors for EntreComp

This chapter describes the key success factors as identified in literature for the EntreComp framework.

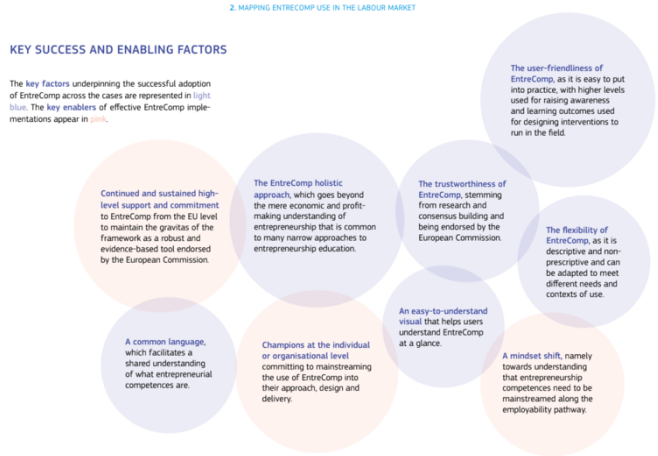

Figure 14: Key success factors for EntreComp (McCallum et al., 2018)

Figure 14 describes the key factors for success for the EntreComp framework. The key factors supporting the widespread adoption of EntreComp are depicted in light blue. The important enabling components of successful EntreComp implementations are highlighted in pink. The following key success factors are defined by McCallum et al. (2018):

- "The EntreComp holistic approach" goes beyond the limited view of entrepreneurship that focuses just on economics and earning a profit, which is typical of many constrained approaches to entrepreneurship education. EntreComp is an enriching view containing five teen competencies and using different perspectives which must be looked from.
- "A common language" which makes it easier for decision-makers, teachers and policymakers to agree on what entrepreneurial competences are.

- "The trustworthiness of EntreComp" resulting from study, reaching an agreement, and receiving the European Commission's support, meaning there is a European wide consensus.
- "An easy-to-understand visual" the framework image helps to understand the competencies and meaning.
- "The flexibility of EntreComp" since it is both descriptive and non-prescriptive and may be tailored to suit various demands and usage circumstances. It can be used for education purposes but also in working environments and of course in many different industries.
- "The user-friendliness of EntreComp" it is simple to implement, with higher levels being utilized to increase awareness and learning outcomes being used to build interventions.

What's more, McCallum et al. (2018) identified the following enabling factors for EntreComp:

- "Continued and sustained high-level support and commitment" to EntreComp from the EU level in order to preserve the framework's stature as a reliable and scientifically supported tool, backed from a governmental perspective.
- "Champions at the individual or organisational level" committing to integrating EntreComp into their strategy, plan, and delivery used on different levels.
- "A mindset shift" specifically in the direction of realizing the necessity of mainstreaming entrepreneurship competencies along the employability journey.

3.2.3. Challenges for EntreComp

McCallum et al. (2018) noted that there are several common challenges that users face when working with the framework. These include the complexity of the framework, which some users find difficult to navigate due to the language used within the learning outcomes, and questions about the number of progression levels and granularity between each level. Additionally, the general nature of the EntreComp learning outcomes means that they need to be adapted to specific contexts, which can be a challenge for users. Lack of awareness among stakeholders and the current lack of connection between policy and industry are also challenges for EntreComp. Finally, there is a need for further guidance on the co-working of EntreComp and DigiComp competences, as no amalgamation of the two frameworks has been reported, even in cases where both frameworks are applied. These common challenges are discussing in the following table:

Challenge	EntreComp relation
Complexity	• The lower levels of specificity in EntreComp can be complex, with some users finding the language used within the learning outcomes too complex. • Some users also had questions about the number of progression levels and the granularity between each level.
Need for adaptation	• EntreComp learning outcomes are general enough to be applicable across sectors, but they need to be adapted to become specific to a context.
Lack of awareness	• A lack of awareness of EntreComp among wider stakeholders was a challenge for many organizations, who needed to raise awareness and build understanding in order to get buy-in to the use of the framework.
Lack of ecosystem integration	• The current lack of connection between policy and industry is a challenge (but also an opportunity) for EntreComp, as the framework can facilitate a mindset shift between business and policy.
Co-working frameworks	• The co-working of EntreComp and DigComp competences is complex, and further guidance is needed. No amalgamation of the two frameworks has been reported, even in cases where both competence frameworks are applied.

Table 3: Common challenges within EntreComp

3.3. EntreComp in research papers

This section looks at the usage of EntreComp in other research papers.

3.3.1 Assessing student competences in Norway and recognition of prior learning (RPL) (Nyström, 2020)

In her research towards recognizing and assessing student entrepreneurship competences, Nyström (2020) interviewed 62 third year business students at a higher education institute in Finland. In the review, the focus was on finding patterns related to perceptions of the EntreComp framework. From the research results, the following became clear:

1. "The framework provides a common language "

Participants compared generic competences with entrepreneurial competences, leading to a reflection process. In that process, terms and competences were used from the EntreComp framework. The EntreComp therefore helped creating a generic, standardized language to compare between students in their discussions.

2. "The framework facilitates awareness of one's own entrepreneurial competences"

Within the focus group, only 14 percent of the informants were entrepreneurs. It was observed that students were able (after discussion) to link entrepreneurial competencies to activities in the past. This means students created more awareness about their entrepreneurial skills, even when not knowing they already had experience with it in the past.

3. "The framework bridges academic and working life"

It helped students matching competences "sought in working life", facilitating deliberate planning and profile building.

In addition, Nyström (2020) emphasized the importance of "recognition of prior learning" (RPL). She identified that "students increasingly acquire competences and knowledge in non-formal and informal (extra- curricular) settings", allowing HEI's to "to shorten students' graduation times and introduce flexibility into the curriculum". An important factor for RPL is the assessment and acknowledgement of a student's individuals' competence. The assessment of prior learning is primarily acquired through experiences, i.e., to engage in entrepreneurial activities, allowing the teachers to design their curriculum in a more flexible way (Cooper et al., 2017).

In the end, it was concluded that "HEI students need a common language and information about competences frameworks in order to successfully initiate processes of recognizing and assessing entrepreneurial learning". What's more, "to initialize RPL processes, learners must be aware of their own entrepreneurial competences and the experiences that have constructed their knowledge". This research made the importance of competence frameworks for the assessment of a student's competence, and the EntreComp helps in identifying these competences. Moreover, it initiates and fuels entrepreneurial possibilities, allowing more extra-curriculum experiences and more flexible education programmes.

3.3.2. Learning process towards entrepreneurial competence

Miço and Cungu (2023) researched the learning process towards entrepreneurial competence. It was mentioned that teachers should master the concepts of entrepreneurship education so they can apply specific competencies, methods, and tools to encourage students' confidence, flexibility, leadership, and initiative. In this research, an online survey was created to gauge the level of entrepreneurial competency among Albanian teachers to better understand this competency. The purpose of the survey was to examine the growth of teachers' entrepreneurial skills as well as their entrepreneurship education and training. The survey's research objective therefore is to assess how entrepreneurial education competence is acquired and how it is applied in pre-university education institutions. Results from the survey showed how important it is for teachers to develop entrepreneurial skills at every stage of their careers, beginning with initial teacher training.

From the Eurydice (2016) report, two main approaches within entrepreneurship education could be distinguished. **One** method emphasizes learning goals related to employability, active citizenship, and entrepreneurial abilities for life and work. This approach treats entrepreneurship education in a broad sense related to European key competencies. The **second** strategy has a more focused objective, emphasizing learning objectives associated with entrepreneurial and business engagement in entrepreneur- oriented education (Wach, 2014).

In 2012, the Albanian educational policies and legislative framework were changed by the European approach towards entrepreneurship education. This is credited to the competence of entrepreneurship, which was added to Albania's legislative and policy framework for education in 2012 for the first time. According to recent studies (Ndou et al. 2018), entrepreneurship education influenced individuals' risk-taking behaviours, the creation of new businesses, and their propensity to work for themselves. According to the dual-pronged approach, entrepreneurship education should help students learn to be more self-reliant in their learning, to strive for their goals, to be creative, to find possibilities that already exist, and to survive in a complex world. Another objective is to encourage students to participate actively in the job market and to view entrepreneurship as a natural career choice (Seikkula-Leino et al. 2019).

Entrepreneurship education aims to foster innovative thinking, a strong sense of self-worth, and empowerment in addition to educating people how to manage a firm. Entrepreneurship education instils a sense of responsibility in students by encouraging them to take charge of their own learning. It also helps students recognize and seize opportunities, encourages inventive learning, fosters confidence in one's own abilities, pushes them to take risks, and fosters teamwork. The main contributors to achieving the objectives of entrepreneurship education and providing students with entrepreneurial competencies, nevertheless, will be teachers. However, recent studies have shown that it has been difficult for teachers to integrate entrepreneurial education.

Miço and Cungu (2023) state that the "assessment of teacher competence on entrepreneurship education, the factors that influence its mastery and the mechanisms of implementing teachers' skills on entrepreneurship education have not been treated sufficiently". Despite the volume of research on the significance and the part that entrepreneurship education plays in a student's development, enabling him to "turn ideas into actions, ideas that generate values for someone other than yourself," there is a gap in the research on the preparation of teachers with the competencies and skills necessary to serve as a bridge between entrepreneurship education and the students.

Therefore, their methodology was based on an online questionnaire in which the level of recognition of entrepreneurial competence by the teaching staff is measured. By emphasizing the factors that contribute to acquiring this competency, such as university studies, in-service training within the context of teachers' professional growth, and support from policies and regulations, the article seeks to assess the entrepreneurship competencies of teachers. The goal of data interpretation is to demonstrate if the current educational program satisfies the objectives of entrepreneurship education.

The study's findings suggest that entrepreneurship competency in education needs to be improved in terms of teaching proficiency, pre-service teacher preparation programs, in-service training, curricula, and stakeholder collaboration with the school. The limitation of this study is that more factors should be considered to further explore teachers' competencies in entrepreneurship education and the relationship between teachers' knowledge and skills and entrepreneurship competencies. An analysis according to the teacher's professional profile should be added to the questionnaire to highlight different levels of entrepreneurship education obtained in different profiles of the teaching profession.

3.3.3. EntreComp framework and its relation to start-up behaviour (Joensuu-Salo et al., 2022)

In their study towards testing the EntreComp framework and its relation to start-up behaviour in, Joensuu-Salo et al. (2022) demonstrated that EntreComp has a relationship to start-up behaviour and is responsive to role models and prior entrepreneurial experience but is not sensitive to gender or educational level. The findings further demonstrate that EntreComp is unidimensional even if its design suggests three discrete sections. For creating variables, the EntreComp framework was used. The full framework consists around 442 learning statements, and therefore is not used fully. The five sub-competencies are described by hints and are used as basis for creating the variables. A seven-point Likert scale was used to evaluate and answer the questions.

3.2.1 Ideas and opportunities.
EC1: I use my imagination and abilities to identify opportunities for creating value.
EC2: I develop creative and purposeful ideas.
EC3: I work towards a vision of my future.
EC4: I make the most of ideas and opportunities.
EC5: I assess the consequences and impact of ideas, opportunities and actions.
3.2.2 Resources.
EC6: I believe in myself and keep developing.
EC7: I know how to stay focused and do not give up.
EC8: I gather and manage the resources I need.
EC9: I have a good understanding of financial and economic issues.
EC10: I inspire, enthuse, and get others on board.
3.2.3 Into action.
EC11: I initiate processes that create value and can take up challenges.
EC12: I know how to prioritize, organize and follow-up.
EC13: I make decisions, thus dealing with uncertainty, ambiguity and risk.
EC14: I know how to team-up, collaborate and network.
EC15: I reflect and learn from both success and failure, my own and other people's.

Hypothesis	Result
H1: EC is a three-dimensional concept	Not confirmed
H2: EC is higher among higher education students than among secondary level students	Not confirmed
H3: Men have higher EC than women	Not confirmed
H4: Individuals with entrepreneurial role models have higher EC than individuals with no role models	Confirmed
H5: Individuals with prior start-up experience have higher EC than individuals with no experience	Confirmed
H6: Nascent entrepreneurs have higher EC than other students	Confirmed
H7: EC explains the start-up behaviour of students	Confirmed

Table 4: variables and hypothesis results (Joensuu-Salo et al., 2022)

The study finds that EC has a unidimensional structure, with cognitive, functional, and behavioural factors reflecting the same construct of EC. The proposed scale contains items measuring different aspects of EC, making it a suitable instrument for measuring EC. The study suggests that EC is more action- and potential-oriented, emphasizing attitude and orientation to the social environment, rather than knowledge resources per se. The study also found no statistically

significant difference in EC between secondary level and higher education students, nor between men and women. Therefore, it calls to question some common assumptions based on earlier studies concerning women's entrepreneurial competence, attitudes, intentions, and actions. The observed gender differences in entrepreneurship arise from factors other than competence, such as cultural values and constructions of entrepreneurship.

3.3.4. Bibliometric analysis of current research on the EntreComp framework (Raţiu et al., 2023)

In their research, Raţiu et al. (2023) presents a bibliometric analysis of the current research on the EntreComp framework, based on publications from June 2016 to June 2022. Therewith, the study offers recommendations for future research in entrepreneurial competences and other related fields that could help practitioners, policy makers, researchers, etc. in their work.

The EntreComp framework has been used in various studies to investigate its effectiveness in developing entrepreneurship competencies in different educational programs and curricula. Quantitative content analysis, face-to-face interviews, and surveys with program leaders or experts were used in these studies. While some programs include entrepreneurship competencies as a feature in their program documentation, others do not. Experts in one study agreed that all 15 EntreComp competencies were essential for trainees, and training programs should address them all (Raţiu et al., 2023).

However, another study noted a lack of reference to enterprise in program documentation and confusion of language associated with enterprise and entrepreneurship. Future research is needed to determine the extent to which entrepreneurship competencies are considered key aspects in the training process at different international universities. The EntreComp framework has been widely recognized as an important driver of competence in entrepreneurial education in different transnational contexts. However, there is a lack of shared vision and development of practice in the use of EntreComp, and there is a need for support and guidance in promoting the learning process to support successful adoption and adaptation of the policy-driven frameworks (Raţiu et al., 2023).

Comparative studies have been conducted to analyse the relationships between the EntreComp framework and other measures, such as entrepreneurial intention, start-up behaviour, and entrepreneurial self-capital. The results of these studies indicate that opportunity identification and evaluation, commitment, decision-making, and team organization (soft skills) positively influence the development of entrepreneurial intention more than the high level of specific knowledge (e.g., on economics, finance, legal). A direct significant correlation relationship was observed between EntreComp competencies and entrepreneurial intention and entrepreneurial self-capital (Raţiu et al., 2023).

Studies have also shown a significant improvement for the subjects who have used EntreComp in their activities, some of which are related to real-life practice (e.g., nurse practitioners, agriculture technicians). EntreComp has been used as a base for self-assessment tools for assessing entrepreneurial competencies/skills. For future developments of the instrument, it was suggested to include illustrative diagrams to visualize strengths and areas for improvement and to expand it with areas that would allow sustainability competencies to be evaluated more specifically (Raţiu et al., 2023).

In conclusion, the EntreComp framework has been effective in developing entrepreneurship competencies in different educational programs and curricula. However, there is a lack of shared vision and development of practice in the use of EntreComp, and support and guidance are needed to promote the learning process successfully. Future research is needed to determine the extent to which entrepreneurship competencies are considered key aspects in the training process at different international universities (Raţiu et al., 2023).

3.4. Formulation of hypotheses

To test data and to form good conclusions, it’s good to form hypotheses to be researched. In research involving data analysis, hypotheses are essential. The alternative hypothesis (H1) contends that there is a substantial difference between the means of the two groups, contrary to the null hypothesis (H0), which contends that there is not. A thorough and objective review of the data is ensured by this hypothesis-driven methodology, resulting in insightful information and enabling evidence-based decision-making. Hypotheses can assist researchers in properly expressing their expectations and findings, which enhances the transparency and reproducibility scientific research. In chapter 4, the available dataset is described thoroughly.

3.4.1. Hypotheses table

Table 5 shows all formed hypotheses based on literature.

	Null hypothesis (H0)	**Alternative hypothesis (H1)**
Hypothesis 1	*"There will be no significant difference in the ability to spot opportunities between people involved in start-up companies and those who are not."*	*"People involved in start-up companies consider themselves better in spotting opportunities (Sanasi, 2023)."*
Hypothesis 2	*"There will be no significant difference in creativity scores between males and females."*	"*Females rate themselves higher on creativity than males (He & Wong, 2021; Matud, Rodriguez, & Grande, 2007)."*
Hypothesis 3	*"There will be no significant difference in the ability to mobilize others between individuals who have experience directing people and those who do not."*	*"People having experience directing people consider themselves better on the competence mobilizing others (Cakir & Adiguzel, 2020)."*
Hypothesis 4	*"There will be no significant difference in the ability to value ideas between individuals with self-employed parents and those without."*	*"People having experience in financial administration consider themselves better on the competence financial and economic literacy (Amagir et al., 2020)."*
Hypothesis 5	*"There will be no significant difference in the ability to value ideas between individuals with self-employed parents and those without."*	*"People with self-employed parents consider themselves better in valuing ideas (Chlosta et al., 2012)."*
Hypothesis 6	*"There will be no significant difference in scores on the Uncertainty, Ambiguity & Risk competence between individuals with self-employed parents and those without."*	*"People with self-employed parents rate themselves higher on uncertainty, ambiguity & risk (Brachert et al., 2020; Schölin et al., 2016)."*

Table 5: Hypothesis on the TBE/IED 2022 - 2023 dataset

3.4.2. Hypothesis 1

Hypothesis 1 is based on research by Sanasi (2023), which researched "entrepreneurial experimentation in business model dynamics". It mentioned that business model dynamics "may encompass business model innovation, aimed at discovering new value creation and capture opportunities", also often the case for fast growing start-ups.

3.4.3. Hypotheses 2

Hypothesis 2 looks at the self-assessment on the competence creativity. This hypothesis is based on research of He & Wong (2021), which researched the "gender differences in the distribution of creativity scores". It mentioned that "females have higher creativity than males", even though this was in a sample of "1098 students in 55 classrooms".

3.4.4. Hypotheses 3

Next, hypothesis 3 looks if people with directing experience assess themselves higher for mobilizing others. In their research towards leader effectiveness in organizations, Cakir & Adiguzel (2020) mentioned that leader effectiveness "requires the use of social power and mobilizing existing resources for purposes". Therefore, it was decided to test whether this experience with directing people would also lead to a higher assessment score for the competence mobilizing others.

3.4.5. Hypotheses 4

Further, hypothesis 4 looks if people would score themselves better on the competence financial and economic literacy. Amagir et al. (2020) researched the financial literacy of high school students in the Netherlands. It was shown that "student ability (English language and mathematical ability), financial experience and parental wealth positively relate with financial literacy", wherefore it was found interesting to analyze it for this student group as well.

3.4.6. Hypotheses 5

Additionally, hypothesis 5 was set up to research the relation between having self-employed parents and the competence to value ideas. Chlosta et al. (2012) researched the effect of having parental role models on being self-employed. It was mentioned that "applied to entrepreneurial families, it appears that their children are more open offspring about potential career paths".

3.4.7. Hypotheses 6

As last, hypothesis 6 looks at the relationship between having self-employed parents and the self-assessment on uncertainty, ambiguity & risk. Brachert et al. (2020) confirmed that "a greater risk-taking propensity is associated with a higher probability of entering self-employment". Schölin et al. (2016) mentioned that "entrepreneurship is characterized by the identifying opportunity, risk taking in order to capitalize on such opportunity, innovating and creating new organizational structures", and considering the studies on the influence of having self-employed parents on their children, this can influence the accompanied risk-taking aspect as well.

3.5. Conclusions and knowledge gaps

In this literature review, in three parts there is looked at the various available literature on entrepreneurship education policies, the EntreComp framework and studies using the EntreComp framework. As first, there has been looked on general entrepreneurship education policies. Thereafter, there the EntreComp framework is explained. Finally, the EntreComp framework in different research papers is researched.

The literature review highlighted several challenges that users face when working with the EntreComp framework, including the complexity of the framework, the need for adaptation to specific contexts, lack of awareness among stakeholders, lack of ecosystem integration, and the co-working of EntreComp competences (McCallum et al., 2018).

The literature also highlighted the importance of policy agendas and research in shaping entrepreneurship education strategies. The role of the European Commission in promoting entrepreneurship as one of the eight European Key Competences was particularly notable. The review also delved into the effects of entrepreneurship education on society and economy, emphasizing its potential for workforce development, fostering entrepreneurial culture, and driving new business growth.

Moreover, the EntreComp framework bridges the gap between academic and working life. It assists students in understanding the relevance and application of their competences in real-world contexts, thereby facilitating deliberate planning and profile building for their future careers. It also highlighted the importance of recognizing prior learning and integrating non-formal and informal experiences into entrepreneurship education. By acknowledging the value of these experiences, educational institutions can design more flexible curricula that incorporate practical and hands-on learning opportunities.

The application of the EntreComp framework in various research contexts was also examined. These studies provided insights into how the framework has been used to assess entrepreneurial competences, its relation to start-up behaviour, and its role in recognizing prior learning. However, despite its widespread use and recognition, the EntreComp framework also faces challenges. These include its complexity, the need for adaptation to specific contexts, and a lack of awareness among wider stakeholders.

The review of entrepreneurship education in the Netherlands revealed a lack of a national policy for entrepreneurship education, indicating a potential area for future development. In summary, the EntreComp framework is a valuable tool for developing entrepreneurship competencies, but more research is needed to fully understand its effectiveness in different contexts and to overcome the challenges associated with its use. Future research should focus on further exploring the application of the EntreComp framework in different educational settings and its impact on entrepreneurship education and practice.

Therefore, chapter 4 will dive into the methodologies used to analyse the data as presented. From the literature review, it appears that there is room for future research to explore EntreComp in different educational settings. As there are not extensive research within Delft Centre for Entrepreneurship on the delivered dataset, it's our task to analyse and interpret it properly. As last, all the output for chapter three is presented in appendix C, in which a distinction is made between the researched policy documents and the appearance of EntreComp in published research papers.

4. Methodologies

In chapter 4, the methodologies of assessment of the EntreComp within Delft Centre for Entrepreneurship are discussed. As problem owner, DCE presented four survey data outcomes (based on years 2021/2022 and 2022/2023 and the two Bachelor study programmes) in the form of Excel sheets. However, due to scoping, only the 2022/2023 dataset is analysed (explanation of choices are included in chapter 6.1.4. and 6.1.6.). The survey is presented in appendix E. The used methodologies are therefore analysed as well as explained. The methodology is partly inspired on the research of López-Núñez et al. (2022) and Armuna et al. (2020), which is explained in appendix E.

4.1. Available DCE data

As mentioned before, from two academic years survey data is available from two study programmes. The 2022/2023 data is based on a 131-question big questionnaire, containing 119 closed-questions which could be answered via a 7-point Likert scale. All these 119 questions are related to the five teen competencies within the EntreComp framework. For each competence, several questions were asked related to that competence. The other 12 questions are more personal questions, based on networking, entrepreneurial experience, age etc.

4.2. Analysis technique

To test the data and to form good conclusions, it's important to form a foundation for the analysis technique on the to be analysed data and hypotheses. good to form hypotheses to be researched. Comparing the means of two independent groups and determining if they are significantly different from one another is done statistically using the t-test. The t-test in this situation is built on hypotheses, which also serve as a framework for interpretation and a guide for the researcher's expectations. Researchers can use the t-test to analyze their data and determine if the observed differences in means are caused by chance or statistically significant differences by generating these hypotheses.

