The making of future entrepreneurs

The relationship between Fablabs and entrepreneurial intentions of students in upper secondary school

Birita í Dali

HÁSKÓLI ÍSLANDS
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Foreword

First and foremost, I wish to thank my advisers, Gunnar Óskarsson and Þuríður Jóhannsdóttir for standing by me and taking on my thesis, helping me navigate the bureaucracy and inner workings of the university rules and in finding my place, my subject and my passion. The thesis is worth 30 ECTS.

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Abstract

This study provides a snapshot of the relationship between use of a fabrication laboratory (Fablab) and the entrepreneurial intentions of students at the upper-secondary school in the Westman Islands (FíV) in Iceland.

The context of the study is established by reviewing relevant academic literature about entrepreneurship, entrepreneurial intentions, the role of education for entrepreneurship and the role of specific entrepreneurship education. Academic literature regarding Fablabs is also reviewed.

A two-part qualitative study provides insight into the goals and intentions of local leaders (Headmistress of the school and Project manager of Fablabs in Iceland) regarding the Fablab, as well as the differences in entrepreneurial intentions of students who have used the Fablab and students who have not.

The findings show that all the students in question had fairly high entrepreneurial intentions when using the Theory of Planned Behavior. Those who had interacted with the Fablab displayed more confidence and actual entrepreneurial skills, as well as a higher propensity to act, which is a part of Shapero's model of entrepreneurial events.

Finally, the study provides a discussion on the findings, how to apply the information gained to educational initiatives, social policies and further research. The conclusion is that the Fablab program is a useful tool for entrepreneurship education, while its influence on entrepreneurial intentions requires further research.

Ágrip

Sköpun frumkvöðla

Þessi rannsókn varpar ljósi á tengslin milli notkunar nemenda Framhaldsskólans í Vestmannaeyjum (FíV) á Fablab (e. fabrication laboratory) og frumkvöðlahneigð þeirra.

Fræðileg umræða um frumkvöðlastarfssemi og frumkvöðlahæfni, hlutverk menntunar í sköpun frumkvöðla og hlutverk frumkvöðlamenntunar sérstaklega, er grundvöllur rannsóknarinnar. Fræðileg rit um Fablab eru einnig til umræðu, til að gefa lesendum betri skilning á Fablab í heild sinni.

Tvískipt eigindleg rannsókn varpar ljósi á markmið og áætlanir þeirra einstaklinga sem hafa mest áhrif á stefnu Fablab í Vestmannaeyjum (skólameistara FíV og verkefnastjóra Fablab), sem og muninn á frumkvöðlahneigð nemenda sem nota Fablab og nemenda sem ekki nota Fablab.

Rannsóknin sýnir að allir nemendur sem tóku þátt eru með jafn háa frumkvöðlahneigð þegar horft er á kenninguna um áætlaða hegðun (e. Theory of Planned Behavior). Hinsvegar voru nemendur sem hafa notað Fablab með meiri tilhneigingu til framkvæmda (e. Propensity to act) heldur en þeir sem hafa ekki notað Fablab. Tilhneiging til framkvæmda er hluti af módeli Shapero um frumkvöðlahæfni (Shapero's model of entrepreneurial events). Notendur Fablab sýndu einnig fram á meiri frumkvöðlahæfni en hinir þátttakendurnir.

Í lokin er umræða um niðurstöður rannsóknarinnar og ábendingar til stefnumótunaraðila, skóla og samfélags um hvernig má nýta þær til viðmiðunar í framtíðinni. Niðurstaðan er sú, að Fablab er hentugt verkfæri fyrir frumkvöðlamenntun þó svo að áhrif þess á frumkvöðlahneigð þarfnist ítarlegri rannsókna.

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1 Introduction

> "Intentions are the single best predictor of any planned behavior" (Krueger, Reilly & Carsrud, 2000, p.412).

Entrepreneurship is important because it creates jobs, improves competitiveness, unlocks personal potential and promotes corporate social responsibility (European Commission, 2003).

Entrepreneurial intention is, simply put, the intention to pursue entrepreneurial work in the future. While intention does not guarantee future behavior, it has long been deemed the best predictor of entrepreneurial behavior, ahead of situational or personal variables (Krueger, Reilly & Carsrud, 2000). Entrepreneurial intention is a complex construct, influenced by various internal and external factors. Entrepreneurial intention applies to individuals who are not entrepreneurs yet. By understanding the precedents of entrepreneurial intention, society gains an opportunity to promote future entrepreneurship by subtly or overtly encouraging specific intentions in the populace (Bird, 1988).

This study provides a snapshot of the relationship between interaction with a fabrication laboratory (Fablab) and the level of entrepreneurial intentions in students.

1.1 Background

1.1.1 Entrepreneurship and entrepreneurial intentions

Entrepreneurship is difficult to define. Seeking to establish firm boundaries between entrepreneurs and small-business owners, Carland, Hoy, Boulton and Carland (1984) proposed that specific traits inherent in entrepreneurs were the point of distinction. Gartner (1989), disagreed, promoting a behavioristic approach. In an attempt to create a unified general definition of entrepreneurship, Gartner (1990) conducted a massive study, where experts gave their definitions. The study produced eight themes of characterization, where 79% of his sample agreed on one combination of themes, and the remainder agreed on a slightly narrower definition.

Defining the entrepreneur is similarly challenging. Studies are divided between functional, personality and behavioral perspectives, studying – in turn – the how, who or why of entrepreneurs (Cope, 2005). For the purposes of this paper, the behavioral perspective will be followed, with references to other perspectives where necessary for clarification or comparative analysis.

The two primary behavioristic theories are Azjen‘s Theory of Planned Behavior (TPB) and Shapero‘s model of the Entrepreneurial Event (SEE). While different, the theories overlap to no small extent, their primary differences being that the TBP includes the construct of *subjective norms*, being norms held by individuals which influence their intentions, while the SEE includes *propensity to act*, being an individual’s ability and drive to translate a desire into action (Krueger, Reilly & Carsrud, 2000). The remaining constructs of both models carry different terms, but similar meanings. *Attitude* of the TPB corresponds to *perceived desirability* in the SEE. Both deal with an individual‘s beliefs regarding entrepreneurship. *Perceived behavioral control* (TPB) corresponds to *perceived feasibility* (SEE). These deal with the individual‘s belief that they can control the outcome and that they have the necessary skills and resources to attain their goals. A related term is self-efficacy, which is a person‘s confidence in their own ability to succeed at a given task (Krueger, Reilly & Carsrud, 2000).

While intentions are important, other barriers and boosters to entrepreneurial entry include complex administrative procedures and laws, finance and investment capital, fear of failure and level of unemployment (European Commission, 2003; Agnar Hansson, Halla Tómasdóttir, Guðrún Mjöll Sigurðardóttir, Lúðvík Elíasson & Rögnvaldur J. Sæmundsson, 2002; Kangasharju & Pekkala, 2002). These barriers and boosters are shared across cultures, but differ in their impact and prevalence. In Iceland, people are particularly afraid of failure, and entrepreneurs tend to be driven by opportunity, as opposed to need (Agnar Hansson et al., 2002).

1.1.2 General education and entrepreneurship education

Strong correlations have been found between education and entrepreneurship (Wadhwa, Freeman & Rissing, 2010). Education imparts vital skills (Metcalfe, 2013), correlates to higher growth potential (Kangasharju & Pekkala, 2002) and has a positive influence on survivability of small firms (Millán, Congregado & Román, 2012). Finally,

level of education has an impact of the wages of entrepreneurs (Robinson and Sexton, 1994).

There has been some disagreement on whether or not entrepreneurship can be taught. The primary argument against the possibility of teaching entrepreneurship comes from researchers who believe that entrepreneurship is trait based (Neck & Greene, 2011). Another view is that the science of entrepreneurship can be taught, while the art of entrepreneurship cannot (Henry, Hill & Leitch, 2005). The final view is that entrepreneurship is teachable in its entirety (Metcalfe, 2013).

The purpose of entrepreneurial education addresses two concepts of education: Entrepreneurial attitudes & Skills and training in business creation (European Commission, 2004). The third aspect is entrepreneurship theory (Fiet, 2001b; Katz, 2003; Kuratko, 2005).

How entrepreneurship is taught differs between schools. Kuratko (2005) discovered a difference between the approaches used by business schools and other schools. Neck and Greene (2011) presented the concept of different "worlds" of entrepreneurship education, dividing the various approaches into one of these worlds. The various worlds all include useable, teachable methods with varying measures of success. The worlds also correspond with the various approaches to entrepreneurship presented at the start of this chapter.

The entrepreneurship path can be divided into five distinct stages, with unique driving and restraining forces for each step along the path. The different steps are linked together by a feedback/reinforcement mechanism, where experience is shared in the form of mentorship, lectures or workshops (Carayannis, Evans and Hanson, 2003).

1.1.3 Entrepreneurship and entrepreneurship education in Iceland

The most detailed study on entrepreneurship in Iceland was the GEM analysis conducted in 2002, which not only established a firm understanding of the nature of entrepreneurship in Iceland, but also analyzed the data in comparison with 36 other European countries. (Agnar Hansson et al., 2002)

The average amount of new startups per capita in Iceland suffered a blow in the recession, but has since stabilized. The recession reduced the amount of new startups

more in the Westman Islands than in the rest of Iceland, and the islands have not recovered their ratio of start-ups since 2008 (Hagstofa Íslands, 2015).

Entrepreneurship education in Iceland lags behind that of other Nordic countries (Svanborg R. Jónsdóttir, 2007) and Europe as a whole (Agnar Hansson et al., 2002). There is a marked need for a clear national policy, a concise definition and greater awareness of entrepreneurship education in Iceland (Svanborg R. Jónsdóttir, 2007).

1.1.4 Fablabs

Fabrication laboratories (Fablabs) are a type of workshop which allow users to create nearly everything they can imagine through the use of digital fabrication. Digital fabrication means that an object is designed and created in a computer, and the computer then controls machines which make the object become a reality. While there are several concerns about Fablab in regards to security, these have been discussed and refuted in academia. Fablabs provide their local community with access to grassroots communities via international networks. These networks range from humanitarian initiatives which improve the quality of life in various regions to education initiatives which provide high quality education in remote areas (Gershenfield, 2012).

Children ages 10-14 gain technological literacy and improved learning skills (Posch & Fitzpatrick, 2012). Young learners are able to participate fully regardless of educational background (Beyers, 2010) and girls participating in Fablab projects gain an increased interest in science, engineering and technology (SET) fields (Dlodlo & Beyers, 2008). At the university level, Fablabs have for example proven successful in engineering courses (Gershenfield, 2012) and architectural programs (Paio, Eloy, Rato, Resende, & de Oliveira, 2012), and enable a more multifaceted teaching approach (Stephenson & Dow, 2014). One of the most important features of Fablabs is their capacity to safely expose students to risk and failure (Carayannis, Evans, & Hanson, 2003).

The values supported by Fablabs are highly compatible with the Icelandic national upper secondary school curriculum, though some aspects more so than others (Mennta og menningarmálaráðuneyti, 2011; Gershenfield, 2012).

The Westman Islands Fablab has been in operation since 2008, but the efficiency or effect of this Fablab have not been studied.

Fablabs are intertwined with innovation, whether as a part of a national agenda or as a locally driven collaborative innovation space (Capdevila, 2014). They have been predicted to change the way cities are structured, with an effect similar to that of the emergence of the internet (Diez, 2012).

1.2 Problem statement

While our understanding of entrepreneurial intentions and Fablabs is fairly extensive, there is a gap in our knowledge of how these fields interact with one another. Additionally, no research has been conducted to ascertain the effectiveness of any Fablab in Iceland.

1.3 Purpose of this study

This is an exploratory study. It probes the relationship between Fablabs and entrepreneurial intentions and attempts to provide scaffolding for a future bridge over this gap through a qualitative study. The school and Fablab chosen are the upper secondary school of the Westman Islands (Framhaldsskólin í Vestmannaeyjum, FíV) and the Westman Islands Fablab, because there are few other influences on the entrepreneurial intentions of the students on this isolated, remote island and because this is the oldest Fablab in Iceland.

1.4 Significance of the study

This paper will be useful for policy makers, educators, researchers and business owners.

Policy makers will gain an overview of the effectiveness of Fablabs in encouraging future entrepreneurial behavior. They can make informed decisions about investments, the establishment of future labs and the value of Fablabs for the economy of the country. Additionally, this paper will place Fablabs in the broader context of the entrepreneurship discussion, which is in great need of new input.

For educators, this paper will provide a glimpse of the effectiveness of the Fablab, and discuss how to increase this effectiveness in the future. This is particularly useful for educators who have access to a Fablab, or hope to gain such access in the future. Additionally, educators gain an example of a different way to teach entrepreneurship, which aids them in providing a more interesting and diverse learning experience for students.

For researchers, this study opens the door to a deeper understanding of the way Fablabs influence users and the possible beneficial effects of a Fablab. It also provides a theoretical baseline on which to expand the academic discussion on entrepreneurial intentions and how to influence them.

Finally, local business owners benefit from a deeper understanding of the Fablab, which can be a competitive asset to them, if used correctly. A potential increase in entrepreneurship in their local environment can only benefit them, as it provides a more competitive environment with more intelligent, innovative employees.

1.5 Primary research questions

The first research question is: Do users of the Westman Island Fablab have higher entrepreneurial intentions than other students? This question is broken down into several sub-questions that each deal with specific aspects that make up intentions.

- Do Fablabs expose users to new normative values?
- Do Fablabs expose users to new significant others?
- Are the subjective norms of Fablab users more favorable of entrepreneurship than those of non-users?
- Are Fablabs users less afraid of failure than non-users?
- Do Fablab users have a higher propensity to act than non-users?
- Do Fablab users have attitudes which are more supportive of entrepreneurship than those of non-users?
- Do Fablab users have higher entrepreneurship self-efficacy than non-users?

The second research questions is: What are the aims and goals of the leaders involved with decision making for the Fablab?

