Should we stop looking for common grounds and start embracing our differences?
- Entrepreneurship education in an Engineering context

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Should we stop looking for common grounds and start embracing our differences?
- Entrepreneurship education in an Engineering context

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Introduction
Throughout the past decades there has been an academic focus on defining what entrepreneurship is and, depending on the answer, whether or not it can be taught. The definitions range from starting and running a business venture to trait theories, mindsets and a method, (i.e (Sarasvathy S. D., What makes entrepreneurs entrepreneurial, 2001) (Shane & Venkataraman, 2000) (Spinosa, Flores, & Dreyfus, 1997)). The first definition is still the most prevailing in the general public though academics have moved beyond the traditional business related explanation. Furthermore it is no longer discussed whether or not entrepreneurship can be taught but more how it should be taught (Kuratko, 2005).

In many countries, as a result of the intense governmental focus on entrepreneurship, educational institutes are met with the challenge of educating entrepreneurial candidates. This has catalyzed the discussion of how entrepreneurship should be taught in the most effective manner (i.e (Handacombe, Rodrigues-Falcon, & Patterson, 2008) (Hannon P. , 2006) (Kurato, 2005) (Bager L. , Blenker, Rasmussen, & Thrane, 2010) (Kirketerp A. L., 2012) (Moberg, 2014)) and various generic models and frameworks have been developed.

The premise behind this paper is that the varying understandings of entrepreneurship and different approaches to entrepreneurship education, is rooted in the fact that across disciplines there are different purposes and target groups for entrepreneurship education and therefore different approaches to it. The main goal and application of entrepreneurship education can both within and between the disciplines vary from developing the student’s ability to engage in cross disciplinary self-managed team work to actual increase the likelihood of students behaving entrepreneurially in the future either in established organizations, in their own start-up or even in projects with social or cultural value creation as main purpose. If we have different purposes with entrepreneurship education and disciplinary differentiated target groups at different levels of progression are we then talking about the same thing? And do the different purposes and target groups call for diverse methodologies and training of different sets of skills and competences?

What happens if we ask the question:” What is effective entrepreneurship education in a specific discipline?” Will that enable us to get a more nuanced understanding of the “elephant” (Gartner, 2001)?

The following paper seeks to exemplify the research impact of using educational disciplines as contextual framing of entrepreneurship education. Yielding the following research questions: What is

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1 This Research was partially funded by The Danish Foundation of Entrepreneurship- Young Enterprise
the purpose, challenges and opportunities of entrepreneurship education in the field of Engineering and how does it affect the pragmatically best methodology of effective entrepreneurship education?

**In Theory**

*What is entrepreneurship?*

This article is based on an understanding of entrepreneurship as mean driven behavior related to opportunities that result in value creation for others (Sarasvathy S. D., *What makes entrepreneurs entrepreneurial*, 2001) (Drabbe, 2014).

According to theory there are different determinants of behavior. Theo Poiesz suggests, with his triade model, that there are three elements that determine behavior, motivation (M), ability (A) and opportunity (O) (Poiesz, 2014).

*Figure 1: The Triad Model*

![Figure 1: The Triad Model](Poiesz, 2014)

This implies that in order to act entrepreneurially one must to some extent be motivated to achieve the result of this behavior. According to motivational theory, like Herzberg’s and Alderfer’s, it depends on the individual what motivates them, hence making the entrepreneurial process highly individual.

Furthermore one must have an opportunity to act entrepreneurially making entrepreneurship context dependent and also amplifying the individual dependency according to the theory that opportunities exist in a nexus between the individual and the process.

*Figure 2: The Nexus of opportunity*

![Figure 2: The Nexus of opportunity](Based on an interpretation of (Shane & Venkataraman, 2000) originating from (Blenker P. &., 2009))
Finally according to the triade model one must to some extent have the abilities to act entrepreneurially. The ability parameter suggests that that in order to behave entrepreneurially a set of skills and competences is required. It is by many believed that these skills and competences can be learned, leading us to the topic of entrepreneurship education.