4.2.1. Choice of analysis technique

There are several ways to analyze the hypothesis as formulated. The choise of the analysis technique is dependent on the measurement levels of the variables To determine the correct use of a analysis technique, the following table was used:

	Independent variable			
Dependent variable	**None**	**Dichotomous**	**Nominal/ordinal**	**Interval/ratio**
Nominal/ordinal		Cross tab & chi-square test	Cross tab & chi-square test	Logit models
Interval/ratio	One-sample test	Independent sample t-test	F-test	Correlation + regression-analysis + paired t-test

Table 6: choice of analysis technique (Kroesen, 2019)

In this case, we test the relation between a dichotomous independent variable (based on the 12 socio-demographic background questions) and a dependent variable on an interval scale (the Likert-scale). In survey research, the Likert scale is frequently used to assess respondents' attitudes, perceptions, and views. Although in practice it is frequently used as an interval scale, formally it is an ordinal scale (Wu & Leung, 2017).

The order or rank of the data is represented using an ordinal scale, which omits the size of the differences between the categories. The Likert scale asks respondents to score their level of agreement or disagreement with a series of statements or objects using a scale that frequently ranges from "strongly agree" to "strongly disagree."Because it is presumed that the gaps between each response category are equal, Likert scales are frequently used as interval scales.

An independent samples t-test is a statistical hypothesis test used to determine if there is a significant difference between the means of two independent groups. The test is designed to assess whether the difference between the means of the two groups is statistically significant or simply due to random chance. According to this presumption, there is no distinction between "strongly agree" and "agree," "agree" and "neutral," "agree" and "disagree," etc. Since

researchers may compute means, carry out parametric tests, and carry out mathematical operations, treating the Likert scale as an interval scale makes statistical analysis and interpretation simpler.

The independent samples t-test is used when we want to compare the means of two different groups on a continuous variable. For example, we might want to compare the average income of men and women or compare the average test scores of students who received a new teaching method versus those who did not.

4.2.2. Independent samples t-test

$$t = \frac{(\overline{x_1} - \overline{x_2}) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Figure 15: formula independent samples t-test

The t-value, which is used to evaluate the difference between the means of two independent groups in relation to the variability within each group, is calculated using the independent samples t-test formula. The difference between the sample means of Groups 1 and 2 is represented by the numerator of the calculation, (X1 - X2). The denominator, sqrt((s1^2 / n1) + (s2^2 / n2)), accounts for the sample sizes of the respective groups (n1 and n2) as well as the standard deviations of Groups 1 and 2.

The t-value measures how much the variance within each group affects the size of the mean differences. The stronger the t-value, the greater the gap between the means.To perform an independent samples t-test in SPSS, you would first need to enter your data into the software. Then, you would select "Independent Samples T Test" from the "Compare Means" option in the "Analyze" menu.

Next, you would select the two variables you want to compare and specify the group variable. The group variable should be a categorical variable that separates the two groups you want to compare. SPSS will then run the t-test and generate output that shows the mean, standard deviation, and significance level for each group, as well as the t-value and p-value for the test.

If the p-value is less than your chosen alpha level (usually 0.05), you can conclude that there is a statistically significant difference between the two groups. If the p-value is greater than your chosen alpha level, you cannot conclude that there is a significant difference between the two groups. The p-value is the probability that the null hypothesis is true. For this analysis, there is only looked at the one-sided p-value. This is done when you can decide on forehand what the direction of the relaton is between the variables of the hypothesis.

Furthemore, for all hypotheses a regression analysis is performed. Regression analysis is a statistical technique used to model the relationship between a dependent variable and one or more independent variable. It is used to to examine the impact of independent variables on the dependent variable and make predictions.

4.2.3. List of variables

Dependent variables	Independent variables
Average Likert-scale score on one of the five teen EntreComp competencies	Gender
Area Ideas & Opportunities: spotting opportunities, creativity, vision, valuing ideas, ethical & sustainable thinking.	Year born
Area Resources: Self-awareness & self-efficacy, motivation & perseverance, mobilizing resources, financial & economic literacy, mobilising others	Start-up involvement
Area Into Action: taking the initiative, planning & management, uncertainty, ambiguity & risk, working with others, learning through experience	Self-employed parents
	Close-to you started business
	>3 months lived foreign country
	Followed entrepreneurship courses
	Followed classes economics and accounting
	Done finance administration before
	Directed people before
	Prefer self-employed career than organization
	Intend to become self-employed directly after graduation
	Self-employed when gained more industry experience

Table 7: dependent and independent variables in dataset

As mentioned earlier, the dependent variables are formed by the average Likert-scale scores per EntreComp competence. The independent variables are formed by the twelve socio-demographic background questions at the end of the survey.

4.2.4. Regression formula

The following equation belongs to the regression analysis:

$$Y = b * X + C$$

Figure 16: regression equation

Where the following variables are present:

Y = dependent, the to be predicted variable
X = value of independent variable
C = constant value
b = to be estimated regression coefficient

The regression analysis is used in statistical analysis to predict the value of the dependent variable based on the values of the independent variables. In that way, we can use the score on the background questions (independent variable) to predict the dependent variable, namely the score on the EntreComp competence.

4.3. Data preparation

The Excel data sheet as received, contained the answers in string form. To perform the analysis, first the “string” answers had to be converted and coded towards numerical values. What’s more, irrelevant data such as response ID, location and recorded date were removed. As last, all the responses must have the finished status “True”, so in the TBE dataset 18 responses were removed because they had the “False” finish status and were identified as invalid entries. In addition, for the descriptive analysis, the questions per competence were seen as belonging to one competence. The IED dataset had 9 invalid entries, and in total 54 valid respondents. All the survey data was gathered in September 2022, meaning at the beginning of the study curricula in the academic year 2022-2023.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Figure 17: Sample mean formula

Figure 17 shows the used formula to calculate the mean of the score on the multiple questions per EntreComp competence in the surveys.

EntreComp Competence	Survey description	Questions
Spotting opportunities	*"Use your imagination and abilities to identify opportunities for creating value. Identify and seize opportunities to create value by exploring the social, cultural and economic landscape. Identify needs and challenges that need to be met."*	*8*
Creativity	*"Develop several ideas and opportunities to create value, including better solutions to existing and new challenges."*	*10*
Vision	*"Develop a vision to turn ideas into action."*	*6*
Valuing ideas	*"Recognise the potential an idea has for creating value and identify suitable ways of making the most out of it."*	*4*
Ethical & sustainable thinking	*"Assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, the market, society and the environment."*	*8*
Self-awareness & self-efficacy	*"Reflect on your needs, aspirations and wants in the short, medium and long term."*	*8*
Motivation & perseverance	*"Determined to turn ideas into action and satisfy your need to achieve."*	*10*
Mobilising resources	*"Get and manage the material, non-material and digital resources needed to turn ideas into action."*	*8*
Financial & economic literacy	*"Estimate the cost of turning an idea into a value-creating activity."*	*6*
Mobilising others	*"Get the support needed to achieve valuable outcomes."*	*8*
Taking the initiative	*"Act and work independently to achieve goals, stick to intentions and carry out planned tasks."*	*6*
Planning & management	*"Define priorities and action plans."*	*12*
Uncertainty, ambiguity & risk	*"Make decisions when the result of that decision is uncertain when the information available is partial or ambiguous, or when there is a risk of unintended outcomes."*	*6*
Working with others	*"Work together and co-operate with others to develop ideas and turn them into action."*	*12*
Learning through experience	*"Learn with others, including peers and mentors."*	*6*

Table 8: all the competences, description and number of questions in the 2022/2023 DCE survey

In the survey, all 15 EntreComp competences were used to question the respondents. All the competences were split out in multiple questions, varying per competence. In order to be able to perform the analysis, the mean or average score per competence was calculated. That means that the sum of all question scores were taken (varying from 1 to 7), and was divided by the amount of questions per competence.

4.4. Reliability analysis with Cronbach's alpha

The number of respondents required in a survey depends on various factors such as the population size, margin of error, and level of confidence desired in the results. However, a general rule of thumb is to have at least 30 respondents to ensure statistical validity.

This is because having a small sample size can lead to unreliable results that may not accurately represent the larger population. With a sample size of less than 30, there is a higher likelihood of chance and random variations affecting the results. A larger sample size helps to reduce the impact of these chance variations and provides a more accurate representation of the population (Memon et al., 2020).

Cronbach's alpha is a measure of internal consistency reliability, which is commonly used in research to assess the extent to which multiple items in a questionnaire or test are measuring the same underlying construct. In other words, it is a way of determining whether all the items in a scale are measuring the same thing (Tavakol & Dennik, 2011).

The alpha coefficient can range from 0 to 1, with higher values indicating greater internal consistency. Interpreting Cronbach's alpha values follows some general guidelines. Values below 0.6 suggest poor internal consistency, requiring scale revision. A range of 0.6 to 0.7 indicates modest consistency, while 0.7 to 0.8 suggests acceptable internal consistency. Values between 0.8 and 0.9 reflect good consistency, while those above 0.9 indicate excellent consistency.

$$\text{Cronbach's Alpha} = \frac{k * \bar{r}}{1 + (k-1)\bar{r}}$$

Figure 18: Cronbach's alpha formula

In this formula, α represents Cronbach's alpha coefficient, k represents the number of items in the scale, r represents the variance of the total scale score. To compute Cronbach's alpha, the formula involves calculating the variance of each item and the variance of the total scale score. The numerator of the formula represents the sum of the item variances, while the denominator represents the sum of both the item and total scale score variances. Subtracting the ratio of the item variances from 1 yields the reliability coefficient

4.5. Conclusions methodology section

In conclusion, Chapter 4 discussed the methodologies employed to assess the EntreComp framework within the data available from Delft Centre for Entrepreneurship. The analysis focuses on the 2022/2023 dataset, derived from a comprehensive 131-question survey administered to students in two Bachelor study programs. The data analysis approach was inspired by the research of López-Núñez et al. (2022) and Armuna et al. (2020), who developed a questionnaire to evaluate self-perceptions of entrepreneurship competencies based on the EntreComp framework.

The findings from López-Núñez et al.'s research demonstrated the validity and reliability of the proposed questionnaire, which addressed the lack of psychometric measuring instruments targeting the full spectrum of competencies suggested by EntreComp. The internal consistency of EntreComp was confirmed through suitable values of Cronbach's alpha indices. This research contributes to the field by providing specific tools to assess self-perceived entrepreneurship competencies.

Furthermore, the analysis incorporated the research of Armuna et al. (2020), which explored the relationship between entrepreneurship competencies and intention in a sample of potential STEM entrepreneurs. Armuna et al. (2020) utilized the EntreComp framework and a questionnaire to gather data. Their findings indicated that gender was not a moderating factor in the positive relationship between competencies and entrepreneurial intentions. An independent samples t-test was used to test the data.

From there, the way to analyse the DCE 2022/2023 dataset is set out. The analysis of the available DCE data utilizes the statistical technique based on table of Kroesen (2019). From there, it was chosen to perform the t-tests, the mean formula, the regression equation, as well as Cronbach's alpha. The independent samples t-test was employed to compare the means of two independent groups on continuous variables.

This statistical test allowed for the assessment of significant differences between groups and provided valuable insights into the relationships between competencies and the examined factors. Hypotheses were formulated based on existing research and allow us to examine the relationships between competencies and specific factors, such as gender and parental background. The choice of analysis techniques was guided by the measurement levels of the variables and the nature of the data.

5. Results

In this chapter, the results of the data analysis will be discussed. This will be done by first looking at the descriptive, univariate statistics of the data. Thereafter, hypothesis will be formed to be tested and analysed within the given data. As last, the reliability of the results will be discussed.

5.1. Descriptive statistics of the respondent group

As first, the data was analysed for the DCE minor program technology-based entrepreneurship (TBE) from the academic year 2022/2023, presented in appendix E. The 2022/2023 data is based on a 131-question big questionnaire, containing 119 closed-questions which could be answered via a 7-point Likert scale. All these 119 questions are related to the five teen competencies within the EntreComp framework. For each competence, several questions were asked related to that competence. The other 12 questions are more personal socio-demographic background questions, based on networking, entrepreneurial experience, age etc. In appendix F, the descriptive statistics are clearly noted in a table and further detailed.

5.1.1. Descriptives TBE dataset

The total number of respondents that filled in the survey was **84 (n = 84) students**. Of that sample, 58 students were **male** and 26 students **female (Q127)**. The age (Q128) varied as well within the sample: 1 (1,19%) student was born in **1990**, 2 (2,38%) in **1995**, 4 (4,76%) in **1998**, 4 (4,76%) in **1999**, 16 (19,05%) in **2000**, 28 (33,33%) in **2001**, 26 (30,95%) in **2002** and 3 (3,57%) students in **2003**.

14 (16,67%) students mentioned they were involved in a start-up company (Q119) before, against the 70 (83,33%) people mentioned they're not. 43 (51,19%) people said that their parents were self-employed (Q120), while 41 (48,81%) respondents said their parents weren't self-employed before. In question 121, people were asked if anyone close to them had started a business before. 60 (71,43%) people responded yes, and 24 (28,57%) no. Question 122 asks the respondents if they have lived more than 3 months in a foreign country, where 14 (16,67%) answered yes and 70 (83,33%) no. Question 123 asks if the respondents have followed entrepreneurship courses before, where 10 (11,9%) answered yes and 74 (88,1%) no.

In question 124, respondents were asked if they followed classes on economics and accounting before, where 44 (52,38%) did and 40 (47,62%) didn't. Question 125 looked at the history of finance administration of the student, were 22 (26,2%) had experience and 62 (73,8%) hadn't. As last, question 126 looked if the respondent had directed people before, where 62 (26,2%) did and 22 (73,8%) didn't.

For question 129 to 131 a 7-answer Likert-scale was used again. Question 129 looked at if the respondent would prefer a career as self-employed to a career as employed in an organization, 1 (1,2%) answered definitely not, 3 (3,6%) not very likely, 10 (11,9%) not likely, 18 (21,4%) moderate, 25 (29,8%) likely, 20 (23,8%) very likely and 7 (8,3%) definitely yes. Question 130 looked at if the respondent intends to become self-employed directly after graduation: 1 (1,2%) answered definitely not, 12 (14,3%) not very likely, 31 (36,9%) not likely, 22 (26,2%) moderate, 13 (15,5%) likely, 3 (3,6%) very likely and 2 (2,4%) definitely yes. As last, question 131 looked if the student intends to become self-employed when I gained more industry experience: 1(1,2%) not very likely, 2 (2,4%) not likely, 13 (15,5%) moderate, 32 (38,1%) likely, 25 (29,8%) very likely, 11 (13,1%) definitely yes.

5.1.2. Descriptives IED dataset

Thereafter, the data was analysed for the other DCE minor program, international entrepreneurship & development (IED), also from the academic year 2022/2023. The questionnaire was completely the same as the TBE survey (see appendix E).

The total number of respondents that filled in the survey was 54 (n = 54), 30 less than the TBE survey. Of the sample, 20 (37,04%) were male and 34 (62,96%) were female. The age varied less than the TBE survey, as 4 people were born in 1999 (7,41%), 25 in 2000 (46,30%), 29 in 2001 (53,70%), 6 in 2002 (11,11%). 10 (18,52%) people were involved in a start-up, where 44 (81,48%) haven't.

Question 120 looked at self-employed parents, where 29 (53,70%) respondents had self-employed parents and 25 (46,30%) hadn't. 39 (72,22%) people had people close to them that started a business, 15 (27,78%) didn't have. 16 (29,63%) people lived 3 months in a foreign country, where 38 (70,37%) people haven't experienced that before.

Question 123 looked if the students followed entrepreneurship courses before, where 7 (12,96%) students had and 47 (87,04%) hadn't. The distributions for respondents having followed classes on economics and accounting was equal, namely for both yes and no 27 (50,00%) answers. 19 (35,19%) people had done finance administration before, where 35 (64,81%) hadn't. Question 126 looked if the respondent directed people where 43 (79,36%) had, and 11 (20,37%) hadn't.

For question 129 to 131 a 7-answer Likert-scale was used. Question 129 looked at if the respondent would prefer a career as self-employed to a career as employed in an organization, 0 (0,00%) answered definitely not, 3 (5,56%) not very likely, 6 not likely (11,11%), 10 (18,52%) moderate, 17 (31,48%) likely, 10 (18,52%) very likely and 8 (14,81%) definitely yes. Question 130 looked at the people having the intention to become self-employed after graduation, where 5 (9,26%) answered definitely not, 9 (16,67%) not very likely, 16 (29,63%) not likely, 14 (25,93%) moderate, 7 (12.96%) likely, 2 (3,70%) very likely and 1 (1,85%) definitely yes. As last, question 131 looked at the people wanting to become self-employed when gained more industry experience.

5.1.3. Description mean values

Nr.	Competence	TBE	IED
1	Spotting opportunities	4,9539	4,7662
2	Creativity	4,8774	4,6981
3	Vision	4,9921	4,9599
4	Valuing ideas	4,1577	4,1111
5	Ethical and sustainable thinking	4,7634	4,8981
6	Self-awareness & self-efficacy	5,5164	5,4838
7	Motivation & perseverance	5,5357	5,5074
8	Mobilising resources	4,8408	4,9491
9	Financial and economic literacy	3,6845	3,8333
10	Mobilising others	4,7113	4,9514
11	Taking the initiative	5,3353	5,5216
12	Planning and management	4,7063	4,8843
13	Uncertainty, ambiguity & risk	4,7321	4,9630
14	Working with others	5,1071	5,3256
15	Learning through experience	5,1071	5,0741

Table 9: all mean values for all five teen competences in both datasets for the academic year 22/23

Table 9 shows all the mean values for the five teen competences for both minor programmes in the datasets. These are the mean values over the mean values for the competencies. What's striking, is that the mean value for competence 9, "financial and economic literacy", is in both datasets the lowest. This competence was in the survey described as *"estimate the cost of turning an idea into a value-creating activity and* is in figure 20 further described as *"plan, put in place and evaluate financial decisions over time"* and *"manage financing to make sure your value-creating activity last over time"*. This means that the student groups don't assess their selves very high in these EntreComp abilities at the start of the minor programmes, scoring 3,6485 for TBE and 3,8333 for IED. In addition, the highest scores were seen on competences 6 and 7, *"self-awareness and self-efficacy"* and *"motivation & perseverance"*, scoring for all four entries higher than 5.5, namely 5,5164 (competence 6) and 5,5357 (competence 7) in the TBE dataset. Also, for the IED dataset the scores with high with 5,4838 for competence 6 and 5,5074 for competence 7. The biggest difference between the mean scores between both datasets was spotted for competence 10, "mobilising others", having a different score of 0,2401 between both TBE and IED. Also, for competence 13 "Uncertainty, ambiguity and risk" the difference was quite high with an observed difference of 0,2309. The smallest difference was spotted on competence 7 with the highest score, namely a difference of 0,0283.

5.2. Data analysis

For the analysis, 6 hypotheses were tested using the independent samples t-test. This is constantly done for both datasets, so for each hypotheses there are two output tables.

5.2.1. Test hypothesis 1

Hypothesis 1 looks at the possible significant relationship between spotting opportunities and start-up involvement. There is the assumption that start-up involvement could lead to a better self-assessment of spotting opportunities, as the experience with a start-up

	Dependent variable: "Spotting Opportunities"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	StartupInvolv
Start-up involvement = "Yes"	4,6375	0,8828	-0,821	0,208	4,842	-0,204
Start-up involvement = "No"	4,8419	0,8840				

	Dependent variable: "Spotting Opportunities"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	StartupInvolv
Start-Up involvement = Yes	5,2054	0,7347	1,503	0,068	4,904	0,302
Start-Up involvement = No	4,9036	0,6760				

Table 10: "Spotting opportunities" vs start-up involvement (above = TBE, under = IED)

Startups provide practical experience in the dynamic world of entrepreneurship, exposing individuals to real-world challenges and the need to identify and seize opportunities for success. By being immersed in a startup environment, individuals gain exposure to market trends, customer needs, and potential gaps in the market that can be transformed into entrepreneurial ventures. These experiences could be benifical for the sentiment to spot opportunities.

Table 10 shows us that for both datasets the hypothesis is not significant, as for both analyses the p-value is above 0.05. In the end, this means there is no significant influence of start-up involvement on the ability to spot-opportunities: H0 is accepted and H1 is rejected. The mean value for the TBE is 0,302 higher for start-up involvement, but in the case of IED the mean value of start-up involvement is even lower than for people not involved in start-ups.

5.2.2. Test hypothesis 2

Hypothesis 2 looks at the potential positive relation between having finance experience and the competence financial & economic literacy.

	Dependent variable: "Financial & Economic Literacy"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	FinanceExp
Finance experience = "Yes"	3,9924	1,3199	1,439	0,077	3,575	0,417
Finance experience = "No"	3,5753	1,1116				

	Dependent variable: "Financial & Economic Literacy"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	FinanceExp
Finance experience = "Yes"	3,9912	1,2328	0,685	0,248	3,748	0,244
Finance experience = "No"	3,7476	1,2572				

Table 11: finance experience vs "Financial & Economic literacy" (above = TBE, under = IED)

An individual's practical knowledge and abilities relating to financial concepts, methods, and practices are enhanced by their finance experience. Working with financial statements, creating budgets, performing financial analysis, and comprehending economic principles are all part of this experience. Individuals get a deeper knowledge of financial and economic ideas as they engage in practical financial decision-making, which immediately enhances their competency in financial and economic literacy within the EntreComp framework.

Table 11 shows one again that both outputs are not significant. This means that having finance experience doesn't mean the respondents have a higher self-assessment on financial & economic literacy: H0 is accepted and H1 is rejected. For both datasets, the means are higher on the EntreComp competence in the case of finance experience. The mean differences however are bigger for TBE (0,417) than for IED (0,244) meaning the TBE difference is more significant.

5.2.3. Test hypothesis 3

Hypothesis 3 test the possible positive relation between gender and being creative. In this case, we assume that females assess themselves more creative than males.

	Dependent variable: "Creativity"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Male
Male	4,7810	0,6818	-1,931	0,028	5,092	-0,311
Female	5,0923	0,8103				

	Dependent variable: "Creativity"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Male
Male	4,3700	0,7947	-2,419	0,010	4,891	-0,521
Female	4,8912	0,7464				

Table 12: Creativity vs males/females

Innovation and creativity help find fresh approaches to enhancing an already-existing good or service in order to maximize the business. This enables to develop novel ideas and alternatives to conventional problems. Some researchers in the past focussed on the creativy differences based on gender , such as Kemmelmeier and Walton (2016) did.

For the analysis, it could be concluded that both outputs were statiscal significant. Both one-side p-values were below the threshold of 0.05 for the p-value. This means that the H1 value could be accepted, meaning that female consider themselves more creative than males in both minor programmes. The mean values are also higher for female in both datasets.

5.2.4. Test hypothesis 4

Hypothesis 4 looks at the possible positive relationship of having experience with directing people and mobilising resources.

	Dependent variable: "Mobilising resources"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Directed people
"Directed people" = Yes	4,8750	0,7085	0,755	0,226	4,744	0,131
"Directed people" = No	4,7433	0,6631				

	Dependent variable: "Mobilising resources"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Directed people
"Directed people" = Yes	5,0087	0,7536	1,201	0,118	4,716	0,293
"Directed people" = No	4,7159	0,5759				

Table 13: Directing people vs mobilising resources

People who have expertise managing people have probably refined their leadership and communication abilities, making it possible for them to persuade stakeholders of the value of resources. Their capacity to create networks and bonds with teammates and collaborators can also be very helpful in mobilizing resources. People can more efficiently access and mobilize resources by utilizing their current networks and forming new ones. What's more, when directing people, you must deal with difficult situations and must make the most out of having limited resources.