- Have the leaders attempted to encourage entrepreneurial intentions?

1.6 Research design

Two homogenous groups will be selected among the students of FíV, one group which has interacted with the Fablab and one which has not. Their responses will be compared in order to provide an understanding of the current situation. The groups will be asked nine open ended questions which will enable us to answer the first research question.

To provide added understanding of the educational environment, aims and goals of FíV and the Fablab, the leaders of these two organizations are interviewed. This will facilitate answering the second research question.

1.7 Assumptions, limitations and scope

It is assumed that all participants of the study will answer the questions honestly and accurately based on their own personal experience and point of view. It is also assumed that the participants provide a representative section of the student population.

Time and money have placed some limitations on this study, as it is conducted in the summer. In the Westman Islands, it is customary for upper secondary school students to work during the summer break. It is therefore more likely that students selected for participation will be unable to participate, to be replaced by students who are not busy. This may skew the sample should there be a difference in the viewpoints of students who have summer jobs and those who do not. It is assumed that this is not the case.

This study deals exclusively with FíV and the Westman Island Fablab and can only provide an assessment of correlation. To verify causality, more time and funding would be required and a more extensive research would be necessary

1.8 Chapter summary

Chapter 1: Introduction provided an overview of the study, which is a qualitative exploration of the relationship between Fablabs and entrepreneurial intentions. A quick introduction to the background was provided, followed by a clarification of the problem, how this study proposes to solve the problem and what that will mean for interested parties. The research design was outlined and assumptions, limitations and scope briefly discussed.

Chapter 2: Literature review will provide the necessary academic discussion on the subjects relevant to the research questions. The chapter begins by defining entrepreneurship and entrepreneurial intentions, particularly highlighting the two main behavioristic theories relevant to intentions. The role of education in entrepreneurship is discussed, with examples given of the various approaches employed by educators. Finally, Fablabs are discussed in sufficient detail so that readers will know what Fablabs

are, how they fit with the Icelandic education system and how they can be used to influence entrepreneurial intentions in users.

Chapter 3: Methodology will give a more in-depth review of the research methodology employed. It will also outline the gathering of material and the primary findings for both the group interviews and the leader interviews.

Chapter 4: Discussion will discuss the findings in context of the reviewed literature and provide advice for policy makers, educators and researchers on how to use this study in their future work.

Chapter 5: Conclusion answers the research questions and brings the journey to an end by placing this study in context of the community where it was conducted.

2 Literature review

2.1 Entrepreneurship and entrepreneurial intentions

Many do not distinguish between entrepreneurship and the establishment of new businesses. This was perceived as a problem by Carland, Hoy, Boulton and Carland, who sought to establish firm boundaries between entrepreneurs and small-business owners. They were in favour of the idea that specific traits were the distinguishing features (1984). Gartner refuted this, stating that future research in entrepreneurship would be most useful if it were to follow a behavioristic approach. In his arguments, he quoted Cole as saying that an entire research center worked for ten years to define the entrepreneur, but never got closer than that each researcher had what he himself saw as a useful definition (Gartner, 1989).

In an attempt to find a single definition of entrepreneurship, Gartner (1990) conducted an extensive study where experts were asked to define it. After a rigorous process, he found that there are 8 themes which characterize the debate of what constitutes the nature of entrepreneurship: The entrepreneur - an individual who possesses specific traits which somehow enable them to pursue entrepreneurial activities. Innovation - the creation of something new or applying new methods to old concepts. Organization creation - a new organization is created. Creating value - entrepreneurship creates value in one way or another. Profit or nonprofit - whether entrepreneurship must be for profit or not. Growth - the level of importance of growth in entrepreneurship. Uniqueness - entrepreneurship must involve uniqueness. The owner/manager - there is a dedicated owner/manager involved. 79% of his sample agreed that there was entrepreneurship as long as an entrepreneur was involved and there was innovation, growth and uniqueness. The rest found that entrepreneurship additionally requires the generation of value or for someone to gain from it.

While no general definition was agreed upon, Gartner's study became the foundation for many researchers to establish their own definitions to be used in their research and literature.

A majority of the articles reviewed in this paper do not distinguish between entrepreneurs and the self-employed, so for the purposes of simplicity, small businesses and the self-employed will be counted as entrepreneurs in discussions about the current situation, whereas the recommendations for educational changes and evaluation of the impact of the Fablab will be based on the assumption that entrepreneurship involves an entrepreneur, innovation, uniqueness and growth in a new or existing organization.

2.1.1 Why entrepreneurship is important

Entrepreneurship is an increasingly important part of the economy of modern countries because it creates jobs, improves competitiveness, unlocks personal potential and promotes corporate social responsibility (European Commission, 2003).

2.1.2 The how, the who and the why of entrepreneurship

When it comes to the study of entrepreneurship, there are three theoretical perspectives. The functional perspective considers the economic process or function and is thus concerned with explaining how entrepreneurship works. The personality perspective is concerned with the individual and often holds that there are certain traits inherent in entrepreneurs which non-entrepreneurs do not possess in the same quantities. This perspective often tries to pinpoint who the entrepreneur is. The behavioral perspective focuses on the behavioristic theories that govern why people become entrepreneurs and how they behave (Cope, 2005).

2.1.3 Behavioristic theories

Behavioristic approaches tend to favor studying entrepreneurial intention, the connection originally made by Barbara Bird in 1988. In an attempt to understand the psychological precursors to entrepreneurship, she applied psychological theories to entrepreneurial behavior.

Intentionality is a state of mind where a person's attention is occupied with obtaining a specific goal. It has been described as a product of attention and consent, as an asset which sustains value despite interruptions and as a process; involving persistence, perseverance and courage. Intentions are included as an aspect within larger constructs of behavioral theory (Bird, 1988).

2.1.3.1 Ajzen's Theory of Planned Behavior (TPB)

The TPB consists of several constructs: attitude, subjective norm, behavioral control and intention and behavior. Attitude, subjective norm and behavioral control combine to create intention, which influences behavior. Actual behavioral control is influenced by the circumstances which the individual finds themselves in which affect his actual ability to control the outcome of his actions. The actual behavioral control influences both the perceived behavioral control and behavior itself.

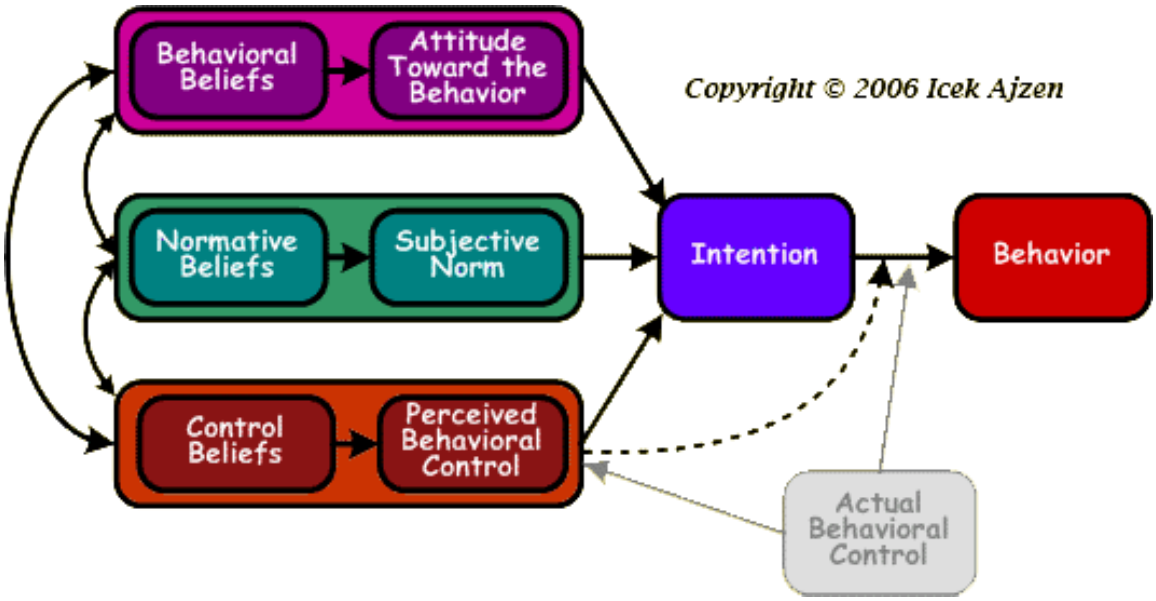

Figure 1: The theory of planned behavior (Ajzen, 2006)

In psychology, a person's attitude is based on his beliefs about a certain action. When his beliefs change or are influenced, his attitude changes. As a simplified example, if a subject believes that the best way to earn good wages is to be employed on a fishing boat, his attitude toward other careers is most likely negative. In a positive light, if a subject believes that a specific action will provide him with something he desires, his attitude toward that action will be positive.

The subjective norm is twofold: on the one hand there are the norms of the local society that the individual is a part of, and on the other hand there is the impact of the views of significant others toward the desired activity. If the individual believes that their parents, friends or spouses will disapprove or approve of an action, this influences the individual's intentions toward performing said action. For example, if someone the

subject looks up to expects them to pursue a specific career, this will presumably have some negative impact on the individual's desire to pursue a different career and vice versa.

Behavioral control is the degree to which the subject can control the outcome of the action. The perceived behavioral control can differ from the actual behavioral control if the subject is operating without all the necessary information. However, if the subject perceives themselves to have a large degree of control of the outcome, they are more likely to perform the action. According to Krueger, Reilly and Carsrud (2000), perceived behavioral control overlaps self-efficacy, which is the individual's perception of their own ability to execute a target behavior or achieve a target objective. Self-efficacy has been proven to be a good indicator of entrepreneurial behavior on its own. Interestingly, this has been tested in Iceland, and the correlation found to be significant (Magnús Orri Schram, Guðrún Mjöll Sigurðardóttir & Rögnvaldur J. Sæmundsson, 2004).

2.1.3.2 Shapero's model of the entrepreneurial event (SEE)

The SEE also consists of four constructs: perceived desirability, propensity to act, perceived feasibility and intentions.

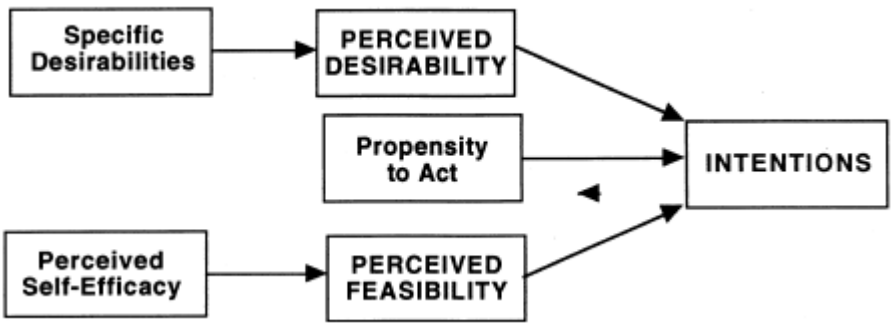

Figure 2: Shapero's model of the entrepreneurial event (Krueger Reilly and Carsrud, 2000, p.418)

Perceived desirability is defined as the "personal attractiveness of starting a business, including both intrapersonal and extra-personal impacts". This construct is similar to the attitude construct of TPB. (Krueger, Reilly, & Carsrud, 2000, p. 419).

Perceived feasibility is similar to perceived behavioral control in TPB, yet a slightly broader term. The things that make up our perceived feasibility are empirical measures of self-efficacy.

Propensity to act is a person's drive or disposition to act on one's decisions, also worded as "The desire to gain control by taking action" (Krueger, Reilly, & Carsrud, 2000, p. 419).

The primary difference between the two models is the Subjective norms (from TPB) and Propensity to act (from SEE) constructs. Comparing and contrasting the two models, Krueger, Reilly and Carsrud (2000) found significant support for both models, although the adjusted R2 was higher for the SEE which means that the predictive validity of the SEE is slightly higher.

2.1.4 Intentions and how to influence them

Although the TPB and SEE models differ slightly, both have significant abilities to identify entrepreneurial intentions. Additionally, while people's intentions are not a guarantee of future behavior, it is currently the single best predictor of future entrepreneurial behavior (Krueger, Reilly, & Carsrud, 2000).

The way the models are constructed provides clues about how to influence intentions. By changing the attitudes, self-efficacy, subjective norms and propensity to act to be more in favor of entrepreneurship, logic dictates that entrepreneurial intentions should rise accordingly.

While intentions are the best way to predict entrepreneurial behavior, there are other factors which serve as barriers or boosters to entrepreneurial entry.

2.1.5 Barriers and boosters of entrepreneurship entry

According to the European Commission (2003), one of the primary barriers of entrepreneurship entry was the complexity of the existing administrative procedures. Agnar Hansson et al. (2002) found that this is not the case in Iceland. Tax systems, procedures and regulations are clear and understandable. However, they identified a lack of programs and support initiatives aimed at entrepreneurs in Iceland, indicating an important area for improvement.

Finance, money and investment capital are another important factor in the emergence of entrepreneurial ventures. Gaining access to bank loans is a particular problem and in Iceland, the situation is particularly dire in regards to venture capital.

Although several small investment funds attempt to enable entrepreneurial start-ups, their efforts are not able to supply all potential entrepreneurs.

A fear of failure is one of the primary reasons why people avoid pursuing entrepreneurial careers. In Iceland, nearly half the population cites a fear of failure as a primary deterrent. Additionally, a fear of failure posits a risk for investors which often outweigh potential rewards, causing them to be more reluctant to invest.

Unemployment has been linked to entrepreneurship, in the sense that entrepreneurship offers a means of escaping unemployment. In some cases, prospective entrepreneurs may postpone their entrepreneurial ventures due to receiving a more desirable employment opportunity, and then revisit their entrepreneurial plans when that opportunity is no longer available (Kangasharju & Pekkala, 2002). In Iceland, the amount of entrepreneurs who began their careers as a result of unemployment was found to be negligible, with almost all entrepreneurs being opportunity driven (Agnar Hansson et al., 2002).

