Supporting the entrepreneurial potential of higher education

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Case Study No. 11:

University of Ljubljana, Slovenia: Applying the Design-Thinking approach to entrepreneurship education

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About the sepHE Study

The study "Supporting the entrepreneurial potential of higher education" was based on a contract between the European Commission, Directorate General Education and Culture (DG EAC), and empirica Gesellschaft für Kommunikations- und Technologieforschung mbH (co-ordinator – Bonn, Germany) as well as the University of Wuppertal, UNESCO Chair of Entrepreneurship and Intercultural Management (Wuppertal, Germany).

The study's main purpose was collecting 20 case studies about insightful practice in entrepreneurship education at European universities. This is one of them. The findings from a cross-case analysis are included in the Final Report which is available at the study's homepage and at DG EAC's website.

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Overview of contents

Abstract

The Faculty of Economics of the University of Ljubljana (FELU) offers courses on undergraduate, graduate and MBA level in entrepreneurship education (EE), including specialisations in entrepreneurship. In 2006, FELU introduced the Design Thinking (DT) approach to EE. DT is a human-centred, action-oriented and iterative problem-solving and idea-generating method. In courses applying DT, student teams generate business ideas, develop entrepreneurial projects and test prototypes through engaging with customers. The DT approach was meant to overcome downsides of a more traditional way of EE, focusing on writing business plans, which FELU applied before. The business plan approach did not trigger much creativity and did not lead to many new ventures. The Ljubljana case shows that the application of DT can generate valuable business ideas and change mindsets towards a consciousness of "being capable". DT courses comprising entrepreneurial projects, start-up weekends and "three euro challenges" were found to be stimulating, action-orientated EE formats. Furthermore, FELU teachers successfully introduced DT in schools for pupils at the age of 12 to 15 and for unemployed people as well. High student motivation as well as suitable staff and sufficient resources for prototyping are important preconditions for achieving good results in applying DT. However, the case study also revealed legal barriers to student entrepreneurship: students lose their privileges when they start their own business, and selling a product without having a company is prohibited.

Case study fact sheet[1]

■ *Full name of the university and location:*	*University of Ljubljana, Faculty of Economics Ljubljana University (FELU), Ljubljana, Slovenia*
■ *Legal status*	*Public*
■ *Location:*	*Ljubljana, Slovenia (FELU branches: Skopje, Macedonia; Prishtina, Kosovo)*
■ *Year of foundation:*	*1919 (FELU: 1946)*
■ *Number of students:*	*48,822 (FELU: 5,500)*
■ *Number of employees*	*5,972* *FELU:* *165 faculty (including teaching assistants)* *97 (administration staff)* *25 long term part-time contracts with foreign faculty*
■ *Budget in most recent financial year:*	*308,347,488 EUR (FELU: not available)*
■ *Academic profile:*	*23 faculties and three art academies*
■ *Entrepreneurial profile:*	*Courses on undergraduate, graduate and MBA level, specialisations in entrepreneurship: BSc, BA and Master.*
■ *Activities focused in this case study:*	*The Design Thinking approach – implementation and experiences at the University of Ljubljana*
■ *Case contact person(s):*	*Prof. Tea Petrin, (former EE programme director), FELU,* *Prof. Mateja Drnovšek, (head of academic department of EE), FELU*

Information included in this case study is from end of year 2014 unless stated differently.

[1] Source for University of Ljubljana data: http://www.uni-lj.si/university/university_in_numbers, Source for FELU data: Prof. Drnovšek.

11.1 The university's entrepreneurship education profile

11.1.1 The university's overall approach to EE

Key characteristics of EE at the University of Ljubljana

At the University of Ljubljana, entrepreneurship education (EE) is taught at the Faculty of Economics (FELU). One basic EE course is also conducted at other faculties. The objective is empowering students to create new businesses, to manage early-stage ventures and to respond entrepreneurially in any other relevant context. EE courses are composed of theoretical EE and the hands-on application of the Design Thinking (DT) approach.

The goal and the contents of EE at FELU evolved over time. It started in 1989, i.e. before the change of the economic system in former Yugoslavia, with one graduate course. Macroeconomic considerations from Prof. Aleš Vahčič, former Deputy Minister of Economy before the civil war, and Prof. Tea Petrin, former Minister of Economy from 1999 to 2004 in Slovenia, built the basis for the introduction of EE. They saw a need for competition and entrepreneurship, including the development of start-ups and SMEs, in order to avoid the collapse of the economic system. Before and after the war, the aim of EE at FELU was first to increase awareness, to develop an entrepreneurial culture among the students and to change their mindsets so that they would recognise the possibility of self-employment or of working in a start-up company.

In 2006, Prof. Vahčič introduced the Design Thinking[2] methodology at FELU, following a visit at the d.school, the Hasso Plattner Institute of Design, in Stanford, US[3], where the methodology was originally developed. The ambition behind DT is to achieve a human-centred, problem-solving and idea-generating method, which is oriented towards the working process of designers. The DT approach, developed by the d.school in Stanford, consists of five steps, used in an iterative way: empathise (i.e. understand the users), define (the problem), ideate (i.e. develop ideas and solutions), prototype, and test.[4] Various authors adapted the order and the steps from three to seven stages.[5]

Exhibit 1-1 illustrates on the left hand side, the basic logic of the process, which seems to be circular or linear at first sight. However, the actual (cognitive) process is rather an iterative way to reach a solution in different learning cycles, switching between the stages, as depicted in the picture on the right. The stages are combined according to the information needed, in particular situations throughout the project. New insights, especially during prototyping and testing, may lead to adjustments in the prior stages, such as redefining the problem, reconsidering customer needs, the need to find new solutions, the adaptation of the prototype, and additional tests.[6] Applying DT, the role of the teacher is supposed to change from being an ex-cathedra lecturer to acting as a coach in supporting the student teams in their development process.