*Entrepreneurship education- Why, Where, Who, What, and How*

Often I am met with the question of “Why entrepreneurship education?” and depending on from what angle you look at it there are numerous reasons:

From a *governmental* perspective, based on an assumed link between entrepreneurship education and future economic growth (Kuratko, 2005), entrepreneurial candidates are needed to ensure growth in the economy and to help sustain the favorable position of the old industrialized countries, which are threatened by decrease in competitive ability and the recovery from the financial crisis, by being drivers of innovation and value creation.

For the *student* entrepreneurship education enables them to develop skills and competences they can use to take charge of their future and to navigate in the uncertainty that awaits them after ended studies. (Gibb, 2010) (Venkataraman, Sarasvathy, Dew, & Foster, 2012)

From an *educational* perspective educating through entrepreneurship, if framed right, is experienced to motivate and engage the students, activating their curiosity and giving them a sense of ownership, supporting their learning process and inspiring them to assume responsibility of their own learning.

One could argue that this is learning for life versus learning for exams.

In terms of answering the questions of “Where”, Handscombe et all (Handcombe, Rodrigues-Falcon, & Patterson, 2008) and Kevin Hindle (Hindle, Teaching entrepreneurship at university: from the wrong building to the right philosophy, 2007) are proponents of ending the business schools monopoly on entrepreneurship education and embedding entrepreneurship education in existing programs rather than having it as a separate entity in itself that can be elected moreover answering the “Who” question with the exciting faculty members.

With multiple forms and purposes of entrepreneurship education (Robinson & Blenker, 2014) the “How” and “What” of effective entrepreneurship education is vividly discussed. A development is seen in the methods used in entrepreneurship education from didactic teaching methods to experiential learning as main teaching method (Hägg & Gabriëlssoon, 2014). This development is supported by research showing that the greatest impact of entrepreneurship education is found not when educating about or for entrepreneurship but through it (Moberg, 2014). Though there arguably lies a natural progression from educating about and for entrepreneurship to educating through entrepreneurship.

In terms of what skills and competences should be developed in entrepreneurship education, the Progression Model (Rasmussen & Nybye, 2013) proposes a set of broadly defined entrepreneurial skills and competences, which they divide into four dimensions, Action, Creativity, Environment and Attitude.
In the model the dimensions are described as follows:

**Action**
Action is understood as a pupil’s or student’s ability and desire to implement value creating initiatives, as well as the ability to realize these initiatives through cooperation, networking and partnerships (Kirketerp 2010; Venkataraman et al. 2012; Sarasvathy & Venkataraman 2011; West 2004). At the same time it is the ability to communicate in a purposive way and to organize, specify, plan and lead activities. The dimension of action also includes the ability to analyze and handle risk (Knight 1921).

**Creativity**
Creativity is understood as the ability to discover and create ideas and opportunities (Shane & Venkataraman, 2000). It is also the ability to combine knowledge, experience and personal resources from different areas in new ways (Sarasvathy S., Causation and effectuation: toward a theoretical shift from economic inevitability to entrepreneurial contingency, 2001); (Herlau & Tetzchner, 2004). Creativity is also the ability to create and revise personal perceptions, to experiment and improvise in order to solve problems and meet challenges (Tanggaard, 2010).

**Environment**
Understanding the environment is perceived as knowledge about and understanding of the world, locally as well as globally. Likewise it is the ability to analyze a context socially, culturally and economically as a setting for value-creating actions and activities (Venkataraman, Sarasvathy, Dew, & Foster, 2012). Understanding the environment is also an understanding of global issues and problems, such as for instance sustainability, environmental issues and resources.

**Attitude**
Attitude is the personal and subjective resources with which students meet challenges and tasks. It is the faith in one’s own ability to act in the world and thus to realize dreams and plans (Pajares, 1996). Personal attitude is based on the ability to work consistently and overcome ambiguity, uncertainty and complexity. It is also the ability to accept and learn from others’ and own failures (Kirketerp A., Pædagogik og didaktik i entreprenørskabsundervisningen, 2010) (Detienne & Chandler, 2004) and to make ethical evaluations and reflections

Source: (Rasmussen & Nybye, 2013)

The model further suggests that in an educational context these dimensions are influenced by the core subject of the professions and study programs. Furthermore with the expansion of knowledge and solidification of professional skills and competences throughout education, one could argue the sample space of the student’s nexus of opportunity (Shane & Venkataraman, 2000) (Blenker P. &., 2009) (Blenker, Frederiksen, Korsgaars, Müller, Neergaard, & Thrane, 2012) expands along with their ability to act entrepreneurially, which according to the triade model potentially will increase the likelihood of students acting entrepreneurially. Advocating the importance of a solid core education as the foundation of the entrepreneurial value creation.

