

Impacts of a challenge-based innovation project course on the entrepreneurial intentions of multidisciplinary student teams

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ABSTRACT

This study set out to explore whether a challenge-based innovation course focusing on design-thinking methods, user-centred design and interdisciplinary teams increases the entrepreneurial intentions of university students by simulating the process of creating a new, innovative product or service. The findings of the study are based on a data set consisting of pre-and post-course survey results. The data analysis shows that the students' perceived feasibility of self-employment and the propensity to act upon it are increased during the course. Consequently, teachers aiming to increase the entrepreneurial intention of university students should consider applying problem-based learning methods in their course curriculum.

Keywords: Innovation education; design thinking; user-centred design; entrepreneurial intentions; problem-based learning.

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INTRODUCTION

As economic growth is slowing down in industrialized societies globally, many publicly-funded activities are faced with stricter requirements to justify the social impact of their funding. Some activities have direct, easily measurable impacts, such as CO₂ reductions or a number of people cured from epidemics – whereas others have indirect impacts which are more difficult to measure, such as research and education. This study focuses on one aspect of the social impact of university education – the acceleration of economic activity. For the benefits of academic education to spill over to the rest of the society, one vehicle for knowledge transfer is entrepreneurship. In particular, we inspect the impact of a multidisciplinary product development course, Challenge Based Innovation (CBI), on the entrepreneurial intention of participating students.

Several previous studies focus on the impact of entrepreneurial universities and entrepreneurship programs on academics' and students' entrepreneurial intentions. In this study, we focus on an individual product development course instead of an entrepreneurship program. We want to examine whether similar impact that previous studies have found in entrepreneurship programs can be achieved in a setting where we emphasize challenge-based innovation by teaching the students design thinking and rapid prototyping in a cross-disciplinary, hands-on setting. During the course, the students select a social challenge as a starting point for the solution that they will develop. The United Nations Sustainable Development Goals (UN SDG's) are used to frame the challenge. Even though the student teams are

guided to explore different business models to improve economic sustainability of the solution, the emphasis is rather on teaching innovation, as well as focusing on the usability and problem-fit of the solution.

The teaching methodology used in CBI course shares many fundamental aspects of Problem-Based Learning (PBL): the approach is student-centred, teachers and mentors act as facilitators rather than disseminators, and the problems framed around the UN SDG's are open-ended. The students are encouraged towards self-directed learning and group work, and many of the workshops promote creativity and innovation as opposed to theory-focused lectures. The teaching team, consisting of both university staff and CERN IdeaSquare coaches, has a moderating effect in the process. The core of the teaching team remained the same throughout the 3-year period.

Our assumption is that when students experience the development cycle of a new product or service in a setting that resembles that of founding a start-up, their entrepreneurial intention is improved through experienced ownership of the product or service, even though entrepreneurship is not emphasized in the learning goals of the course. In conclusion, the broad research question is:

Does the Challenge Based Innovation (CBI) course change the students' attitude towards self-employment?

THEORETICAL BACKGROUND

The entrepreneurial intention of university students is a frequently visited topic in research literature. Inclination towards entrepreneurship is commonly associated with several personal characteristics, such as values and attitudes, personal goals, creativity, risk-taking propensity and locus of control. Education can also serve a preparatory function in relation to new venture initiation or founding a start-up, whereby the transfer of knowledge and the acquisition and development of relevant skills would be expected to increase self-efficacy and effectiveness of the potential entrepreneur (Bandura 1986, Gorman et al. 1997, Souitaris et al. 2007) found that entrepreneurial programmes raise the overall entrepreneurial intention of science and engineering students, and that inspiration, defined as a “construct with an emotional element”, is the programme’s most influential benefit. Lüthje and Franke (2003) discovered that attitude towards entrepreneurship and risk-taking propensity contributed to entrepreneurial intentions of MIT technical students slightly more than contextual factors did.