2.2 The role of education in regards to entrepreneurship

2.2.1 Education in general

While the success stories of college dropouts like Steve Jobs (and the oft-forgotten Steve Wozniak) who founded Apple, and Zuckerberg who created Facebook are popular and well known, they remain outliers. In 2008, 92% of U.S. born tech founders held a bachelor's degree (Wadhwa, Freeman & Rissing, 2010). This implies a strong correlation between education in general and entrepreneurship. Robert Metcalfe (2013), successful entrepreneur and professor of innovation, argues that this implies that education imparts vital skills to future entrepreneurs.

In Finland, the level of education of the founder was found to increase the survival rate of new companies. In addition, higher education of the entrepreneur correlates to a higher growth potential for the venture (Kangasharju & Pekkala, 2002). More recently, formal education was found to have a positive impact on the survival of small firms in Europe (Millán, Congregado & Román, 2012).

Despite its importance, survival is only one aspect of entrepreneurial success. Taylor (1999) describes how many chose to exit self-employment in favor of wage employment

as opposed to exiting due to bankruptcy. This is corroborated by the findings in Finland, where during an economic downturn, firms run by highly educated were less likely to exit, while during economic upturn, they were more likely to exit than those run by less educated people. The reasons for this were deemed to be that during an economic upturn, there was a higher demand for people with higher education, thus making wage employment more attractive than self-employment in those cases (Kangasharju & Pekkala, 2002).

In developing countries, higher educated workers are more likely to pursue wage employment or non-agricultural entrepreneurship. Effect varies based on gender, rural or urban residence and share of agriculture in the economy, but in general less educated workers were more likely to pursue self-employment in agriculture (Van der Sluis, Van Praag & Vijverberg, 2005).

Robinson and Sexton (1994) found that years of education increased the likelihood of becoming self-employed and that those who are self-employed average at more years of education than those who work for others. They found that previous experience has a similar but weaker effect on self-employment, and that years of education have a greater positive impact on the wages of the self-employed than of those who work for others.

2.2.2 Can entrepreneurship be taught?

Knowing the effect of formal education in general on entrepreneurial success, one might wonder whether there is any need for entrepreneurship education at all. Some may even wonder whether entrepreneurship can be taught at all.

This question often has its roots in the discussion of what makes an entrepreneur. Those who follow the theory that entrepreneurship is trait based and inherent in certain individuals will dispute that it can be taught, as they view it as something indistinguishable from the individual (Neck & Greene, 2011).

Klein and Bullock (2006) found that entrepreneurship can be taught, but they discovered a rift between the economic theories of entrepreneurship and the curriculum of entrepreneurial educators. One of the reasons they identified for this disparity is that *economists* view entrepreneurship as a function that helps understand markets and macroeconomics, while *educators* attempt to explain how and why it

works and how to train and prepare future entrepreneurs - concerns which are irrelevant to the economic theorist. This implies the need for a separate entrepreneurship education curriculum and faculty to teach it.

Collette Henry, Frances Hill and Claire Leitch (2005) proposed that there are two aspects of entrepreneurship, the science and the art. According to them, the science of entrepreneurship - which consists of skills such as for example business planning and finance - can be taught, while the art of entrepreneurship - the intangible part - cannot.

According to Metcalfe, the question of whether entrepreneurship can be taught is obsolete. He suggests that we ask instead: "What various things do we have to teach to whom to increase the flow of successful innovative startups and thereby freedom and prosperity?" (Metcalfe, 2013, p.129) His own view is that there are only three aspects of entrepreneurship which are needed in order to facilitate new venture creation: ambition, creativity and selling.

2.2.3 The purpose of entrepreneurial education

According to the European Commission (2004), there are two concepts of entrepreneurship that are taught. The first is a broader concept of education for entrepreneurial attitudes and skills, which involves developing certain personal qualities and is not directly focused on the creation of new businesses and the second is a more specific concept of training in how to create a business. There is academic support for a third concept: the study of entrepreneurship theory, which seeks to discover and explain how entrepreneurship works (Fiet, 2001a; Katz, 2003; Kuratko, 2005).

2.2.4 How should entrepreneurship be taught?

2.2.4.1 Learning, incubation resources and inspiration

There is a difference in entrepreneurship education used in business schools and that used in other schools (Kuratko, 2005). Souitaris, Zerbinati, and Al-Laham (2007) studied the effect of entrepreneurship programs on science and engineering students. They were seeking to ascertain whether the entrepreneurship programs increased entrepreneurial intentions in the students. They identified three primary benefits that students gain from such programs: Learning, Inspiration and Incubation Resources.

Learning - which is divided into knowing why, what, how, who and when things should be done - has been known to increase self-efficacy, but has also been shown to increase the likelihood of entrepreneurial success. Wilson, Kickul and Marlino (2007) suggested that lack of self-efficacy can limit the perceived careers available to students as early as middle school and upper secondary school, and that courses aimed at increasing self-efficacy at that age are particularly important.

Incubation resources refers to connections made during the course which can later evolve into business contacts or an important support structure for the future entrepreneur.

Inspiration was described as a "trigger", which causes an emotional reaction or drive toward a new "target". It was likened to the experience of falling in love.

In their findings, inspiration was identified as the beneficial result which had the greatest positive effect on the attitude and intentions of participants. They posited that since inspiration was the primary reason for increased attitude and intentions of entrepreneurship, the emotional factor is important, in addition to the external and psychological factors identified by other. In other words, they determined that entrepreneurship programs raised entrepreneurial intentions most significantly for students in science and engineering fields by serving as a "trigger" for inspiration (Souitaris, Zerbinati, & Al-Laham, 2007).

2.2.4.2 The worlds of entrepreneurship education

Neck and Greene (2011) presented three "worlds" of entrepreneurship education and suggested a fourth as a new alternative. Their outline provides a framework for discussion, so in this section their suggested "worlds" are considered in the context of academic literature on entrepreneurship education. Entrepreneurial intention should be one of the things entrepreneurial education attempts to foster (Liñán, Rodríguez-Cohard and Rueda-Cantuche, 2011). Consequently, particular care will be taken to observe the impact on entrepreneurial intentions in each "world".

2.2.4.2.1 The entrepreneur world

The Entrepreneur world follows the personality perspective (Cope, 2005), and teaches business basics through lectures, exams and assessment. In this world, it is assumed

that the students already possess the necessary traits to be entrepreneurs and therefore the aim of the educator is to provide the necessary business basics to succeed (Neck & Greene, 2011).

The effectiveness of one program following this type of entrepreneurial education was discussed by Oosterbeek, Van Praag and Ijsselstein (2010). The program in question taught basics of business economics, tax law, economics, finance and financial accounting. The program was mandatory and the results were decidedly negative. Students' self-efficacy in entrepreneurship remained virtually unchanged, while entrepreneurial intentions decreased. While they recognize that the decrease in intentions may be due to students gaining more realistic perceptions of their own abilities, they also posited that the fault may lie with the program, as students seemed to dislike it.

2.2.4.2.2 The process world

This world follows the functional perspective (Cope 2005), and teaches entrepreneurship as a process with a beginning and an end. It assumes that there are known variables for which there are optimal reactions. It is focused primarily on business plans, case studies and business modelling. This is the most "teachable" approach, since it is possible to teach it step by step and describe each step carefully in a sequential format (Neck & Greene, 2011).

One program which falls within the "process world" is the Young Achievement Australia (YAA) business skills program, which aims to teach students about the firm life-cycle, marketing, human resources, finance, manufacturing and general management responsibilities. An analysis of the impact of the program found that participation in the program had a positive influence on perceptions of both desirability and feasibility of entrepreneurship (Peterman & Kennedy, 2003). This is interesting, since perceived feasibility and personal attitude towards entrepreneurship have been found to be particularly significant when it comes to predicting entrepreneurial intentions (Liñán & Chen, 2009; Liñán, Rodríguez-Cohard and Rueda-Cantuche, 2011).

Some discussion exists on what the scope should be of this approach to entrepreneurship education. Some scholars propose an extended educational program

which is not only concerned with the pre-start up and start-up phase, but also covers how to deal with the growth phase (Pretorius, Nieman & van Vuuren, 2005).

2.2.4.2.3 The cognition world

The theory behind this world is based on the behavioral perspective (Cope 2005) and focuses on the idea of thinking and acting like an entrepreneur. It focuses on the individual, but combines this with the process approach to create a new philosophy based on thinking and doing. In this world, entrepreneurship is taught through case studies, simulations and scripting and considers the cognitive act of deciding to engage in entrepreneurial activity (Neck & Greene, 2011).

In Sweden, several universities of business and entrepreneurship use methods to teach entrepreneurship that fall into the cognition world. Rasmussen and Sørheim (2006) called it the "action based" approach. In this action based approach there is an emphasis on learning by doing and on providing support for fledgling entrepreneurs with a strong cooperation between the universities and local industries. There is an emphasis on student involvement and new venture creation with practical, real experience for each student. The aim is to increase these student's skills and abilities to succeed as self-employed entrepreneurs.

If the measure of success is the amount of new start-ups created as part of or as a result of participation in the entrepreneurial programs and activities of these universities, teaching entrepreneurship in this way has been highly successful. However, this particular study did not measure the influence on entrepreneurial intentions. Instead it was assumed that - since the students chose to attend schools that specialize in business and entrepreneurship - their entrepreneurial intentions were high before participating in the programs.

2.2.4.2.4 The method world

The new world Neck and Greene outline is dubbed the method world and functions like a toolbox, intended to give students a set of skills and methods to deal with the unpredictability of entrepreneurial life. Rather than teaching students the discipline of entrepreneurship, they teach the students methods to navigate the world of entrepreneurship. The primary idea is that students should learn by doing. In this world

new teaching methods are employed such as serious games, observation, practice, reflection, co-curricular activities and design.

Neck and Greene (2011) offer an extensive example portfolio of how entrepreneurship education works within the "method world", but do not offer any measurement of success, neither in the intentions of students nor in entrepreneurial ventures undertaken by students after their studies are concluded. This is an area which requires further research.

2.2.4.3 Driving and restraining forces and the feedback mechanism.

Carayannis, Evans and Hanson (2003) decomposed the entrepreneurship career path into five stages: Foundation, Awakening, Specialization, Creation and Maturing.

Entrepreneurs at different stages of their individual career paths interact with one another through a mechanism called the Reinforcement/feedback mechanism, which also includes cultural values, social structures and other driving or restraining forces. Each stage has its own driving and restraining forces.

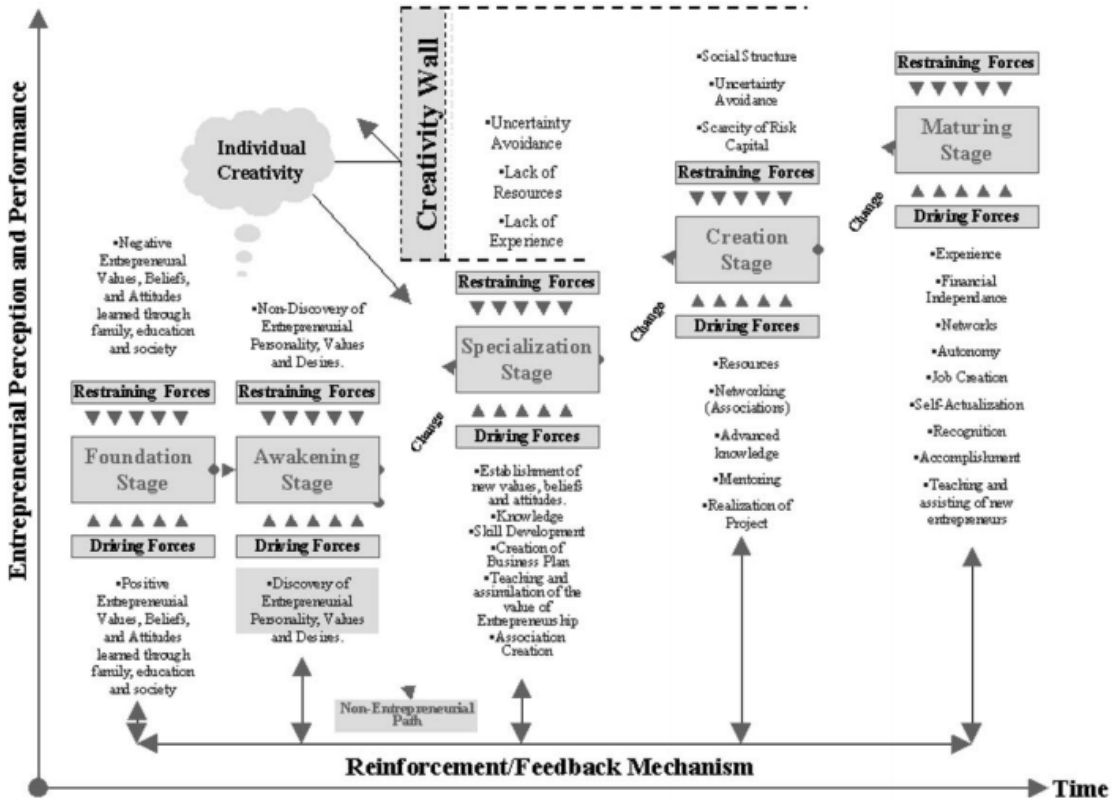

Figure 3: Entrepreneurial perception and performance (Carayannis, Evans and Hanson, 2003)

The primary forces that influence the foundation stage are positive or negative entrepreneurial beliefs, values and attitudes learned through family, education and society, while at the awakening stage, the primary force is discovery or non-discovery of entrepreneurial personality, values and desires.

Once these two stages are completed, the individual makes a choice of whether to pursue the entrepreneurship path or not. The remaining stages each deal with the entrepreneur gaining specialized skills, creating a company and seeing it mature, and at each stage, the entrepreneur has new skills and insights which should be shared with entrepreneurs further back in the path.