In terms of education methodology there is a continuum ranging from a generic “one size fits all” approach to the resource demanding truly individual centered entrepreneurship education that Blenker et al are advocating (Blenker, Frederiksen, Korsgaars, Müller, Neergaard, & Thrane, 2012).

*Figure 3: Entrepreneurship education, from one extreme to another*

<table>
<thead>
<tr>
<th>Generic</th>
<th>Discipline specific</th>
<th>Individual centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>One size fits all</td>
<td>Mass customization</td>
<td>Customization</td>
</tr>
</tbody>
</table>

Source: Own contribution
In practice at educational institutes the generic approach is often prevailing, due to the structure and frame factors of curricular activities. General methodological frameworks for entrepreneurship education have been developed like the KIE-Model (Jensen & Kromann-Andersen, 2009) and the ME2 model (ME2- Model for entrepreneurial education, 2013). In between the methodological two extremes is discipline specific entrepreneurship education, a sort of mass customized entrepreneurship education, advocated by Jones and Matlay (Jones & Matley, 2011). Given limited resources at the educational institutes, prohibiting the individual centered education, and the context and individual dependency of entrepreneurship, that challenges generic education, maybe the key to efficient and effective entrepreneurship education is in the discipline specific education. Defining context in entrepreneurship education by discipline may also enable the development of a deeper understanding of what effective entrepreneurship education is. For this reason I ask: Should we stop looking for common grounds and embrace our differences, in order to lift entrepreneurship education to the next level? Leading to the question “What do educators need to customize, the pedagogy, didactics and/or methods of entrepreneurship education?” If we initially define the context and target group based on educational programs, as prior mentioned actionable research questions like: “What is the purpose, challenges and opportunities of entrepreneurship education in the field of Engineering and how does it affect the pragmatically best methodology of effective entrepreneurship education?” emerges. To exemplify the potential dredging of effective entrepreneurship education context framing the research can bring, the following will focus on what challenges and opportunities arise when focusing on entrepreneurship education in an engineering context.

Methodology
To answer the question: “What is the purpose(s), challenges and opportunities of entrepreneurship education in the field of engineering and how does it affect the pragmatically best didactic methodology of effective entrepreneurship education?” two questions are raised:
1: What characterizes engineering students, what is their professional heritage and perceived professional identity?
2: How does the engineering student’s professional heritage and identity influence their ability to engage in entrepreneurial behavior/processes?
Answering these questions should consequently shed some light on what the purpose of entrepreneurship education is in the field of engineering and enable discussion on didactic methodology.
Initially a theoretical literature study in done in order to answer the two questions stated above. Furthermore an empirical study is done as a longitudinal single case study. To circumvent potential methodological problems, limit the focus of the case study and ensure comparability for future research and development purposes Blenker et al’s suggested integrative framework is applied to the extent possible (Blenker, Elmholdt, Korsgaard, & Wagner, 2014). Empirical richness is ensured by multi-sourced data collection, student interviews conducted by “outsiders”, student surveys, lesson plans,
course description, grading and lecturer observations is triangulated to increase the validity and reliability of the case study.

Results
In the following the results of the literature review and case study is disclosed

The engineering bird in hand – History and Identity
In theory difficulties prevails in defining what engineering is and who is an engineer, a symptom of this is the tendency of circular definitions (Mitcham, 2009), an engineer is a person who conducts engineering and engineering is the activities conducted by an engineer. To get a more tangible understanding of the field a brief review of the history of engineering is done and a study of engineering student’s own perception of their professional identity is presented.

History
The field of engineering has a military origin (Mitcham, 2009). Engineers solved to concrete problems of strategic relevance in war and defense, rendering the engineer mission critical and failing fatal. The term civil engineer was later introduced to describe people with similar functions in a non-military setting (Mitcham, 2009) (Wagner, 2006). The engineer’s new role in society fostered a deeper state interdependency, the engineers solved concrete problems for the state i.e. issues relating to infrastructure and supplies, and the state ensured engineering education and thereby the legitimacy of the field.