Gorman et al. (1997) found in their literature review that previous studies emphasize the importance of skill-building courses such as negotiation, leadership and creative thinking, exposure to technological innovation, new product development and programs geared toward creativity, multi-disciplinary and process-oriented approaches, as well as theory-based practical applications. Yar Hamidi et al. (2008) found that programmes focusing on acting and creative thinking and problem-based learning improve students’ entrepreneurial intentions.

James and Bell (2013) proposed preliminary results from a survey of PBL business course’s effects on students’ willingness of pursuing on self-employment. Bell et al. (2015) re-evaluated those results and with results from related literature they concluded that PBL, characterized by student-centred approaches, where teachers act as facilitators rather than disseminators, and open or ill-structured problems serve as the initial stimulus for learning, would seem to contribute to entrepreneurship education which, in turn, according to Zhao et al. (2005) has an effect on students’ intentions toward entrepreneurship.

According to the theory of planned behavior (Ajzen 1991), an individual’s intention to engage in a behavior indicates how likely he or she is to act. Entrepreneurial intentions have been found to be a good way to predict entrepreneurship, which is why entrepreneurship is the type of planned behavior for which intention models are well suited. According to the Shapero-Krueger model, intentions stem from three factors: perceived desirability (the personal attractiveness of starting a business), propensity to act (personal disposition to act on one’s decisions – a sort of “I will do it” behavior), and perceived feasibility (the degree to which one feels personally capable of starting a business). Both Ajzen’s theory of

planned behavior and Shapero model of the ‘Entrepreneurial Event’ have been found useful. However, the Shapero-Krueger model is slightly superior in the specific study of entrepreneurial intentions (Krueger et al. 1993) Thus, this study focuses on the perceived desirability, perceived feasibility and the propensity to act to predict entrepreneurial intentions among the CBI-students.

Based on theoretical discussion, we present the following research hypotheses:

1. Will the Challenge Based Innovation course increase participating students’ perceived desirability of self-employment?

H0 Q1: The CBI course does not increase the perceived desirability of self-employment

2. Will the Challenge Based Innovation course increase participating students’ perceived feasibility of self-employment?

H0 Q2: The CBI course does not increase the perceived feasibility of self-employment

3. Will the Challenge Based Innovation course increase participating students’ propensity to act on self-employment?

H0 Q3: The CBI course does not increase the propensity to act on self-employment

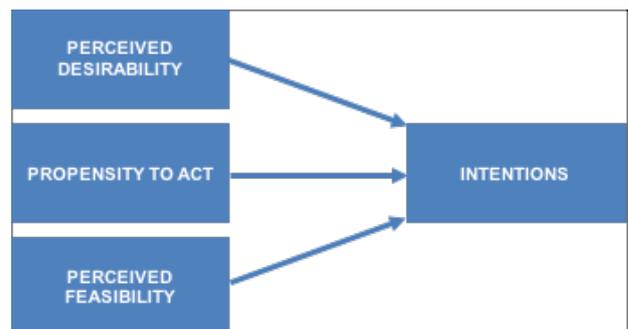


Fig. 1: The Shapero-Krueger model of entrepreneurial intentions (modified from Krueger et al. 2000)

METHOD AND DATA

The data set consists of pre- and post-course questionnaire data from 89 students who participated in the CBI course during the years 2015 – 2017 inclusive. The pre-course questionnaire was performed at the beginning of the course. The post-course questionnaire was performed a few weeks after the course, once the students had submitted their final projects and prototypes.

Replying to the questionnaire was mandatory for all students, but it didn't affect their grading. In total, 5 questionnaire answers were removed due to insufficient data provided, i.e. the final data set subject to analysis consisted of 84 pre- and post-course submissions.

The represented universities include ESADE business school (21 answers), IED Barcelona design school (24 answers), UPC engineering school (26 answers), UNIMORE with a mix of backgrounds from engineering, design, business and natural sciences, (12 students) and Politecnico di Milano (1 answer). The questionnaire consisted of 20 background information questions and 50-60 questions related to the CBI course experience. The background questions were related to the students' academic career (field of education, years in university, work experience), previous team work experience, as well as the use of online and educational resources and social media. The CBI-course-specific questions were related to the students' motivation to participate in the course, their learning experience, impact of the course on the students' mindset, occupational preferences, as well as their views on self-employment. The data was anonymized before analysis.