2.3 Entrepreneurship and entrepreneurial intentions

2.3.1 Entrepreneurship in Iceland

There is a dearth of recent research about the situation of entrepreneurship in Iceland. One important contributor is the Global Entrepreneurship Monitor (GEM), an annual report which gathers and analyses data about entrepreneurship on a global scale. Unfortunately, Iceland has only participated once, in 2002. The data from that year revealed some interesting characteristics about Icelandic entrepreneurship.

According to the 2002 GEM analysis of Iceland, 11.3% of the population is involved in entrepreneurship, the tenth highest percentage of the 37 nations in the sample. Very few Icelandic entrepreneurs start companies out of necessity. The majority start companies to exploit business opportunities. Nearly half the population feel that they have the skills, knowledge and experience to start a company, and perceive opportunities for new firms in the area where they live. 34% indicated that fear of failure prevented them from starting companies, which is an unusually high percentage for a Nordic country. Approximately 70% of the owners of new companies in Iceland did not think that society would find their offerings new or unique. The analysis further revealed that Icelandic people are generally eager to try new things and are positive towards change which allows them to recognize opportunities more easily. Iceland's position in between Europe and the US allows them to adopt the best practices of each continent. Icelandic people tend to have a high propensity to act, and many dream of creating their own company (Agnar Hansson et al., 2002).

2.3.2 New startups in the Westman Islands

The table below displays the fraction of people in Iceland, Reykjavik and the Westman Islands who establish companies. When compared to the national average, the Westman Islands have had a consistently low amount of startups per capita since 2008. While Iceland has an average of 3-4 new companies per 500 people, the Westman Islands have consistently had 1-2 new companies per 500 people since 2009. This indicates both room and need for improvement.

The proportional change from year to year tends to roughly follow the same trends as the rest of the country, which indicates that the situation for prospective entrepreneurs in the Westman Islands has remained fairly constant for the time period in question. While Reykjavik has retained a rate of approximately 1 more company per 500 inhabitants above the national average, the Westman Islands have not regained their position since 2008, where they had over 3 companies per 500.

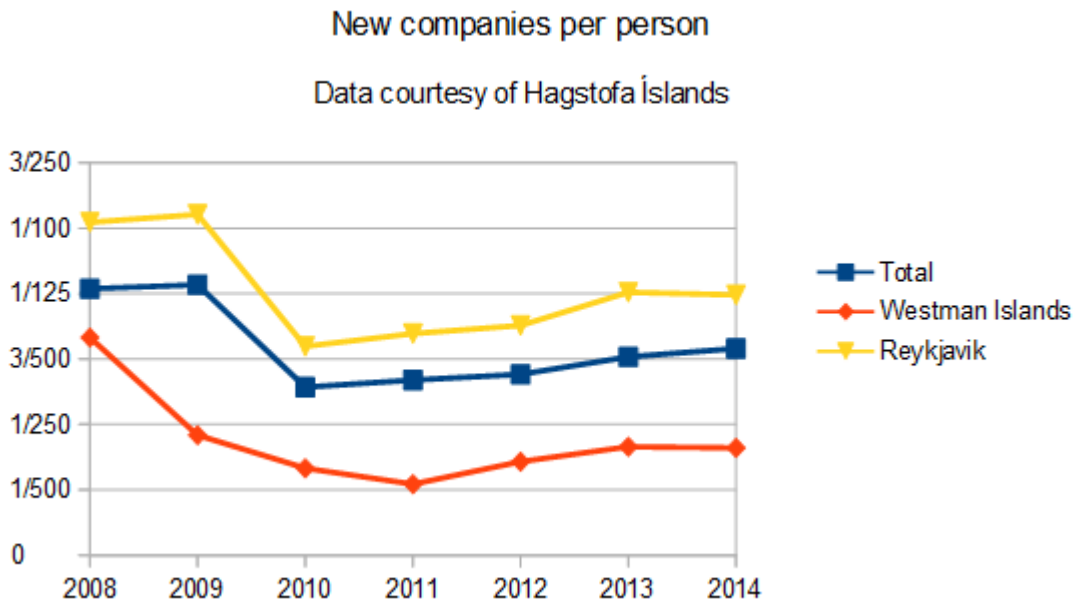

Figure 4: New companies per person in Iceland, Reykjavík and the Westman Islands (Hagstofa Íslands, 2015a; Hagstofa Íslands, 2015b)

The Westman Islands have a problem on their hands, which policy makers and educators should take steps to rectify.

2.3.3 Status of entrepreneurial education in Iceland.

According to the 2002 GEM analysis, there is a lack of entrepreneurship education on all levels of education. Not enough emphasis is on the possibility of venture creation and there has not been sufficient systematic support of entrepreneurship in the educational system. On the bright side, cooperation with the local industries was exceptionally good. Areas identified for improvement are problem solving skills and encouraging innovativeness and creativity in students. An increased emphasis should also be on STEM field and international marketing and there is a need for increased support for entrepreneurship at all levels of education (Agnar Hansson et al., 2002).

Iceland has not kept pace with other Nordic countries when it comes to entrepreneurship education. In 2007, one study analyzed the availability of entrepreneurship education in vocational education and training and found it to be sporadic. Many elements of entrepreneurship education can be found in various subjects, although courses that specifically focus on entrepreneurship education are mainly taken by students pursuing business studies. Good examples of various entrepreneurship education undertakings were found in schools all over the country, but exist due to the initiative of individuals (Svanborg R. Jónsdóttir, 2007).

This study further recommended that Iceland develop a clear national policy - and create a concise definition - of entrepreneurship education, that awareness of the importance of entrepreneurship education be raised, more training be made available to teachers involved in entrepreneurship education and that further research be conducted to monitor and enhance entrepreneurship teaching.

In 2012, a study comparing the entrepreneurship education initiatives in the Nordic countries found that Iceland was the only Nordic country without a national strategy for entrepreneurship education. The study analyzed five dimensions of entrepreneurship education (status in parentheses):

- Developing the national strategy framework (nonexistent).
- Support to educational institutions (haphazard).
- Teacher education and training (lackluster).
- Developing an active role of local and regional authorities (variable).
- Engaging with businesses and private associations and organizations (minimal).

In each of these dimensions, Iceland had very little to display. The primary initiative of the Icelandic government in entrepreneurship education was the annual innovation competition for primary school students (Nýsköpunarkeppni Grunnskólanema). The paper stated that despite not having a national strategy: "...Iceland has started to catch up, and is now focusing on teacher training in both basic teacher education as well as continuing in-service training..." (Chiu, 2012, p.26).

According to the author's rigorous analysis of the situation of entrepreneurship and innovation education in Iceland, there is a lot of improvement that can and should be strived for. While this analysis agrees with previously mentioned factors of a need for an increased emphasis on innovation and entrepreneurship education in almost all secondary schools in the country, as well as increased cooperation with local businesses, it also mentions a need for increased support of student ventures and educational initiatives. She specifically mentions Fablabs as one of the important tools which should be made widely available (Svanborg R. Jónsdóttir, 2013).

2.4 Fablabs

2.4.1 What is a Fablab?

Fabrication laboratories (Fablabs) are workshops which contain all the equipment required to make almost anything you can imagine. On one hand, computers loaded with all the necessary software (and access to huge databases of designs made by other users) stand ready to allow the user create digital designs of any object they can imagine. On the other hand, 3D printers, laser cutters and other machines stand ready to print, carve, cut and mold these digital designs into real objects.

Fablabs are generally manned by skilled professionals who stand ready to assist users with their creations. The actual process of creating the item is up to the user. This means that the user learns a great deal about proportions, design, materials, digital imaging and a whole lot more in the process of creating their chosen object.

To illustrate the range of things that can be created in a Fablab, one need only search for "Fablab creations" in one's preferred search engine and one discovers images of anything from clothes to replacement parts for broken equipment, from guns to farming equipment, from prosthetic limbs to furniture, from houses to robots to new

3D printing machines. Companies use Fablabs to create prototypes of new ideas. Individuals use Fablabs to create objects tailored specifically to solve their needs.

The process of designing a digital item which is then fabricated is called digital fabrication, and is considered by some to be a part of the digital revolution (Gershenfield, 2012). The first steps in digital fabrication began when computers were first connected to machines to automate parts of the fabrication process. The technology has since developed to where the human part of the process is all digital and machines can take care of the rest. This enables any user to create products for a market of one. No market size is too small.

Naturally, the primary obstacle for most people to pursue digital fabrication is caused by the considerable expenses related to the machines. This is where Fablabs come in, since they allow a community to gain access to the technology without the users having to front all the expenses themselves. In some Fablabs, the users only pay for the materials they use, while others charge a fee depending on the amount of time and machines used.

2.4.2 General concerns regarding digital fabrication

According to Gershenfield (2012), some of the primary concerns that governments and others have regarding digital fabrication are security issues. The first is concerned with the ability of the machines to replicate themselves. Since some of these machines work at a microscopic or even nano-scopic level, their ability to self-replicate could grow out of control. This is however not realistic at present time, since the machines are not advanced enough.

Another issue is the potential for individuals to print items which are a security risk to others. For example, users have created gun parts that are otherwise heavily regulated, as well as master keys for locks which are otherwise deemed safe. While the first impression may be that the technology must be restricted, this is easier said than done, and ultimately is not feasible, as the parts needed could either be produced by the machines themselves or are mass-produced and used for many applications. However, the experience so far is that weapons can generally be obtained cheaper and more easily through other channels and that Fablabs in conflict zones are used as an alternative to fighting, through education, dissemination of information etc.

The third concern is related to intellectual property. If digital fabrication is made freely available, it will become as easy to copy a chair or a car as it is to copy music or movies and even harder to prove such theft. The spread of digital fabrication tools instead follows the lead of open-source software companies, by creating open-source hardware companies.

2.4.3 The Fablab networks

While personal fabrication is the first part of the benefits brought to a community by a Fablab, the second part is contained in grassroots community development, which supplies communities with the tools to develop at their own rate, in tune with local culture (Mikhak, Lyon, Gorton, Gershenfeld, McEnnis, & Taylor, 2002). An extension of this community is the worldwide cooperation and communication that takes place between Fablabs in the form of regional programs like the United States Fab lab network and Fablab.nl in Belgium, the Netherlands and Luxemburg, which take on projects that are too big for a single lab to handle, such as the establishment of new labs. These regional networks in turn link together in the International Fab Foundation to cooperate on a global scale (Gershenfield, 2012).

The Fablab networks are a type of incubation resource as described by Souitaris, Zerbinati and Al-Laham (2007). Some networks are educational in nature, such as the Fab Academy, which exists to accommodate students who have exceeded the local capacity for education in digital fabrication (Gershenfield, 2012). Others exist to share ideas and information, like the Digital Fabrication Laboratory, which allows users from all over the world to access existing creations to adapt to their own needs (Bull, Maddox, Marks, McAnear, Schmidt, Schrum et al., 2010).

The various Fablab networks relate to entrepreneurship theory in many ways. A firm's ability to interact with external sources to access, acquire and develop new knowledge that they can exploit in their innovation processes in one of the key elements for sustainable competitive advantage (Gunnar Óskarsson, 2005). However, the unique culture within Fablabs of applying open-source licensing to commons-based peer production calls for a different sort of exploitation than traditional business models would assume (Troxler & Wolf, 2010).

2.4.4 How do Fablabs interact with education?

2.4.4.1 Kindergarten

Little has been written about the exploration of kindergarteners in Fablabs, likely due to the complexity of the computers and machines. However, the Fablab in Barcelona has a Fab Kids program which is available for kids as young as 5 years old. The projects which involve the youngest children primarily allow them to participate in assembling structures cut with a laser cutter (Fab Lab Barcelona, online resource 2015).

2.4.4.2 Young learners

According to a report presented by Posch and Fitzpatrick (2012), children aged 10-14 gain technological literacy and improved learning skills through interaction with Fablabs, the primary challenge identified being time constraints. The subjects of their study were allowed to participate in 2d and 3d designing and printing as well as electronics and programming. Their workshop was too short for participants to finish all their projects. The workshop was intentionally not associated with school or traditional education. The participating children displayed happiness over learning goals, despite not having had these learning goals presented to them. One even mentioned that it was interesting to understand physics.

In South Africa, the challenge of engaging young learners in active innovation was tackled in part through a project dubbed FabKids. The experience of students taking part in a FabKids program was outlined in a study published in 2010. The feedback of what participants felt they had learned was highly positive, with a broad spectrum of learning taking place across a wide range of skills. In addition, participants underlined the importance of teamwork. Experience of the first students revealed that regardless of educational background, all students involved were able to participate fully in the project. Participants were divided into groups. Their assignment was to design a business card holder which would catch the attention of people passing by (Beyers, 2010).

According to Beyers (2010), all participants were able to solve the problem without a teacher telling them how to do so, thus learning on a deeper, more meaningful level. One problem with the project was that students had to travel to the Fablab. Once they returned to their respective schools, there was little support to

maintain the creative and innovative “high” they had gained. To meet this need, he suggested the use of “Fab hubs” where schools would have access to the hub, at least digitally, in the sense that students would design and develop their digital creations and email them to be printed at the Fab hub. This way, multiple schools can benefit from a single Fab lab.

2.4.4.3 Upper Secondary school

In Iceland, the Fablabs have been primarily integrated with upper secondary school programs while remaining open to other schools and the community as a whole. In South Africa, researchers studied how female high-school students experienced the fab lab environment, and found that interaction with the Fablab served to increase interest in science, engineering and technology (SET) fields (Dlodlo, N. & Beyers, R. N., 2009).

2.4.4.4 University

Fablabs have been integrated in university programs around the world, such as architecture and biomedical engineering. In addition, unique programs have been developed, such as the Fab Academy, which offers educational resources beyond what is available locally.

Fablabs originated at MIT, in collaboration with other interested parties. In the beginning, Neil Gershenfield taught a course named “How to make almost anything” to teach students how to use subtractive and additive fabrication machines, but was overwhelmed by the amount of students who wished to become “Makers”. Maker is a term for people who make things. This developed into a recurring program which continues to be heavily sought after. Students learned how to use a wide range of machines and programs as well as learning about sustainable design and materials (Gershenfield, 2012).