With the industrialization the link between engineers and technical paradigm was solidified. Engineering was set equal to progression (Wisnioski, 2009). The purpose of the field of engineering was still founded in problem solving, mastering and exploiting nature and resources for civilization was the goal and technological development becomes the mean to the end (Wagner, 2006). The rapid progression falls victim to postmodern critique of the consequences. This leads to an ethic codex which breaks with the role of an engineer to serve the state but rather the greater good for society and mankind. With the development over history serving a greater good becomes an embedded part of the engineering identity (Mitcham, 2009) (Downey, Lucena, & Mitcham, 2007).

After this brief review of the historical development of the engineers role in society the following section focuses on what in theory is described to be the engineering identity.

Identity
The engineering field has a strong base in math and natural science (Downey, Lucena, & Mitcham, 2007) which is applied as an instrument for actual engineering focus. With the foundation in math and natural science causal thinking is trained and used to organize knowledge. Pawley describes the way of thinking as math linked (Pawley, 2009). Technology is the core and the object of engineering but importance of non-technical complimentary skills and competences are increasingly acknowledge (Abraham, 2005) (Warhuus & Blenker, 2013).
If looking at personality traits in the discourse about the engineer, hardship and endurance relating to demanding workloads emerge (Godfrey & Parker, 2010), articulating the engineering sector as a demanding profession. Though rooted in math and natural sciences, which on higher levels requires the ability of abstract thinking, engineering is highly application oriented (Fry & Stephanie, 2015) rendering the engineer with a need for balancing between practical knowledge forms with a scientific knowledge base (Haymann, 2009). With a foundation in math and natural science and a strong focus on application of technology with the purpose of building/making/constructing something (Pawley, 2009) to solve problems, maybe engineers, in a Dewey interpretation, are pragmatics at the core of their identity.

The Engineering students identity
A study done among first year engineering students in Denmark found that the students had five dominating perspectives on the engineering identity (Haase, 2012). Most predominating is the notion of an engineer as a creator of something. A second prevailing perspective is that the core of engineering is science and technology and it requires a high level of specific talent. Furthermore there was a notion of an engineering approach rooted in rationality and collaboration. The fourth perspective was a societal importance relating to the practical problem solving. The least emphasized perspective is the business and commercial focus of engineering, the notion that the problem solving takes place in a market context.

Figure 4: The House of engineering identity

Problem solving is put at the center of the house of engineering identity because it seems to relate to all the perspectives. With this brief review of the heritage and the students’ own perspective of the engineering identity a potential common part of the engineering students’ bird in hand (Sarasvathy S., 2008) is described.
In the following a case study is presented to exemplify what challenges emerge when engineering students is facilitated through a generic entrepreneurship elective.

**Case Course description**
In the following, inspired by Blenker et al (Blenker, Elmholdt, Korsgaard, & Wagner, 2014), for comparative purposes the activities and elements of the entrepreneurship education in the case is described. Furthermore the overview is used to outline what activities and elements are considered areas of interest and what elements are considered as frame factors.

**Table 1: Activities and elements in the case study categorized by, context, courses, programs, students, teachers, processes and effects and commented on relevance to the study at hand.**

<table>
<thead>
<tr>
<th>Context</th>
<th>Courses</th>
<th>Programs</th>
<th>Students</th>
<th>Teachers</th>
<th>Processes</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danish University College</td>
<td>Generic 5 ECTS elective course in Entrepreneurship</td>
<td>The elective is offered at bachelor level to: Engineering ICT, Global business, Mechanical and Civil &gt;6th semester</td>
<td>19 - 25 years old, Various nationalities and professional backgrounds, Full degree and exchange students</td>
<td>1 main facilitator with a business background + Guest lectures with varying fields of expertise + Guest speakers</td>
<td>- Teachers development of the course - Students Learning Process</td>
<td>It is measured on an individual level</td>
</tr>
<tr>
<td>With an international student body</td>
<td></td>
<td>Business: - Marketing economist 2nd semester - Various international business degrees</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame factor</td>
<td>Object of case study</td>
<td>Frame Factor</td>
<td>The difference in professional background is of interest. Focusing on engineering students</td>
<td>Frame factor</td>
<td>Student learning process is of interest</td>
<td>Frame factor</td>
</tr>
<tr>
<td>Source: Own contribution</td>
<td></td>
<td></td>
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</tbody>
</table>