The questions subject to analysis were selected based on the theoretical framework which assumes that intention is a good way to predict entrepreneurship, and entrepreneurial intention stems from perceived desirability, perceived feasibility, as well as from propensity to act. The selected questions are presented in the results chapter.

The study method utilises a quantitative approach based on the data that has been collected with the pre- and post-course questionnaires. The students' perceptions were measured on a 7-point Likert-type scale. Means and standard deviations of the students' answers pre- and post-course were compared to discover how the students' perceptions had changed during the course. A t-Test (paired two sample for means, alpha = 0.05) was performed on Microsoft Excel to analyse statistical significance in order to determine whether the null hypotheses can be rejected.

RESULTS

The results of the data analysis exhibit growth on entrepreneurial intention among the students. The perceived desirability increased from 5.02 pre-course to 5.18 post-course (where a larger number signifies greater preference towards self-employment as opposed to being employed by someone else), i.e. by 3%; the perceived feasibility increased from 3.48 to 3.11 (where a smaller number signifies stronger agreement to the perceived easiness of pursuing self-employment), i.e. by 11%; and the propensity to act increased from 4.58 to 4.86 (where a larger number signifies the increased likelihood of pursuing self-employment), i.e. by 6%. The year-by-year and overall change are presented in Tables 1-3.

Tab. 1. Perceived desirability: Year-by-year results for the question *If you were to choose between running your own business and being employed by someone, what would you prefer? (1 = prefer to be employed by someone, 7 = prefer to be self-employed)*

Course (n)	Pre-course (\bar{x} , s)	Post-course (\bar{x} , s)
2015 (26)	(4.73, 1.78)	(4.96, 1.76)
2016 (32)	(5.34, 1.68)	(5.41, 1.81)
2017 (26)	(4.92, 1.72)	(5.12, 1.56)
Total (84)	(5.02, 1.72)	(5.18, 1.71)

Tab. 2. Perceived feasibility: Year-by-year results for the question *If I wanted to, I could easily pursue a career as self-employed? (1 = strongly agree, 7 = strongly disagree)*

Course (n)	Pre-course (\bar{x} , s)	Post-course (\bar{x} , s)
2015 (26)	(3.62, 1.60)	(3.31, 1.44)
2016 (32)	(3.78, 1.76)	(3.25, 1.57)
2017 (26)	(3.04, 1.37)	(2.72, 1.31)
Total (84)	(3.48, 1.62)	(3.11, 1.45)

Tab. 3. Propensity to act: Year-by-year results for the question *How likely is it that you will pursue a career as self-employed? (1 = unlikely, 7 = likely)*

Course (n)	Pre-course (\bar{x} , s)	Post-course (\bar{x} , s)
2015 (26)	(4.54, 1.68)	(4.81, 1.52)
2016 (32)	(4.81, 1.47)	(4.88, 1.70)
2017 (26)	(4.35, 1.70)	(4.88, 1.40)
Total (84)	(4.58, 1.60)	(4.86, 1.54)

When analysing the results for the whole three-year sample (n = 84), the results for the change in the likelihood of self-employment (p = 0.04) and the perceived feasibility of self-employment (p = 0.04) were found statistically significant with an alpha of 0.05. However, the results of the analysis on the first question, measuring the desirability of self-employment vis-à-vis being employed by someone else, were not statistically significant (p = 0.39). Thus, our findings answer the research questions as follows:

H0 Q1: not rejected, i.e. the CBI course does not significantly increase the perceived desirability of self-employment over being employed by someone else.