What could be concluded from the analysis is that both outputs are not significant, meaning that there is no significant influence of having experience with directing people on mobilizing resources. Both P-values are above the threshold of 0,05.

5.2.5. Test hypothesis 5

Hypothesis 5 looks at the possible relationship between having self-employed parents and the ability to value ideas.

	Dependent variable: "Valuing ideas"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Self-employed parents
"Self-employed parents" = Yes	4,2965	0,7967	1,645	0,052	4,012	0,284
"Self-employed parents" = No	4,0122	0,7865				

	Dependent variable: "Valuing ideas"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Self-employed parents
"Self-employed parents" = Yes	4,1638	1,0183	0,438	0,332	4,050	0,114
"Self-employed parents" = No	4,0500	0,8690				

Table 14: Self-employed parents vs valuing ideas (above = TBE, under = IED)

People who grow up in entrepreneurial families are more likely to have an entrepreneurial attitude because they have firsthand experience with the process of converting ideas into profitable businesses. Parents who work for themselves have a strong positive influence that encourages people to recognize and accept novel ideas. Additionally, growing up in a business atmosphere exposes people to several facets of entrepreneurship, such as financial management, marketing plans, and business planning. This familiarity with the corporate environment fosters an appreciation for the need of developing and appreciating ideas as essential components of entrepreneurial success. Additionally, self-employed parents frequently foster a welcoming environment that promotes innovation and idea production, and to value ideas.

From the analysis output, it could be concluded that the TBE output is significant (p-value = 0,052) and the IED is not. This means that within the dataset having self-employed parents lead to a better self-assessment of valuing ideas (H1 accepted). For the IED dataset, H0 is accepted, meaning there is no influence of having self-employed parents on the self-assessment of valuing ideas.

5.2.6. Test hypothesis 6

Hypothesis 6 tests the relation between having self-employed parents and the ability to deal with uncertainty, ambiguity and risk. Being raised in an entrepreneurial family exposes people to the inherent dangers and uncertainties of owning a firm. A resilient mentality and a comfort level with taking calculated risks can be instilled in children by watching their parents deal with difficult situations and make judgments in the face of ambiguity.

	Dependent variable: "Uncertainty, Ambiguity and Risk"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Self-employed parents
"Self-employed parents" = Yes	4,7903	0,8278	-0,259	0,398	4,756	-0,047
"Self-employed parents" = No	4,7561	0,8258				

	Dependent variable: "Uncertainty, Ambiguity and Risk"					
Independent variable	Mean	St Deviation	t-value	One-sided P-value	Constant	Self-employed parents
"Self-employed parents" = Yes	4,1667	1,2223	2,199	0,016	3,447	0,720
"Self-employed parents" = No	3,4467	1,1733				

Table 15: Self-employed parents vs uncertainty, ambiguity and risk (above = TBE, under = IED)

Parents who own their own businesses frequently involve their kids in various elements of their businesses, giving them firsthand experience with the difficulties and complexity of running a business. Individuals can gain a practical understanding of risk assessment, problem-solving, and decision-making under ambiguous circumstances thanks to this involvement. Individuals develop their ability to manage uncertainty and ambiguity by actively engaging in entrepreneurial activities, which increases their competency in this area of entrepreneurship.

Additionally, parents who work for themselves can act as mentors and guides by imparting their wisdom and expertise in managing risk and uncertainty. They can share insightful knowledge, tactics, and coping processes that people can use in similar circumstances.

The hypothesis is significant within the IED (P-value = 0,016) dataset, meaning having self-employed parents have a positive influence on dealing with the described competence. However, this is not the case for the TBE dataset, where the p-value is 0,398.

5.3. Reliability analysis & statistical validation

Nr.	Competence	TBE	IED
1	Spotting opportunities	0,694	0,807
2	Creativity	0,753	0,817
3	Vision	0,731	0,741
4	Valuing ideas	0,523	0,682
5	Ethical and sustainable thinking	0,769	0,783
6	Self-awareness & self-efficacy	0,772	0,826
7	Motivation & perseverance	0,831	0,855
8	Mobilising resources	0,730	0,738
9	Financial and economic literacy	0,855	0,882
10	Mobilising others	0,845	0,875
11	Taking the initiative	0,799	0,803
12	Planning and management	0,872	0,876
13	Uncertainty & risk	0,787	0,821
14	Working with other	0,856	0,836
15	Learning through experience	0,761	0,791

Table 16: Cronbach's alpha values for all 15 EntreComp competencies for both TBE and IED (internal validity)

As can be seen in table 16, only 1 factor scores lower than 0.6 meaning poor internal consistency. This is the case for competence 4 "valuing ideas" for the TBE dataset, with a Cronbach's alpha of 0,523. Furthermore, 2 factors score between 0.6 and 0.7, namely "spotting opportunities" (0,694) in the TBE dataset and "valuing ideas" (0,682) for the IED dataset. The rest of all Cronbach alpha score are all above 0.7, meaning great internal consistency.

To improve Cronbach's alpha value, several strategies can be implemented. One approach is to increase the number of items in the scale or questionnaire. By adding more items, a greater variation in the construct being measured can be captured, potentially increasing the overall reliability. It is important, however, to ensure that the additional items are conceptually relevant and effectively measure the construct of interest.

Another strategy involves reviewing and revising existing items. This entails evaluating the clarity, redundancy, and relevance of the items. Any items that do not significantly contribute to measuring the construct or are redundant with others can be removed. Additionally, ambiguous or confusing items can be revised to enhance clarity and improve the overall reliability of the scale.

5.4. Data-analysis conclusions

In conclusion, this chapter presented the results of the data analysis conducted for the DCE minor programs, Technology-Based Entrepreneurship (TBE) and International Entrepreneurship & Development (IED), for the academic year 2022/2023. Descriptive statistics provided an overview of the respondent groups in terms of demographics and background characteristics.

The mean values for the five teen competencies within the EntreComp framework were examined, highlighting variations between the competencies and datasets.
The subsequent data analysis involved testing multiple hypotheses using the independent samples t-test. The results indicated that there was no significant relationship between start-up involvement and the ability to spot opportunities.

Likewise, having finance experience did not significantly impact self-assessment of financial and economic literacy. However, gender was found to have a significant influence, with females considering themselves more creative than males in both minor programs. Furthermore, the analysis revealed no significant relationship between experience in directing people and mobilizing resources. However, having self-employed parents had a significant impact on the self-assessment of valuing ideas in the TBE dataset, while no such relationship was observed in the IED dataset.

Overall, these findings provide insights into the self-assessment of entrepreneurial competencies among students in the DCE minor programs. They contribute to a better understanding of the factors that may influence the development of entrepreneurial skills and attitudes. Further research and exploration are recommended to delve deeper into these relationships and identify additional factors that may contribute to entrepreneurial success. It must not be forgotten that the insignificant outcomes are also of great importance.

6. Discussion

This chapter serves as a platform for engaging in a comprehensive and insightful discussion on the key findings, observations, and implications derived from the research conducted. It delves into the intricacies of the topic, drawing upon the extensive research, empirical data, and theoretical frameworks that have shaped this study.

By delving into the discussion, it intends to present a nuanced understanding of entrepreneurship education while addressing the central research questions and objectives established in the earlier chapters. This section serves as a space to critically evaluate the research findings, interpret their significance, and examine their potential implications within the broader context of entrepreneurship education.

6.1. Limitations and recommendations for future research

Relevant limitations and recommendations for future research are presented in this paragraph.

6.1.1. DCE Sample selection

As first, the data-analysis only used results from students at DCE, which means the whole research was very scoped. The availability of a scoped pool of participants can restrict the sample size for the study. This limitation may impact the representativeness of the findings and the ability to draw broader conclusions about the application and effectiveness of the EntreComp framework. What's more, the narrow focus on a single institution might overlook the influence of contextual factors specific to that environment. The homogeneity of the sample comprising solely DCE students may result in a skewed representation of entrepreneurial competences and practices. This sample of students might possess unique characteristics or experiences that differentiate them from the broader population of entrepreneurs or aspiring entrepreneurs. DCE's specific curriculum may play a significant role in shaping the entrepreneurial competences observed among the students. Therefore, the restricted sample size resulting from this focused approach may influence the statistical power and precision. Future research could consider expanding a sample beyond DCE and incorporating participants from various entrepreneurial programs, institutions, or geographical locations. A broader sample would enhance the representativeness of the findings, allowing for a more robust assessment of the EntreComp framework's applicability and effectiveness in diverse entrepreneurial contexts.

6.1.2. EntreComp scope

What's more, this research was very scoped to the EntreComp framework. Even though EntreComp has been widely recognized as a critical driver of competence in entrepreneurial education (Seikkula-Leino et al., 2021), research and innovations are not limited to this framework. The EntreComp framework relies on subjective (self-) assessments of entrepreneurial competences. The interpretation and judgment of these competences might vary among different researchers, evaluators, or stakeholders involved in the assessment process. This subjectivity can introduce bias and affect the consistency and reliability of the research outcomes. Furthermore, the EntreComp framework primarily focuses on identifying and developing entrepreneurial competences. While competences are undeniably crucial, entrepreneurship is also influenced by contextual factors such as market conditions, industry dynamics, and socio-economic environments. Socio-economic disparities, regulatory frameworks, access to resources, and systemic biases are among the external influences that can shape entrepreneurial outcomes. It's recommended to look more to those contextual factors in the future as well. Entrepreneurship is a dynamic and ever-evolving field, influenced by rapid technological advancements, changing market trends, and societal transformations. The EntreComp framework, as a static model, might struggle to keep pace with these constant changes. However, the framework is still quite a new one, meaning further research is necessary to examine its applicability and effectiveness across different contexts and populations.

6.1.3. Hypothesis selection

In addition, only six hypotheses were tested for both datasets, based on literature. However, there were many more hypotheses that could have been tested as relation between socio-demographic background questions and EntreComp competencies. What's more, multiple variables could be included in one hypothesis, meaning a more extensive test could be done. Additionally, the study's focus on EntreComp competencies and socio-demographic factors might overlook other important variables that could influence entrepreneurial behaviour. Future research could explore the relation between other variables and come up with more extensive hypothesis. As last, a letter was sent in week 15 to DCE teachers to ask their input for interesting hypotheses between the dependent and independent variables. Unfortunately, no (fast) responses were given, meaning there is room for their input in future research.

6.1.4. Survey limitations

The 2022/2023 DCE survey was analysed for this master thesis. The survey was quite lengthy, containing 119 7-point Likert-scale questions . One limitation of such a lengthy survey is the potential for respondent fatigue or response bias (Egleston et al., 2011). Participants may become fatigued or less engaged as they progress through the extensive survey, which could compromise the accuracy and reliability of their responses. To mitigate this limitation, future research could consider shortening the survey length while still capturing the essential aspects of all EntreComp competencies. Another limitation is the reliance on Likert scale questions, which measure respondents' levels of agreement or disagreement with statements. While Likert scales offer a structured approach, they can oversimplify complex concepts and limit participants' ability to express nuanced views (Hartley, 2014). Future research could consider incorporating more open-ended questions or qualitative approaches to capture more detailed and contextualized insights into entrepreneurial competencies. This would provide a more holistic understanding of participants' perspectives and experiences. As last, the initial approach was to design a conjoint analysis as survey type for DCE. Due to dependencies in the research and the ending of both minor programs in January, this has never been carried out. Future research could test this new way of analysis for DCE, to look in more detail to the trade-offs students make when choosing certain EntreComp attributes and levels. Appendix L shows the survey design as proposed to DCE for a conjoint analysis at the beginning of their study programs. The students are asked to choose the combination of EntreComp competences they want to develop the most in their upcoming education program. In that way, DCE could further analyse and specify their students wishes based on their backgrounds.

6.1.5. Statistical test selection

In addition, there are some points to be discussed on the statistical test. For the hypotheses, the independent samples t-test has been conducted. Therefore, the Likert-scale was considered as an interval scale. Another interpretation of the Likert-scale would lead to doing another statistical test. What's more, the last three questions are not used in the hypothesis, which would also have led to another independent variable scale. As last, there was also the attempt to perform a factor analysis on the dataset. However, there was the error of "this matrix is not positive definite", "this extraction is skipped". Therefore, in the end the analysis was not performed. The non-positive definiteness of the matrix highlights potential issues with the interrelationships among the variables. It suggests that the variables included in the analysis may not exhibit strong correlations or relationships.

6.1.6. Other recommendations for future research

As last, there are some more recommendations that could be made. Another key recommendation is to focus more on examining growth over time. While the present study offers valuable insights into the impact of entrepreneurship programs, it only captures a snapshot of students' competencies in September 2022. Investigating the long-term effects of these programs and tracking the growth and development of individuals' entrepreneurial competencies over an extended period would provide a deeper understanding of the program's effectiveness. What's more, the 2021/2022 dataset could be analysed with point in time to really see the development of competencies among students.

7. Conclusion

In this concluding chapter, we bring together the key findings and insights obtained throughout this master's thesis, offering a comprehensive summary of the research conducted. This has been done based on the main research question that has been central this entire thesis:

"How can the EntreComp framework be used to assess entrepreneurship competences among students following the Delft Centre for Entrepreneurship education programmes?"

The primary objective of this study was to investigate the EntreComp framework and its survey results for DCE. Now, for every analysis made, we come up with conclusions.

7.1. Research findings and practical implications

The key findings of this research are set out in chapter 5, presenting the statistically significant hypotheses, reliability analysis and mean values. The implications of these findings are specifically scoped down to DCE's education, in specific for the two minor programs IED and TBE, and therefore offering new academic insights. In this part, the research findings and implications are highlighted, and presenting the impact of it on entrepreneurship education research.

7.1.1. Moving EntreComp research and literature reflection

The statistical analysis and conjoint analysis provide DCE with a basis of ways to analyse their data and how they can do even newer methods of assessment using the EntreComp framework. The methodologies section provides a structural approach for DCE with possible ways to analyse their data, in which the EntreComp framework and data always form a point to start with. What's more, the literature review shows key action points for entrepreneurship education research in various research, including EntreComp analyses in research papers encountering limitations and knowledge gaps. Looking back at literature, the following tables could be used:

Challenges	Key success factors
Complexity	Holistic approach
Need for adaptation	Common language
Lack of awareness	Flexibility
Lack of ecosystem integration	User-friendliness

Table 17: EntreComp challenges and key success factors (McCallum et al., 2018)

In conclusion, the challenges of EntreComp should not be overlooked. The EntreComp framework offers significant benefits for integrating entrepreneurship education. It provides a holistic approach, encompassing fifteen competencies and moving beyond a narrow focus on profit. EntreComp serves as a common language, facilitating consensus among stakeholders and enabling effective collaboration. Its trustworthiness is supported by extensive study and European Commission endorsement. The visual representation of the framework aids comprehension, while its flexibility allows for adaptation to various contexts. EntreComp's user-friendly nature makes implementation straightforward, with different levels catering to increased awareness and targeted interventions.

While the EntreComp framework offers numerous advantages, it is important to acknowledge and address the challenges it presents. The complexity of the framework's language and the need for adaptation to specific contexts require careful consideration and potential simplification. The lack of awareness among stakeholders calls for efforts to raise awareness and build understanding to gain wider support. Additionally, the integration between policy and industry should be improved to maximize the framework's impact. Further guidance and clarification are also needed for the co-working of EntreComp with other competence frameworks.

Authors	Article title	Contents
Nyström (2020)	Recognizing and assessing student entrepreneurship competences	Recognition of prior-learning
Miço and Cungu (2023)	Entrepreneurship Education, a Challenging Learning Process towards Entrepreneurial Competence in Education	EntreComp competency in education needs to be improved in terms of teaching proficiency
Joensuu-Salo et al. (2022)	Testing the EntreComp framework and its relation to start-up behaviour in seven European countries	EC can be addressed as a unidimensional construct and connect it to start-up behaviour
Rațiu et al. (2023)	EntreComp Framework: A Bibliometric Review and Research Trends.	Lack of shared vision and development of practice in the use of EntreComp, indicating the need for support and guidance in promoting the learning process effectively.
López-Núñez et al. (2020)	EntreComp Questionnaire: A Self-Assessment Tool for Entrepreneurship Competencies	Questionnaire presented a tool to assess the entrepreneurship competencies included in the EntreComp framework
Armuna et al. (2016)	From stand-up to start-up: exploring entrepreneurship competences and STEM women's intention	Entrepreneurship competences held by a group of potential STEM entrepreneurs by identifying differences by gender

Table 18: EntreComp in literature research papers

Table 18 shows a synthesis of EntreComp in research papers. In conclusion, the literature review on EntreComp research papers highlights the importance of recognizing prior learning, improving teaching proficiency, and connecting competences to start-up behavior in entrepreneurship education. The lack of shared vision and development of practice indicates the need for support and guidance, while questionnaires provide a valuable tool for assessing entrepreneurship competencies. Additionally, addressing gender differences is crucial for fostering equal opportunities. Implementing these findings can enhance the effectiveness of entrepreneurship education and support the development of successful entrepreneurs.

7.1.2. Adopting societal needs and tackling EntreComp challenges

Furthermore, the research findings shows the societal relevancy. Literature shows the importance of integration of entrepreneurship into our education systems, bringing in entrepreneurial individuals in either organizations or new businesses. This would lead to community engagement, new venture creation, workforce development and an entrepreneurial culture. In that place, EntreComp brings in a common, universal language and a holistic approach to look at entrepreneurial competences as seen in chapter 3.2.2 and figure 19. This research also tackles several challenges which goes along with EntreComp, as seen in chapter 3.3.3. As first, this research challenges the lack of awareness, as it shows much research done in this area and provide new insights on how to assess, analyse and use EntreComp. What's more, it discusses and challenges the complexity of EntreComp, as this research tries to bring a proper analysis and new ways to look at EntreComp as a framework. In more detail, for the Netherlands it's especially important to have stronger integration between education and external stakeholders, and to go to a national strategy on entrepreneurship education.

Figure 19: effects of entrepreneurship in education (European Commission, 2014)

7.1.3. Improving awareness and use of EntreComp

In addition, the research can also be used by other researchers and on other universities to assess their students' competences, mainly with the emphasis on their progression and development. Therefore, this research is also meant to improve the awareness around EntreComp and its possibilities. It would also be good to discuss this with various industries. By making EntreComp understandable and widespread, this could have a serious impact on students' entrepreneurial spirit and can be paid back when they end up in to working field. The analysis also revealed a lack of shared vision and development of practice in the use of EntreComp, meaning this research also contribute to a broader

development of EntreComp for TU Delft. As last, this research also contributes to communication on the benefits of EE as well as sharing knowledge and experience to enhance teaching, as set out as key action points by the EU as seen in appendix D.

7.2. Turning research findings into recommendations

Translating large datasets into usable conclusions is complicated. The data remains a snapshot in time, and statistical analyses cannot always be transformed into practical recommendations. Therefore, it's of great importance to bridge the gap between theory and practical advice.

The mean value for competence 9, "financial and economic literacy", is in both datasets the lowest. This means that the student groups don't assess their selves very high in these EntreComp abilities at the start of the minor programmes, scoring 3,6485 for TBE and 3,8333 for IED. In addition, the highest scores were seen on competences 6 and 7, *"self-awareness and self-efficacy"* and *"motivation & perseverance"*, scoring for all four entries higher than 5.5. Therefore, it's recommended to focus more on awareness on the competence "financial and economic literacy" within DCE education.

In addition, three hypotheses were found (partly) significant: the relation between self-employed parents and valuing ideas (TBE), creativity on gender, and self-employed parents on uncertainty, ambiguity and risk (IED). All the other hypotheses were found insignificant, meaning there was no difference observed between the two researched groups.

Therefore, it's recommended it emphasize the creativity competence under males, as the difference is significant with females for both programs. For TBE it's recommended to focus on the competence of valuing ideas under students without self-employed parents, as there is a significant difference as well. As last, for IED it's seen that people with self-employed parents differ significantly on the competence uncertainty, ambiguity and risk, meaning handling uncertainty under these groups can be emphasized.

It must not be forgotten that the insignificant outcomes are also of great importance. No differences were spotted for start-up involvement on spotting opportunities. Also, finance experience didn't have any influence on financial and economic literacy. Also, having directed people didn't have influence on mobilising resources.

As last, Cronbach's alpha is used to test the internal validity of the dataset. Only one factor scores lower than 0.6 meaning, there is poor internal consistency within the competence. This is the case for competence 4 "valuing ideas" for the TBE dataset, with a Cronbach's alpha of 0,523. Furthermore, 2 factors score between 0.6 and 0.7, namely "spotting opportunities" (0,694) in the TBE dataset and "valuing ideas" (0,682) for the IED dataset. The rest of all Cronbach alpha score are all above 0.7, meaning great internal consistency.

Therefore, it's recommended to revise the question around "valuing ideas", by increasing the number of items in the scale. By adding more items, a greater variation in the construct being measured can be captured, potentially increasing the overall reliability. It is important, however, to ensure that the additional items are conceptually relevant and effectively measure the construct of interest.

7.3. Research relevance for DCE and wider picture of EE

This research has a relevance for DCE, but also for the wider picture of entrepreneurship education. For DCE, understanding how to effectively measure entrepreneurial competences is crucial for assessing the impact of their educational programs and identifying areas for improvement. The research provides valuable insights into the utilization of EntreComp as a common language and holistic approach for evaluating entrepreneurial competences. This understanding can inform curriculum development, teaching methods, and assessment strategies at DCE, enhancing the overall effectiveness of their entrepreneurship education initiatives. The research collected many important academic resources, forming a synthesis of information that can contribute to TU Delft's and DCE's entrepreneurial vision, as now formulated in subchapter 3.1.5.

Moreover, the study's findings have implications beyond DCE, offering valuable insights for the wider field of entrepreneurship education. The increasing popularity of entrepreneurial education among students indicates the growing recognition of the importance of an entrepreneurial mindset in today's dynamic and competitive world. By examining the challenges and opportunities in integrating the EntreComp framework, this research contributes to the advancement of entrepreneurship education practices at a broader scale.

The research highlights the need for a shared vision and collaborative efforts among educational institutions, policymakers, and stakeholders to leverage the EntreComp framework effectively, such as sketched in subchapter 3.3.4. It emphasizes the importance of aligning educational strategies with standardized frameworks for measuring interdisciplinary competences, thereby enabling a comprehensive evaluation of entrepreneurial development.

In conclusion, this research is highly relevant to DCE's pursuit of enhancing entrepreneurship education and provides valuable insights for the wider field. By addressing the challenges and opportunities in integrating the EntreComp framework, the study contributes to the development of effective measurement practices for assessing entrepreneurial competences. Ultimately, this research aims to foster the growth of a new generation of entrepreneurs equipped with the necessary skills and mindset to drive innovation, economic growth, and societal impact.

7.4. Further EntreComp research recommendations for DCE

In the end, this survey also has its limitations. Therefore, the following actionable guidelines are concluded:

1. Look at EntreComp development over time: To gain a comprehensive understanding of students' progress, it is recommended to measure their development in entrepreneurial competences at multiple points in time. Tracking self-assessments over time allows teachers to observe and analyze changes in students' perceptions of their competences, providing valuable insights for enhancing educational interventions.
2. Test more hypotheses: While this research examined six hypotheses, further exploration of the relationships between variables can be conducted using the existing dataset. A more extensive analysis of the data would lead to the discovery of additional statistically significant conclusions, which can inform and improve entrepreneurship education at DCE. Exploring a broader range of hypotheses provides a more comprehensive understanding of the factors influencing the development of entrepreneurial competences among students.
3. Use other statistical tests: In this research, an independent samples t-test was chosen for analysis. However, consideration should be given to the selection of appropriate scales for variables. Exploring alternative statistical tests can contribute to a more nuanced analysis of the data, providing a robust evaluation of the relationships and patterns within the dataset.
4. Try conjoint analysis or other survey types: In addition to the proposed conjoint analysis, other survey types, such as incorporating more open-ended questions, can be explored. Utilizing different survey methodologies can offer additional insights into the nuances and complexities of entrepreneurial competences among students.