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2 See Plattner et al. (2009); Waloszek (2012); Ingle, B. (2013); d.school (2013).

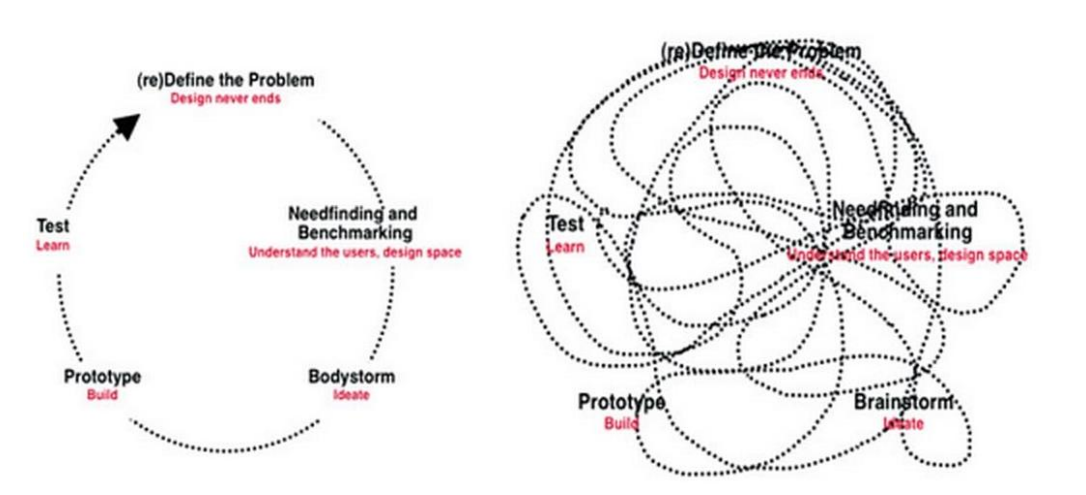
3 See http://dschool.stanford.edu/.

4 In Exhibit 1-1, steps one and two are swapped. Nevertheless, the underlying idea persists.

5 E.g. Plattner et al. (2009): (1) understand, (2) observe, (3) define point of view, (4) ideate, (5) prototype, (6) test. An overview of different process models can be found in Waloszek (2012).

6 See Zupan et al. (2013), p. 3f.

Exhibit 111-1: The Design Thinking process



Source: Zupan et al. (2013) from Meinel/Leifer (2011), p. 14.

Hence, at FELU, key aspects of using the concept are an in-depth understanding of potential customers' problems and needs, team-based generation of ideas, fast and low cost prototyping and testing, and an iterative way of connecting the different steps. The multi-disciplinarity of teams, a core part of the general DT approach, is not yet achieved in most of the courses since students from other faculties are not regularly involved.

Today, DT is applied at FELU in several EE courses at undergraduate and graduate levels as well as in the MBA programme. DT is also applied in extra-curricular activities comprising start-up weekends, EE in schools for pupils at the age of 12 to 15 and EE for unemployed people. These can be considered as new models in EE.

Publicity of the case

While the original approach from Stanford can be seen as a general problem-solving and idea-generating approach for multiple disciplines, the University of Ljubljana was one of the first universities to connect the Design Thinking approach to EE. This connection has also found attention in literature.[7] However, the FELU case is not yet widely known across Europe.

11.1.2 Leadership and governance

Extent of high level commitment to implementing entrepreneurship

The Rector of the University of Ljubljana (Prof. Dr. Ivan Svetlik) has a positive attitude with regard to entrepreneurship, according to one interviewee. In his previous position as a Minister of Employment, he passed a law in order to foster entrepreneurship and self-employment of previously unemployed people. The Vice Rector (Prof. Maja Makovec Brenčič) of the University is highly supportive of the DT approach and promotes it across the University. In addition, the FELU's past Dean and the current Dean were said to be supportive of the DT approach. DT is also well promoted within FELU. Every year one

[7] See e.g. Ingle (2013), Zupan et al. (2013).

strategic conference and one pedagogical conference are held by the faculty. In recent years, the DT approach was promoted in these conferences.[8]

Importance of entrepreneurship in the university's strategy

EE and DT do not have a top priority in the University of Ljubljana's strategy. The orientation towards research and academic excellence dominates the overall strategy. However, **entrepreneurship is mentioned explicitly** in the strategy's section "3.3. Use of knowledge - third dimension of the university" of the University's strategy: "The University of Ljubljana exercises social responsibility by transferring the created knowledge into practice. This is achieved by the developmental, research, and professional activities, by employment of graduates in other organizations, by encouraging entrepreneurship, by counselling services and by including professional experts in educational activities, by lifelong learning programmes."[9]

Level of autonomy to introduce EE courses

FELU established the DT approach bottom-up. This was possible because of the faculty's actual autonomy in designing their courses. At FELU, there is a two tier approach with regard to the teachers' autonomy: teachers and the team of the academic unit can make independent decisions about small changes in teaching pedagogy and methods used, materials and the like. Big changes such as names of the course and the names of the lecturers responsible for the course need to be accredited through the Slovenian Quality Assurance Agency for Higher Education (SQAA, in Slovenian NAKVIS[10]). The teachers have to announce course changes to the SQAA annually. However, it was stated in the interviews for this case study that normally no one would refuse proposed changes if they are in line with the learning objectives of the course.