At Instituto Universitário de Lisboa, a Fablab was established to enable digital fabrication in an architectural context. The development process was detailed in a research paper published in 2012. The relationship between conception and production is particularly important in architecture and has been drastically changed by the digital revolution by creating a direct link between these two previously separate phases of the architectural design process (Paio, Eloy, Rato, Resende, & de Oliveira, 2012).

When deciding on the scope of the Vitruvius Fablab, the school found inspiration in the experiences of other architectural schools. The experience of Brazilian architectural schools was that there were three lines of action that can be pursued in a fabrication laboratory: Research, applied development and education, and that the best results are had when all three are pursued. (Celani, G. 2012)

The founders of the Vitruvius Fablab saw the primary challenge of using the Fablab for education to be one of attitude. 3D printing is traditionally viewed as a tool for presenting architectural work, but not as an integral part of the architectural design. As students become more familiar with and fluent in the use of digital fabrication a gap appears because professors are less fluent in digital fabrication and thus do not realize the possibilities ingrained in digital fabrication (Paio et al, 2012).

Stephenson and Dow (2014), elaborated on the importance of a multifaceted teaching approach. While some students thrive in a theoretically led environment, many students learn better when exposed to an environment that provides “discovery based, authentic educational experiences” which allows them to apply theory in a practical way. This allows “conceptual thinkers” and “practical doers” to engage equally in the learning process.

2.4.5 Exposure to risk and failure in Fablabs

Interaction with a Fablab falls under the “method world” of entrepreneurship education, in that it allows students to build skills and gain experiences which prepare them for the challenges faced by entrepreneurs without exposing them to real risks (Neck & Greene, 2011). In their South African experiment, Dlodlo and Beyers (2008) noted that they required prototypes to be created out of cheaper material, so that initial mistakes were not fatal, but rather a natural part of the development process. Learning to accept mistakes as opportunities for learning, rather than failure, is an important part of the innovative entrepreneurial process and facilitates learning on a deep, personal scale (Blikstein, 2013). Lack of acceptance of failure restrains individuals from becoming entrepreneurs (Carayannis, Evans, & Hanson, 2003).

2.4.6 Compatibility of values in the Icelandic school system and Fablabs

The Icelandic upper secondary school curriculum (Aðalnámsskrá Framhaldsskóla) is based on 6 core values:

- literacy
- sustainability
- democracy & human rights
- equality
- health & welfare
- creativity

These values are intended to underlie and suffuse all aspects of education, in such a way as to promote the importance of them while teaching everything else. This means that in a course on mathematics, issues related to sustainability may be used for examples. When learning a new language, the local system of governance may be discussed etc. (Mennta og menningarmálaráðuneyti, 2011).

2.4.6.1 Literacy

Digital fabrication greatly increases the technological literacy of students. Interaction with a Fablab requires computer literacy, digital design literacy as well as fabrication literacy, and gives students a personal interest in becoming as fluent as possible in these fields. In addition, users are encouraged to share designs and ideas, which requires at least basic literacy in communication, reading and writing (Dlodlo & Beyers, 2009; Gershenfield, 2012).

In order to understand what Fablab does for technological literacy, it is important to put it in context of skills and competence. Technological skills indicate rote learning of specific tasks. Technological literacy means a general set of skills and intellectual dispositions important for all citizens. Technological competence is the in depth knowledge and expertise required for specialists and engineers to do their jobs. According to Blikstein “The distinction identifies fluency with technology as no longer a vocational skill or a way to train future science, technology, engineering and mathematics (STEM) workers, but knowledge valuable for every citizen. “(Blikstein, 2013, p.3).

2.4.6.2 Sustainability

While the Fablabs do not require users to recycle, reuse or consider the environment, it is an implicit part of the movement itself. Students have to deal with limited resources (Dlodlo & Beyers, 2009) and are given resources to print spare parts to fix broken possessions rather than discarding them. In addition, future plans in digital fabrication are to digitize the building blocks themselves. Gershenfield (2012) compared the process to that of building with Lego blocks, except that the Lego blocks themselves would know where to go. The scale could be microscopic or even smaller, and the objects could be broken back to component parts to be remade into new configurations.

2.4.6.3 Democracy & human rights

> "Just as the democratization of information through personal computers was a key advance of the 20th century, the democratization of production through improvements in fabrication technologies will be a pivotal development in the 21st century." (Bull, G., & Groves, J., 2009, p.36)

Among other things, Fablabs have been used to provide Internet to a village in Afghanistan and to create cheap prosthetics for children. Several labs have been established in developing regions to empower users to create tools and equipment necessary to improve living conditions and opportunities for the future.

In the context of Icelandic education, Fablabs can be used to encourage discussion on what type of human rights can be provided via digital fabrication. Issues of infrastructure, communication and dissemination of information can be explored through physical models.

The digital revolution has been hailed as a "democratization of fabrication", especially when brought to classrooms. Blikstein (2013) even called it a democratization of invention, arguing that since interaction with Fablabs can bring technological literacy to the average student, it democratizes invention. Invention is no longer the sole privilege of the educated, but a process available to anyone who has an idea. By making invention and fabrication something that every citizen can influence, it has essentially been democratized.

2.4.6.4 Equality

The tenets of equality run strong in the Fablab community as well, as anyone is welcome, and in some areas girls in particular are encouraged to participate, to increase their interest in Science, Engineering and Technology (SET) fields. (Dlodlo & Beyers, 2009)

In 2009, Dlodlo and Beyers addressed gender inequality in science, engineering and technology (SET) fields by conducting a study where young girls were given tasks in a Fablab and their experience recorded.

According to the study, participants "...acquired a number of skills including computer-aided design, research skills, communication skills, teamwork skills, technical drawing skills, writing skills and problem-solving skills. Exposure to technology enhanced the girls' confidence in being able to handle technology-related tasks." (Dlodlo & Beyers, 2009, p.1).

Through their research, they discovered that girls are much less likely to pursue SET fields of study, partially due to societal stigma or ingrained stereotypes of what women should and shouldn't do. The importance of introducing early on the hands on experience of digital fabrication can change this trend by giving girls a tangible example of what SET fields can enable them to accomplish.

2.4.6.5 Health & welfare

In addition to providing working prosthesis for disabled individuals, Fablabs can be used in health related fields such as biomedical engineering. According to Stephenson and Dow (2014), applications range from the creation of specialized tools and instruments to the visualization of abstract models.

2.4.6.6 Creativity

Fablabs are based on the idea of enabling anyone to make anything. As such, they encourage creativity in every user. They encourage users to see problems that need fixing, and to create innovative solutions suited for each individual case.

Overall, the core values of the Icelandic education system are suitably well covered by the Fablab ideals. While literacy, creativity and sustainability are most strongly represented, the other core values can easily be integrated in a Fablab centered curriculum.

2.4.7 The Westman Islands Fablab

The Icelandic Fablabs were established in order to increase knowledge about personalized production, digitized industrial production and to empower innovation in Iceland. In addition, the fab lab project is meant to increase the public's technological know-how and general awareness of technology. Finally, the project is meant to create a platform for innovation and to increase the competitive abilities of companies, educational institutions and students (Nýsköpunarmiðstöð Íslands, 2012).

The Fablab in the Westman Islands was the first to be established in Iceland. It began operations in 2008 and has been physically integrated in the Westman Islands Upper Secondary School (FíV) in 2015 (Fablab website, 2015).

FíV has an average of 250-260 students a year and only 10-20 are able to participate in the Fablab program each year due to physical space constraints, despite a high amount of interest from students (Svanborg Rannveig Jónsdóttir, 2013).

2.4.8 Fablabs and innovation

Innovation is one of the core components of Fablabs, mentioned as an important cornerstone of the mission statement for the Icelandic Fablab organization.

Gershenfield (2012) described Fablabs as being a blend of top-down and bottom-up spaces. Some are a part of a national agenda of innovation, these initiatives tend to have better funding, but experience difficulties in reaching local communities. Other Fablabs are created at the behest of a group of interested individuals who seek to fill a need in their local community. These then tend to join the networks as discussed earlier.

Fablabs are a type of collaborative innovation space, which was described by Capdevila (2014) as a top-down organization with an explorative agenda. According to Capdevila, exploitation and exploration of new opportunities are equally important for the competitiveness of firms, as exploitation is linked to certainty, productivity and efficiency while exploration deals with creativity, uncertainty, exploration and acceptance of failure.

2.4.9 Citizen-based innovation

According to Tomas Diez (2012), Fablabs and digital fabrication signal a significant change in the way humans live their lives. By placing access to meaningful innovation in the hands of the average citizen, the way we innovate changes from a top down model to a bottom-up model. Rather than requiring highly educated individuals to do the necessary research and development to discover groundbreaking innovations, he argues that innovation will happen much more rapidly, in the hands of those who need the change that the innovation will bring.

He further states that cities will invariably change to accommodate personal digital fabrication, since it brings intrinsic changes to what we need, just like the internet greatly reduced our need to physically travel to take care of daily tasks and errands.

2.4.10 Fablabs and entrepreneurship

Fablabs are a window into the world of peer-produced, community based digital fabrication.

Just like businesses based on developing and distributing open-source software thrive and expand, businesses based on developing and distributing open-source hardware can thrive. Benkler (2003) outlines the benefits of non-market based production, and suggests that it offers an alternative to the current market-based business models.

In 2003, Benkler wrote about the networked information economy:

> "In a nutshell … productivity and growth can be sustained in a pattern that differs fundamentally from the industrial information economy of the twentieth century in two crucial characteristics. First, nonmarket production...can play a much more important role than it could in the physical economy. Second, radically decentralized production and distribution, whether market-based or not, can similarly play a much more important role." (Benkler, 2003, p.1246)

Troxler (2010) describes how a robot developed in a Fablab and subsequently shared online wound up being produced by a manufacturing company in another country, earning the creator - who had never expected to gain financially from making the robot

- money based on the sales of his creation. In this particular case, the creator gained from sharing, in a way that he would not have gained if he had kept his design private.

In an effort to describe some of the functioning business models that have evolved around 3D design, Cautela, Pisano, Pironti and Rieple (2012) outlined three different base building blocks for business models: Customer value proposition, key resource and key process. All of these are competitive advantages that can be utilized by 3D printing companies.

2.5 Influencing entrepreneurial intentions through education in general and Fablabs in particular

The relationship between Fablabs and the intentions of students who have interacted with them has been somewhat well recorded in a roundabout way. Despite a lack of research specifically discussing intentions, most of the literature contains discussion of the changed perspectives and attitudes of participants toward Fablabs, creativity and technology, as well as changed attitudes toward Science, Engineering and Technology fields (Beyers, 2010; Dlodlo & Beyers, 2008).

2.5.1 Influencing attitudes

It has often been mentioned that the temporal distance between measurable entrepreneurial intentions and actual entrepreneurial behavior can be substantial. According to Fujita, Eyal, Chaiken, Trope & Liberman (2008), temporal distance changes attitudes, so that specific arguments are more effective at changing attitudes when the relevant object is temporally distant than when it is temporally close.

In other words, it is important to keep in mind how far into the future the career decision of becoming an entrepreneur is, when choosing how to influence a student's attitude towards becoming an entrepreneur. When the career decision is temporally distant, i.e. months or years in the future, high-quality, abstract arguments are more persuasive than low quality, concrete arguments.

Examples of a low-quality, concrete arguments are "you can save money by making the item yourself" or "you can add personal touches to your wardrobe", while examples of high-quality, abstract arguments are "this will change the dynamics of the local community for the better" or "this is more sustainable in the long run".

Fablabs are fully capable of supplying both types of arguments and can therefore both encourage short term positive attitudes towards entrepreneurship which are useful within days or weeks; for example for student projects or inter-school competitions; and long term positive attitudes toward entrepreneurship which are useful months or years from now, when students need to decide on whether or not to follow an entrepreneurial path.

2.5.2 Influencing self-efficacy

Entrepreneurial self-efficacy is the self-confidence that one has the necessary skills to succeed in creating a business. Women are more likely to doubt their own abilities, entrepreneurial self-efficacy is therefore of greater concern for women than for men. Wilson, Kickul and Marlino (2007) found that the increase in entrepreneurial self-efficacy after entrepreneurship education was far greater for women than men, women ending up with higher self-efficacy levels than men at the conclusion of the program. They emphasize the particular importance of providing entrepreneurial education to female students of all socioeconomic and ethnic backgrounds.

One way to increase self-efficacy is by providing mentoring early in the process. Mentoring has proven to positively affect the self-efficacy of mentees, although entrepreneurial intentions have been observed to drop. To avoid loss of intentions, mentorship should occur before the entrepreneur has proceeded too far along the entrepreneurial path. (St-Jean & Mathieu, 2015).

According to BarNir, Watson and Hutchins (2011), mentors increased women's entrepreneurial self-efficacy to a greater extent than men's, although the effect was positive for both genders.

The importance of early mentorship coincides with the Reinforcement/feedback mechanism proposed by Carayannis, Evans and Hanson (2003), which proposed that entrepreneurs at all levels of the entrepreneurial path should share knowledge and experience.

Mentorship is supplied by Fablabs in two ways. One is through talented and highly qualified individuals who know the inner workings of Fablabs, and the other is through the extensive networks which are a natural part of the Fablabs. It would be useful, however, to increase participation of local businesses in the application of lessons

learned in Fablabs to real-life situations, either by discussing the exploitation of new discoveries, or by assisting students in recognizing needs and opportunities in their local environment, which could be solved through the use of skills gained in the Fablab.

2.5.3 Influencing subjective norms

The norms in Iceland are positive toward entrepreneurship. However, these norms are offset by high levels of fear of failure (Agnar Hansson et al., 2002).

Since subjective norms are the perceived norms of significant others, they are not generally something educational institutions can influence directly. However, by supplying new "significant others", such as beloved mentors or entrepreneurially minded friends and colleagues, new norms can be introduced as a result. Thus, the role of educational institutions in influencing subjective norms is in part to facilitate such relationships, and in part to reinforce local norms that are positive toward entrepreneurship.