The object of the case study is a generic 5 ects elective entrepreneurship, it was first developed as a summer school elective course “Entrepreneurship –from innovation to realization”(EIR) and later implemented during the semester and called Entrepreneurship (ENT). Over time there have been changes in the lecturing methodology but the underlying didactics and pedagogy remains unchanged. The course is based on the ME2 model (ME2- Model for entrepreneurial education, 2013), in which the entrepreneurial process is broken down into four stages; understanding means, disclosing disharmonies,
qualifying opportunities and realizing the value. In the operationalization process of the model, Bager et al’s book on entrepreneurship education (Bager L. T., Blenker, Rasmussen, & Thrane, 2010) is used. The primary aim of the course is to increase the likelihood of students displaying entrepreneurial behaviour in the future by developing and strengthening the students’ self-efficacy (Bandura, Self-efficacy: toward a unifying theory of behavioral change., 1977), in a learning by doing processes where the focus is on educating for and primarily through entrepreneurship rather than about (Hannon P. D., 2006).

The learning goals are formulated as a skill set and specific competences:

**Skills:**
After completing the course the student should be able to:
- Qualify a business idea
- Plan and allocate resources
- Make a start-up budget
- Conduct a competitive analysis
- Create and test a business model
- Present a business idea

**Competences:**
Actively work in teams with creativity and idea generation. Identify and evaluate business ideas.

Though the learning goals have a strong business focus what I emphasised in practice is developing a business model, based on the students own ideas, and testing the hypothesis of the model in a lean start-up approach.

A strong source of inspiration for the didactic methodologies applied in the course and the activities in the course is the “push-method”, which seeks to apply the seven enterprise-didactic strategies (Change of habits, role models, reward for action, courage to fail, mean driven, self-awareness and reflection, experiences of success), to train the students to achieve a transformation from thoughts to action (Kirketerp A. L., 2012).

The education about entrepreneurship is in this case based on Sarasvathy’s article from 2001 (Sarasvathy S. D., What makes entrepreneurs entrepreneurial?, 2001) and Sarasvathy & Venkataraman’s article from 2011 (Sarasvathy & Venkataraman, Entrepreneurship as Method: Open Questions for an Entrepreneurial Future, 2011), Shane & Venkataraman’s article from 2000 (Shane & Venkataraman, 2000 )and Spinosa et all’s article from 1997 (Spinosa, Flores, & Dreyfus, 1997), combined offering the students an understanding of entrepreneurship as a self-initiated, internal-motivated, action-oriented, effectuation process in which the individual, based on disharmonies, defined by its nexus of opportunities, identifies and creates entrepreneurial opportunities and exploit these in a value creation for others, rather than the mere process of founding a company.
In terms of educating for entrepreneurship, the students are introduced to varying themes and workshops. I.e intercultural and inter-professional, entrepreneurship centred teamwork, based on a cultural readiness test (Oomkes & H, 1992), Personality trait theories based on Jung’s Typology test and a self-efficacy test. Furthermore the students are given lectures in the use of Osterwalder’s Business Model Canvas (Osterwalder & Pigneur, 2010) which is used as a process tool and the lean start-up philosophy advocating early prototyping. In addition to this workshops are held during the course where the students are educated for entrepreneurship in relation to the topics of for instance: Idea generation, Intellectual property, budgeting and fundraising, negotiations, marketing & communications and pitching.

Early in the course the students are divided into teams based on motivation to solve a self-defined problem. In teams the students are educated through entrepreneurship, the course is structured to include idea generation, idea qualification, idea conceptualisation, early prototyping and gaining buy-in from external stakeholders through pitching.

For the latter two terms the students participating in the elective have been challenged to sign up for a national entrepreneurship competitions with the purpose of upping the stakes in terms of presentation of the ideas. The grading of the course is a pass/fail grading (except for exchange students) based on student portfolios that include both individual and group assignments.

The description of the case course ends here. In the following empirical data is searched to find evidence of how engineering students experience this type of learning process, or in other words how the engineering students’ bird in hand functions in an entrepreneurial process framed by a generic entrepreneurship elective, the focus will be on expressed challenges.