11.1.3 Resources: people and financial capacity

Human resources for entrepreneurship education

The academic department of entrepreneurship was formerly led by Prof. Vahčič and Prof. Petrin, both of whom retired in July 2014 but are still active. Today the unit is led by Prof. Mateja Drnovšek who co-ordinates EE course outlines and contents in her team. Formally, the academic department of entrepreneurship comprises nine professors, associate and assistant professors as well as teaching assistants. Two entrepreneurs, Dr. Rok Stritar and Blaž Zupan, are employed and teach at FELU, mostly with the DT method, while pursuing their academic career. One assistant professor, Prof. Dr. Anja Nabergoj, regularly teaches at Stanford University, Hasso Plattner Institute ("d.school").

Financial resources for entrepreneurship education

When introducing the DT approach, the material and some equipment in the prototyping room was financed by Prof. Vahčič and Prof. Petrin from their own private money. Later,

[8] In June 2014, the academic unit of entrepreneurship was asked to use DT to manage one of the conference's parallel sessions. In 2013, the DT approach was presented to all faculty members.

[9] See http://www.uni-lj.si/university/strategy/ for the University's mission, http://www.uni-lj.si/university/mission_values_and_vision/ for its mission statement, and for FELU http://www.ef.uni-lj.si/mission_&_vision.

[10] See http://test.nakvis.si/en-GB/Content/Details/8.

when other instructors beside Prof. Vahčič used the room, the university paid for the extension and the additional equipment of the prototyping facility. In fact, the academic Department of Entrepreneurship has not been allocated any budget. Its decision power is therefore limited. The University and FELU receive funding per student, which is then allocated by FELU. Additionally, FELU funds novel teaching approaches such as DT, which is beyond the lump-sum money per student. This is based on money FELU earns with commercial research, consulting and part-time education programmes.[11]

11.2 Entrepreneurship in curricula and teaching

11.2.1 Overview about curricular offers

The entrepreneurship education curriculum at FELU comprises theoretical EE courses and the "hands-on" application of DT in various courses on undergraduate, graduate and MBA level. FELU offers a specialisation in entrepreneurship on undergraduate level (BSc and BA) and on graduate level (Master in Entrepreneurship), both in Slovenian language.[12] The EE course "Business Design" is part of FELU's MBA Programme. Exhibit 1-2 shows a list of FELU's EE courses which are offered after Bologna reform was introduced in 2006. The graduate programme on entrepreneurship was introduced already in 1992. Some of the courses in the Bologna graduate entrepreneurship programme are a continuation of the first programme introduced in 1992. Some of the courses are electives.

Furthermore, there are EE bridges to school education in Slovenia as well as EE offers to unemployed people.

Exhibit 111-2: Overview about curricular EE offers at the University of Ljubljana

No.	Course name	Objectives / contents	Target group	Offered since [year]	No. of participants in 2013/14
	Undergraduate				
1	Entrepreneurship (FELU)	Basics of business plan, partially DT method (recently)	Undergraduate FELU students (Bachelor degree)	1996	370
2	Entrepreneurship (Erasmus)	Basics of business plan, DT method / project work[13]: Development of viable, desirable and technologically feasible prototypes Market testing of the prototypes	Undergraduate Erasmus students at FELU (Bachelor degree)	2010	140

[11] Several other schools within the University are not that proactive and solely depend on the money allocated by the university (government).

[12] A Master programme in English is offered in Prishtina, Kosovo, which is not analysed in this case.

[13] The Erasmus course "Entrepreneurship" (2), constitutes a mix of contents of the course "Entrepreneurship" (1) and "Entrepreneurial Project 1" (4).

3	Entrepreneurship (other faculties)	Basics of business plan, DT method / project work: Development of viable, desirable and technologically feasible prototypes Market testing of the prototypes (This course combines contents of the course “Entrepreneurship” (1) and “Entrepreneurial Project 1” (4). There is more focus on project work and DT than in the Erasmus course.)	Separate courses for undergraduate students (bachelor degree) at the Faculty of Chemistry, the Faculty of Civic and Geodetic Engineering, the Faculty of Computer and Information Science, the Faculty of Natural Sciences	2010	approx. 60-100 at each faculty
4	Entrepreneurial Project 1	DT method / project work: Development of viable, desirable and technologically feasible prototypes Market testing of the prototypes	Undergraduate FELU students, (Bachelor degree)	2006	65
5	Effective Presentations	Training students’ communication skills, partially DT method (recently)	Undergraduate FELU students, (Bachelor degree)	2006	30
6	Family Business	Specificities of family-run businesses	Undergraduate FELU students, (Bachelor degree)	2006	20
7	Development of Entrepreneurial Opportunities	DT method / project work: Empathy, opportunity identification, opportunity development	Undergraduate FELU students, (Bachelor degree)	2006	37
8	Risky ventures	Theoretical / seminars: Financial planning for growing entrepreneurial ventures	Undergraduate FELU students, (Bachelor degree)	2006	65
9	Entrepreneurs’ Profile	Theoretical/case studies Specificities of different profiles of entrepreneurs (starting from different theoretical approaches) and their role in the economy and society as well as identifying factors of their success	Undergraduate FELU students (Bachelor degree)	2010**	12
	Graduate				
9	Theory of Entrepreneurship	Theoretical / seminars: Introduction to different important topics in entrepreneurship theory Practical application of theoretical concepts	Graduate FELU students, (Master degree)	2006*	50
10	Technological Entrepreneurship	DT method (partially): Developing technological opportunities Technology management New product development	Graduate FELU students, (Master degree)	2006	35
11	Counselling for SMEs	Counselling to SMEs, theoretical aspects and practical applications	Graduate FELU students, (Master degree)	2006*	35