7.5. Reflecting remark

Reflecting on the data collection process and database used in this master thesis, it can be acknowledged that the chosen methods provided valuable insights for the research. Looking back at the beginning of the research process, I've had some issues with the scoping of the research methodologies. I was doubting on performing interviews or spreading a survey among students. I was happy about the help of the committee in this scoping, as they advised me to purely focus on the 2022/2023 dataset to prevent any dependencies for the research. Also, the datasets would provide enough interesting insights for the research. However, it was disappointing that the 2022/2023 DCE survey didn't have multiple points in time per student so the differences in mean scores on the competences could be compared and analyzed over time. That could even have given more concrete recommendations towards the DCE teaching section. On the other hand, the 2021/2022 DCE survey required lots of data preparation, and seen the time constraints I couldn't analyze that anymore.

The 2022/2023 DCE survey was large containing 119 questions, so I would recommend shortening the survey next time and try other types of surveys such as the conjoint analysis for the next cohort. I suggest performing a similar experiment among the IED and TBE students for the 2023/2024 academic year based on EntreComp, ang again to use three points in time (beginning, middle and end) to see their scores on the EntreComp competencies. Reflecting on the EntreComp framework, it is essential to question its applicability, measurement possibilities, and integration to identify areas for improvement. Additionally, critical evaluation of the measurement and assessment tools employed to evaluate these competencies can help identify limitations and biases that may exist. Furthermore, exploring the integration and coherence of EntreComp with other competency frameworks and educational approaches is crucial to foster synergies and address potential conflicts. I found the EntreComp a very usable and understandable framework, providing a common language for almost everyone on entrepreneurship competencies. However, this doesn't mean competencies could be added or removed to make the framework more inclusive.

7.6. Concluding remark

Overall, this master thesis tried to assess the use of EntreComp within DCE's education programs. The proposed conjoint analysis, the literature findings and statistical analysis provide structural research findings, having various impactions for DCE's education. The recommendations brought forward in this research should be considered as one step forward to the integration of EntreComp into entrepreneurship education. It brings us all one step closer to a more understandable view on the use of EntreComp, as we come into an era in which entrepreneurship education and skills becomes increasingly important.

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Appendix A: EntreComp Competencies

This appendix describes all the EntreComp competencies in more detail to provide a good overview. As mentioned in chapter 3, the EntreComp framework contains three overarching areas, each containing five separate competencies. The descriptions in this appendix A are all based on the publication of McCallum et al. (2020).

Competences per area
IDEAS & OPPORTUNITIES

COMPETENCE	HINT	DESCRIPTION
1.1 Spotting opportunities	Use your imagination and abilities to identify opportunities for creating value	• Identify and seize opportunities to create value by exploring the social, cultural and economic landscape • Identify needs and challenges that need to be met • Establish new connections and bring together scattered elements of the landscape to create opportunities to create value
1.2 Creativity	Develop creative and purposeful ideas	• Develop several ideas and opportunities to create value, including better solutions to existing and new challenges • Explore and experiment with innovative approaches • Combine knowledge and resources to achieve valuable effects
1.3 Vision	Work towards your vision of the future	• Imagine the future • Develop a vision to turn ideas into action • Visualise future scenarios to help guide effort and action
1.4 Valuing ideas	Make the most of ideas and opportunities	• Judge what value is in social, cultural and economic terms • Recognise the potential an idea has for creating value and identify suitable ways of making the most out of it
1.5 Ethical & sustainable thinking	Assess the consequences and impact of ideas, opportunities and actions	• Assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, the market, society and the environment • Reflect on how sustainable long-term social, cultural and economic goals are, and the course of action chosen • Act responsibly

Figure 20: Ideas & Opportunities competencies (McCallum et al., 2020)

The Ideas & Opportunities area within the EntreComp framework focuses on recognizing and seizing opportunities, generating ideas, and fostering creativity and innovation. It encompasses the ability to identify and assess potential business ideas, as well as the capacity to spot opportunities for innovation and development.

Competences per area
RESOURCES

COMPETENCE	HINT	DESCRIPTION
2.1 Self-awareness & self-efficacy	Believe in yourself and keep developing	• Reflect on your needs, aspirations and wants in the short, medium and long term • Identify and assess your individual and group strengths and weaknesses • Believe in your ability to influence the course of events, despite uncertainty, setbacks and temporary failures
2.2 Motivation & perseverance	Stay focused and don't give up	• Be determined to turn ideas into action and satisfy your need to achieve • Be prepared to be patient and keep trying to achieve your long-term individual or group aims • Be resilient under pressure, adversity, and temporary failure
2.3 Mobilising resources	Gather and manage the resources you need	• Get and manage the material, non-material and digital resources needed to turn ideas into action • Make the most of limited resources • Get and manage the competences needed at any stage, including technical, legal, tax and digital competences
2.4 Financial & economic literacy	Develop financial and economic know-how	• Estimate the cost of turning an idea into a value-creating activity • Plan, put in place and evaluate financial decisions over time • Manage financing to make sure your value-creating activity can last over the long term
2.5 Mobilising others	Inspire, enthuse and get others on board	• Inspire and enthuse relevant stakeholders • Get the support needed to achieve valuable outcomes • Demonstrate effective communication, persuasion, negotiation and leadership

Figure 21: Resources competencies (McCallum et al., 2020)

The Resources area within the EntreComp framework focuses on the necessary inputs and support systems that entrepreneurs require to turn their ideas and opportunities into tangible ventures. This area recognizes that access to resources is essential for sustainable entrepreneurship and business development.

Competences per area
INTO ACTION

COMPETENCE	HINT	DESCRIPTION
3.1 Taking the initiative	Go for it	• Initiate processes that create value • Take up challenges • Act and work independently to achieve goals, stick to intentions and carry out planned tasks
3.2 Planning & management	Prioritise, organise and follow up	• Set long-, medium- and short-term goals • Define priorities and action plans • Adapt to unforeseen changes
3.3 Coping with uncertainty, ambiguity & risk	Make decisions dealing with uncertainty, ambiguity and risk	• Make decisions when the result of that decision is uncertain, when the information available is partial or ambiguous, or when there is a risk of unintended outcomes • Within the value-creating process, include structured ways of testing ideas and prototypes from the early stages, to reduce risks of failing • Handle fast-moving situations promptly and flexibly
3.4 Working with others	Team up, collaborate and network	• Work together and co-operate with others to develop ideas and turn them into action • Network • Solve conflicts and face up to competition positively when necessary
3.5 Learning through experience	Learn by doing	• Use any initiative for value creation as a learning opportunity • Learn with others, including peers and mentors • Reflect and learn from both success and failure (your own and other people's)

Figure 22: Resources competencies (McCallum et al., 2020)

The Into Action area within the EntreComp framework focuses on the practical implementation and execution of entrepreneurial ideas and opportunities. It encompasses the skills, actions, and behaviors that entrepreneurs need to bring their plans to life and transform them into viable businesses. This area emphasizes the ability to take initiative, make decisions, and persevere in the face of challenges.

Appendix B: EE strategy phases of development

This appendix is based on the report of the European Commission (2014) on the thematic working group on entrepreneurship education, which shows the different phases of development in entrepreneurship education. In addition, it covers entrepreneurship education strategy requirements and an overview of possible policy approaches around EE.

PHASES	I. EQUIPPING (INITIAL PREPARATION & BENCHMARKING)	II. ENGAGE PUBLIC SECTOR, EDUCATIONAL ORGANIZATIONS & EXPERTS	III. ENGAGE PRIVATE SECTOR (PROFIT AND NON-PROFIT)	IV. EMPOWERING YOUNG ENTREPRENERUSHIP AT THE LOCAL LEVEL	V. MANAGEMENT, EVALUATION & DISSEMINATION
OBJECTIVES	• Nomination of inter-ministerial working group and lead partner for the development of national strategy in entrepreneurship education and training • Benchmark good practices from other Member States;	• Develop a platform with representation from the key entrepreneurship education & training public entities • Stakeholder consultation to establish wide-ranging buy-in and comprehension • Develop high level strategic aims and objectives • Integrate strategy with identified good practice	• Prepare and execute the preliminary roll-out of national strategy to share and discuss the strategy with the private and non-profit sector across all regions • Revise strategy with private sector and NGO input resulting from national roll-out meetings	• Provide guidance (capacity building) to public, private and third sector entities on youth entrepreneurship at a local level • Engage municipalities to promote pilot actions at the local level targeted at specific issues of local concern (e.g. highly ambitious youth or economically inactive/at-risk/unemployed)	• Develop a policy brief with actions for future direction in line with changing economic priorities & model in country • Promoting management and ongoing monitoring to ensure the efficiency and effectiveness of the results • Test evaluation framework that allows analysis of processes, outcomes and assessment presented by the public – private partnership
ACTIVITIES	• Engage a group of key stakeholders (ministries and public entities) and prepare the international exchange • Possible visit to and exchange with good practice countries • Integrate previous actions	• Build the national strategy from good practices and key documents (e.g. Oslo Agenda; Rethinking Education; Entrepreneurship 2020 Action Plan) • Involve and consult with Ministries that have a role for entrepreneurship and education	• Presentation of National Strategy on Entrepreneurship Education • Share good practices from International Partners • Collect inputs/feedback for improving the Strategy	• Develop a workshop run by lead national partner(s) • Provide technical inputs for the development of pilot actions targeting at risk young at the local level • Follow-up on pilot actions	• Conducting coordination meetings • Conducting partnership meetings • Developing evaluation framework • National symposium event • Create policy brief
RESULTS	• Diagnosis of entrepreneurship education Benchmark entrepreneurship education developed • Sharing experiences between different countries • Increased awareness of public and private sector on the added-value of developing a national strategy • Increased knowledge	• Cross-ministry involvement of key stakeholders • Preliminary strategy from public sector entities • Co-development of national roll out and NGO engagement plan	• An agreed definition for a National Strategy on Entrepreneurship Education • Increased participation of NGOs and the private sector on the development and implementation of public policies	• Municipalities and key local stakeholders develop their entrepreneurship agenda in their region / local level • Municipalities and key stakeholders promote and deliver entrepreneurial awareness, experiences and opportunities for young people	• National strategy endorsed at the highest political level • Capacity building of project partners on management and evaluation
PRODUCTS	• Benchmark report • Diagnostic on national entrepreneurship education	• Public sector platform for the development of a national strategy • Protocols established between governmental entities	• Regional workshops around the country • "National Strategy on Entrepreneurship Education and Training" document	• Pilot actions reports	• Policy report • Quarterly reports and Final report • *Follow-up* report • Communication materials • Dissemination event
STAKE HOLDERS	Public Entities (recommended) • Ministry of Education • Ministry of Economy • Ministry of Employment / Social Affairs • Commission on Gender Equality • Commission on Immigrant Affairs Public Entities (other possible) • Ministry of Agriculture • Ministry of Finance • Regional governments • Stakeholders & Governments in other Member States	Recommended and possible Public Entities (see Phase I) • National/international experts • Educational Organisations/Institutions • Teachers unions • Associations of students & young entrepreneurs	Recommended and possible Public Entities (see Phase I) • National/international experts • Educational Institutions • Teachers unions • Parent groups Social partners: • Trade unions & employer groups • Entrepreneurs & companies • Relevant NGOs & local community organizations • Associations of students & young entrepreneurs	• Actors at the local level community level of entities in phase III	Principally Responsible: • Lead public entities • Lead private entities Involve: • All actors involved in national and regional/local level roll out

Table 19: The Phases of Development of an Entrepreneurship Education Strategy (European Commission, 2014)

Table 19 illustrates possible phases of development and highlights elements like the need to involve not only a variety of different ministries but also a wider spectrum of stakeholders. Moreover, it offers an action-based approach and illustrates the goals, tasks, outcomes, products, and stakeholders at each level. This model is an action plan that can serve as inspiration for individuals just beginning this journey or for those looking to pinpoint the shortcomings of their existing strategies.

An entrepreneurship education strategy should:[31]

- **Involve all education levels** and disciplines, including non-formal learning
- **Engage across government** - such as education, lifelong learning, employment and economic development
- **Consider a lead organisation** and regular reviews of actions by all partners involved
- **Engage stakeholders** – developed in collaboration with education providers and practitioners, as well as a range of wider stakeholders such as business and community
- **Draw on experience from practice**
- **Encourage and develop partnerships** between business, community and education at all levels
- **Have evaluation and monitoring built in**, with links to internationally comparable data to provide measure of progress.
- **Identify resources and funding** to be used from local, national and/or EU level
- **Address curricula** reform and innovation at all levels, including flexibility, pedagogies, learning outcomes and assessment,
- **Include practical entrepreneurial experiences** for all learners
- **Include training for educators and educational leaders** receive sufficient training and overall support
- **Ensure career guidance is a focus** at all levels and pre-start support is included to support aspiring entrepreneurs

Figure 23: entrepreneurship education strategy requirements (European Commission, 2014)

Figure 23 shows the entrepreneurship education strategy requirements.

POLICY APPROACH	POLICY ADVANTAGES	POLICY DISADVANTAGES	EXAMPLES - list not exhaustive
Specific Strategy on entrepreneurship education	• Common vision across government • Outcomes and impact reflect policy drivers for all involved Ministries • Direct engagement from stakeholders on theme	• Not embedded into policies that directly target education and training audience • May not translate into tangible engagement by all Ministerial partners	Croatia; Italy (national for VET, some regions have strategies); Sweden
Education policy explicitly mentions entrepreneurship education as objective	• Entrepreneurship education highlighted as priority within education policy • Directly embedded within policies directed at learning system	• May not be recognised as contributor to economic and employment policies or outcomes	Austria; Czech Republic; Finland; France; Greece; Spain; Hungary; Latvia; Malta; Poland; Slovakia; UK-Northern Ireland; UK-Scotland; Portugal
Both specific strategy AND other policies (education, economic and/or employment) explicitly mention entrepreneurship education	• Comprehensive approach reflecting joined up government policy • Specific strategy translated into tailored approaches in key areas such as education, careers, employment and economic growth	• Not all policies may be properly linked without common vision	Belgium-NL; Denmark; Estonia; Finland; Lithuania; Luxembourg; UK-Wales
Education policy implicitly mentions knowledge, skills and/or attitudes associated with entrepreneurship	• Entrepreneurship related knowledge, skills and attitudes included within curricula objectives	• Education and training audience do not recognise importance of entrepreneurship education as a thematic priority • May not be recognised as a contributor to economic and employment agenda • Does not reflect key competence approach	Belgium-FR; Bulgaria; Cyprus; Germany; Ireland; UK -England
Wider policy (economic or employment policy) explicitly mentions entrepreneurship education	• Entrepreneurship education recognised as a framework condition for economic growth and employment (as well as social wellbeing) • Can be pre-cursor for joined up approach with education policy	• Not directed at education and training audience • Does not directly engage education policy areas	Spain; France; Netherlands; Portugal; Romania; Slovenia

Table 20: Overview of Policy approaches, advantages and disadvantages (European Commission, 2014)

Table 20 gives an overview of policy approaches. In the Netherlands, it turns it that there is a wider policy explicitly mentioning entrepreneurship education recognized as a framework condition for economic growth and employment.

Appendix C: Theoretical framework researched policy documents on EE and EntreComp research papers

Appendix C summarizes all researched policy documents on EE, and EntreComp research papers. It therefore forms the theoretical framework.

Authors	**Article title**	**Conclusions**
Lilischkis et al. (2021)	A Guide to Fostering Entrepreneurship Education	*"The project identified five main areas where decision makers could become active: training educators, ensuring stakeholders' cooperation, sharing knowledge, raising awareness of EE benefits as well as conducting research and analysis about EE."*
Eurydice (2016)	Entrepreneurship Education at School in Europe	*"Progress is most needed in two areas – learning outcomes and teacher education. The development of comprehensive and consistent learning outcomes, applied across several levels of education and specifically assessed is essential."*
European Commission (2014)	Thematic Working Group on Entrepreneurship Education	*"Mobilities for learners and staff, to undertake a learning and/or professional experience in another country, and entrepreneurship education is relevant to the anticipated outcomes of these mobilities. Support for Policy Reforms includes opportunities for Prospective Initiatives linked to entrepreneurship education, with Forward Looking Cooperation Projects to try out new policy approaches."*
EU-hub (2019)	Checking the pulse of Entrepreneurship Education in Europe	*"Several numerical conclusions on EE on national strategies, collaboration between ministries, type of national strategies, use of EntreComp, use of EE in countries and improvement on education"*
Gibcus (2012)	Effects and impact of entrepreneurship programmes in higher education	*"Entrepreneurship education improves the entrepreneurship key competence. Entrepreneurship alumni have better entrepreneurial skills and more knowledge of entrepreneurship. Entrepreneurship education improves the intentions towards entrepreneurship. Entrepreneurship alumni search for opportunities. Entrepreneurship education has a positive impact on the individual's employability. Entrepreneurship education has an impact on society and on the economy."*
European Commission (2007)	Key competences for lifelong learning: European Reference Framework	*"The Recommendation is a reference tool for education and training stakeholders. It sets up a common understanding of competences needed nowadays and in the future. The reference framework presents successful ways to promote competence development through innovative learning approaches, assessment methods or support to educational staf"*
Ahmad & Hoffman (2007)	A Framework for Addressing and Measuring Entrepreneurship	*"It is fair to say that very few, probably none, of these efforts capture or embody entrepreneurship. These initiatives and requests led the OECD to create an Entrepreneurship Indicators Programme that has been at the vanguard of investigations and developments that seek to improve our current understanding and measurement of entrepreneurship."*

Lackeus (2015)	Entrepreneurship in Education: What, why, when, how	*"This report aims to clarify some basic tenets of entrepreneurship in education, focusing on what it is, why it is relevant to society, when it is applied or not and how to do it in practice. The many challenges have also been discussed, such as lack of support, time and resources in educational institutions, assessment difficulties for both teachers and researchers. Despite its promising effects on students and society, it is important to keep in mind that the field of entrepreneurial education is in a quite early stage of development."*
Baggen et al. (2021)	Inzicht in ondernemerschapsonderwijs	*"Entrepreneurship means value creation. Value creation for others, with others. The value can be social, environmental or economic or a combination of the three. The following recommendations are made• Gain more insight into the current situation. •Towards a national model for entrepreneurship education in the Netherlands. • systematic monitoring and evaluation of entrepreneurship research. •Invest in teachers as key actors of entrepreneurship education. • Facilitating lifelong development for entrepreneurs and employees. •Stronger integration between education and external stakeholders and role models."*
Margherita et al. (2016)	EntreComp: The Entrepreneurship Competence Framework	*"The EntreComp study was launched by the JRC on behalf of DG Employment, Social Affairs and Inclusion, in January 2015. Its ambition is to build a bridge between the worlds of education and work, by contributing to a better understanding and promotion of entrepreneurship competence in Europe. The EntreComp ultimately aims to facilitate peer learning and exchange among Member States and eventually to have a positive impact on the mobility, employability and active participation of citizens in society and the economy."*
McCallum et al. (2020)	EntreComp at Work The European Entrepreneurship Competence Framework in action in the labour market: a selection of case studies	*"The 10 case studies in the EntreComp at work report highlight the diversity of ways in which EntreComp can be used, including workforce development, design of training, support for start-ups, and design of personal development plans. Our hope is that these new publications serve as a call to action for greater uptake of EntreComp and delivering on the goals of the European Skills Agenda."*
McCallum et al. (2018)	EntreComp into action A user guide to the European Entrepreneurship Competence Framework	*"EntreComp into Action is a guide to help individuals and organisations explore why, when and how they can use EntreComp the Entrepreneurship Competence Framework published by the European Commission in 2016. The entrepreneurship competence is increasingly recognised as a competence for life, relevant to personal development and fulfilment and finding and progressing in employment."*

Table 21: Researched policy documents on EE

Authors	Article title	Conclusions
Nyström (2020)	Recognizing and assessing student entrepreneurship competences	*Emphasized the importance of "**recognition of prior learning**" (RPL). She identified that "students increasingly acquire competences and knowledge in non-formal and informal (extra- curricular) settings", allowing HEI's to "to shorten students' graduation times and introduce flexibility into the curriculum".*
Miço and Cungu (2023)	Entrepreneurship Education, a Challenging Learning Process towards Entrepreneurial Competence in Education	*"The study's findings suggest that entrepreneurship competency in education needs to be improved in terms of teaching proficiency, pre-service teacher preparation programs, in-service training, curricula, and stakeholder collaboration with the school. The limitation of this study is that more factors should be considered to further explore teachers' competencies in entrepreneurship education and the relationship between teachers' knowledge and skills and entrepreneurship competencies."*
Joensuu-Salo et al. (2022)	Testing the EntreComp framework and its relation to start-up behaviour in seven European countries	*"This study contributes to entrepreneurship literature by proposing a relatively simple way of measuring EC, based on the widely discussed EntreComp framework. Despite its wide use in many educational institutions in the European Union (EU), the EntreComp framework has not been widely used in research, possibly due to the width and depth of the competence it portrays. The study provides a validated scale of 15 items that can be easily applied to for example measuring development over students' study years. The results also demonstrate that EC can be addressed as a unidimensional construct and connect it to start-up behaviour."*
Raţiu et al. (2023)	EntreComp Framework: A Bibliometric Review and Research Trends.	*"Provides insights into the current research landscape on the EntreComp framework. The analysis reveals a lack of shared vision and development of practice in the use of EntreComp, indicating the need for support and guidance in promoting the learning process effectively. Future research can focus on developing guidelines and best practices for implementing EntreComp in different educational programs and contexts."*
López-Núñez et al. (2020)	EntreComp Questionnaire: A Self-Assessment Tool for Entrepreneurship Competencies	*"The questionnaire presented a tool to assess the entrepreneurship competencies included in the EntreComp framework, and competencies to generate social, cultural, or economic value at work or in society and that allow personal and professional development. Based on the results of this work and the challenges in promoting sustainability educa-tion and lifelong learning, future efforts should be aimed at consolidating the EntreComp Questionnaire and expanding it with areas that would allow sustainability competencies to be evaluated more specifically."*
Armuna et al. (2016)	From stand-up to start-up: exploring entrepreneurship competences and STEM women's intention	*"This paper contributes to an understanding of the entrepreneurship competences held by a group of potential STEM entrepreneurs by identifying differences by gender and exploring which ones are more closely related to higher entrepreneurship intention, which can contribute to orienting education initiatives."*

Table 22: Researched EntreComp papers

Appendix D: Key action points for EE on different hierarchical levels

This appendix describes all key action points for entrepreneurship education, as defined by Lilischkis et al. (2021) in "The guide to fostering entrepreneurship education five key actions towards a digital, green and resilient Europe."

1. **"Develop EE competence of leaders and teachers in education institutions" (Lilischkis et al., 2021).**

Key Action 1: Increase teachers' and leaders' EE competence through initial and continuous professional training and peer networks; **teacher training "** (Lilischkis et al., 2021)

Entrepreneurship education challenges educators, mainly because of a transformation of their roles and new competences. However, Lilischkis et al. (2021) concluded that most teachers lack EE competence. The main bottleneck to improvement on EE within the EU seemed to be a lack of proper teacher training.

Action 1.1 – local level:
"Become more ambitious in training educators about entrepreneurial competences on-site" (Lilischkis et al., 2021).
As described, "an effective implementation of EE requires significant changes in the way teachers are educated". It is advised to all educators to acquaint themselves with challenges and opportunities of EE in their subject. Moreover, it's recommended to the business sector to establish long-term partnerships with schools.