**Case study results**

In the midterm evaluation 36% of the respondents answered no or to a limited extent when asked: “Does the applied teaching style help you to acquire new knowledge?” This number might be biased due to low a response rate, 22 out of 97 students responded, and it is not discipline specific to engineering students since the midterm evaluation is anonymous. Never the less it leads to the hypothesis that the applied generic methodology of entrepreneurship education does not support the learning process of all the students very well.

In the quest of getting a better understanding of what the challenge truly are an analysis is conducted of the engineering student interviews. The interviews were conducted at the end of the semester by a third party not known to the students.
The result is really interesting in the table below statements from 10 engineering students regarding their challenges in the course are divided into categories and implications are elaborated on.

*Table 2: Result of data analysis, categorized statements and implications*

<table>
<thead>
<tr>
<th>Category</th>
<th>Statements</th>
<th>Implication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Focus on motivation and effort</strong></td>
<td>S2: Need to put an effort into the course in order to get something out of it</td>
<td>- Focusing on grades make the learning process goal driven as opposed to a mean driven process with the purpose of creating value for others.</td>
</tr>
<tr>
<td></td>
<td>S7: Difficulties figuring out what is required to pass</td>
<td>- If the motivation is only to get a passing grade with a minimum effort the attractiveness of the behavioural outcome of acting entrepreneurially is not that great and according to the triade model the likelihood of the behaviour occurring decreases.</td>
</tr>
<tr>
<td></td>
<td>S9: Difficulty motivating the team</td>
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<td></td>
<td>S8: Not a real problem=not serious</td>
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<td></td>
<td>S17 I haven’t had a course like this I didn’t know how much effort to put into it to pass/how much time to spend on it, I’m very busy and want to focus on getting high grades were we are graded (as opposed to pass/fail graded)</td>
<td></td>
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<tr>
<td></td>
<td>S21 challenging to find the time for a fictive project</td>
<td></td>
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<tr>
<td></td>
<td>S22 lack motivation because all of the assignments didn’t make sense to me</td>
<td></td>
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<tr>
<td><strong>Focus on teamwork</strong></td>
<td>S1: Challenge in teamwork</td>
<td>- The chosen methodology of having students learning in international and cross disciplinary teams are a challenge in itself. The purpose of the teamwork is to develop the student’s teamwork competences, but in some cases it works counterproductively if the teamwork is too much of a challenge.</td>
</tr>
<tr>
<td></td>
<td>S9: Difficulty motivating the team</td>
<td></td>
</tr>
<tr>
<td><strong>Focusing on the process of learning Through Entrepreneurship</strong></td>
<td>S4: Boring slow process, S5 The project(learning through entrepreneurship) was challenging S8: Not a real problem=not serious</td>
<td>- The didactic foundation of the course, learning through entrepreneurship, is a highly articulated challenge for the engineering students on numerous levels. Being unfamiliar with this type of learning process poses as a challenge in terms of developing and acquiring new knowledge. At the essence the student’s knowledgebase and experiences with learning does not comply with the didactic method used. It poses as a barrier for generating new knowledge through the applied didactics and methodologies.</td>
</tr>
<tr>
<td></td>
<td>S10: I didn’t learn anything</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S12: New way of learning is difficult</td>
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<tr>
<td></td>
<td>S13 I Had the wrong assumptions I didn’t think we were allowed to change our business model</td>
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<td></td>
<td>S15: the entire process was a challenge</td>
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<tr>
<td></td>
<td>S16: I couldn’t see the outcome at the beginning</td>
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</tr>
<tr>
<td></td>
<td>S17 I haven’t had a course like this I didn’t know how much effort to put into it to pass/how much time to spend on it, I’m very busy and want to focus on getting high grades were we are graded (as opposed to pass/fail graded)</td>
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<td></td>
<td>S18: It was not what I expected I’m used to learning theory</td>
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<td></td>
<td>S19 challenging in speaking with stakeholders (how to)</td>
<td></td>
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<td></td>
<td>S20 Different course compared to others</td>
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<td></td>
<td>S23 Not just learn theory, we need to try the tools we were given and I did not expect that.</td>
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<td></td>
<td>S24 It was difficult because I do not consider myself as an entrepreneur</td>
<td></td>
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<tr>
<td><strong>Misfit between own identity and perceived identity of an entrepreneur</strong></td>
<td>S3: Challenge with public speaking</td>
<td>The student’s preconceptions about their own identity and perceived requirements for engaging in an entrepreneurial process functions as a barrier for learning/new knowledge creation.</td>
</tr>
<tr>
<td></td>
<td>S6: I’m not an entrepreneur</td>
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<td></td>
<td>S11: I was pressured to be creative which I’m really not</td>
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<td></td>
<td>S14: I do not have the mindset required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S24 It was difficult because I do not consider myself as an entrepreneur</td>
<td></td>
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</tbody>
</table>