12	Entrepreneurial Project 2	DT method / project: New product development through DT method, action oriented	Graduate FELU students, (Master degree)	2006	40
13	Financing growing ventures	Addressing specific issues related to financing start-ups and growing ventures	Graduate FELU students, (Master degree)	2006*	43
14	Cluster dynamics	The role of cluster in start-up promotion	Graduate FELU students, (Master degree)	2006	Currently not offered
15	Entrepreneurship policy and infrastructure	Theoretical justification for entrepreneurship policy, entrepreneurship policy in practice, institutional support to entrepreneurship	Graduate FELU students, (Master degree)	2006*	16
16	International Entrepreneurship	Theoretical / seminars: SME internationalisation	Graduate FELU students, (Master degree)	2008	35
17	Business Ethics	Learning of business ethics through cases of specific situations	Graduate FELU students, (Master degree)	2006*, **	50
18	Innovation management	Addressing specific issues related to IP in young ventures	Graduate FELU students, (Master degree)	2006*, **	40
19	Change management	Understanding and learning about processes of corporate renewal	Graduate FELU students, (Master degree)	2006**	40
20	Business Design	DT method: Understanding and developing solutions for established ventures through DT	MBA / Executive students at FELU	2012	15

Notes:
* This course has its roots in the first version of the entrepreneurship programme at graduate level which was introduced at FELU in 1992 (PHARE programme in cooperation with Sterling University, Institute of Social Science, The Hague and Universitad Politecnica de Madrid).

** Elective course

11.2.2 Target groups

Main target groups of entrepreneurship education at FELU

FELU offers EE mainly to students from the same faculty. An exception is the undergraduate course “Entrepreneurship”, which is taught to about 60 to 100 students each semester at the Faculties of Chemistry, Civic and Geodetic Engineering, Computer and Information Science, and Natural Science. The other EE courses are offered to FELU students at undergraduate, graduate or MBA level.

FELU recently developed five profiles of students as target groups for EE, according to the students’ career targets. The development of these profiles was motivated by a faculty-wide initiative of the FELU Board to revise the graduate entrepreneurship courses. The profiles include:

- Start-up entrepreneurs;
- Successors of a family business;
- People interested in social ventures or companies or other social organisations;
- Employees developing business models and opportunities for growth-oriented new companies and growth in existing companies;
- Start-up consultants.

Before, there were only three target groups specified for the graduate Master of Science in Entrepreneurship programme: start-up entrepreneurs, entrepreneurship policy makers, and successors in family businesses.

Bridges to school education

In 2013, FELU started an EE programme pilot in Slovenian primary schools.[14] The course called "With Creativity and Innovativeness to an Enterprising Mindset" includes DT and is tested in ten primary schools for pupils at the age of 12 to 15 (in the 7th, 8th and 9th grade). The course is offered as an extra-curricular school activity. In the school year 2015/16 it will be offered as an elective course. The objective of the course is to develop an entrepreneurial mindset of pupils in primary schools. It is considered to be too early to include the target of building a new business at that age. The course's focus is on problem-solving and becoming active with the DT method "through real problems, through real projects that they need to implement in the real world. It is not something that they learn from their books" (Blaž Zupan).

The primary school EE programme was initiated at a forum of stakeholders from politics, ministries and various agencies where FELU presented the design thinking approach. The Director of the Research Centre from the governmental agency for education saw the need to apply the DT approach in primary schools as a basic problem solving method. The administrative part of the project is managed by one person in the governmental agency, while Blaž Zupan from FELU is responsible for the content, the methodology of the course including DT and the teachers' education. The teachers' education in DT was conducted in a two-day workshop with two teachers from each primary school, 20 teachers in total.[15]

At the beginning of the course, the pupils, together with the teachers, started with observing and looking for real problems relevant and meaningful to them. One project, for example, evolved from the problem of unused school rooms – due to the decreasing number of primary schools' pupils in Slovenia. Using the DT approach, the pupils installed a sports room where people could use sports equipment for training during free time. The course participants equipped the room after finding some sponsors. They posted rules on how to use the room and they promoted the use of the room to other primary students. Another project was initiated in co-operation with the Slovenian tourist society. The society sought to upgrade an educational trail in the forests. The primary pupils redesigned the trail, created signs, did some test tours with the teachers as guides and handed over the developed solution to local guides when ending the course.

[14] Primary schooling in Slovenia is divided into two periods and ends at the age of about 14/15 with the second period. See: http://en.wikipedia.org/wiki/Education_in_Slovenia.