Action 1.2 – national and regional level:
"Support EE in initial teacher training and in continuous professional development, especially for principals" (Lilischkis et al., 2021).

To largen the entrepreneurship education in the EU, governmental bodies could tackle teacher shortcomings via 1) initial teacher training, 2) quality programmes for continuous professional development to support EE teachers and 3) national networks of teacher and education institutions to share and increase EE knowledge. It was also concluded that EE needs sufficient funding, where there is currently a lack of reliable long-term funding of EE by governmental bodies.

Action 1.3 – European level:
"Initiate and fund European-wide train-the-trainer programmes in EE, including mentor networks" (Lilischkis et al., 2021).
It was concluded that the OECD noticed a lack of teacher training in EE in the EU. Moreover, the teacher trainings often lack "strategy or development plans and are often underfunded". There is a need for a European EE network between different education institutions. As last, main drivers of EE were identified, with the following examples: "teacher training, believe in entrepreneurship as policy maker, prepare a serious strategy, clear leadership, put into school system as obligatory at early age" etc.

2. **"Encourage cooperation of EE stakeholders about policies and curricula" (Lilischkis et al., 2021).**

Key Action 2:
"EE actors could seek broad **cooperation** between all types of stakeholders on all geographical levels" (Lilischkis et al., 2021).
One of the biggest strengths of EE are the broad benefits for many stakeholders and industries: from local communities to national and European institutions.

Action 2.1 – local level:
"Education institutions could link up with the local community for EE – with municipalities, civil society, businesses" (Lilischkis et al., 2021).
On a local level, schools and education institutions could engage community members in EE practice, through lectures, visits and practical projects. Labour unions and employers' organizations could incentivize business to

involve within EE projects. As example, Austria has a national for EE including 65 stakeholders, such as ministries, the economic chamber, banks. foundations and universities.

Action 2.2 – national/regional level:
"Establish a broad national or regional policy platform to develop EE curricula and agree on targets" (Lilischkis et al., 2021).
It was concluded that the integration of entrepreneurial learning into national or regional curricula is crucial and should be made possible by educational institutions. Many European countries have reformed their curricula to include EE, focusing on innovation and creativity competence, complex problem-solving, teamwork, and leadership. Governments can establish platforms to enhance cross-ministerial collaboration and involve actors from various policy domains, including the business sector and civil society organizations.

Action 2.3 – European level:
"Encourage and facilitate a broad European policy platform for the work on EE" (Lilischkis et al., 2021).
To promote EE on a European scale, it is necessary to cooperate with stakeholders at the European level, especially with the transition to a sustainable and digital economy, and a focus on education frameworks like EntreComp. The European Commission can play a leadership role in EE by providing funding for relevant projects and collaborating with various Directorate-Generals. An external entity can be mandated with implementing, assessing, monitoring, and driving EE in cooperation with several Directorate-Generals.

3. **"Communicate what EE is and what benefits it brings" (Lilischkis et al., 2021).**

Key Action 3: **Communicate the benefits of EE and how it builds competences for life (Lilischkis et al., 2021)**
Negative connotations associated with entrepreneurship, such as commercialism and capitalism, often impede the implementation of EE in schools and its integration into curricula. To overcome these perceptions, the benefits of EE need to be communicated and false perceptions debunked, as educators often lack knowledge of its positive impacts. It is important to explain that EE develops competences such as self-confidence, teamwork, and perseverance, and is not limited to starting a business but rather teaches how to create value in general.

Action 3.1 – local level:
"Use the EntreComp Framework to promote entrepreneurship as a transversal competence on the spot" (Lilischkis et al., 2021).
The EntreComp framework defines entrepreneurship as a basic and transversal competence useful for many spheres of life and is becoming a reference for initiatives that aim to foster European citizens' entrepreneurial capacity. It consists of three interconnected competence areas: Ideas and opportunities, Resources, and into action, which embrace different types of entrepreneurships. Educational institutions can cooperate with local enterprises to bring life to frameworks such as EntreComp and create visibility for their EE activities through media coverage. This can help prevent negative reactions from parents and the fear of negative effects on students' performance, as more teachers may find frameworks such as EntreComp helpful.

Action 3.2 – national and regional level:
"Introduce reforms towards more competence-oriented learning and more entrepreneurial activity" (Lilischkis et al., 2021)
To acknowledge entrepreneurship as a competence, it is important to introduce competence-oriented ways of learning and curricula. Governments can introduce competency-based curricula while initiating campaigns to emphasize the development of transversal skills, such as cooperation and critical thinking, in addition to reaching subject goals. Public authorities can raise awareness by supporting, recognizing, and rewarding EE initiatives through summits and awards. Authorities can also adapt the legal framework to support students' entrepreneurial activities.

Action 3.3 – European level:
"Raise awareness, recognise and reward EE efforts and initiatives on European level" (Lilischkis et al., 2021).
The effectiveness of awareness-raising campaigns for environmental education (EE) can be improved by highlighting good practices from other countries rather than relying solely on local practices. The European Commission has long promoted EE as a strategic policy objective and encourages all students to have at least one entrepreneurial experience before finishing compulsory education. Therefore, it is important to identify and acknowledge European front runners in EE among schools, teachers, and principals. Recognizing and rewarding such initiatives and individuals can serve as a model for other countries and inspire peer-learning.

4. **"Measure and compare EE practice and impact in pan-European research" (Lilischkis et al., 2021).**

Key Action 4:
"Conduct research about EE methods, impacts, and policies across different types of entrepreneurship"
(Lilischkis et al., 2021).
To contribute to key European policy agendas, there is a need for pan-European data that identifies the most useful EE policies and methods, as well as how to train teaching staff and achieve impact. In the future, the focus of EE research should expand beyond starting up businesses to non-profit entrepreneurship to serve diversity. National and regional policies that aim to foster EE must also be mapped and evaluated to provide a systematic overview of their impact, which can aid policymaking across Europe. However, there is currently a lack of research on the long-term impact of EE.

Action 4.1 – local level:
"Higher education institutions could strengthen EE research together with their ecosystem" (Lilischkis et al., 2021).
EE teaching and training take place at the local level and thus more research is needed to explore how stakeholders in local entrepreneurial ecosystems can implement national or regional EE policies, particularly in different types of entrepreneurship. Higher education institutions can integrate research, teaching, and transfer of entrepreneurship to benefit EE research in understanding the conditions under which certain methods work. Additionally, faculties could encourage and support students in writing thesis papers about EE subjects that consider the specificities of their institution's EE ecosystems. Finally, policymakers could support grass-roots research at the local level, facilitate comparative studies, and identify common themes to address in EE policies.

Action 4.2 – national level:
Initiate and coordinate national research in EE practice and mainstreaming (Lilischkis et al., 2021).
Ministries responsible for educational policy need scientific advice on two related issues**: the treatment effect** of EE practice, which looks at the impact on students who participate in it, and the **selection effect** of EE mainstreaming, which considers why some young people don't take part in EE (Parker, 2018). Research on entrepreneurship policy often **does not differentiate** enough between these two effects, so national research initiatives could study the **treatment effectiveness** of EE for different types of entrepreneurship to gain insights on how to reach different groups of students interested in entrepreneurship. Research could also analyse the paths in which **selection into or out of participation in EE** takes place to more effectively mainstream EE.

Action 4.3 – European level:
Conduct pan-European research about EE methods and policies for different types of entrepreneurship (Lilischkis et al., 2021).
Pan-European research could be beneficial in investigating different forms of entrepreneurship and entrepreneurship education strategies and policies. The European Commission could sponsor research projects focusing on green and social entrepreneurship and encourage the creation of a repository of studies on EE policies and their effectiveness. Furthermore, the EC could explore the synergy of the **EntreComp** framework with other frameworks.

5. **"Share EE knowledge and experience to enhance teaching and learning" (Lilischkis et al., 2021).**

Key action 5:
Support sharing and peer-learning about EE across Europe (Lilischkis et al., 2021)
There must be more systematic peer learning about EE that considers Europe's digital and green transitions because the sharing of EE information, tools, methodologies, and experiences is currently underdeveloped. The seminars for the EE-WE project have emphasized the actions being taken to promote EE throughout Europe. Indicating that much more could be accomplished if practitioners and experts shared their experiences and plans, it appeared that participants were eager to learn from one another. By mimicking real-life scenarios, EE can boost students' motivation and learning effectiveness.

Action 5.1 – local level:
Increase peer-learning in and beyond education institutions (Lilischkis et al., 2021).
A **culture shift** in educational institutions is necessary to encourage entrepreneurial practices among instructors and develop a positive attitude toward EE. Higher education institutions can accomplish this by setting up **peer-learning**

mechanisms that encourage the sharing of EE-related experiences, techniques, and technologies. Leaders in higher education can encourage the use of EE by their teaching staff by offering **incentives** such on-the-spot assistance from other staff members or outside specialists from the working world.

Action 5.2 – regional and national level:
Establish national and regional peer learning networks for EE (Lilischkis et al., 2021).
Very few nations have networks in place for sharing EE expertise and experiences. Establishing regional and national networks to display education systems where EE is integrated into initial teacher training will allow EE educators and excellent practice institutions to promote these systems, which may encourage other institutions to follow. Governments can provide funding to help headteachers, higher education administrators, and teaching staff develop national or regional networks that can help advance EE through peer-to-peer learning and mutual assistance.

Action 5.3 – European level:
Foster sharing of EE knowledge across Europe – especially for teachers and ministries (Lilischkis et al., 2021).
The EE-WE project participants think that strong leadership and support from European organizations are essential to accelerating EE. It is important to recognize and support European communities of practice, and teachers should have access to top-notch resources. Peer-learning networks can be established and developed between neighbouring nations. The creation of self-assessment tools for schools based on EntreComp can be encouraged by the European Commission, who can also establish standards for European best practices. Additionally, they can promote the recognition of European nations that have made strides in EE and organize frequent peer-learning gatherings for ministry representatives to share their perspectives on the introduction and improvement of EE teaching and learning.

Appendix E. Data-analysis inspiration

The data-analysis in this Master thesis is partly based on the research of López-Núñez et al. (2022). They named that the framework has received attention as a self-assessment tool, but there are still few instruments available that target the entire spectrum of competencies suggested by EntreComp. The main goal of their study was to evaluate the validity and reliability of the self-perceptions of the entrepreneurship competencies questionnaire proposed by Armuna (2020), which aimed to help address the current lack of psychometric measuring instruments. This is because there aren't any specific tools available to evaluate the self-perception of entrepreneurship competencies.
The following hypotheses were formed the proposed questionnaire (1) displayed a four-dimensional model (Ideas and Opportunities, Personal Resources, Specific Knowledge, Into Action), (2) has good internal consistency (reliability), and (3) has a positive relationship between entrepreneurial intention and entrepreneurial self-capital. The total sample was randomly split into two subsamples, maintaining the same mean sociographic characteristics, percentage of representation of the various knowledge areas, and gender presented in the total sample in both, to assess validity evidence based on the internal structure of the EntreComp questionnaire.

Item	Component			
	1	2	3	4
1. Spotting opportunities	0.63	0.38	0.20	0.05
2. Creativity	0.59	0.41	0.10	−0.05
3. Vision	0.75	0.15	0.10	0.17
4. Valuing ideas	0.78	0.16	0.14	0.09
5. Ethical and sustainable thinking	0.74	0.04	0.09	0.19
6. Self-efficacy	0.47	0.27	0.05	0.31
7. Motivation, perseverance	0.31	0.61	0.15	0.18
8. Mobility resources	0.34	0.52	0.19	0.18
9. Leadership skills	0.18	0.73	0.15	0.13
10. Communication skills	0.09	0.72	0.02	0.22
11. Multidisciplinary skills	0.25	0.51	0.29	0.28
12. Digital know how	0.07	0.11	0.61	0.18
13. Legal know how	0.07	0.00	0.79	0.05
14. Financial and economic know how	0.07	0.05	0.82	-0.00
15. Development of new products and services	0.23	0.24	0.71	0.06
16. Defining priorities and actions plans	0.35	0.33	0.42	0.20
17. Making decisions dealing with uncertainty, ambiguity, and risks	0.25	0.51	0.38	0.23
18. Networking skills	0.09	0.40	0.59	0.07
19. Team working	0.03	0.24	0.09	0.61
20. Problem solving skills	0.26	0.40	0.13	0.55
21. Learn by doing	0.15	0.16	0.09	0.73
22. Learn from mistakes	0.14	0.06	0.07	0.77

Item	Mean	*SD*	Corrected Item-Total Correlation	Cronbach's α If Item Deleted	Subscales (α; Mean: *SD*)
1	4.91	1.11	0.65	0.78	Ideas and opportunities (0.83; 26.16; 4.40)
2	5.23	1.26	0.57	0.81	
3	5.41	1.14	0.64	0.78	
4	5.27	1.14	0.68	0.77	
5	5.35	1.06	0.56	0.81	
7	5.03	1.34	0.62	0.78	Personal resources (0.82; 31.18; 5.79)
8	5.30	1.16	0.58	0.79	
9	5.18	1.54	0.62	0.78	
10	5.45	1.32	0.55	0.80	
11	5.39	1.16	0.59	0.79	
17	4.83	1.40	0.58	0.79	
12	5.03	1.43	0.49	0.79	Specific knowledge (0.80; 19.55; 5.68)
13	3.23	1.48	0.60	0.76	
14	3.42	1.58	0.64	0.74	
15	4.05	1.48	0.63	0.74	
18	3.82	1.63	0.55	0.77	
19	5.87	1.14	0.46	0.69	Into action (0.72; 23.92; 3.05)
20	5.74	1.06	0.54	0.64	
21	6.07	0.99	0.52	0.65	
22	6.25	0.93	0.52	0.65	

Table 23: Rotated component matrix, descriptives and internal validity of López-Núñez et al. (2022) research

The first element, titled "Ideas and Opportunities," is composed of the same five abilities listed in Armuna et al. (2020) and EntreComp framework (identifying opportunities, creativity, vision, appreciating ideas, and ethical and sustainable thinking). Six elements made up the second aspect, "Personal Resources," which included motivation, perseverance, mobility resources, leadership skills, communication skills, multidisciplinary skills, making decisions dealing with uncertainty, ambiguity, and risks competence. Finally, an examination of EntreComp's internal consistency revealed suitable values in accordance with accepted guidelines, which were supported by each subscale's Cronbach's alpha indices. López-Núñez et al. (2022) the importance of the study by highlighting it has “important practical implications since it fills the gap of specific tools to assess the self-perception of entrepreneurship competencies”.

The research of López-Núñez et al. (2022) was based on Armuna et al. (2020) research. Armuna et al. (2020) explored *“the relationship between entrepreneurship competencies and intention (EI) of a sample of potential STEM entrepreneurs in order to assess the conventional assumption on women exhibiting lower rates of entrepreneurship intention than men and that the lack of competence perceived is a higher barrier to be an entrepreneur for them”*. The EntreComp framework was used as model for analysis, where data gathering was based on a questionnaire.

The conducted analysis uses t-test and factor analysis to examine the link between competencies and skill elements in EI. The hypothesis that women are less likely than men to pursue entrepreneurship was not supported by the data. Additionally, there are marginal gender disparities in self-perceived competencies. What's more, Armuna et al. (2020) named that "the study confirms the hypothesis of a positive relationship between competences and EI, but here gender is not a moderating factor".

The study tested the following hypothesis in a specific STEM sample:

- *H1: "Female entrepreneurship competences perception is lower than men"*
- *H2: "There is a positive relationship between competences and entrepreneurship intention"*
- *H3: "Gender moderates the positive relationship between competences and entrepreneurial intentions so that the relationship is stronger for female STEM students compared to male STEM students"*

The survey was conducted in June 2017 under students of the ActuaUPM program, under students at the Technical University Madrid, with a technical background. What's more, they joined the program because they "already have a business idea to explore and potentially launch, but the setting up of the venture has not started yet". The dependent variables were based on entrepreneurship intention, measuring "the intention of becoming an entrepreneur in the sense of setting up a new business sometime in the future". All items were measured on a 7-point Likert-scale. In this case, the independent variables were formed by the five teen EntreComp competencies, and splitting out and adding variables brought the total to twenty-two independent variables. It was mentioned that "that the general perception of entrepreneurship competences is quite high, with most values over 4".

	No	Percentage
Sex	138	100%
Men	114	82.6%
Women	24	17.4%
Age (mean)	28,21	
Family main occupations	138	100%
Self-employed	42	30.4%
Private sector	61	44.2%
Public sector	67	48.6%
Other	6	0.04%
Participants major	138	100%
Technical or scientific	130	94.2%
Social sciences	5	3.6%
Other	3	2.2%
Studies	138	100%
Graduate/Master/PhD	100	72.5%
Undergraduate	38	27.5%
Work experience	138	100%
Previous work experience	91	65.9%
Not previous work experience	47	34.1%
Entrepreneurship education	138	100%
Previous EEP	33	23.9%
Not previous EEP	105	76.1%

	Mean			t-test for Equality of Means	
	Male $N=114$	Fem $N=24$	Dif	t	p value
Ideas and Opportunities (ID)					
O1- Identify opportunities to create value and challenges that need to be met	5.46	5.33	0.123	0.468	0.640
O2- Development of creative and purposeful ideas	5.84	5.83	0.009	0.030	0.976
O3- Visualisation of future scenarios to guide effort and action	5.60	5.83	−0.237	−0.995	0.322
O4- Recognise the potential that an idea has for creating value	5.44	4.79	0.647	2.518	0.013
O5- Assess the consequences and impact of ideas, opportunities and actions	5.43	5.29	0.138	0.580	0.563
Personal Resources (PR)					
O6- Identify and assess my individual and group strengths and weaknesses	5.67	5.75	−0.083	−0.351	0.726
O7- Determination to turn into action my ideas, being resilient under pressure, adversity and temporary failure	5.71	5.79	−0.081	−0.284	0.777
O8- Making the most of limited resources	5.82	5.88	−0.059	−0.227	0.821
O9- Leadership skills	5.70	5.54	0.160	0.515	0.611
O-10 Communication skills	5.58	5.88	−0.296	−1.065	0.289
O11- Multidisciplinary skills	6.10	6.42	−0.320	−1.573	0.118
Specific Knowledge (SK)					
O12- Digital know how	5.79	5.08	0.706	2.514	0.013
O13- Legal know how	3.18	3.04	0.134	0.389	0.698
O14- Financial and economic know how	4.11	3.46	0.656	1.974	0.050
Into Action (IA)					
O15- Development of new products and services	5.47	5.25	0.224	0.864	0.389
O16- Defining priorities and action plans	5.62	5.92	−0.294	−1.670	0.102
O17- Making decisions dealing with uncertainty, ambiguity and risk	5.47	5.54	−0.068	−0.248	0.804
O17- Networking skills and making professional contacts	4.92	4.79	0.129	0.373	0.710
O19- Team working	5.90	6.42	−0.513	−2.177	0.031
O20- Problem solving skills	5.93	6.29	−0.362	−1.727	0.086
O21- Learn by doing	6.37	6.46	−0.090	−0.496	0.620
O22- Learn from mistakes	6.32	6.33	−0.018	−0.088	0.930

Figure 24: research outcomes assessment Entrepreneurship competencies by Armuna et al. (2020)

The literature review that has been conducted show that it is difficult to define an overarching framework for what is called entrepreneurial competencies. As a reference for analysis, this paper relies on the theoretical framework of EntreComp, which is proposed as a general guide to support entrepreneurship education.

In previous studies, women tended to rate their entrepreneurial skills lower than men, but in her STEM sample there were no significant gender differences except for these four variables. is not. Across the sample, these aspiring STEM entrepreneurs in her see themselves as having a multidisciplinary profile,

learning through hands-on learning, working in teams, problem solving, and the ability to capitalize on mistakes.

Next, an analysis of entrepreneurship confirms that all individuals share a common interest in becoming entrepreneurs, and in this STEM case study, it is widely believed that entrepreneurship is lower. Despite our hypothesis, entrepreneurship has been shown not to differ significantly between female and male profiles. more women than men. Finally, we used regression analysis with gender as a moderating factor to examine whether there were competencies closely associated with higher entrepreneurial orientation than men (or women).

Limitations were named by the ability to gain more insights about the relations between intentions and the effectively launch of the business and potential differences by gender. What's more "better observation of the evolution of these competences through any entrepreneurship program and the intention to start a business could help to evaluate the effectiveness of the methodologies and contents taught and contribute to further research into the impact of entrepreneurship education" .

Appendix E: EntreComp Survey in 2022/2023 under TBE and IED students

Entrecomp IED/TBE Final Reduced Questions 2022/2023 (Scholten et al., 2022)

Dear student in International Entrepreneurship & Development / Technology-based Entrepreneurship,

Thanks for taking the time to fill out this questionnaire, which should take **approximately 20-30 minutes** to fill out. The purpose of this questionnaire is to help you reflect on the development of your entrepreneurial skills and it will help us improve the minor. The questionnaire is based on the EU's EntreComp framework, which provides a self-assessment tools for entrepreneurial skills and resources.

You will **not be assessed or graded in any way** based on the responses you provide to this questionnaire. Furthermore, we will **protect your personal data in all responses** to ensure that individual students cannot be identified without your consent.

Finally, **please be honest** in your assessment of your skills. The more honestly you answer the questions, the more effective this tool will be in tracking your development. Please don't hesitate to get in touch with your instructors if you have any further questions.

Many thanks and all the best,

Titus, Ellen, Tom, Victor, Allissa, Ben and the whole IED/TBE Team

START OF QUESTIONNAIRE

Q3.1 **SPOTTING OPPORTUNITIES**
Use your imagination and abilities to identify opportunities for creating value. Identify and seize opportunities to create value by exploring the social, cultural and economic landscape. Identify needs and challenges that need to be met.

1/131:
I can describe different analytical approaches to identify entrepreneurial opportunities

Q3.2
2/131:
I can judge opportunities for creating value and decide whether to follow these up at different levels of the system (micro, meso or macro) I am working in.

Q3.3
3/131:
I can take apart established practices and challenge mainstream thought to create opportunities and look at challenges in different ways.

Q3.4
4/131:
I can cluster different opportunities or identify synergies among different opportunities to make the most out of them.

Q3.5
5/131:
I can carry out a needs analysis involving relevant stakeholders.

Q3.6
6/131:
I can produce a ‘roadmap’ which matches the needs with the actions needed to deal with them and helps me create value.

Q3.7
7/131:
I can identify the boundaries of the system that are relevant to my (or my team's) value-creating activity.

Q3.8
8/131:
I can monitor relevant trends and see how they create threats and new opportunities to create value.

Q4.1
CREATIVITY
Develop several ideas and opportunities to create value, including better solutions to existing and new challenges.

9/131:
I can experiment with my skills and competences in situations that are new to me.

Q4.2
10/131:
I can combine my understanding of different contexts to transfer knowledge, ideas and solutions across different areas.

Q4.3
11/131:
I can describe different techniques to test innovative ideas with users or customers.

Q4.4
12/131:
I can design new processes to involve stakeholders in generating, developing and testing ideas that create customer value.

Q4.5
13/131:
I can describe and explain different approaches to shaping open-ended problems and different problem-solving strategies.

Q4.6
14/131:
I can use a mix of creative techniques to keep generating customer value over time.

Q4.7
15/131:
I can develop and deliver customer value based on the core features of my (or my team’s) idea and progressively adding more.

Q4.8
16/131:
I can apply different design approaches to create customer value through new products, processes or services.

Q4.9
17/131:
I can describe how innovations diffuse in society, culture and the market.