Source: Own contribution
The challenges expressed by the engineering students are supported by observations made by the lecturer. It is found that specifically engineering students have problems engaging in mean driven processes and there is a tendency among these students to ask the lecturer to define goals or to approve the goals set by the students. Engineering students is also found to have a tendency to “stick to the plan” rather than engage in a hypothesis testing next-best-step approach. Generally the team formation process does not appear to be based on common interests and motivations, but rather based on relations between the students. They set a team based on who they would like to work with rather than based on the problems they are motivated to solve. In the groups where people with no prior relations are put together in order to gain a certain volume, there are often conflicts. If the conflicts are solved they poses at great learning experiences, but in the cases where the conflicts are not resolved they become barriers for learning and development.

Furthermore it is found interesting that the quotient of failing students is higher among engineering students than business students, 27% to 14% (a comparison of proportions have been done, and it is not possible to infer anything based on this result, possible due to a relatively small sample size of the engineering group, 22 students out of the total of 97 students, but for this case it is a remarkable difference). Grades should ideally reflect effort and ability, but maybe they also reflect how the education content, methodology, maybe even the pedagogy and didactics, affects the students’ learning process depending on their existing knowledgebase and cognitive learning pattern/way of thinking and learning.

In conclusion this generic course has fallen between two stools in terms of target groups trying to serve both engineering and business students with different levels of prior experience with entrepreneurship at the same time. It was intended that students should develop entrepreneurial skills and competences by learning through entrepreneurship and to expand the students’ entrepreneurial opportunities and enable them to compensate for professional and personal limitations through cross disciplinary teamwork. But evidence is found that engineering students are challenged in their learning process during the generic entrepreneurship course. Not advocating to abandonment of the applied pedagogy or didactics in the case elective, since it has been proven effective (Moberg, 2014), this is merely pointing out that a number of engineering students display symptoms of a learning problems in the case course. This gives rice to a suspicion of a mismatch between the applied generic entrepreneurship didactics, the form and the content of the case study course and the engineering target group. From the research two questions emerges:

1: How can the learning process be truly mean driven when the course is graded?
2: Is there a gap between the didactic methodologies applied in the generic entrepreneurship education and the engineering students’ knowledge base, cognitive learning patterns and the engineering identity?
The first question cast doubt on the notion that it is possible to educate through mean driven processes as a curricular activity.
The second question renders the problem of generic entrepreneurship education a knowledge sociological problem; because generic education does not take into account what knowledge base and structure it is building upon.
With this said, the section below concludes by discuss the opportunities and challenges that emerges when an engineering bird in hand is the basis of entrepreneurship.

**Conclusion**
The focus of this paper was to examine what would happened if research in entrepreneurship education was context specific to one educational diciplin.
The following questions were raised:
“What is the purpose, challenges and opportunities of entrepreneurship education in the field of Engineering and how does it affect the pragmatically best methodology of effective entrepreneurship education?”
And the sub questions:
1: What characterizes engineering students, what is their professional heritage and identity?
2: How does the engineering student’s professional heritage and identity influence their ability to engage in entrepreneurial behavior/processes?
A literature review was done in order to describe the engineering bird in hand in terms of heritage and identity and a case study was done in order to exemplify what challenges emerges when the generally described engineering bird in hand is the foundation of developing skills and competences when educating though entrepreneurship.
Below is a summary of the challenges and opportunities found based on the understanding of entrepreneurship as mean driven behavior related to opportunities that result in value creation for others, the described engineering bird in hand and findings of the case study. This should consequently shed some light on what the purpose of entrepreneurship education is in the field of engineering which can form the grounds for a new discussion about the what, where, when, who and how of engineering specific entrepreneurship education.