Fablabs provide just such relationships and networks, and are based on ideals of innovation, exploration and discovery.

2.5.4 Influencing propensity to act

Current theories on influencing propensity to act are related to "learned optimism" (Seligman, 1991 by Krueger et al. 2000) and mindfulness (Chatzisarantis & Hagger, 2007).

Mindful individuals have been proven to be more likely to act on their intentions than less mindful individuals. In the words of Chatzisarantis and Hagger: "...heightened awareness and attention to inner experiences and environmental influences, characterizing mindful individuals, facilitate a successful translation of intentions into actions." (Chatzisarantis & Hagger, 2007, p.671).

There is no direct way for Fablabs to change a person's propensity to act, but they do supply a ready environment for students to practice mindfulness or learned optimism exercises learned in other classes. Additionally, students take responsibility for their own work and receive real, tangible rewards for work well done, which can serve as reinforcement to such lessons.

3 Methodology

3.1 Research questions

According to the academic literature, Fablabs encourage deep learning and the acceptance of failure, increase self-efficacy, encourage innovation and problem solving and connect users to a vast network of innovation.

The primary research question of this paper is “Do users of the Westman Island Fablab have higher entrepreneurial intentions than other students?”

It is not within the scope of this paper to explore whether the relationship is causal, simply to ascertain whether there is correlation.

Since Fablabs function as collaborative innovation communities, users are presumably introduced to new “significant others” and new normative values. It is therefore posited that Fablabs positively influence the subjective norms of students toward entrepreneurship. In order to explore this possible connection, a group of three sub-questions is presented: “Do Fablabs expose users to new normative values?”, “Do Fablabs expose users to new significant others?” and “Are the subjective norms of Fablab users more favorable of entrepreneurship than those of non-users?”

One of the primary things that deter people from entrepreneurial pursuits is a fear of failure (Agnar Hansson et.al, 2002). Fablabs teach users to come to terms with failure. As a result, it is interesting to search for the answer to the next sub question: “Are Fablabs users less afraid of failure than non-users?” In addition, a fear of failure presumably tends to reduce propensity to act. If Fablab users are less afraid of failure, perhaps this is reflected in a higher propensity to act. The second question in this set is therefore: “Do Fablab users have a higher propensity to act than non-users?”

Attitudes are based on our beliefs about certain actions. If Fablabs influence the beliefs of users, “do Fablab users have attitudes which are more supportive of entrepreneurship than those of non-users?”

Fablabs provide users with technological literacy, the know-how of making things and an environment which encourages the exploration of new discoveries. Learning and

hands-on experience are some of the primary ways of improving self-efficacy. Do Fablab users have higher entrepreneurship self-efficacy than non-users?

The second category of research questions relate to the organization behind the Fablab in the Westman Islands. The primary research question here is "What are the aims and goals of the leaders involved with decision making for the Fablab?" This is an important question, as it enables us to perceive the purpose of the Fablab in the eyes of its decision makers. If their aims and goals are supportive of increasing entrepreneurial intentions, it can be assumed that Fablabs users have higher entrepreneurial intentions than non-users. This leads to the final question: Have the leaders attempted to encourage entrepreneurial intentions?

3.2 Research approach

In order to answer the research questions with regards to the Westman Islands Fablab, two focus groups will be drawn, one from the students who have used the Fablab and one from the rest of the student population of FíV. Each group will consist of 5-8 students and every effort will be made to have the groups as homogenous as possible. Each group will be asked the same set of questions designed to measure entrepreneurial intentions.

3.2.1 Qualitative application of the entrepreneurial intentions questionnaire

The questions are based on the Entrepreneurial Intentions Questionnaire (EIQ) created by Liñán and Chen (2009) to be used in quantitative studies of entrepreneurial intentions. Several iterations of the EIQ exist and have been used in various publications (Liñán, Urbano & Guerrero, 2011; Jaén & Liñán, 2013). As they are all developments of the original, they focus on similar pieces of information. The various fields vary in their importance in this qualitative study. Some are answered by the pre-interview process, others are irrelevant due to the age of the participants.

In all three iterations of the EIQ, the education and experience of the participants is ascertained. While this is an important factor in a quantitative study of university students, it is accounted for in the description of the groups in this study. Demographic information is similarly known beforehand. The entrepreneurial knowledge of the students is assumed to be fairly low, although some of the students who interact with

the Fablab have participated in Fablab based entrepreneurship programs. In accordance with the research questions of this study, questions that gauge the professional attraction, social valuation and entrepreneurial intention of students are used. Additionally, attitude towards entrepreneurial activity and entrepreneurship ability and skills are explored. Entrepreneurial capacity and objectives are not a part of the research questions of this study, so those areas are not explicitly searched for in the interview questions.

Secondary interviews will be conducted with the headmistress of FíV and the project manager of the Westman Islands Fablab to discuss whether entrepreneurial intentions have been considered as a desirable outcome of Fablab interaction, as well as gleaning a deeper understanding of the running of the Fablab, the courses taught and the infrastructure surrounding it. These two individuals have been identified as the leaders associated with the Fablab. They are the ones who decide how to allocate resources and where efforts should be focused. Their plans and goals for the Fablab and the students associated with it are relevant to this study, since it aids in understanding the current status of the Fablab and can be useful in recommending future behavior. Knowing what they are trying to accomplish with the Fablab enables this study to discuss to what extent they have been successful, as well as allowing for the discussion on whether measurable results are the result of the decisions made by the leaders or a natural by-product of the Fablab itself.

3.2.2 Structure of the groups

The students participating in the study were randomly selected and contacted by the headmistress of FíV. Due to the timing of the study and the custom of students to work summer jobs right up until the end of summer vacation, some adjustments had to be made in order to find enough students to participate in the group interviews at once. In the end, both groups contain primarily students who have high academic scores and good attendance. This was done in order to avoid a selection bias for either group.

3.2.2.1 Group 1, FL (Fablab) group

Group 1 consists of 5 young men between the ages of 18 and 21. They are a blend of students in their final year of secondary education and recent alumni. They have all taken courses in Fablab and all know one another. Given the small population of the

Westman Islands and how few students attend FíV, it is impossible to assemble a group where the participants do not know one another beforehand.

3.2.2.2 Group 2, NF (non-Fablab) group

Group 2 consists of 7 young people, 2 female and 5 male between the ages of 17 and 25. They too are either recent alumni or students in their final year. None of them have taken courses in Fablab, but they all know each other beforehand for the same reasons mentioned for the FL group.

3.2.2.3 A note on the gender balance of the two groups

Attempts were made to include girls in both groups, but there are very few girls who have taken Fablab courses, and those who have were all busy or had moved from the islands. There was some discussion about having the NF group consist entirely of males in order to reflect the FL group, but in the end, the decision was made to have the NF group be mixed gender, in order to have the NF group reflect the population of the school more accurately.

Since this study does not study the relationship of gender and entrepreneurial intentions or Fablab participation, this should not skew the ability of the study to answer the research questions but it is nonetheless a detail which bears keeping in mind, especially considering the gender imbalance recorded when it comes to entrepreneurship and self-efficacy.

3.2.3 Group interviews

Nine interview questions were devised which allow us to answer the research questions of the study. The interview questions were devised based on the TPB and SEE models. Participants are given the opportunity to add any observations or comments not covered by the 9 questions at the end of each interview.

3.2.4 The questions

3.2.4.1 What do you want to be when you "grow up"?

This question is both an ice-breaker and an initial measure of the intentions of the students. The tone is light, there is no right or wrong answer and most people have some answer for this.

Without having influenced them with any questions about entrepreneurship, this question gauges their plans or dreams for the future. The aim is that the answers will reflect how much thought the students have put into their future plans. While not being a direct indicator of entrepreneurial intention, it does provide an insight into the professional attraction of the students.

There was a surprisingly stark difference between the two groups in their answers to this question. All respondents from the FL group were interested in technical fields. Their responses were specific and detailed. They mentioned which programs they intended to take at the university, or where they planned to work as apprentices. Some outlined their 2-3 year plans.

The respondents from the NF group were more vague and undecided. While most expressed an interest in pursuing a university degree, they did not specify which programs they would like to study. There was a prevalent desire to stand out and excel, but it lacked direction.

While neither group expressed a desire to become entrepreneurs, the discovery that the Fablab-users are more decided in what they will do may be an indicator of a higher propensity to act.

3.2.4.2 Is it best to work in a big company, a small company or to start your own company?

This question asks the groups to evaluate what sort of employment situation is most desirable. Rather than singling out and asking specifically about entrepreneurship, the question asks the groups to argue the desirability of entrepreneurship in context of other employment situations and to decide which situation is most desirable and why.

This is a way to assess the professional attraction for the individuals, but also gives a fairly good indication of the groups' attitudes toward entrepreneurship.

Both groups initially came out in favor of entrepreneurship over working for a small or large business, but the discussions forked out from there. In the FL group, they mainly agreed that they would first want to gain more practical experience before starting their own businesses. Their views on large vs. small businesses gave an interesting insight into what they valued in a future workplace. While they valued the efficiency and structure of large businesses as well as their importance to society, they

all shared a preference for what they perceived to be the more intimate, friendly and more personal atmosphere of smaller businesses.

The NF group saw entrepreneurship as a way to stand out and make their own path. They saw no difference in the size of the business, provided that the position is interesting and challenging to the individual.

Both groups identified the significance of risk involved with entrepreneurship.

3.2.4.3 Are there any individuals or groups in your lives who influence your plans for the future?

Here, the aim is to identify the relevant significant others. To get a good measure of the subjective norms towards entrepreneurship, it is followed up with a sub-question: How would these individuals or groups react if you decided to become entrepreneurs?

In both groups, family was perceived as the primary set of significant others. In the FL group, the group mentioned several examples of parents who worked in the fishing industry strongly discouraging their children from following in their footsteps. Additionally, they mentioned scientists and philosophers that have made an impression. The NF group showed a strong sense of individualism, stating that friends had no effect on what they wanted to do.

When asked about groups or organizations that may have had an impact, the NF group mentioned that sports may have some impact, as well as the search and rescue team. The FL group on the other hand all agreed that the Fablab had had a great impact on their choices. They explained that they had learned a great deal about their own strengths and weaknesses, as well as learning what they like and dislike to do. According to the group, one of the most important things they gained from Fablab was knowledge of what they *don't* want to do in the future.

The FL group agreed that their significant others would approve of their decision, should they choose to become entrepreneurs. They felt that the significant others would be supportive and happy that they had chosen to do something that makes them happy. One group member said: "I don't know who said it, but there was some famous philosopher who said that if you find a job that you love, you never need to work a day in your life from then on." The group all agreed with this sentiment.

The NF group similarly believe that their parents in particular would be supportive of their choices, proud and pleased, with one student mentioning that parents can be a moderating force, in that they will approve, as long as the entrepreneurship venture isn't "some kind of mess".

3.2.4.4 How do you feel about taking risks in life? -and in your professional life?

This question departs slightly from intention models in that it attempts to discern risk-aversion and fear of failure in the groups. Since risk aversion and fear of failure heavily influence decision making, they are included here.

The NF group saw risk as an unavoidable part of life. They mentioned the risk associated with being different and making your own path to achieve your dreams.

One participant shared his outlook: "Those who never make mistakes never do anything." with which the rest of the group agreed.

The FL group was similar, although they stated that taking risks depends on the pros and cons associated with it, and that the circumstances of the risk are important.

Risk taking in a professional context was found to be thrilling. The FL group agreed that even if the venture would only "semi-succeed" it would be worth taking the risk of creating their own business. They also stated that they would feel safer doing it with a group than all by themselves. These colleagues would be sounding boards, voices of reason and a safety net.

The NF group found it important to take risks in your professional life. They would not take risks unless it is for something they love. They underlined the importance of knowing the risks and the danger associated before making a choice.

Neither group showed a particular aversion to risk, but the fear of failure was more prevalent in the NF group.

3.2.4.5 What would you do if you were taking a risk with a project and it didn't work out?

The fifth question elaborates on risk aversion and fear of failure by asking the groups to discuss how to react to failure, gauging whether or not they feel competent in dealing with failure.

While both groups responded that it was important to learn from the mistakes and to keep trying, the difference lay in the depth of experience that the groups possessed.

The NF group did not have much to say, other than that they would learn from the mistake, keep trying or move on.

The FL group discussed the importance of learning and gaining more experience before trying again, attempting to fix the problem, find out why it didn't work out and if there is no hope of salvaging it, simply to learn from your mistakes and move on. The primary difference is the specificity of discovering what went wrong and attempting to fix it, which speaks volumes about the attitude of the FL group towards dealing with failure. They showed a clear depth of experience which prepared them better for such an eventuality than the participants in the NF group.

3.2.4.6 What do you think about entrepreneurship?

This question allows the group to discuss their attitudes toward entrepreneurship and should provide a clear idea of the groups' views on the desirability of entrepreneurship.

The NF group did not understand the term entrepreneurship at first. After having it explained, they expressed admiration for the profession and a desire to be entrepreneurs themselves. They saw entrepreneurs as people willing to take risks. They also saw the potential for success, for people following an entrepreneurial career, as well as seeing entrepreneurship as a means to do something you love.

The FL group had very positive opinions of entrepreneurship. Their views ranged from it being the "best thing in the world" to being highly important for the development of society. They saw it intermingled with and nearly indistinguishable from innovation. They discussed entrepreneurship as a field and in context of society, rather than as a personal career option.

3.2.4.7 Could you become successful entrepreneurs?

Here the perceived behavioral control, self-efficacy and perceived feasibility is examined by asking the group to establish whether or not they perceive themselves capable of becoming successful entrepreneurs.

The sub question - why? - asks them to elaborate, in an attempt to gain an understanding of the reasons for their confidence or lack thereof.