Q4.10
18/131:
I can identify the steps needed to research the potential for an innovative idea in light of its development into an existing enterprise, a new venture or an opportunity for social change.

Q5.1
VISION
Develop a vision to turn ideas into action.

19/131:
I can use my understanding of the context to identify different strategic visions for creating value.
Q5.2
20/131:
I can show different audiences the benefits of my vision during turbulent times.

Q5.3
21/131:
I can explain the role of a vision statement for strategic planning.

Q5.4
22/131:
I can encourage enthusiasm and a sense of belonging around a convincing vision.

Q5.5
23/131:
I can identify the changes needed to achieve my vision.

Q5.6
24/131:
I can create a ‘roadmap’ based on my vision for creating value.

Q6.1
VALUING IDEAS
Recognise the potential an idea has for creating value and identify suitable ways of making the most out of it.

25/131:
I recognise the many forms of value that could be created through entrepreneurship, such as social, cultural or economic value.

Q6.2
26/131:
I can develop strategies to effectively make the most of opportunities to create value in my organisation or venture.

Q6.3
27/131:
I can tell the difference between trademarks, registered design rights, patents, geographical indications, trade secrets, confidentiality agreements and copyright licences, including open, public-domain licences such as creative commons.

Q6.4
28/131:
I can develop a strategy on intellectual property rights that is tailored to the market's competition.

Q7.1
ETHICAL & SUSTAINABLE THINKING

Assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, the market, society and the environment.

29/131:
I can argue that ideas for creating value should be supported by ethics and values relating to gender, equality, fairness, social justice and environmental sustainability.

Q7.2
30/131:
I make it my priority to make sure that ethical behaviour is respected and promoted in my area of influence.

Q7.3
31/131:
I can discuss the impact an organisation has on the environment (and vice versa).

Q7.4
32/131:
I can choose adequate methods for analysing environmental impact based on their advantages and disadvantages.

Q7.5
33/131:
I can analyse the implications of my value-creating activity within the boundaries of the system I am working in.

Q7.6
34/131:
I can choose 'measure indicators' to monitor and assess the impact of my value-creating activity.

Q7.7
35/131:
I can discuss a range of accountability methods for both functional and strategic accountability

Q7.8
36/131:
I can use the accountability methods that hold me responsible to our internal and external stakeholders.

Q8.1
SELF-AWARENESS & SELF-EFFICACY
Reflect on your needs, aspirations and wants in the short, medium and long term.

37/131:
I can reflect on my individual and group needs, wants, interests and aspirations in relation to opportunities and future prospects.

Q8.2
38/131:
I can translate my needs, wants, interests and aspirations into goals that help me reach them.

Q8.3
39/131:
I can judge my strengths and weaknesses and those of others in relation to opportunities for creating value.

Q8.4
40/131:
I can team up with others to compensate for our weaknesses and add to our strengths.

Q8.5
41/131:
I can judge the control I have over my achievements (compared with any control from outside influences).

Q8.6
42/131:
I believe in my ability to carry out what I have imagined and planned, despite obstacles, limited

Q8.7
43/131:
I can discuss how a realistic understanding and evaluation of my personal attitudes, skills and knowledge can influence my decision-making, relationships with other people and quality of life.

Q8.8
44/131:
I can design professional development strategies for my team based on a clear understanding of strengths and weaknesses, in relation to both current and future opportunities to create value.

Q9.1
MOTIVATION & PERSEVERANCE
Determined to turn ideas into action and satisfy your need to achieve.

45/131:
I am motivated by the idea of creating value for myself and others.

Q9.2
46/131:
I can regulate my own behaviour to stay driven and achieve the benefits of turning ideas into valuable action.

Q9.3
47/131:
I can coach others to stay motivated, encouraging them to commit to what they want to achieve.

Q9.4
48/131:
I can create the right climate to motivate my team (for example, by celebrating successes, by learning from failures and by encouraging innovative ways to tackle problems).

Q9.5
49/131:
I can use strategies to keep my team motivated and focused on creating value.

Q9.6
50/131:
I can reward initiative, effort, and achievement appropriately within my team and organisation.

Q9.7
51/131:
I can devise strategies to overcome standard difficult circumstances.

Q9.8
52/131:
I can cope with unexpected change, setbacks and failures (for example, job loss).

Q9.9
53/131:
I can celebrate short-term achievements, in order to stay motivated.

Q9.10
54/131:
I can stay focused on my vision and goals, despite challenges.

Q10.1
MOBILISING RESOURCES
Get and manage the material, non-material and digital resources needed to turn ideas into action

55/131:
I can develop a plan for dealing with limited resources when setting up my value-creating activity.

Q10.2
56/131:
I can judge the key resources needed to support an innovative idea or opportunity to launch a new venture.

Q10.3
57/131:
I take into account the non-material cost of using resources when taking decisions about my value-creating activities.

Q10.4
58/131:
I can identify the opportunities that using resources efficiently and the circular economy bring to my organisation.

Q10.5
59/131:
I can manage my time effectively, using techniques and tools that help make me (or my team) productive.

Q10.6
60/131:
I can develop effective time-management procedures that meet the specific needs of my value-creating activity.

Q10.7
61/131:
I can find support to help me take advantage of an opportunity to create value (for example, advisor or consultancy services, peer or mentor support).

Q10.8
62/131:
I can develop a network of flexible and responsive providers from outside the organisation who support my value-creating activity.

Q11.1
FINANCIAL & ECONOMIC LITERACY
Estimate the cost of turning an idea into a value-creating activity.

63/131:
I can explain the difference between a balance sheet and a profit and loss account.

Q11.2
64/131:
I can use financial indicators to compare the financial health of my value-creating activity with that of competitors'.

Q11.3
65/131:
I can apply the financial planning and forecasting concepts that I need to turn ideas into action (for example, profit or not for profit).

Q11.4
66/131:
I can judge the cash-flow needs of an organisation that handles many value-creating activities that depend on each other.

Q11.5
67/131:
I can choose the most appropriate sources of funding to start up or expand a value-creating activity.

Q11.6
68/131:
I can raise funds and secure revenue from different sources and manage the diversity of those sources.

Q12.1
MOBILISING OTHERS
Get the support needed to achieve valuable outcomes.

69/131:
I can get endorsement from others to support my value-creating activity.

Q12.2
70/131:
I can maintain momentum with my team, partners and stakeholders when involved in a challenging situation.

Q12.3
71/131:
I can pitch effectively in front of potential investors or donors.

Q12.4
72/131:
I can pitch a call to action that gets stakeholders, such as funders, customers, partners etc., on board.

Q12.5
73/131:
I can communicate the vision for my venture in a way that inspires and persuades stakeholders, such as funders, partner organisations, volunteers, new members and (non) government organizations.

Q12.6
74/131:
I can take part in constructive discussions with stakeholders (funders, partners and non-government organisations, etc.) that my idea is targeted at.

Q12.7
75/131:
I can influence opinions in relation to my value-creating activity, through a planned approach to social media.

Q12.8
76/131:
I can define a communication strategy to mobilise people in relation to my (or my team's) value-creating activity.

Q13.1
TAKING THE INITIATIVE

Act and work independently to achieve goals, stick to intentions and carry out planned tasks.

77/131:
I can take individual and group responsibility in value-creating activities.

Q13.2
78/131:
I can encourage others to take responsibility in value-creating activities.

Q13.3
79/131:
I am driven by the possibility of being able to initiate value-creating activities independently.

Q13.4
80/131:
I can motivate others to take initiative and reward them appropriately within my team.

Q13.5
81/131:
I take action on new ideas and opportunities, which will add value to a new or existing value-creating venture.

Q13.6
82/131:
I can encourage others to take the initiative in solving problems and creating value within my team and organisation.

Q14.1
PLANNING & MANAGEMENT
Define priorities and action plans.

83/131:
I can define long-term goals arising from the vision for my (or my team's) value-creating activity.

Q14.2
84/131:
I can design a strategy to achieve goals in line with my team's long-term vision.

Q14.3
85/131:
I can apply the basics of project management in managing a value creating activity.

Q14.4
86/131:
I can develop and stick to a detailed project management plan, adjusting to changing circumstances to make sure goals are reached.

Q14.5
87/131:
I can develop a business plan based on the model, describing how to achieve the value identified.

Q14.6
88/131:
I can keep my planning methods updated and adapt them to changing circumstances.

Q14.7
89/131:
I can define the priorities to meet my (or my team's) vision.

Q14.8
90/131:
I can define priorities in uncertain circumstances, with partial or ambiguous information.

Q14.9
91/131:
I can describe different methods for performance and impact monitoring.

Q14.10
92/131:
I can develop the performance indicators I (or my team) need to monitor progress towards a successful outcome in changing circumstances.

Q14.11
93/131:
I can adapt my plans to achieve my goals in light of changes that are outside my control.

Q14.12
94/131:
I can use the results of monitoring to adjust vision, aims, priorities, resource planning, action steps or any other aspect of the value-creating process.

Q15.1
UNCERTAINTY, AMBIGUITY & RISK
Make decisions when the result of that decision is uncertain, when the information available is partial or ambiguous, or when there is a risk of unintended outcomes.

95/131:
I can find ways of making decisions when the information is incomplete.

Q15.2
96/131:
I can make decisions evaluating the different elements in a situation that is uncertain and ambiguous.

Q15.3
97/131:
I can apply the concept of affordable losses to make decisions when creating value.

Q15.4
98/131:
I can assess the risks my venture is exposed to as conditions change.

Q15.5
99/131:
I can demonstrate that I can make decisions by weighing up both the risks and the expected benefits of a value-creating activity.

Q15.6
100/131:
I can come up with strategies to reduce the risk of my value-creating initiative becoming obsolete.

Q16.1
WORKING WITH OTHERS
Work together and co-operate with others to develop ideas and turn them into action.

101/131:
I can value diversity as a possible source of ideas and opportunities.

Q16.2
102/131:
Outside of my organisation, I have a diverse network to help find and evaluate ideas that can create value.

Q16.3
103/131:
I can face and solve conflicts.

Q16.4
104/131:
I can manage conflicts effectively.

Q16.5
105/131:
I can listen to my end users.

Q16.6
106/131:
I can pull together information from a wide range of sources to understand my end users' needs.

Q16.7
107/131:
I can build a team based on the individual knowledge, skills and attitudes of each member.

Q16.8
108/131:
I can build an organisation’s capacity to create value by encouraging people to work together.

Q16.9
109/131:
I can use techniques and tools that help people to work together.

Q16.10
110/131:
I can design working methods and incentives that enable team members to work well together.

Q16.11
111/131:
I can use my network to find the right people to work on my (or my team's) value-creating activity.

Q16.12
112/131:
I can design effective processes to build networks of different or new stakeholders and keep them engaged.

Q17.1
LEARNING THROUGH EXPERIENCE
Learn with others, including peers and mentors.

113/131:
I can judge if and how I have achieved my goals, so that I can evaluate my performance and learn from it.

Q17.2
114/131:

I can take my team or the organisation to a higher level of performance, based on the feedback collected and by learning lessons from achievements and failures.

Q17.3
115/131:
I can find and choose opportunities to overcome my (or my team's) weaknesses and to develop my (or my team's) strengths.

Q17.4
116/131:
I can design and put in place a strategy for my venture to continue to generate value.

Q17.5
117/131:
I can integrate lifelong learning into my personal development strategy and career progress.

Q17.6
118/131:
I can learn from the impact-monitoring and evaluation activities that I have designed to track the progress of my value-creating activity.

Q276
119/131:
Have you ever been involved in starting up a company before?

- ○ Yes (1)
- ○ No (2)

Q277
120/131:

My parents are self-employed, they started companies themselves

- ○ Yes (1)
- ○ No (2)

Q278
121/131:
Has anyone else, close to you, started a business?

- ○ Yes (1)
- ○ No (2)

Q279
122/131:
I have lived for a longer period (>3 months) foreign country

- Yes (1)
- No (2)

Q280
123/131:
I have followed courses on entrepreneurship before

- Yes (1)
- No (2)

Q281
124/131:
I had classes in economics and accounting before

- Yes (1)
- No (2)

Q283
125/131:
I have done finance administration before (bv. penningmeester bij vereniging of evenement)

- Yes (1)
- No (2)

Q284
126/131:
I have directed people before (bv. sport trainer geweest, commissie voorzitter etc)

- Yes (1)
- No (2)

Q18.3
127/131:
What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Diverse (3)
- ○ Prefer not to say (4)

Q18.5
128/131:
In which year were you born?

_____

Q287
129/131:
I would prefer a career as self-employed to a career as employed in an organization

- ○ Definitely not (1)
- ○ Not very likely (2)
- ○ Not likely (3)
- ○ Moderate (4)
- ○ Likely (5)
- ○ Very likely (6)
- ○ Definitely yes (7)

Q288
130/131:
I intend to become self-employed after I am graduated (=directly after finishing school)

- Definitely not (1)
- Not very likely (2)
- Not likely (3)
- Moderate (4)
- Likely (5)
- Very likely (6)
- Definitely yes (7)

Q290
131/131:
I intend to become self-employed when I gained more industry experience

- Definitely not (1)
- Not very likely (2)
- Not likely (3)
- Moderate (4)
- Likely (5)
- Very likely (6)
- Definitely yes (7)

Appendix F: descriptive data tables

In this appendix, an overview is given of all the descriptive data on the two analysed datasets. These two tables are based on the twelve socio-demographic background questions, placed at the end of the survey.

Characteristic (n = 84)	Category	N =	Sample%
Gender	Male	58	69,05%
	Female	26	30,95%
Year born	1990	1	1,19%
	1995	2	2,38%
	1998	4	4,76%
	1999	4	4,76%
	2000	16	19,05%
	2001	28	33,33%
	2002	26	30,95%
	2003	3	3,57%
Start-up involvement	Yes	14	16,67%
	No	70	83,33%
Self-employed parents	Yes	43	51,19%
	No	41	48,81%
Close-to you started business	Yes	60	71,43%
	No	24	28,57%
>3 months lived foreign country	Yes	14	16,67%
	No	70	83,33%
Followed entrepreneurship courses	Yes	10	11,90%
	No	74	88,10%
Followed classes economics and accounting	Yes	44	52,38%
	No	40	47,62%
Done finance administration before	Yes	22	26,20%
	No	62	73,80%
Directed people before	Yes	62	26,20%
	No	22	73,80%
Prefer self-employed career than organization	Definitely not	1	1,20%
	Not very likely	3	3,60%
	Not likely	10	11,90%
	Moderate	18	21,40%
	Likely	25	29,80%
	Very likely	20	23,80%
	Definitely yes	7	8,30%
Intend to become self-employed directly after graduation	Definitely not	1	1,20%
	Not very likely	12	14,30%
	Not likely	31	36,90%
	Moderate	22	26,20%
	Likely	13	15,50%
	Very likely	3	3,60%
	Definitely yes	2	2,40%
Self-employed when gained more industry experience	Definitely not	0	0,00%
	Not very likely	1	1,20%
	Not likely	2	2,40%
	Moderate	13	15,50%
	Likely	32	38,00%
	Very likely	25	29,80%
	Definitely yes	11	13,10%

Table 24: characteristics of TBE dataset

The total amount of valid participants is 84. Seen the specific scope of the survey, that's quite an adequate number. What's striking is that there are quite more males than female participating in TBE that year. What's more, the year of birth doesn't differ much, as most people are born in either 2000, 2001 or 2002. The differences between these years are not very interesting, as they are very close to each other. The most people answered no on the questions on start-up involvement, lived in a foreign country, followed entrepreneurship courses before and experience with finance administration. However, most people have followed classes on economics and accounting before, have directed

people and did have self-employed parents. What also could be concluded is that most respondents strive for a self-employed career after having gained more industry experience.

Characteristic (n = 54)	Category	N =	Sample%
Gender	Male	20	37,04%
	Female	34	62,96%
Year born	1999	4	7,41%
	2000	25	46,30%
	2001	29	53,70%
	2002	6	11,11%
Start-up involvement	Yes	10	18,52%
	No	44	81,48%
Self-employed parents	Yes	29	53,70%
	No	25	46,30%
Close-to you started business	Yes	39	72,22%
	No	15	27,78%
>3 months lived foreign country	Yes	16	29,63%
	No	38	70,37%
Followed entrepreneurship courses	Yes	7	12,96%
	No	47	87,04%
Followed classes economics and accounting	Yes	27	50,00%
	No	27	50,00%
Done finance administration before	Yes	19	35,19%
	No	35	64,81%
Directed people before	Yes	43	79,63%
	No	11	20,37%
Prefer self-employed career than organization	Definitely not	0	0,00%
	Not very likely	3	5,56%
	Not likely	6	11,11%
	Moderate	10	18,52%
	Likely	17	31,48%
	Very likely	10	18,52%
	Definitely yes	8	14,81%
Intend to become self-employed directly after graduation	Definitely not	5	9,26%
	Not very likely	9	16,67%
	Not likely	16	29,63%
	Moderate	14	25,93%
	Likely	7	12,96%
	Very likely	2	3,70%
	Definitely yes	1	1,85%
Self-employed when gained more industry experience	Definitely not	0	0,00%
	Not very likely	2	3,70%
	Not likely	3	5,56%
	Moderate	9	16,67%
	Likely	18	33,33%
	Very likely	13	24,07%
	Definitely yes	9	16,67%

Table 25: characteristics of IED dataset

Within the IED dataset, there were 54 valid respondents, 30 less than the TBE dataset. It's interesting to see that the gender distribution here is quite different, as there are more females than males following IED. The year of birth is here quite similar, however there are way less people born in 2002. The distributions are further quite similar to the TBE dataset. Once again, most people answered no on start-up involvement, lived in a foreign country, followed entrepreneurship courses and done finance administration before. Most people have directed people before, had self-employed parents and know people close to them that started a business. The distributions are quite equal for self-employed parents and followed classes on economics and accounting. Once again, most participants strive for a self-employed career, after having gained more industry experience.

Appendix G: Competence comparison

For the data-analysis, there is also looked at the number of answers given per answer option within the dataset. This is done by summing up the number of answers per EntreComp competence.

AA.1 Spotting opportunities

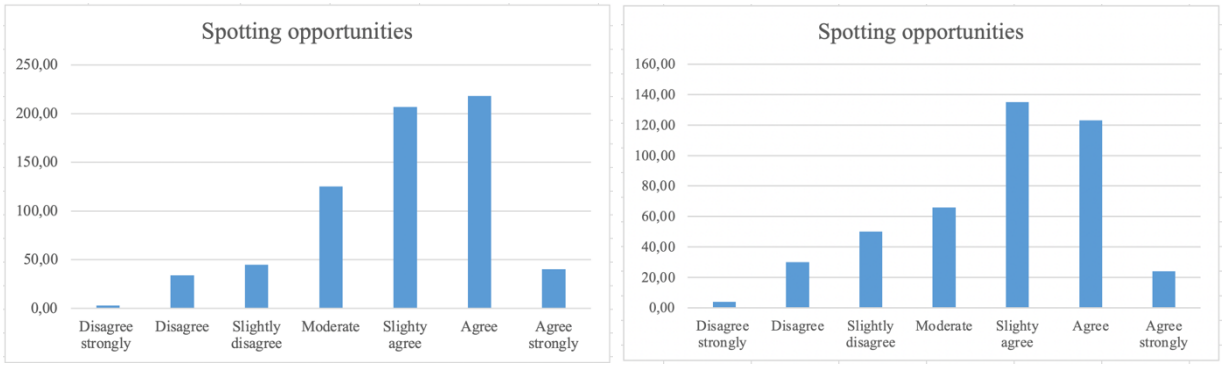

Table 26: "Spotting opportunities" scores for TBE (left) and IED (right)

As can be seen, the trend similar for both programmes. However, the tendency is more towards agree for TBE than for IED.

AA.2 Creativity

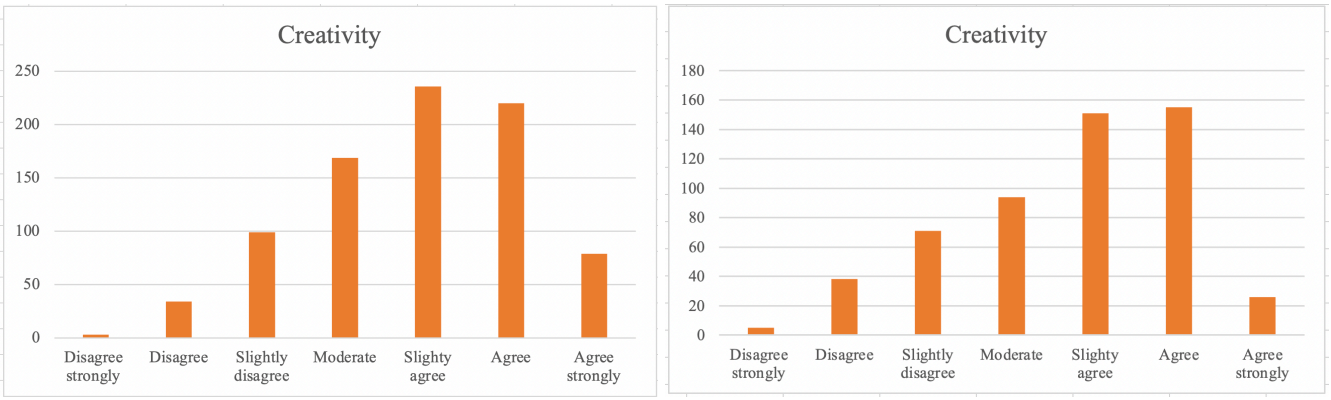

Table 27: "Creativity" scores for TBE (left) and IED (right)

For creativity, the trend is quite similar as well. For both programs, the most chosen answer is either slightly agree or agree.

AA.3 Vision

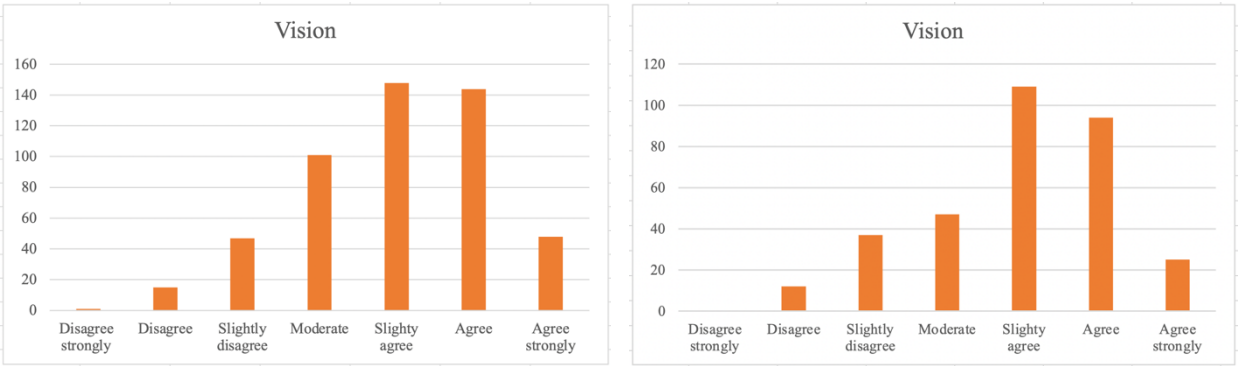

Table 28: "Vision" scores for TBE (left) and IED (right)

AA.4 Valuing ideas

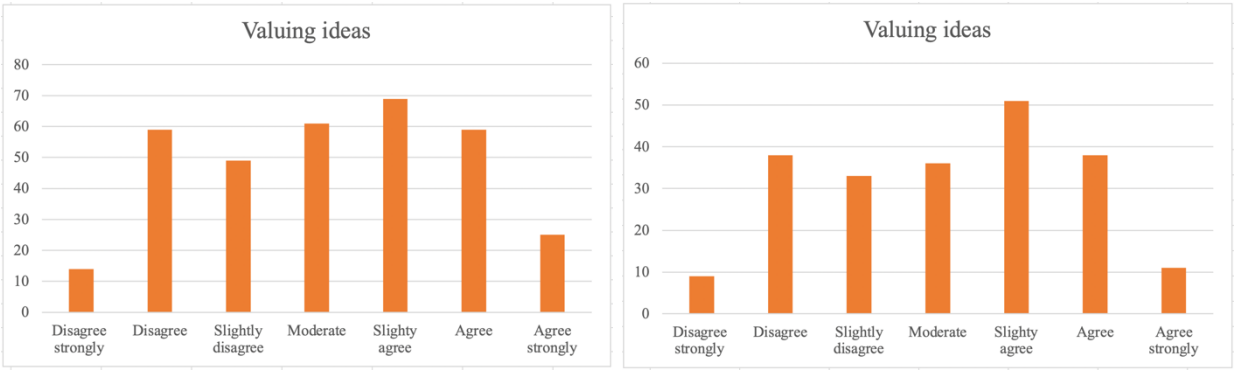

Table 29: "Valuing ideas" scores for TBE (left) and IED (right)

For "valuing ideas", a more divided pattern is observed.