[15] Asking the question, whether the two days are appropriate to educate teachers, the interviewee responded: "If they get it, they get it in 2 days, if not I can work with them a month."

In the project pilot, feedback meetings with the teachers were conducted in the middle and at the end of the project. It was pointed out that it is necessary that the pupils choose problems on their own in order to ensure their motivation and active participation. In the test phase, some teachers had imposed the topics, which led to poor motivation and poor results, since the problem was not meaningful to the pupils. In contrast, in another project, the teacher gave the pupils two weeks to observe problems in their surroundings, i.e. at school and with their family at home. After writing the collected problems on the wall, they chose to work on new lockers for the school, which was a very successful project implemented by highly motivated pupils: “They really dig into everything because they find it meaningful. They go outside and bring people in. They work after hours, they work during weekends.” The rule that the teachers should leave the pupils to choose their problems will therefore be part of the adapted curricular rules in the rollout phase. As regards the role of the teachers using the DT approach, it was pointed out that the role change from a traditional teacher to a coach was sometimes difficult. In the traditional role, the teachers “know everything” and they decide the content and the homework they give. In the new role, they have to accept the topics the pupils chose and coach them in the DT process. In this case, the teachers sometimes know less about the problem and its focused solution than the pupils.

Additionally, after the pilot programme was over, a separate half-day workshop was held at each of the ten schools. All teachers were invited to attend and learn the method and think about the ways it could be implemented within or among their individual courses. More than 250 teachers attended these workshops, a number which indicates a high level of interest.

Since the pilot project was successful, the target of the project team, including the governmental agency, is to offer the course to all 400 primary schools in Slovenia in next year’s curriculum.

Continuous education: DT course for unemployed people

Together with the Employment Service of Slovenia, FELU developed a DT course for 30 unemployed people. The course took three months, with a weekly class of three hours. Two FELU teachers and an experienced professional delivered the course. The combination of young FELU teachers and an experienced professional was said to be very fruitful. One FELU teacher also mentioned that interdisciplinary teams of three people would be an optimal size to teach DT.

According to the teachers, it was especially interesting to see how the unemployed participants changed their mindset and perception during the course. At the beginning, they were very pessimistic with regard to their situation: “There are 120,000 people unemployed, the unemployment rate is 12%, there is no way we can find a job.” Applying DT, they were increasingly proactive in understanding potential employers, especially their economic situation, their concerns when employing people, and their needs. Over 60% of the participants of the course found a job or started their own business. The course teachers considered the offer a success.

11.2.3 Designing lectures and courses – basic curricular decisions

Objectives

The general objective of EE at FELU is empowering students to start new businesses and helping them manage early ventures. Applying DT in EE intends to create valuable business ideas and also to develop a hands-on, action-oriented mind-set and relevant skills which students can use in practice.

Key aspects in using the DT concept at FELU in the different courses include the following:

- A deep understanding of potential customers' problems and needs, for example through interviews and customer visits;
- Joint, team based generation of ideas in brainstorming sessions;
- Visualisation of the ideas through sketching and fast, real prototyping;
- Real world testing, involving potential customers for feedback and learning;
- An iterative way of applying the different steps in loops, learning from failure and successes.

The reason for introducing the DT approach at FELU in 2006 was the downside of the traditional EE approach applied before. The former focused on developing and writing business plans. Many students simply "recycled" ideas and business plans from the years before. Moreover, the ideas were not seen as very creative and remained abstract, as the development of the business plan was mainly a writing exercise. A lecturer estimated that a large part of the students, approximately 70%, did not really understand that they were supposed to develop a business: "Students would forget about the big goal of developing a business, they would split the work into small tasks and then put everything together." In addition, the impact of EE was considered to be low, since few of the students actually started new businesses.

Until today, DT has increasingly permeated the courses, although some courses remain theoretical and are taught in a traditional, ex-cathedra way.

In the following, selected course examples illustrate how the DT approach was implemented at FELU, why it was implemented in a certain way and what experiences were made during the implementation in terms of successes and failures. A key challenge throughout the courses is the low motivation of a part of the students in conducting DT projects, especially at undergraduate level.

The following are the four main courses in which DT is applied and which are described in more detail: "Entrepreneurship", "Development of Entrepreneurial Opportunities", "Entrepreneurial Project 1" (all undergraduate level) and "Entrepreneurial Project 2" (graduate level). According to one interviewee, FELU "started with courses that are the most action oriented. Since then, the DT approach has spilled over to other courses as well". The course "Effective Presentations" illustrates that DT can also be applied to teach other subjects than entrepreneurship.

"Entrepreneurship" – Undergraduate

The course "Entrepreneurship" is mandatory for almost all undergraduate students of the economic faculty. Therefore, approximately 400 students participate each year in the Slovenian track and approximately 150 in the English (Erasmus) track. The Erasmus

course “Entrepreneurship” constitutes a mix of contents of the course “Entrepreneurship” for FELU students and “Entrepreneurial Project 1” (described below), since the Erasmus students only have one course in EE. Introducing the DT approach in a course of such a large size, i.e. 400 students, in the FELU track was described to be a challenge.