Both groups believed that most people can become successful entrepreneurs if they chose to try. All but one person out of both groups believed themselves fully capable of becoming successful entrepreneurs. Members of the FL group mentioned the importance of having a good head on your shoulders, learning the right skills, gaining the right experience and having the right luck to really succeed, while members of the NF group mentioned the importance of self-confidence and persistence.

When asked why they perceived themselves capable of becoming successful entrepreneurs, the NF group listed internal traits, such as self-confidence and determination, while the FL group listed a wide variety of external factors ranging from good upbringing to the vast amount of unexplored potential for innovation. The FL group also mentioned the necessity of setting goals for oneself, stepping out of the comfort zone, taking risks and dreaming big.

3.2.4.8 How would you go about innovating if given the opportunity?

This question is meant to give a realistic representation of the actual abilities of students in the group when it comes to innovation. If they have ideas of where to start and how to proceed, it can be assumed that they are more capable of innovation than if they do not.

The NF group outlined how they would go about gaining support for their idea. They agreed that it would be best to have a team to work with, develop the idea and present it to others.

Again, the FL group displayed their experience in innovation. They discussed specific projects they had participated in. They said that they would begin by brainstorming, then weeding out ideas until the remaining ideas were viable and workable, and then select the best idea out of those. Once the idea had been selected, the process of implementing it seemed less of a concern.

3.2.4.9 How good are you at following plans and achieving personal goals?

The final question deals with propensity to act, which is an important part of the SEE model.

Both groups seemed equally confident in their own capabilities of acting on plans and achieving personal goals. There was no notable difference in how the two groups answered this question. Both groups felt that they are good at motivating themselves to show up to classes and practices on time, hand in homework and generally be responsible. They did note a difficulty in waking up, although they attributed this to their age, rather than any lack of self-discipline.

3.2.4.10 Is there anything you would like to add about entrepreneurship?

Finally, each group was asked if they had anything to add. This was done in order to allow them to air any thoughts or opinions about entrepreneurship that they had not been able to mention during the course of the interview, again, to give an insight into how the groups think about entrepreneurship.

The NF group stated that there should be more entrepreneurship, mentioning the potential for becoming rich, “like the founders of Apple”. The potential of gaining personal wealth seemed important to them.

The FL group, on the other hand, spoke of how entrepreneurship should be a part of the core curriculum in upper secondary school, how making entrepreneurship a required subject might encourage more girls to participate, and that gender disparity was a problem. They mentioned how girls seem to think that Fablabs and entrepreneurship are nerdy activities and not considered “cool”. They also connected this set of social norms to gender based wage discrepancy and why girls tend to avoid science, technology, engineering and math (STEM) fields.

Finally, the FL group stated that entrepreneurship is fun and important for the community.

3.2.5 Interviews with the decision makers for the Westman Islands Fablab.

The purpose of these interviews is to provide an understanding of the driving forces behind the Westman Islands Fablab, in order to enable the application of the knowledge gained from this study to the real world. The interviews discuss the purpose of the Fablab in context of students, the school and the community and the skills and values encouraged in students interacting with the Fablab. They also touch on how the headmistress and project manager view the networks associated with the Fablab, the

past, present and future uses of Fablab and the success of the local Fablab so far. Finally, the headmistress is asked of her hopes for graduates of FíV and the project manager is asked of his hopes for students who come through the Fablab, in order to identify the core aims of these two leaders and how they translate to the goals for the Fablab.

3.2.5.1 The purpose of the Fablab, as perceived by its leaders.

The purpose of the Fablab is to benefit students, the school and the community. The benefits to the students are that they gain increased technological knowledge, interest and awareness and technical capability. The aim is also to increase the interest in STEM education, VET studies and engineering studies. Additionally, the purpose is to provide students with a more diverse learning environment, where they gain the opportunity to interact with technology which would otherwise be unavailable to them.

Further, the Fablab is meant to increase the interest and knowledge of entrepreneurship and increase the opportunities for the students.

The Fablab enables the school to teach students so that they are better prepared for future studies or jobs by showing them a wide variety of technology and tools to communicate and create. In addition, the Fablab increases the competitiveness of the school, as it is a point of differentiation from other schools.

The society also benefits from increased competitiveness, as local companies and individuals reach a higher capability in technology and industry. The need for change is dire, as the society is going through extensive technological developments. Jobs which have traditionally been important to the small community are becoming obsolete through automatization, both aboard fishing vessels and in fish processing. The headmistress underlined the need for acknowledging this inevitable change, and creating something new to replace the lost jobs. While she did not know what this new industry might be, she believes that an important place to start is to teach the people who need those future jobs how to think creatively, use technology to their advantage and enable them to create future jobs, so that the community can continue thriving.

3.2.5.2 The skills students gain from interaction with a Fablab

Fablabs provide an environment which encourages students to think creatively, and to apply that creativity to practical purposes. By making things, they gain the courage to

create. They learn from their failures and mistakes and how to troubleshoot their creations until they work. They gain self-esteem and learn to pinpoint their individual fields of interest. While Fablabs cause students to become more self-confident, they also give students a greater appreciation of their own strengths and weaknesses, making them better at team work. They learn that they are valuable to the team, and that the team is valuable to them.

Fablabs help students find their path, what they want to do in the future. They learn to identify opportunity for change, improvement and entrepreneurship. Finally, they learn the basics of design thinking and the design process.

3.2.5.3 The values students gain from interaction with a Fablab

The values cultivated in the students are sustainable thinking and learning to appreciate sustainable life, as well as the value of sharing knowledge. According to the project manager, “When [the students] share knowledge, they also gain a lot of knowledge.”

Another important set of values are the value of teamwork and international collaboration. These break borders between cultures.

The headmistress intends that the Fablab should encourage students to devote themselves to their assignments, that they will see value in them, as well as potential for further study or work. She also hopes they gain self-discipline, work-ethics, communication abilities and the ability to receive and provide constructive criticism.

3.2.5.4 The importance of the Fablab communities and networks.

The international networks associated with the Fablabs are of immense importance due to the isolation of the Westman Islands. They provide an important connection to the rest of the world. The project manager stated that the networks that come with the Fablab are the most important part of a Fablab; the international community of people who cooperate and share knowledge in order to make life better, either by making it more fun or by increasing the quality of life in different parts of the world. It is of great importance that the students feel that they can be an active part of the world, even on a remote, isolated island.

3.2.5.5 The use of the Fablab so far

So far, FíV has offered special, elective courses in the Fablab. However, starting in the school-year of 2015/2016 the school will offer a mandatory course on entrepreneurship for all students, where the Fablab will be incorporated.

Outside the school, the Fablab has been quite popular. The Project manager estimated that 6-7% of the island's population visit the Fablab every month. A group of kids from the age of 12 years visit the Fablab on a daily basis. People from the general public and local companies use it as well.

3.2.5.6 Measuring the success of the Fablab

No formal measurements of success have been conducted on behalf of the school, although the achievements of students who have interacted with the Fablab give some indication of success. Students who have interacted with the Fablab have for example performed better in entrepreneurial competitions, winning several such competitions in the past few years.

The Fablab measures the amount of visitors, workshops and teachers that have been trained there. While these statistics are important, there are, according to the project manager, many positive effects which are more difficult to measure, such as the impact the Fablab has on people's lives. Fablabs influence the career choices of students, but to what extent and in what way has not been studied yet. Observation also serves to inform us that students who have interacted with the Fablab tend to become more focused and interested in their studies.

3.2.5.7 The future of the Westman Island Fablab

Both the headmistress and the project manager are excited about the next step of the collaboration between FíV and the Fablab. The Fablab is moving to a new location, which is based within the school building of FíV. The new location provides better facilities for the Fablab, more space, and improved accessibility of the Fablab for students of FíV. The relocation is scheduled to be completed by the start of the school year in the fall of 2015.

The aim is that more teachers will seize the opportunity to implement the Fablab into various subjects which are currently not related to making things. With an increased interest in the use of the Fablab facilities, more students will be exposed to

the skills and values presented by the Fablab, resulting in graduates who are more prepared for the job market.

A desired effect of the increased activity is also an improvement of the level of education available in the Fablab and an improvement of the quality of teaching methods. Through the use of networks such as the Fab Academy, higher education can be made available in the Westman Islands in a wider range of subjects than is currently available. The Fablab will provide access to knowledge that was previously out of reach, and improve the international connections of the school. By connecting the school with other upper secondary schools and universities all over the world, the school becomes more competitive and the quality of both the school and the Fablab will improve.

Both the headmistress and the project manager further hope that the Fablab will increase the local interest in scientific fields, as this would indirectly improve the competitiveness of the local fishing related businesses. Already, one of the local Fablab projects is to develop items and equipment needed for biochemical purposes. FíV has highly qualified teachers in scientific fields, most notably a Doctor of biochemistry.

All the above steps are first and foremost intended to facilitate future jobs in the community.

3.2.5.8 Hopes for graduates of FíV and the Fablab

The primary hopes that the headmistress and the project manager have for the students who graduate from FíV or interact with the Fablab is that they find "themselves" and the path they wish to follow after they move on. There is a sense of hope for the individual students that they will grow and thrive, but also an overarching wish that the students will chose to do so in the community where they grew up. The hope that the Fablab and the school can combat the brain drain that the community is experiencing is prevalent.

> "...we need more diversity of jobs on the island and I believe that that will succeed within a few years. That when those kids have sought for higher education that they will come back and create new job opportunities here on the island." - Frosti Gíslason, Project manager of Fablabs in Iceland. (August 14th, 2015)

3.2.5.9 Final thoughts regarding Fablabs and its role in education

Although it is difficult to measure, the impact of the Fablab is easily observed. It changes the minds of people who interact with it. They gain more self-esteem and self-efficacy than they had before. The Fablab opens the eyes of people for the opportunities of international cooperation and how to live and work in an isolated community without losing touch with the technological development of the world.

The school has a responsibility to evolve along with the community and to assist students in embracing and adapting to the changing technology around them. Fablabs are a good way for schools to accomplish this. It is the nature of schools to be slightly behind technical and scientific developments. Schools must teach that which is and prepare the road so that students can face what's coming. Using Fablabs, they can do so by introducing the students to technology early on, helping them see potential for development.

4 Discussion

It is apparent that there are several important differences between Fablab users and non Fablab users when it comes to entrepreneurship and entrepreneurial intentions.

4.1 Fablabs and subjective norms towards entrepreneurship

Subjective norms are a part of the TPB. While norms are something shared by a culture or a community, subjective norms are the personal norms of each individual, which are based on social norms as well as the opinions of significant others (Ajzen, 2011; Krueger, Reilly, & Carsrud, 2000). The leaders involved with the Fablab stated clear intentions of encouraging specific norms in students involved with the Fablab. These norms were in the form of the value of sharing knowledge, a sense of responsibility for the community and a desire for cooperation, locally and internationally. While none of these directly involve entrepreneurial intentions, it appears that the school and community are already settled in a norm which is highly positive towards entrepreneurship. Both groups displayed favorable views, and a belief that their families would be supportive, should they choose to become entrepreneurs.

This tendency for norms to be supportive of entrepreneurship in Iceland concurs with previous research (Agnar Hansson et al., 2002). The fact that Icelandic norms are already positive toward entrepreneurship may be a reason why encouraging positive entrepreneurial norms is not a priority for the leaders of the Fablab.

Fablab users displayed a higher understanding of the importance of gender equality and displayed a sense of responsibility towards the community which was not present among those who had not interacted with the Fablab.

Fablabs expose users to new normative values. However, the values users are exposed to are not entrepreneurial values, as such. The fact that values can be shared with users of the Fablab does indicate that it would be possible to encourage positive entrepreneurial norms in the Fablab in the future.

While the Fablab users unanimously stated that the Fablab had helped them decide what they wanted to do in the future, they mentioned its ability to show them what

they were good at and what they liked as well as what they were less good at and liked less. They did not mention the presence or absence of significant others within the network. The question of whether Fablabs expose users to new significant others therefore remains unanswered.

In future research, it may be advisable to consider the model of entrepreneurial perception and performance (see fig.3) and the part that the Fablab networks and community play in the reinforcement/feedback mechanism (Carayannis, Evans and Hanson, 2003).

Both groups displayed subjective norms that were highly in favor of entrepreneurship. This is most likely a result of the local norms already being positive toward entrepreneurship and the norms within FíV encouraging entrepreneurship in the students.

4.2 Fablabs and failure

Fablabs offer an important feature to users in the shape of the exposure to non-fatal failure, and lessons in how to deal with said failure. The leaders correctly identified the importance of experiencing failure, and encourage the ability to give and receive criticism as well as the tenets of cooperation. These skills and values help students deal with failure in a positive way.

It is evident that some experience of failure is possessed by non-users as well as users of the Fablab. Both groups displayed knowledge of learning from mistakes and moving on. However, it was strikingly evident that Fablab users had more experience with actually learning from their mistakes. They showed a clear knowledge, gained from experience, of what it means to learn from a failed project, to try to fix it, to gain more experience and return to it.

The NF group did not shy away from the prospect of failure any more than the FL group. When discussing the importance of taking risks, both groups discussed the importance of knowing the pros and cons, and deemed it acceptable and even necessary to take risks to do “what you love”. While it was evident that the FL group was no less afraid of failure than the NF group, this is a sign of the general courage of the students involved in the study. In future research, it would be interesting to study the ability of students to deal with failure, although ironically, ability to deal with failure

does not influence entrepreneurial intentions as much as fear of failure does (Agnar Hansson et al, 2002). Perhaps the ability to deal with failure influences entrepreneurial self-efficacy and thus, indirectly, influences intentions.

4.3 Fablabs and the propensity to act

According to the opinions of the students themselves, both groups felt that they were quite good at managing their time and motivating themselves to get things done. However, as an observer, the fact that all the students who had interacted with the Fablab knew what they wanted to do, and had already taken steps to make those plans a reality, while those who had no Fablab experience had only vague ideas about their plans, indicates that the Fablab users have a higher propensity to act, even though they may not be aware of it themselves. This further indicates the value of a qualitative research approach, since people are often not aware of their own strengths.