AA.5 Ethical & sustainable thinking

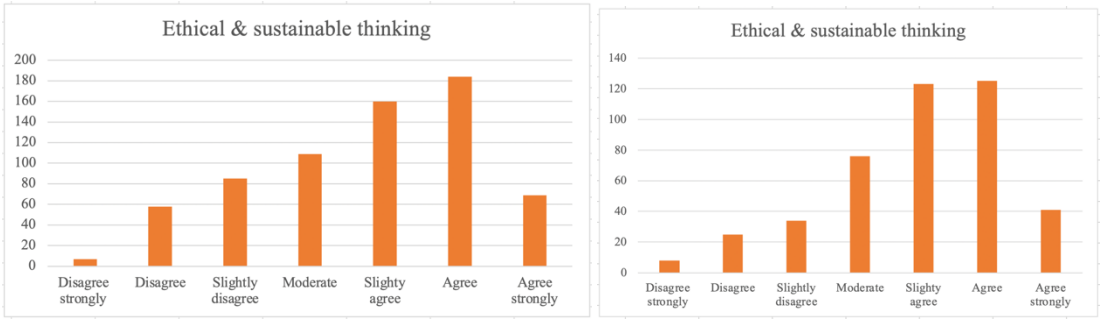

Table 30: "Ethical & sustainable thinking" scores for TBE (left) and IED (right)

AA.6 Self-awareness & self-efficacy

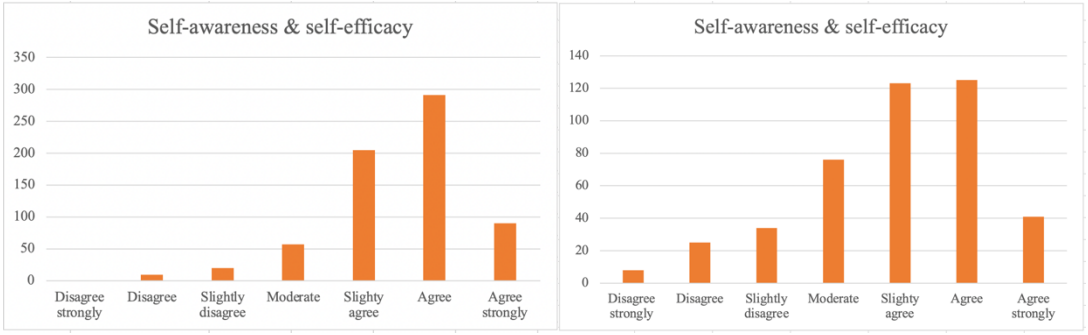

Table 31: "Self-awareness & self-efficacy" scores for TBE (left) and IED (right)

For self-awareness & self-efficacy, the tendency of answers is very to slightly agree and agree.

AA.7 Motivation & perseverance

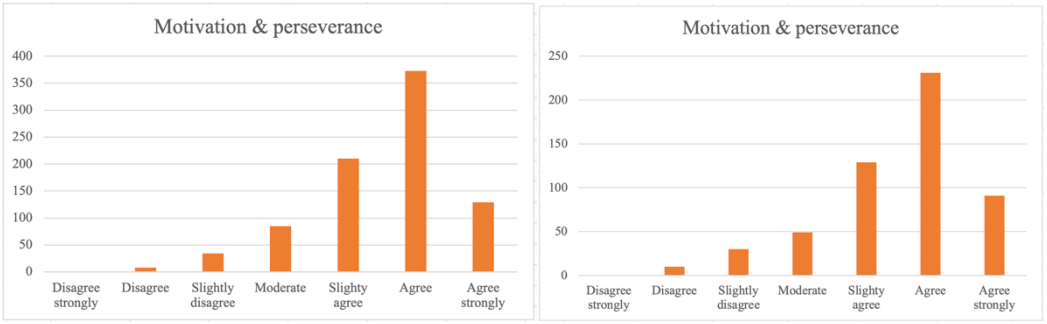

Table 32: "Motivation & perseverance" scores for TBE (left) and IED (right)

For motivation & perseverance, the tendency is very much towards "agree".

AA.8 Mobilising resources

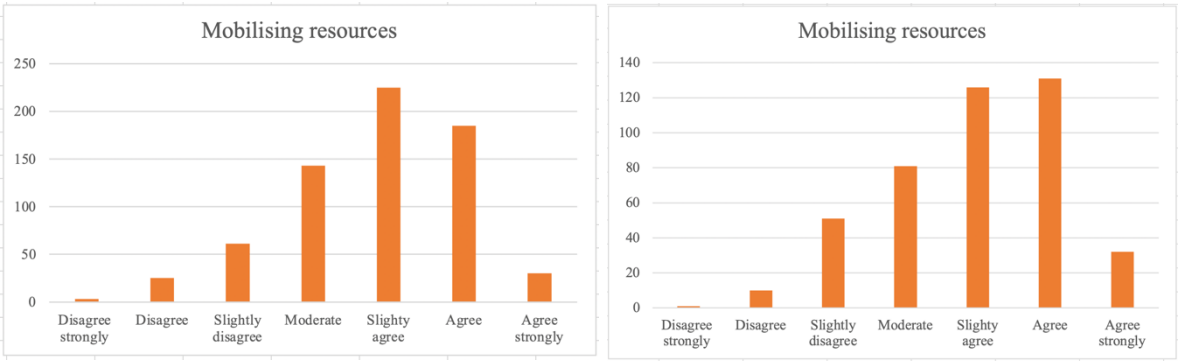

Table 33: "Mobilising resources" scores for TBE (left) and IED (right)

AA.9 Financial & economic literacy

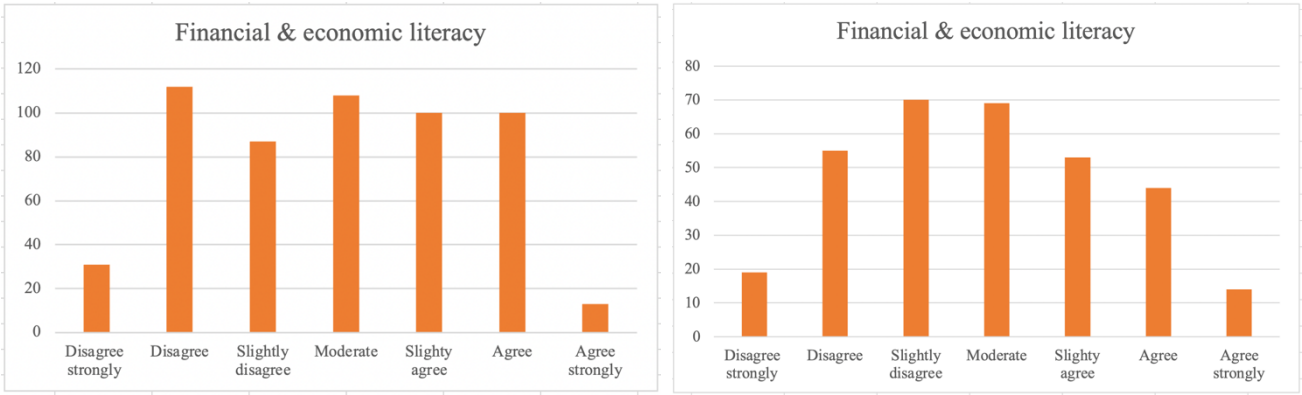

Table 34: "Financial & economic literacy" scores for TBE (left) and IED (right)

For the financial & economic literacy competence, there is a more divided trend.

AA.10 Mobilising others

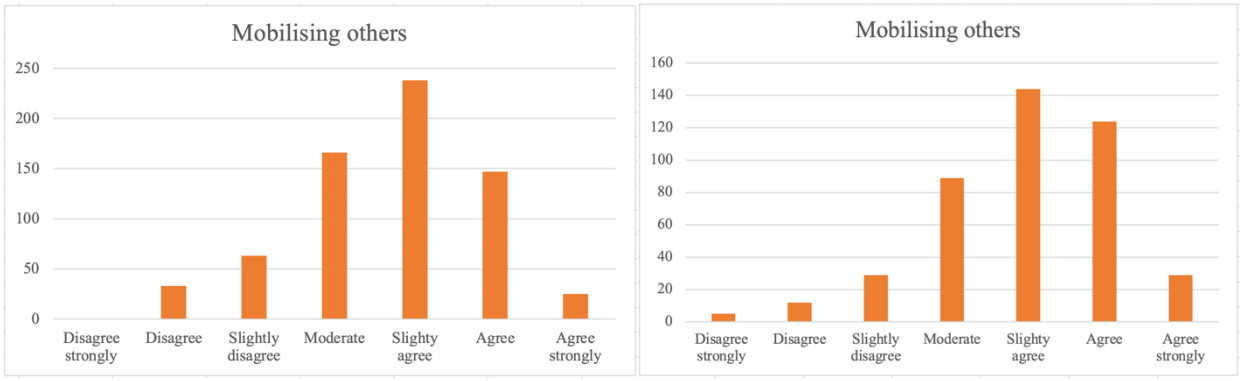

Table 35: "Mobilising others" scores for TBE (left) and IED (right)

AA.11 Taking the initiative

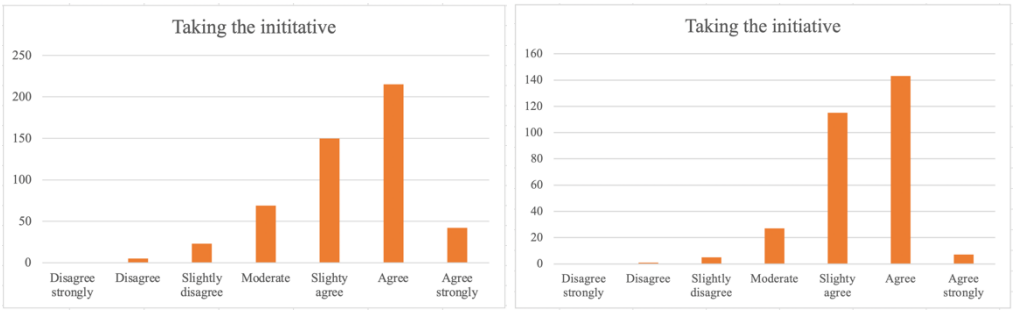

Table 36: "Taking the initiative" scores for TBE (left) and IED (right)

AA.12 Planning & management

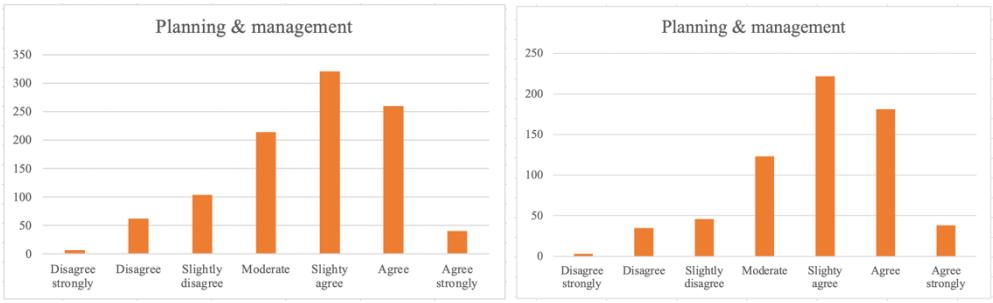

Table 37: "Planning & management" scores for TBE (left) and IED (right)

AA.13 Uncertainty, ambiguity & risk

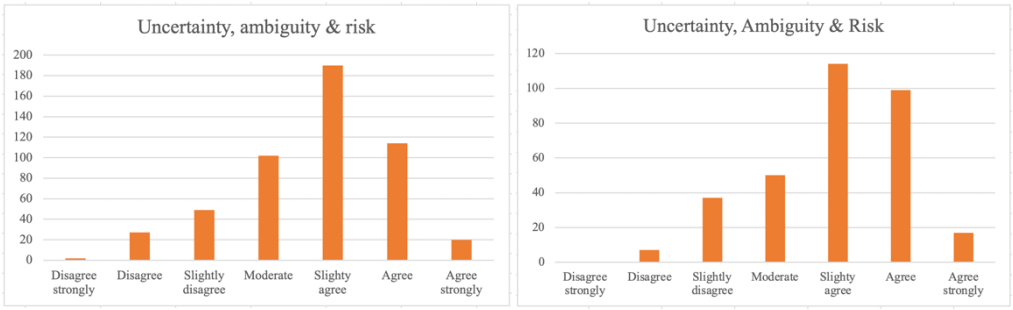

Table 38: "Uncertainty, ambiguity & risk" scores for TBE (left) and IED (right)

AA.14 Working with others

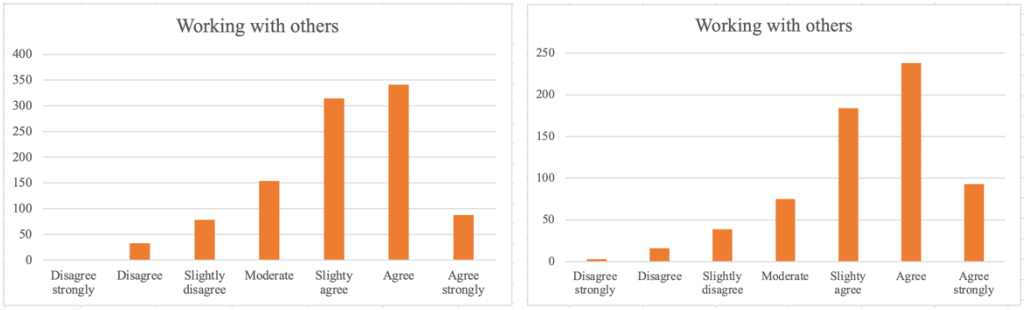

Table 39: "Working with others" scores for TBE (left) and IED (right)

AA.15 Learning through experience

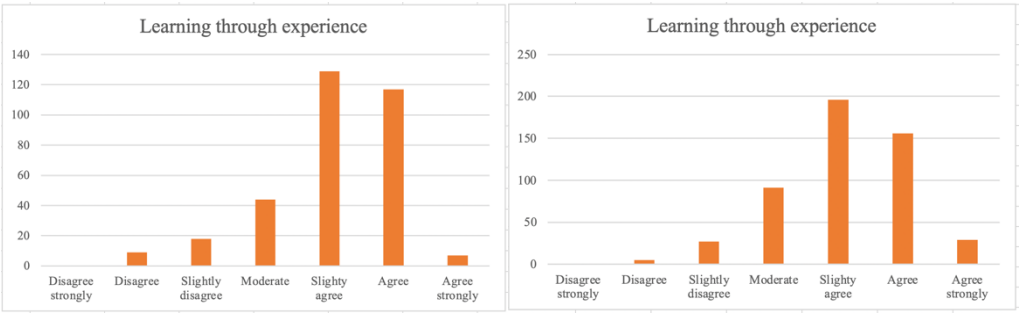

Table 40: "Learning through experience" scores for TBE (left) and IED (right)

Appendix H: Flyers IED and TBE

This appendix shows the flyers with information for upcoming students for both the Bachelor minor programmes technology-based entrepreneurship and international entrepreneurship & development.

Figure 25: IED flyer (Wakeling, 2023)

2 DELFT

De werknemers en oprichters van Chako. Zij moeten de door de TU-studenten bedachte machines bedienen. FOTO PRIVEBEZIT

TU-studenten pakken vervuiling Zanzibar aan

Course list

First quarter:

- Entrepreneuriall Thinking (4ECTS)
- Preparations for Intercultural Research Project (7 ECTS)
- Development, Sustainability & Impact (4ECTS)

Second quarter:

- Intercultural Integration Project (15 ECTS)

Please note

This programme is highly demanding. You will not have time to do any resits for other courses. Also, it requires a solid ability to adapt to a different cultural setting where you will work and live intensively with your team during the internship abroad

Above all, this programme is part of the ever-changing political and environmental global context. In the circumstances such as red or amber Dutch government travel advice, we must prioritise students' and partners' health and safety. This might mean you cannot travel abroad to your project's location. Instead, we will adapt by offering an internship based in the Netherlands, possibly combined with online interactions with stakeholders in the Global South. Such projects will be organised in cooperation with partners that can facilitate the intercultural learning goals of the programme.

Entry requirements

- Have fulltime availability for the programme (NO re-sits planned for semester 1)
- Being selected for the minor
- This minor is open for English speaking
- students

Application procedure

The full procedure and dates for applying for this minor will be published on: tudelft.nl/minors.

Be sure you have pre-registered for the minor on EduXchange.
As this is a selection minor, after pre-registration you still need to complete a short application.

Prepare a motivational video of max two minutes in which you convince us why we should select you. You will be able to submit a URL of the video in the application form below. In this video tell us:

- Why do you want to participate (how will this contribute to you as an individual and your future career)?
- What experience you have (e.g. through extra-curricular activities)?
- You may also want to highlight any culturally diverse or team-work experiences.
- Remember to illustrate your experiences with concrete examples.

The IED minor application form.

For any question regarding the application procedure, you can contact Gareth Wakeling: g.m.wakeling@tudelft.nl.

Minor coordinators

Gareth Wakeling
E: G.M.Wakeling@tudelft.nl

More information?

tudelft.nl/tbm/ied

TU Delft | Empowering Entrepreneurial Minds

March 2023

Figure 26: TBE flyer (Dolkens, 2023)

What subjects will you be taught?

The courses attached to this minor aim to provide a general but thorough introduction to the specific aspects of technology-based entrepreneurship. Each course highlights one or more aspects of “technopreneur-ship”. The curriculum is coherent and covers the main aspects of entrepreneurship. It draws from the TU-wide range of entrepreneurship-oriented disciplines:

- Introduction to Technology-Based Entrepreneurship
- Case study
- Product and service design & prototyping
- Finance for Entrepreneurs
- Business Marketing for Engineers
- Managing Startups

For whom?

This minor is intended for entrepreneurial undergraduate students from all faculties within TU Delft and external students from Erasmus University Rotterdam and Leiden University. A selection procedure may be part of the admission process. The language of the minor is English and the maximum number of students is set to 120.

For whom?

This is a non-selection minor. For further details of the registration procedures and deadlines please check: tudelft.nl/minors.

Minor coordinator

Drs T. L. Dolkens (Tom)

More information?

tudelft.nl/tbm/TechBas

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March 2023

Appendix I. Letter feedback request DCE

TU Delft
Delft University of Technology

SEN2331: CoSEM Master Thesis
"Analysis of Entrepreneurship Competencies' development among students"

Mitchell Looij
4957903

Data-analysis recommendations

Dear teacher/professor,

My name is Mitchell, and for my Master thesis I am conducting research to evaluate and test hypotheses on the 2022/2023 survey output for the minor programmes technology-based entrepreneurship (TBE) and international entrepreneurship and development (IED) at Delft Centre for Entrepreneurship. The questionnaire is based on the EU's EntreComp framework, which provides a self-assessment tool for entrepreneurial skills and resources.

The survey output contained 84 valid respondents for TBE, and 54 valid respondents for IED. All the answers were given at the ***beginning of the study programmes, in September 2022.*** *This means they only measure the self-assessment one point in time.*

Currently, I'm in the middle of the data-analysis in which I try to see relevant relation between the dependent and independent variables in the dataset. The hypotheses based on these interesting relationships could be confirmed (or not) and could therefore lead to interesting recommendations on the education programmes at DCE.

The survey was quite long, containing 119 questions all related to the competence of the EntreComp framework. Therewith, there were 12 socio-demographic background questions included to identify the type of respondent.

To give you a good overview of the background of the respondents, I've made on overview of the 12 socio-demographic questions for both surveys. Please see the appendix of this letter for a good overview.

The EntreComp framework contains 15 competences all related to entrepreneurial skills, which is shown here:

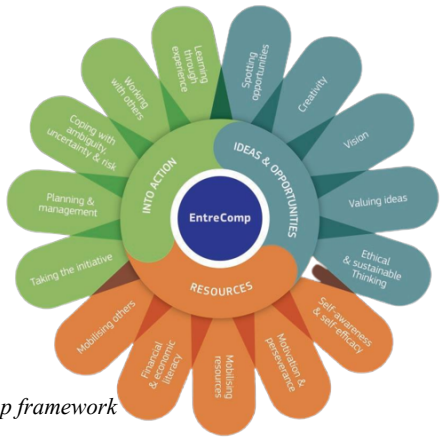

Figure 1: the EntreComp framework

In the survey, multiple questions were made per competence. I've also made an overview of the number of questions per competence:

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Mitchell Looij
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EntreComp Competence	Survey description	Questions
Spotting opportunities	"Use your imagination and abilities to identify opportunities for creating value. Identify and seize opportunities to create value by exploring the social, cultural and economic landscape. Identify needs and challenges that need to be met."	8
Creativity	"Develop several ideas and opportunities to create value, including better solutions to existing and new challenges."	10
Vision	"Develop a vision to turn ideas into action."	6
Valuing ideas	"Recognise the potential an idea has for creating value and identify suitable ways of making the most out of it."	4
Ethical & sustainable thinking	"Assess the consequences of ideas that bring value and the effect of entrepreneurial action on the target community, the market, society and the environment."	8
Self-awareness & self-efficacy	"Reflect on your needs, aspirations and wants in the short, medium and long term."	8
Motivation & perseverance	"Determined to turn ideas into action and satisfy your need to achieve."	10
Mobilising resources	"Get and manage the material, non-material and digital resources needed to turn ideas into action."	8
Financial & economic literacy	"Estimate the cost of turning an idea into a value-creating activity."	6
Mobilising others	"Get the support needed to achieve valuable outcomes."	8
Taking the initiative	"Act and work independently to achieve goals, stick to intentions and carry out planned tasks."	6
Planning & management	"Define priorities and action plans."	12
Uncertainty, ambiguity & risk	"Make decisions when the result of that decision is uncertain when the information available is partial or ambiguous, or when there is a risk of unintended outcomes."	6
Working with others	"Work together and co-operate with others to develop ideas and turn them into action."	12
Learning through experience	"Learn with others, including peers and mentors."	6

Table 1: EntreComp competencies, the survey description and number of questions per competence, also the dependent variables

To see relations and connections between the different variables in the dataset, I've made up 6 hypotheses so far. These are based on empirical research. However, you as teacher and expert being linked to DCE, might identify innovative and new relations between variables to be tested. Therefore, I ask for your input: what do you want to be analysed by me? In the table hereunder, I show the identified hypotheses so far:

	Null hypothesis, H0	Alternative hypothesis, H1
Hypothesis 1	"There will be no significant difference in the ability to spot opportunities between people involved in start-up companies and those who are not."	"People involved in start-up companies consider themselves better in spotting opportunities (Sanasi, 2023)."
Hypothesis 2 Significant	"There will be no significant difference in creativity scores between males and females."	"Females have a higher score on creativity than males (He & Wong, 2021)."
Hypothesis 3	"There will be no significant difference in the ability to mobilize others between individuals who have experience directing people and those who do not."	"People having experience directing people score better on the competence mobilizing others (Cakir & Adiguzel, 2020)."
Hypothesis 4	"There will be no significant difference in the ability to value ideas between individuals with self-employed parents and those without."	"People having experience in financial administration score better on the competence financial and economic literacy (Amagir et al., 2020)."
Hypothesis 5 Significant	"There will be no significant difference in the ability to value ideas between individuals with self-employed parents and those without."	"People with self-employed parents are better in valuing ideas (Lindquist et al., 2015)."
Hypothesis 6	"There will be no significant difference in scores on the Uncertainty, Ambiguity & Risk competence between individuals with self-employed parents and those without."	"People with self-employed parents score higher on uncertainty, ambiguity & risk (Chlosta et al., 2012)."