Before the introduction of DT, the students were split into groups according to their surnames. A mentor was assigned to each group. At the beginning of the course, the students spent three to four weeks to determine their business idea. Thereafter, they developed a business plan with weekly homework and weekly presentations of what they did during the week. At the end, they presented a complete business plan. Since this approach did not trigger a satisfactory level of motivation and creativity, the teachers changed the course radically by introducing DT and adapting the course plan as well as the team composition. Instead of spending four weeks on developing an idea, the students now have to group and develop an idea in advance in order to attend the course: according to the interviewed lecturer, “that worked perfectly” in the last course in 2013/2014. Two weeks before the course started, the lecturers had posted this requirement and the related process on the internet for those who did not have an idea that there was a market place available with an organised way to match up. The market place was not virtual but physical, with an announced time to meet in a room at FELU. Thus, students were not grouped according to their surnames but had to choose their own group (“as in the real world as entrepreneurs”): in the first official meeting of the course, the teams had to present an idea “that would be their first prototype.” Hence, the students received the first feedback in the first session, which was described to be very helpful.

In addition, the teachers cancelled the weekly mandatory seminars. Instead, the students had the possibility to sign up for individual consultancies (via internet) which were not mandatory. After three weeks the students had to present their project and a first business plan to a jury of three people, including academics and entrepreneurs, in order to receive further feedback. The presentation included a developed solution including prototypes, tested market needs and a preliminary business plan including financial issues. The jury gave “real life feedback”, such as not being “too nice”. In order to avoid very subjective assessments, especially with regard to the “appeal of the idea”, the jury is always composed of three people. After this presentation, the students had theoretical lectures, e.g. on more extensive financial planning using an Excel-based simulation tool. For the final presentation in front of the jury, they had to further develop their business plan and work on the aspects that the jury had pointed out. Again, the students could sign up for individual consultancies in between the two presentations.

According to the teacher of this course, the results of the course improved significantly: “We found out that for the last 20 years we did the seminars in vain”. The teacher, who is an entrepreneur himself, mentioned that the share of ideas that could be turned into actual businesses was much higher with the new approach. Moreover, teachers gave better grades throughout the whole class. However, the results between groups with motivated students and groups with unmotivated students could be better distinguished due to very good performance of the motivated ones and poor performance of unmotivated ones.

“Development of Entrepreneurial Opportunities” – Undergraduate

The course “Development of Entrepreneurial Opportunities” is offered to students at the undergraduate level (Bachelor degree) with a specialisation in entrepreneurship. The

course runs for six weeks with a “double load” of two official sessions a week. In addition, the students have to meet at least twice a week for group work on the projects. According to one lecturer, it is important that students meet several times a week and not just once in order to achieve good working results. After a two-hour introduction of DT in the first class, the students have to work on two DT projects, one lasting for two weeks and the second one for four weeks. The teachers introduce a broad topic, for example healthy food, for which the students have to interview customers, develop ideas and build prototypes. Recognising the difficulties that especially undergraduate students will face in interviewing real customers, the course starts with interviewing students at the university before any other external target groups can be interviewed.. The lecturers also bring potential customers into the classroom and help students to develop the conversation. One teacher stated that especially at the undergraduate level, the coaching of the student teams and developing students’ trust in the teachers as coaches convince the students more about the DT method, rather than PowerPoint presentations of international firms that have already used the method successfully. Such presentations would be more important to graduate or MBA students, as they already work in companies and might have to argue internally to apply the method.

The course also contains the “Three Euro Challenge”, which was asserted by one interviewed undergraduate student to be a very good learning experience. The challenge stems originally from an exercise by Tina Seelig at Stanford University. FELU adapted it for their purposes. Each student team receives three euros and has to develop and sell “something” to earn money. The team with the highest earnings wins the competition. The time period in which the money has to be gained varies from 48 hours to ten days. In one course in which an interviewed student participated, student teams sold home-made lemonade, muffins or wine, collected and sold scrap metal or organised a club event with entrance fees. Due to the legal problems of selling without a registered company, the teachers allowed the students to ask people also for charitable donations. According to the participating student, this influenced the selling experience as the charity aspect “gave a lot of extra points”. In any case, the event was seen as a very good learning experience since the students had to overcome contact barriers and to sell their value proposition to real customers.

“Entrepreneurial Project 1” – Undergraduate

The course “Entrepreneurial Project 1” is offered to students in their last year of undergraduate studies in the entrepreneurship specialisation. The objective of the course is to develop an individual entrepreneurial project. In the first years after introducing the DT approach in 2006, the focus was on group work with mentors from businesses and academia and a few lectures in between the project work. In 2013 and 2014, there was a change towards an individual approach, while also eliminating most lectures. The students should develop their own projects which might be turned into businesses later on. For students whose parents own a company, there was also the possibility to analyse problems and find solutions in and for the family business. However, the results of the course in 2013/2014 were not as good as expected. While one part of the students was said to be really motivated to achieve good results, a large part of students was not motivated for the individual projects despite having the possibility to choose their own projects. The importance of choosing the problems and ideas to work on by themselves was mentioned by some of the interviewed students as a contributing factor toward their motivation.