**The Engineering bird in hand at the basis for entrepreneurship- Theory and practice**
Briefly summarizing what challenges and opportunities have been spotted during this research relating to conducting education through entrepreneurship for engineering students.
Fist relating to the challenges the following was noticed. The engineering way of thinking is rooted in causation; this collides with the entrepreneurial way of thinking which is rooted in effectuation.
Furthermore rational thinking cultivates a belief in one objective right solution which is often sought in theory and function as a barrier for the lean start up approach.
Failing is historically inherited not an option for an engineer due to the massive consequences which leads to an error minimization approach to problem solving. This contrasts the entrepreneurial fail fast and fail forward notion and emphasis on looking at mistakes as a crucial part of the learning process. A founding pillar of the engineering identity is that they make things, which is a different focus than creating value for others. Furthermore a tendency of learning for exams and focusing on resource optimization rather than innovation affects the motivation to act entrepreneurially.

Looking at potential opportunities problem solving is in the DNA of an engineer which is a great starting point for a value creation process. Furthermore engineering is application oriented and with a large professional toolbox there lies a great potential for behaving entrepreneurially cf. the capability parameter in the triade model (Poiesz, 2014). And finally according to the progression (Rasmussen & Nybye, 2013) model hardship and endurance are some of the attitude related competences that support entrepreneurial behavior.

*Figure 5: Opportunities and challenges related to cultivate entrepreneurial behavior among engineering students (in the center is the Triad model (Poiesz, 2014))*

Learning for exams not for life  ➔ Goal driven behaviour
- Lack of motivation to take Action*
- Poor influence on Attitude*, cutting corners.

The opportunity is given in the case, but many students do not take it.

Creativity* is not necessarily a part of identity, preventing combining of knowledge in new ways.

The Engineering approach** ➔ Math linked/Causal thinking ➔ Effectuation
- Analytical approach ➔ lean start-up
- Error reduction ➔ Fail fast fail forward

The field of engineering** is application oriented; it translates technology and science into problem solving.

Five of the elements in “The house of engineering identity”** dovetail with entrepreneurship:
1: Problem solving as motivation and foundation for value creation
2: Scientific-technical core increase the capacity for acting entrepreneurially
3: Creating things can be a method for creating value
4: Societal importance can increase the focus on creating value for others
5: A solidification of the business/commercial focus can increase an understanding of the Environment* of the value creation

Source: Own contribution
*Linked to the progression model (Rasmussen & Nybye, 2013)
**Linked to engineering heritage and identity
An attempt to translate these challenges and opportunities into the purpose of entrepreneurship education is made below:

The purpose specific to entrepreneurship education in an engineering context becomes to develop complimentary skills and competence, which enables the students to use their professional toolbox in new contexts and enable them to see their profession in a market context. Furthermore the students need to develop a sort of cognitive adaptation that will allow them to use effectuation as well as causation.

If so, what implications does it have on the founding pedagogy and the applied didactic methodology?

If the problem of generic entrepreneurship education is a knowledge sociological problem the engineering students maybe needs to be “matured” beyond the scope of a 5 ects elective, before engaging in this type of education. This advocates an embedment of discipline specific entrepreneurship education in the entire engineering education program. This would bridge the gap between generic entrepreneurship methodology and the engineering students’ knowledge base and structure, enabling them to fully engage in learning processes through entrepreneurship.

**Implication**

If the one of the central challenges of educating engineering students through entrepreneurship if the disharmony between the engineering approach to knowledge creation and problem solving and the entrepreneurial approach (effectuation) maybe this needs to be addressed in the core curriculum of engineering education. If we look at entrepreneurship education not as singular occurring events but as a progression over time it is possible to make a progression that would allow for the different purposes and forms of entrepreneurship education, from generic to individual centered, to supplement each other and there by maximize the effect of entrepreneurship education.

*Figure 6: Suggested Progression over time in entrepreneurship education.*

Source: Own contribution
This means we move beyond either or solutions in entrepreneurship education and ensure the opportunity to mature students into learning through entrepreneurship.
Bibliografi