Table 2: the six identified and tested hypotheses so far.

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Mitchell Looij
4957903

So, do you want to see for example the relation between self-employed parents (independent variables) and the EntreComp competence "Spotting Opportunities"? Or do you see other interesting possible connections to be tested? Please help me with your input on interesting patterns, so I could test them and include them in my analysis for good recommendations. Feel free to reach out to me via m.b.looij@student.tudelft.nl or Ellen van Andel via mail, and I'll keep you updated what the results of the analysis will be.

Appendix J. Human Research Ethics Approval

Date 21-Apr-2023
Contact person Dr. Cath Cotton, Policy Advisor Academic Integrity
E-mail c.m.cotton@tudelft.nl

TU Delft Delft University of Technology

Human Research Ethics Committee TU Delft
(http://hrec.tudelft.nl)

Visiting address
Jaffalaan 5 (building 31)
2628 BX Delft

Postal address
P.O. Box 5015 2600 GA Delft
The Netherlands

Ethics Approval Application: "Analysis of Entrepreneurship Competencies' development among students"

Applicant: Looij, Mitchell

Dear Mitchell Looij,

It is a pleasure to inform you that your application mentioned above has been approved.

Thanks very much for your submission to the HREC which has been conditionally approved. Please note that this approval is subject to your ensuring that the following condition is fulfilled:

1) How will you recruit participants? Make sure that participants don't feel in any way pressured to partake in your research.

In addition to any specific conditions or notes, the HREC provides the following standard advice to all applicants:

- In light of recent tax changes, we advise that you confirm any proposed remuneration of research subjects with your faculty contract manager before going ahead.
- Please make sure when you carry out your research that you confirm contemporary covid protocols with your faculty HSE advisor, and that ongoing covid risks and precautions are flagged in the informed consent with particular attention to this where there are physically vulnerable (eg: elderly or with underlying conditions) participants involved.
- Our default advice is not to publish transcripts or transcript summaries, but to retain these privately for specific purposes/checking; and if they are to be made public then only if fully anonymised and the transcript/summary itself approved by participants for specific purpose.
- Where there are collaborating (including funding) partners, appropriate formal agreements including clarity on responsibilities, including data ownership, responsibilities and access, should be in place and that relevant aspects of such agreements (such as access to raw or other data) are clear in the Informed Consent.

Good luck with your research!

Appendix K. Data Management Plan

"Analysis of Entrepreneurship Competencies' development among students"

0. Administrative questions

1. Name of data management support staff consulted during the preparation of this plan.

My faculty data steward, Nicolas Dintzner, has reviewed this DMP on 13/04/2023.

2. Date of consultation with support staff.

2023-04-13

I. Data description and collection or re-use of existing data

3. Provide a general description of the type of data you will be working with, including any re-used data:

Type of data	File format(s)	How will data be collected (for re-used data: source and terms of use)?	Purpose of processing	Storage location	Who will have access to the data
Anonymised survey data evaluating DCE courses from two past academic years	.csv files	Re-use of existing data from DCE	To understand the current way of student assessment and course evaluation	Onedrive	Research supervisors and the project team (Victor Scholten and Ellen van Andel)
Qualitative anonymous interview data on reviewing new assessment methods	.docx files	Face-to-face interviews	To understand and analyze opinions on new assessment methods	Onedrive	Research supervisors and the project team (Victor Scholten and Ellen van Andel)
Quantitative data on new assessment method	.docx files/.csv files	Online survey	To review and analyze the answers given on decision-making	Onedrive	Research supervisors and the project team (Victor Scholten and Ellen van Andel)
Audio file on interviews	aac file	iPhone	To rephrase interview data	Onedrive	Research supervisors and the project team (Victor Scholten and Ellen van Andel)

4. How much data storage will you require during the project lifetime?

- < 250 GB

II. Documentation and data quality

5. What documentation will accompany data?

- Methodology of data collection

III. Storage and backup during research process

6. Where will the data (and code, if applicable) be stored and backed-up during the project lifetime?

- OneDrive

IV. Legal and ethical requirements, codes of conduct

7. Does your research involve human subjects or 3rd party datasets collected from human participants?

- Yes

8A. Will you work with personal data? (information about an identified or identifiable natural person)

If you are not sure which option to select, ask your Faculty Data Steward for advice. You can also check with the privacy website or contact the privacy team: privacy-tud@tudelft.nl

- Yes

8B. Will you work with any other types of confidential or classified data or code as listed below? (tick all that apply)

If you are not sure which option to select, ask your Faculty Data Steward for advice.

- No, I will not work with any confidential or classified data/code

9. How will ownership of the data and intellectual property rights to the data be managed?

For projects involving commercially-sensitive research or research involving third parties, seek advice of your Faculty Contract Manager when answering this question. If this is not the case, you can use the example below.

The datasets underlying the published papers will be publicly released following the TU Delft Research Data Framework Policy. During the active phase of research, the first supervisor from TU Delft will oversee the access rights to data. They will be released publicly no later than at the time of publication of corresponding research papers.

10. Which personal data will you process? Tick all that apply

- Data collected in Informed Consent form (names and email addresses)
- Gender, date of birth and/or age
- Email addresses and/or other addresses for digital communication
- Names and addresses

No addresses will be saved.

11. Please list the categories of data subjects

Students of DCE

12. Will you be sharing personal data with individuals/organisations outside of the EEA (European Economic Area)?

- No

15. What is the legal ground for personal data processing?

- Informed consent

16. Please describe the informed consent procedure you will follow:

Three essential elements make up the informed consent process: (1) providing potential research participants with the information they need to make an informed choice; (2) facilitating their understanding of what has been disclosed; and (3) encouraging their decision to participate in the study to be voluntary. All participants will be asked for a checked consent before the start of the interview/assessment method.

17. Where will you store the signed consent forms?

- Same storage solutions as explained in question 6

18. Does the processing of the personal data result in a high risk to the data subjects?

If the processing of the personal data results in a high risk to the data subjects, it is required to perform a Data Protection Impact Assessment (DPIA). In order to determine if there is a high risk for the data subjects, please check if any of the options below that are applicable to the processing of the personal data during your research (check all that apply).
If two or more of the options listed below apply, you will have to complete the DPIA. Please get in touch with the privacy team: privacy-tud@tudelft.nl to receive support with DPIA.
If only one of the options listed below applies, your project might need a DPIA. Please get in touch with the privacy team: privacy-tud@tudelft.nl to get advice as to whether DPIA is necessary.
If you have any additional comments, please add them in the box below.

- None of the above applies

22. What will happen with personal research data after the end of the research project?

- Personal data will be shared with others - please explain which personal data will be shared, with whom, how and whether you have specified this in the informed consent form

All the data is anonymised and checked if tracing is possible based on the interviews. No personal data of the participants will be shared.

23. How long will (pseudonymised) personal data be stored for?

- Other - please state the duration and explain the rationale below

Data will be shared with the first supervisor Ellen and will be deleted at a minimum of 1 month after defence.

24. What is the purpose of sharing personal data?

- For research purposes, which are in-line with the original research purpose for which data have been collected

25. Will your study participants be asked for their consent for data sharing?

- Yes, in consent form - please explain below what you will do with data from participants who did not consent to data sharing

If no consent is given for the sharing of (anonymized) data, the assessment/interview will not be held.

V. Data sharing and long-term preservation

27. Apart from personal data mentioned in question 22, will any other data be publicly shared?

- All other non-personal data (and code) underlying published articles / reports / theses

29. How will you share research data (and code), including the one mentioned in question 22?

- My data will be shared in a different way - please explain below

The data will be shared together with the public release of the thesis only with the supervisor.

30. How much of your data will be shared in a research data repository?

- < 100 GB

31. When will the data (or code) be shared?

- As soon as corresponding results (papers, theses, reports) are published

32. Under what licence will be the data/code released?

- CC BY-ND

VI. Data management responsibilities and resources

33. Is TU Delft the lead institution for this project?

- Yes, leading the collaboration - please provide details of the type of collaboration and the involved parties below

34. If you leave TU Delft (or are unavailable), who is going to be responsible for the data resulting from this project?

The first supervisor of this project, Ellen.

35. What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

Data will be checked upon regularly. In terms of financial, I rely on safety protocols and procedures from the TU Delft. Data management will be done by the project team.

Appendix L. Conjoint analysis design

In this appendix L, the conjoint analysis design is discussed and promoted, as it was one of the first ideas to perform under DCE students.

TU Delft

Q1. **Explanation about this survey**

This survey is based on testing choices associated with the Entrecomp framework. This model is divided into three main components: "Ideas & Opportunities", "Resources" and "Into Action". Each one of them presents five competences which are important to develop an entrepreneurial mindset. According to Entrecomp, 15 transversal and soft skills have been identified as key components for the development of an entrepreneurial mindset which are interrelated and interconnected and should be treated as part of a whole. To test which choices people make when developing their entrepreneurial mindset and skills, this survey uses a choice experiment. As a respondent, we will present you with 9 questions, in which you must each time make a choice between 3 combinations of competencies, each originating from one of the three main components. Based on your socio-demographic characteristics and choices of factors, we can measure what the choices are based on and where expectations can be made for education (Delft Center for Entrepreneurship) in their education. In the end, we want you to choose which combination of three competencies you would like to develop the most in the upcoming education program.

Explanation about the Entrecomp framework

The European Union has translated the concept of "entrepreneurship" into a model that can be used to talk about entrepreneurship in a universal way: the Entrepreneurship Competence Framework, or EntreComp. This model is divided into three main components: "Ideas & Opportunities", "Resources" and "Into Action". Each of them presents five competencies important to develop an entrepreneurial mindset. Being entrepreneurial enables people to act and transform into shared value ideas and opportunities. The promotion of entrepreneurial learning informs citizens how to keep up in a changing environment so that they can adapt more quickly to changes but also get a grip on their future. Please take into account the following Entrecomp framework:

Figure 1: EntreComp framework (Bacigalupo et al., 2016)

Figure 27: first page of conjoint analysis design

As can be seen figure 27, the first page introduces the survey and EntreComp framework to the DCE students. It's made clear that the conjoint analysis let them choose three combinations of EntreComp competencies. In the end, they have to choose the combination of competencies which they would like to develop the most in the education program.

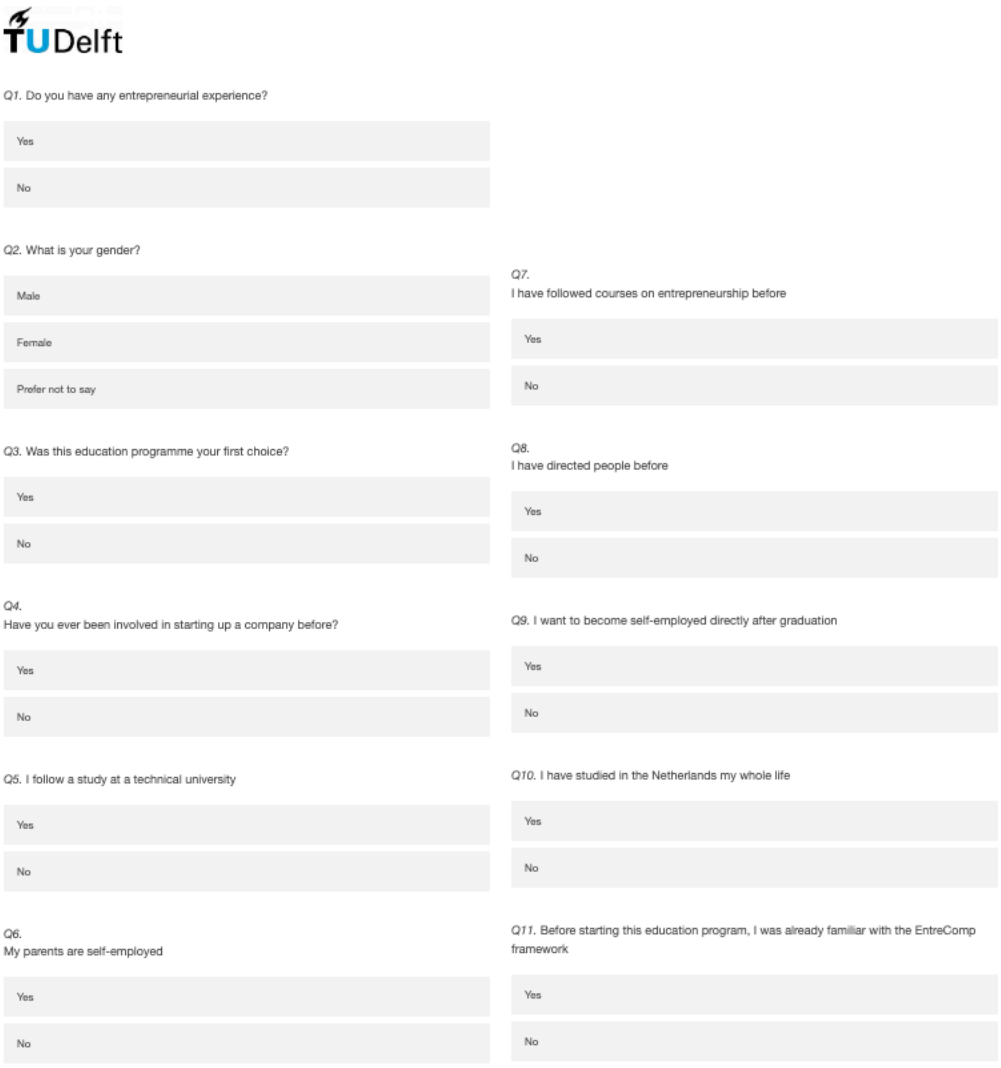
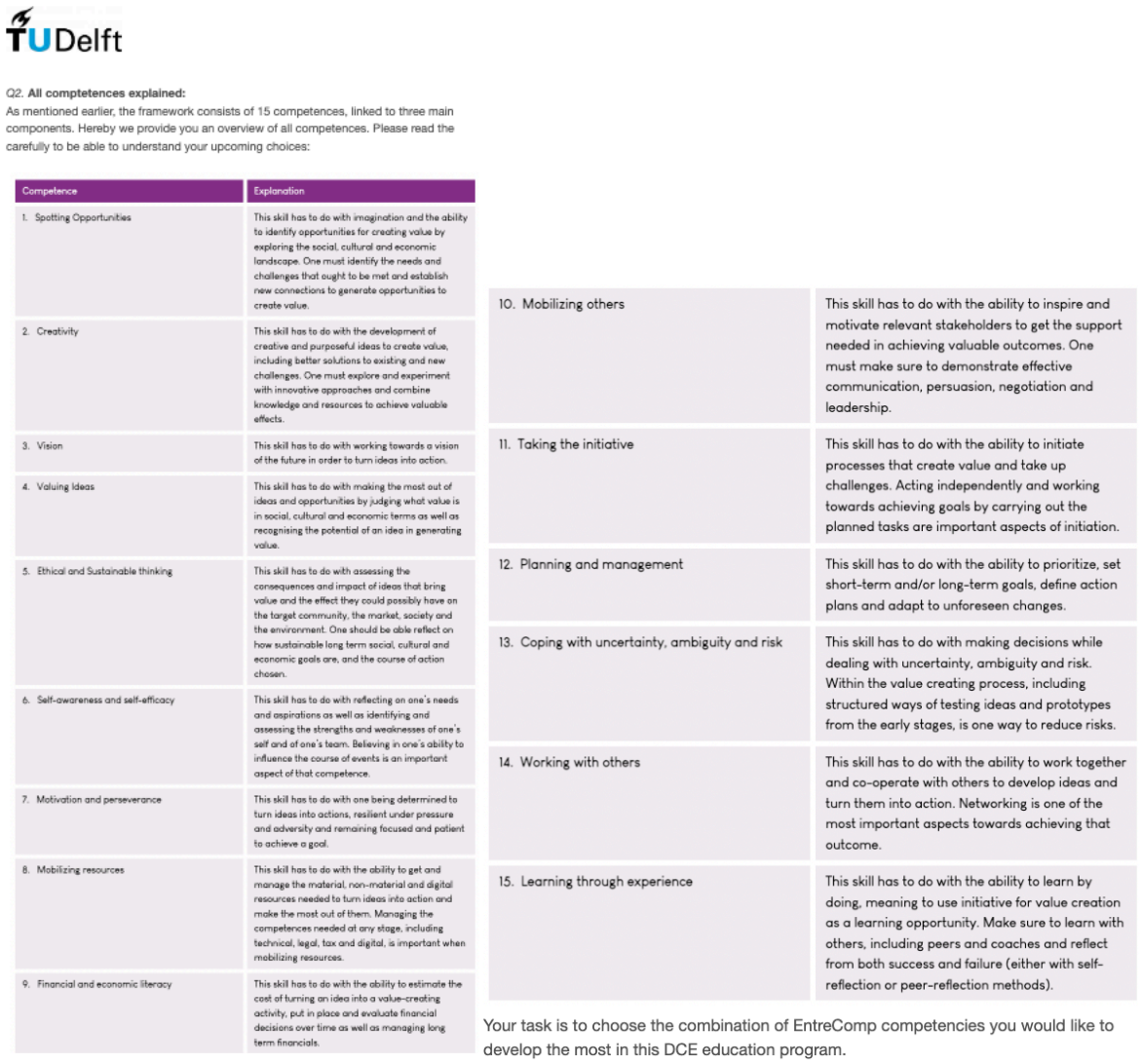


Figure 28: page two of the conjoint analysis including socio-demographic background questions

This page asks after the socio-demographixc background of the students. This is partly based on the survey of Scholten et al. (2022), as see able in appendix E. However, questions are also included on the familiarness with EntreComp, the technical background of the students, and if the student have studied in Netherlands his whole life.



TU Delft

Q2. **All competences explained:**
As mentioned earlier, the framework consists of 15 competences, linked to three main components. Hereby we provide you an overview of all competences. Please read the carefully to be able to understand your upcoming choices:

Competence	Explanation
1. Spotting Opportunities	This skill has to do with imagination and the ability to identify opportunities for creating value by exploring the social, cultural and economic landscape. One must identify the needs and challenges that ought to be met and establish new connections to generate opportunities to create value.
2. Creativity	This skill has to do with the development of creative and purposeful ideas to create value, including better solutions to existing and new challenges. One must explore and experiment with innovative approaches and combine knowledge and resources to achieve valuable effects.
3. Vision	This skill has to do with working towards a vision of the future in order to turn ideas into action.
4. Valuing Ideas	This skill has to do with making the most out of ideas and opportunities by judging what value is in social, cultural and economic terms as well as recognising the potential of an idea in generating value.
5. Ethical and Sustainable thinking	This skill has to do with assessing the consequences and impact of ideas that bring value and the effect they could possibly have on the target community, the market, society and the environment. One should be able reflect on how sustainable long term social, cultural and economic goals are, and the course of action chosen.
6. Self-awareness and self-efficacy	This skill has to do with reflecting on one's needs and aspirations as well as identifying and assessing the strengths and weaknesses of one's self and of one's team. Believing in one's ability to influence the course of events is an important aspect of that competence.
7. Motivation and perseverance	This skill has to do with one being determined to turn ideas into actions, resilient under pressure and adversity and remaining focused and patient to achieve a goal.
8. Mobilizing resources	This skill has to do with the ability to get and manage the material, non-material and digital resources needed to turn ideas into action and make the most out of them. Managing the competences needed at any stage, including technical, legal, tax and digital, is important when mobilizing resources.
9. Financial and economic literacy	This skill has to do with the ability to estimate the cost of turning an idea into a value-creating activity, put in place and evaluate financial decisions over time as well as managing long term financials.
10. Mobilizing others	This skill has to do with the ability to inspire and motivate relevant stakeholders to get the support needed in achieving valuable outcomes. One must make sure to demonstrate effective communication, persuasion, negotiation and leadership.
11. Taking the initiative	This skill has to do with the ability to initiate processes that create value and take up challenges. Acting independently and working towards achieving goals by carrying out the planned tasks are important aspects of initiation.
12. Planning and management	This skill has to do with the ability to prioritize, set short-term and/or long-term goals, define action plans and adapt to unforeseen changes.
13. Coping with uncertainty, ambiguity and risk	This skill has to do with making decisions while dealing with uncertainty, ambiguity and risk. Within the value creating process, including structured ways of testing ideas and prototypes from the early stages, is one way to reduce risks.
14. Working with others	This skill has to do with the ability to work together and co-operate with others to develop ideas and turn them into action. Networking is one of the most important aspects towards achieving that outcome.
15. Learning through experience	This skill has to do with the ability to learn by doing, meaning to use initiative for value creation as a learning opportunity. Make sure to learn with others, including peers and coaches and reflect from both success and failure (either with self-reflection or peer-reflection methods).

Your task is to choose the combination of EntreComp competencies you would like to develop the most in this DCE education program.

Figure 29: third page explaining all EntreComp competences separately (Bacigalupo et al., 2016)

This page once more explains all EntreComp that need to be traded off separately.

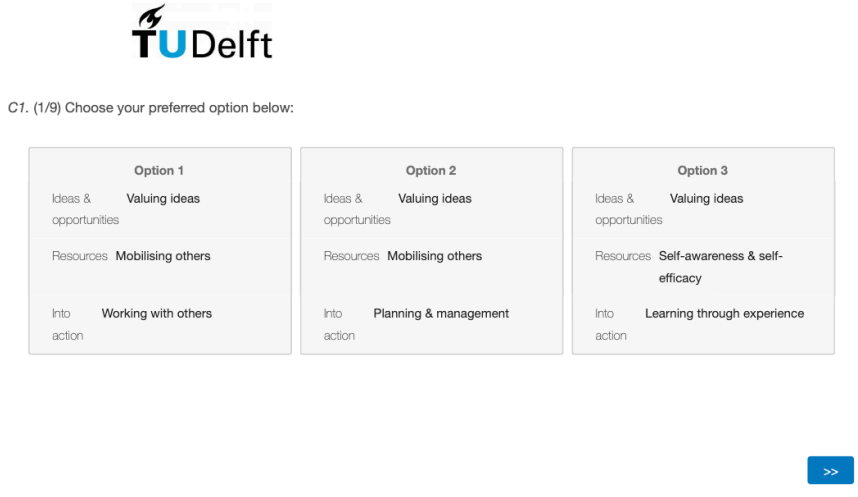


Figure 30: combinations of EntreComp competencies to choose from

As last, Figure 30 shows the three packages where the students can choose from. The packages are automatically generated by Qualtrics. In this case, three options are given and in total the students are asked to make 9 choices. However, the number of options per question and number of questions can of course be changed. When asked more options per question and more questions per respondent, the fewer respondents needed.