The results of the last course were considered to a large part as poor in terms of projects and prototypes, and the degree of satisfaction of both students and teachers was not high. According to the interviewees, one reason for the low motivation among students was the repeated application of the DT method in their undergraduate studies. Anticipating such problems, the teachers' original aim was to develop the course "one step further", with the target of setting up students' own business. However, most of the participants showed limited entrepreneurial intention according to the interviewees, including both students and teachers. This was attributed to the limited entrepreneurial culture in Slovenia in general, and the influence of the parents, the negative connotation of entrepreneurship and profit as well as legal and economic barriers (see sections 1.4.2 and 1.4.3 below in this case study). In addition, it was mentioned that some of the students have ideas but sometimes they think these ideas are not good enough, too "crazy", or they do not talk about it because they fear negative feedback and failure. Moreover, the individual consultation sessions during the projects were not sufficiently successful either. Each student had the possibility to receive individual consultations twice during the project. Sometimes "they felt under attack" when the teachers posed questions to them. Other students brought a non-disclosure agreement (NDA) to the teachers, being afraid that their idea could be stolen. In this course, the individual ideas and projects are not shown to others, only to the teachers, who in these cases signed the NDA. A large part of the students, however, "had the mission to get out as soon as possible". Both teachers and student as interviewees stated: "If someone does not want to develop his entrepreneurial project, you cannot help him. If students have their own projects, about which they are enthusiastic, then you can teach them very well."

The second part of the course in 2013/2014, a **mandatory start-up weekend**, was mentioned to be very successful. Start-up weekends were a result of DT work which a student had done on one of the FELU courses. In start-up weekends, an entrepreneurial project based on the DT approach is developed within a weekend. It starts on Friday evening, with a final presentation on Sunday. At the beginning, a brief market place is organised, in which the students divide into two teams for one and a half hour. Thereafter, they start to work "as quickly as possible", distributed over ten rooms of the university. The teachers take a consulting role by visiting the teams in a relaxed and hands-on atmosphere, "having fun" together with the students. The students develop their ideas, build prototypes and test them on the market in three days up to the final presentation in front of a jury. The jury consists of three panellists, not including the teachers from the weekend, and sometimes include investors. They grade the students on their business ideas, presentations and prototypes. Up to now, six start-up weekends were realised, with the last one being mandatory. According to a teacher, the mandatory start up weekend "turned out to be super great. It was so successful because people did not have anything else on their mind. They just come there and worked on their projects. They would throw away a weekend and say 'so we are here we can work on the project'". Compared to the voluntary start up weekends, the lecturer said that the mandatory weekend was even better at achieving good results in terms of ideas, prototypes and presentations.

"Entrepreneurial Project 2" – Graduate

In the course "Entrepreneurial Project 2", at the graduate level, the students work in teams on developing new ideas and prototypes. In contrast to the course "Entrepreneurial Project 1", which was for undergraduates and in which the individual ideas and projects are not shown publicly, in Project 2 everything that is developed is public property. When

the course is finished, students and teachers can take the ideas and start a business (see the description of Optiprint and Printbox as a successful example in chapter 1.6). For building the prototypes, students have to take some of their own money to buy prototyping material. However, there is also a small course budget available for buying material. Partly, also in the first years of undergraduate studies, the students work on projects that have been initiated by company partners. The company partners stem mainly from Prof. Vahčič's network, who still teaches graduate courses. Working with company partners has the advantage that the students receive practical experience in working together with the companies.

"Effective Presentations"

One of the teachers chose to apply DT in the course "Effective Presentations". The students had to give at least five presentations during the course in a "trial and error" process. The student audience gave feedback for improving the presentations. The teachers acted as moderators and also gave hints. The course was one of the best-graded courses with regard to student satisfaction. The students stated that they learned very much. According to the lecturer, the advantage of applying this method is that students can keep their authenticity with individual feedback. They are not influenced by a standard way of doing a presentation, which would be taught in the traditional way. "Basically we do not teach them anything. We force them to teach themselves and that is a very effective way", as quoted by the teacher responsible for the course.

11.2.4 Setting of entrepreneurship teaching

For FELU students, the EE courses take part in faculty rooms. At FELU, "pragmatic" prototyping rooms with relevant tools such as screwdrivers, pliers, drilling machine, etc. have been established (see pictures in the annex) which students in DT use after passing a security and quality test. EE courses at other faculties, i.e. Chemistry, Civic and Geodetic Engineering, Computer and Information Science, and Natural Sciences, are held by FELU teachers, but there are no prototyping rooms available.

11.2.5 Instructors: teachers and mentors

Professors, other employees and external lecturers of the university

The academic department of entrepreneurship at FELU comprises nine teachers (see full list in the annex). There have been four full professors until July 2014. In July 2014, Prof. Dr. Tea Petrin and Prof. Dr. Aleš Vahčič, who initiated DT at FELU, retired but are still active in the EE unit. In addition, two assistant professors and five teaching assistants give lectures in EE. Guest lecturers, e.g. from companies in Prof. Vahčič's network, are invited to complement the lectures, also in the courses taught with the DT approach.

Out of the nine active professors, assistant professors and teaching assistants, four apply the DT method. One assistant professor, Prof. Dr. Anja Nabergoj, teaches regularly in Stanford at the d.school leveraging the experiences between the two institutions.