H0 Q2: rejected, H1: The CBI course increases the perceived feasibility of self-employment

H0 Q3: rejected, H1: The CBI course increases the propensity to act on self-employment

When comparing the year-by-year results, it can be seen that for each of the observed components of entrepreneurial intention, an improvement can be seen for

each consecutive year, but the magnitude of the change varies. For perceived desirability, the change was 5% in 2015, 1% in 2016 and 3% in 2017. For perceived feasibility, it was 9% in 2015, 14% in 2016 and 8% in 2017. For propensity to act, the change was 6% in 2015, 1% in 2016 and 12% in 2017.

DISCUSSION AND CONCLUSIONS

To conclude, the CBI course has a positive effect on the entrepreneurial intentions of the participating students, although the magnitude of the change seems to differ between years. One reason for this can be that while the course concept has remained relatively the same every year, the observed annual variation on the magnitude of the change could be explained by the participating students' backgrounds, group dynamics and experienced success of the course project.

An additional interesting observation is that even though the 24 surveyed IED (design) students exhibited the greatest increase in the perceived feasibility of entrepreneurship ("If I wanted to, I could easily pursue a career as self-employed") from 3.33 to 2.63 (where a smaller number signifies a greater agreement with the claim), i.e. 21% improvement, they only exhibited a 2% increase in the likeliness of pursuing a career as self-employed, or the propensity to act. Contrary to the design students' views, the 21 ESADE (business) students exhibited a decrease in the perceived feasibility of 6% from 3.33 to 3.52 (where a smaller number signifies greater agreement with the claim); however, their propensity to act increased by 13% from 4.52 to 5.10. In other words, the increase in the perceived difficulty among the business students didn't scare them off, while the increase in the perceived easiness among the design students didn't encourage them to seek self-employment. These results are interesting as they signal that the different components that contribute to entrepreneurial intention according to the Shapero-Krueger do not correlate strongly with each other within our sample.

Among the students that reported an increase in their propensity to act (n = 33), the most impactful reasons for increased likeliness to pursue a career as self-employed (on a scale of 1-7 where 1 = strongly disagree and 7 = strongly agree) were *to take advantage of your creative needs* (5.65), *to create something* (5.63), *to participate in the whole creative process* (5.53), *self-realization* (5.42), *to have and interesting job* (5.41) and *to have a challenging job* (5.32). The least important reasons for self-employment were *economic opportunity* (4.54), *to follow all the tasks from a to z* (4.54), *to keep a large proportion of the result* (4.69), *have authority* (4.77) and *to be your own boss* (4.88). This shows that students who exhibited an increase in the likelihood of entrepreneurship were more driven by motivations related to creativity and self-fulfilment than money and power.

In one sense, the course can be seen as a way of sensemaking – a process through which people work to understand issues and events that are novel, ambiguous, confusing, or in some other way violate expectations (Matilis & Christianson, 2014). For students with no prior experience in self-employment, aspiring entrepreneurs can make sense of the connections between different technologies, product functions, customers' preferences and market structure (Ravasi & Turati, 2005). These are all aspects that are addressed during the CBI course.

Limitations of the study include the generalizability of the findings to other courses that apply similar teaching methodologies, especially in cultures that differ greatly in perceptions related to entrepreneurship to those of students enrolled in Southern European universities. Moreover, although the results show an increase in the perceived feasibility of self-employment and propensity to act on it, it does not look into how these perceptions have actually materialized among the students. A larger sample would also be required to study how the results might differ when variables such as gender, previous experience in self-employment or academic success are considered.

The findings of our study show that a teaching methodology that positions open-ended societal problems as a starting point, fosters innovation and creativity, utilises design thinking methods and promotes self-directed learning and group work, can improve students' entrepreneurial intentions in a similar fashion as entrepreneurship courses. Implications for future research include collecting more data on future courses and testing whether similar findings can be discovered with a larger or different sample than our majorly Spanish-Italian sample; a follow-up study to find out whether the increased entrepreneurial intentions translate into entrepreneurial actions; as well as a qualitative study on the reasons why Challenge-Based Innovation and Problem-Based Learning contribute to the observed outcomes.

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