Fablab users were found to have a higher propensity to act than non-users. It would be interesting to pursue more in-depth research of Fablabs and the propensity to act, since this study gives us but a glimpse of what might be a much deeper, broader impact of the Fablab. The relationship between a Fablab experience and mindful behavior (Chatzisarantis & Hagger, 2007) is another field which has not been explored yet, but could provide important information regarding the effect of Fablabs on users.

As far as the leaders are concerned, they may be satisfied that their goals of helping the students find their “path” in life were successful, for the users of the Fablab. It will be interesting to see if this effect will continue to be present should interaction with the Fablab be made mandatory. In essence, the question is whether the effect is causal, or whether a higher propensity to act is present in those students who make the choice of participating in the Fablab on their own volition.

4.4 Fablabs and attitudes toward entrepreneurship

As readers may recall, a person’s attitude is based on his beliefs about a certain action. The leaders of the Fablab in question stated that one of the aims of the Fablab is to change the way people think. Consequently, a part of the purpose of a Fablab is to change the beliefs of those who interact with it, and in turn, change their attitudes toward specific actions.

The students who had not interacted with the Fablab had positive beliefs about entrepreneurship. They believed that entrepreneurs have the potential to become rich and that entrepreneurs are individuals who stand apart from employed workers in a favorable way. They believed that on a personal scale, it is desirable to be an entrepreneur. Their attitude toward entrepreneurship reflected these beliefs and was primarily favorable of entrepreneurship.

The beliefs of the students who had interacted with the Fablab were on a different level entirely. While they too believed that entrepreneurship will lead to freedom, a chance to pursue what they love and innovation, they did not mention money, other than as a means to an end. They further stated beliefs that entrepreneurship is essential to any community, important for the economy, innovation and the development and improvement of living conditions. Their attitudes toward entrepreneurship were highly favorable.

Given than both groups displayed positive attitudes toward entrepreneurship, it can't directly be said that Fablab users have attitudes which are more supportive of entrepreneurship than non-users. On an individual level, the attitudes were equally favorable of entrepreneurship. However, in respect to the importance of entrepreneurship for the community and society as a whole, the attitudes were much higher for those students who had interacted with the Fablab.

4.5 Fablabs and entrepreneurship self-efficacy

As was discovered, Fablab users have an increased ability to deal with failure. This indicates a deeper confidence and skill in dealing with the unknown. However, it does not necessarily mean that the Fablab students have a higher self-efficacy of entrepreneurship than the rest.

The NF group had fairly high overall entrepreneurship self-efficacy. They justified their confidence in their abilities in their self-confidence and determination, which indicates that their general self-efficacy is high, which translates to entrepreneurial self-efficacy. They had high amounts of self-confidence, and seemed to be under the impression that they could do anything they set their mind to. Whether or not this self-efficacy is justified in terms of entrepreneurship remains to be seen.

The FL group also displayed high self-efficacy, although it seemed more specific to their individual chosen fields of interest. They had clearer ideas on how to go about becoming entrepreneurs and how to innovate. In addition, several of the students who have interacted with the Fablab have participated in and won competitions in entrepreneurship. Their self-efficacy seems different, more rooted in actual skills and experience, than that of the NF group. Finally, the answer to the question of whether Fablab users have higher innovation self-efficacy than non-users is negative and gives way to a different assessment: The entrepreneurship self-efficacy of Fablab users seems more firmly based in concrete experience and knowledge than the entrepreneurship self-efficacy of those who have not interacted with the Fablab.

4.6 Fablabs and entrepreneurial intentions

Based on the TPB, the elements of entrepreneurial intentions are subjective norms, attitude and perceived behavioral control (Ajzen, 2011; Krueger, Reilly, & Carsrud, 2000). In this study, evidence has been unearthed that subjective norms are similarly high, attitudes nearly the same and perceived behavioral control (discussed above as self-efficacy) similar between the two groups.

Using the theory of SEE, the factors that determine entrepreneurial intentions are perceived desirability, which is similar to attitude; propensity to act and perceived feasibility, which is similar to self-efficacy (Krueger, Reilly, & Carsrud, 2000). While perceived desirability and feasibility are similar between the two groups, propensity to act was higher for the group of students who had interacted with the Fablab.

The primary research question of whether Fablab users have higher entrepreneurial intentions than non-users depends on which theoretical model is used. The TPB finds no significant difference between users and non-users, while the SEE finds a difference. Krueger, Reilly and Carsrud (2000) found that the SEE is slightly more reliable at predicting future behavior than the TPB. It is the position of this study that students who interact with the Fablab have slightly higher entrepreneurial intentions with regards to the SEE than students who have not interacted with the Fablab.

4.7 The potential relationship between Fablabs and entrepreneurial success

The findings of this study show that there are several benefits of the Fablab with regards to entrepreneurship, despite its debatable effect on entrepreneurial intentions.

The ability of the students in the FL group to plan ahead and perceive their potential impact on society indicates that the hopes of the Fablab leaders may be fulfilled. Once these students are done, they give every indication that they intend to return to the Westman Islands, where they may very well create their own companies or otherwise take on entrepreneurial roles.

Additionally, their prospect of gaining success in the form of survivability of a new firm or product are increased by the level of experience and skill gained, whether from interaction with the Fablab itself or due to existing traits in the students who chose to interact with the Fablab.

One of the more interesting discoveries of the study was that the Fablab not only shows students what they want to do, but also what they don't want to do. Fablab users were decided on their paths but also knew quite specifically which paths they were not interested in. These paths differed from student to student, which indicates that it is not a result of a preference on behalf of the teachers or project manager but rather a matter of personal discovery and preference for each student.

4.8 Fablab and the various theories on how to teach entrepreneurship.

4.8.1 Fablab and learning, incubation resources and inspiration

Fablabs provide an interesting and different approach to practical learning, a wealth of incubation resources in the form of networks and international collaboration, but perhaps most importantly, Fablabs provide a great deal of inspiration and have been shown to greatly increase the interest of students towards ETS fields as well as providing a great environment for creative thinking (Gershenfeld, 2012; Dlodlo & Beyers, 2008). This sort of inspiration is particularly important for increasing attitude and intentions of entrepreneurship (Souitaris, Zerbinati, & Al-Laham, 2007).

The inspiration was evident in the participants from the FL group. They displayed a unified form of astonishment of the possibility for future discovery, a curiosity and an interest in participating in that discovery.

4.8.2 Fablab and the worlds of entrepreneurship education

Fablabs apply most aptly to the cognition and method worlds of entrepreneurship. Similar in nature to entrepreneurship programs based on serious games, observation and the other methods outlined by Neck and Greene (2011), Fablabs nonetheless offer a slightly more tangible approach in that students experience the act of designing and creating - and ultimately enjoying - their own creations.

Fablabs fit well in the "action based" approach presented by Rasmussen and Sørheim (2006) which is focused on learning by doing and on a strong collaboration between the community and the student. Their approach was intended for students at the university level, however, and would therefore need to be adapted to suit the upper secondary school level.

4.8.3 Fablabs and entrepreneurial perception and performance

Fablabs can be an effective way to influence both perception and performance in students. The primary forces at the awakening stage were discovery or non-discovery of entrepreneurial personality, values and desires (Carayannis, Evans and Hanson, 2003). As this study discovered, Fablabs show students not only what they enjoy, but also what they do not. Using the Fablab to encourage these personalities, values and desires can thus be highly influential at the awakening stage of the entrepreneurial path.

The reinforcement/feedback mechanism fits perfectly with the Fablab idea of sharing knowledge and experience. As the project manager of the Westman Islands Fablab stated: "The networks that come with the Fablab are the most important part of the Fablab." These networks do not only include innovative individuals and successful entrepreneurs, but also students and business professionals from around the world.

4.9 Further research

In order to fully understand the relationship between Fablabs, education and entrepreneurial intentions, further research is required. The first step is to conduct a longitudinal, quantitative study of entrepreneurial intentions in students, using a pre,

post and post-post study approach to ascertain whether courses in a Fablab change the entrepreneurial intentions of students, and if so, to what extent. This would provide a deep understanding of the relationship, as well as provide reliable data for further analysis.

While this study provides an indication as to the differences between students who have interacted with the Fablab and students who have not, it is impossible to verify a relationship of causality based on the available information. Corroborative research needs to be done to establish that the trends found are replicable and reliable.

Ideally, students from all over the country would be included in future studies. With funding, the interactions with the Fablabs can be controlled, so that all participants receive the same experience, for which the impact on intentions can be measured.

Once the relationship has been reliably established and verified, it will be useful to conduct research into entrepreneurial behavior, to see how reliable entrepreneurial intentions are at predicting entrepreneurial behavior. Additionally, such research would provide a greater understanding of the likelihood of entrepreneurial success for the students in question.

Research into the relationship between interaction with a Fablab and a reduction in gender disparity in STEM fields and entrepreneurial ventures would be highly beneficial, as girls are currently much less likely to pursue these areas. Finding ways to encourage girls to make informed decisions is imperative, if this gap is to be bridged.

Further qualitative studies would be useful to verify the findings of this study and increase our understanding of the relationship between Fablabs and entrepreneurial intentions as well as entrepreneurial behavior and success.

Since no formal studies have been made to measure the level of success of the Fablab, this is a deficiency in need of rectifying. Hopefully, this study has shed some light on the situation, but much more rigorous and in-depth research is required in the long-term, in order to fully understand the impact of the Fablab on the students, community and teachers.

4.10 Recommendations for educators

Even in this very limited study there is a clear indication that interaction with a Fablab is highly beneficial to students. It is important to train teachers in how to incorporate this educational tool in their teaching methods, as they are understandably reluctant to do so. I would recommend using methods and experience gained in adapting teaching methods to other technological advances, such as computers and the internet.

Gaining a wide acceptance of digital fabrication is an important part of gaining the interest of teachers and students alike. I would recommend hosting annual displays of Fablab creations at the school, as a way to showcase the usefulness of the lab. Additionally, parents may become more interested, and the community better informed of the possibilities inherent in the lab.

If the reader will recall the entrepreneurship perception and performance model by Carayannis, Evans and Hanson (2003) shown in 2.2.4.3, the role of the Fablab lies in the awakening stage of the entrepreneurial path. This formative step of the path is influenced by the discovery or non-discovery of entrepreneurial personality, values and desires. The role of education must therefore be to aid in the discovery of these attributes. Not all students will have these values, desires or personalities, but those who do need help with discovering them.

This study found that the FL group displayed a great deal of these attributes. By keeping the entrepreneurship perception and performance model in mind, educators can make more informed decisions in how to plan teaching methods and material. In the case of the Fablab, it is important to use the feedback/reinforcement mechanism by encouraging local and international entrepreneurs to advise and even mentor prospective entrepreneurs. Further, it would be beneficial to encourage students in later Fablab courses to interact with and encourage new Fablab users, in order to cultivate the community of sharing knowledge and experience locally.

4.11 Recommendations for social policy and community initiatives

It is clear that access to funds is one of the primary obstacles to entrepreneurial entry. Legislation and bureaucracy in Iceland seem to adequately support the establishment of new businesses, while the structure surrounding venture capital, loans and investment are in need of reinforcement.

Since a fear of failure has been found to inhibit Icelandic people more than in most other European countries, this should be an issue of primary concern for policy makers. The Westman Islands city council should adopt social policies which encourage new venture creation. The establishment of cheap offices for small businesses, small loans designed to aid start-up creation and insurance for investors against early failure could go a long way in removing some of the fear of failure inherent in prospective entrepreneurs.

In order to increase the chances of survival, the council could offer free or cheap access to legal and financial advisors for new businesses, encourage an atmosphere of sharing experience among local businesses and provide venues for local businesses to display their innovations and progress, both to show young people what local businesses are doing and to establish a dialogue between existing businesses and employers and future employees or competitors.

5 Conclusion

Entrepreneurship is important, not only to society as a whole, but to the Westman Islands in particular. As a small fishing community in danger of brain drain, loss of population and loss of jobs, the Westman Islands are in an increasingly dire need of finding new occupations for the young adults of the community.

Education has been shown to both increase entrepreneurial intentions and the chances of entrepreneurial success as well as the potential wages of entrepreneurs. Entrepreneurial education is particularly important in increasing entrepreneurial intentions in students at the upper secondary level, and the Fablab is an ideal venue for such entrepreneurial education.

The primary research question of this paper was: Do users of the Westman Island Fablab have higher entrepreneurial intentions than other students?

The answer is divided. According to the TPB, there was no stark difference between users of the Fablab and other students. According to the SEE, there was considerable difference in the propensity to act, insofar as this can be gleaned from their ability to make plans and decisions regarding their future and acting on these plans and decisions, which indicates a difference in entrepreneurial intentions as a result.

A need emerged for a discussion on what educational initiatives and policies could be adapted to achieve/increase the effect of Fablabs on entrepreneurial intentions.

Most importantly, initiatives which encourage entrepreneurial behavior should be encouraged in the community. FíV's intention of making an entrepreneurship course mandatory for all students is a very good step in helping all students discover whether they are interested in pursuing an entrepreneurial career or not.

Increasing teacher participation in the Fablab and encouraging active discussions on teaching methods and opportunities which relate to the Fablab is imperative. The teachers are a driving force of deciding what students learn and their positive views and fluency in teaching with a Fablab are imperative to the success of the Fablab in influencing students in a positive way.

In order to succeed, should they choose an entrepreneurial path, the students will need to gain knowledge and experience after graduating from FíV. It is important that FíV not only encourage entrepreneurial intentions, but also provide students a realistic knowledge of their own skills and deficiencies, so that the students who wish to pursue an entrepreneurial path know what knowledge and experience to pursue before becoming entrepreneurs.

Interaction with a Fablab cannot create future entrepreneurs on its own. As for now, it is unknown whether there is a causal relationship. What *is* known is that for the Fablab users participating in this study, the Fablab has been an imperative part of their path to self-discovery. A path they have found years ahead of their peers.

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