"Real entrepreneurs" as teachers

FELU's entrepreneurship unit also comprises two entrepreneurs, Dr. Rok Stritar and Blaž Zupan, MSc. They are fully employed at FELU while running their companies (see further

details in section 1.6.1). They teach mostly in courses including DT, e.g. Entrepreneurship, Entrepreneurial Projects, Development of Entrepreneurial Opportunities, Effective Presentations. Both are also involved in research on entrepreneurship. Dr. Rok Stritar completed his PhD thesis at FELU, while Blaž Zupan is actively researching DT in his doctoral studies. As entrepreneurs, they intend to give direct, "real life" feedback to the students. Since they see students as responsible for their entrepreneurial projects, they give them more freedom in the courses in terms of organising their work and limited attendance in seminars. The increased freedom seems to work especially well for students with high motivation and involvement. It is discussable whether the direct feedback and the increased self-responsibility foster the learning impact on students with low motivation and low self-confidence. One interviewee mentioned the low level of active involvement in one of the courses. On the other hand, some interviewees mentioned that more freedom, for instance, in terms of choosing their own problem, often leads to increased motivation and involvement.

11.2.6 Management of entrepreneurship education

In the academic department of EE at FELU, new teachers are introduced to DT through an informal "master-apprentice" model. Inexperienced teachers start co-teaching with experienced DT teachers. As they receive feedback throughout the courses by the experienced teachers and by the students, they become increasingly independent. In 2006, after Prof. Vahčič introduced DT at FELU, he started involving Anja Nabergoj, Rok Stritar and Blaž Zupan in teaching the methodology. Mateja Drnovšek shortly joined thereafter and received, together with Anja Nabergoj, additional DT coaching at the d.school in Stanford. Today, all of them teach DT autonomously in their courses. The informal "master-apprentice" qualification system continues with new and young teachers.

11.3 Extra-curricular activities in entrepreneurship education

Overview about extra-curricular entrepreneurship activities

Extra-curricular activities at the University of Ljubljana related to EE comprise start-up weekends, consulting as well as workshops and presentations for external organisations.

Exhibit 11-3: Overview about extra-curricular EE activities at the University of Ljubljana.

No.	Name	Contents	Target group	Offered since [year]	No. of participants in 2013/14:
1	Start-up Weekends	DT method / project in one weekend	All students from the University	2014	~ 400
2	Consulting	Projects including DT, teaching the DT methodology	Companies and their employees	2014	30 + 20 (two sub-projects in 2014)
3	Workshops and Lectures	Introduction of DT, working with DT	Other universities, nascent entrepreneurs, governmental organisations, unemployed, established ventures	2006	n/a

Start-up weekends

FELU's start-up weekends are usually voluntary events. An exception is one mandatory event in the undergraduate course "Entrepreneurial Project 1". The weekends are open to students from all faculties of the University of Ljubljana, the University of Maribor and Primorska University. Most start-up weekends are, in fact, not organised by FELU but by other faculties or other Slovenian institutions supporting entrepreneurship. However, the structure is similar to the mandatory weekend described above and FELU teachers mentor the teams. For example, one start up weekend in 2014 was sponsored and organised by the University of Ljubljana's Biotechnical Faculty and its students, but it was open to students from all faculties. The weekend focussed on the topic of "how to create value from wood" since Slovenia has an abundance of forests. In the academic year 2013/14, approximately 400 students took part in six start-up weekends, including the mandatory one.

Consulting

FELU also applied the DT approach in a consulting project for a major Slovenian company on two occasions. The first occasion concerned organisational redesign and strategy building, the second was of a technical nature. There were no students involved in the activities. The participants (30 and 20) were the employees of the company. The consulting work was intended to teach the DT methodology. The participants were meant to learn how to think and work using the methodology.

In addition, the academic unit conducted consulting projects to solve companies' challenges with the staff of the unit applying DT – for example, increasing the number of visitors of a major Spa and wellness centre in Ljubljana. In those projects there were a few students involved as the "workforce". All of the consulting activities were considered to be successful.

Workshops and lectures

FELU staff members often conduct lectures and small DT workshops outside the University of Ljubljana. For example, the external locations include other universities during university events, for nascent entrepreneurs in the start-up ecosystem in Slovenia, in governmental organisations, for unemployed people (see chapter 1.2.2.), and also in established ventures. The objective of the lectures and workshops is to introduce the DT methodology and to foster problem solving in a DT manner among the participants. The FELU team does not keep track of the number of workshops and participants.

11.4 Institutional aspects of entrepreneurship education

11.4.1 Organisational set-up and change

Application of DT in other faculties

EE including DT already spilled over to other faculties at the University of Ljubljana. A course called "Entrepreneurship" is offered to undergraduate students at the Faculties of Chemistry, Civic and Geodetic Engineering, Computer and Information Science, and Natural Sciences. There is a separate course held at each faculty. Similar to the Erasmus

course, the course taught at the other faculties includes a mix of contents of the courses "Entrepreneurship" for FELU students and "Entrepreneurial Project 1". However, in the latter course, there is more focus on project work and DT than in the Erasmus course, so it is more comparable to "Entrepreneurial Project 1". However, no prototyping room can be used because the lectures are held in other faculty locations.

Depending on the faculty and year, usually 60 to 100 students attend the course at each faculty. The courses are conducted by different teachers of FELU's academic Department of Entrepreneurship. Until the academic year 2014/15, the teachers did not co-ordinate themselves much with regard to the content of the lectures at the other faculties. Today, such co-ordination takes place and the content offered in courses other faculties is similar.

FELU offers EE to other faculties when Vice-Deans from other faculties demand for it. One interviewee from FELU said that "it is not that we would be selling our method to other faculties".

Barriers to multi-disciplinarity

Multi-disciplinarity of the DT approach is, apart from a few exceptions, not yet achieved. Exceptions were the courses "Entrepreneurial Project 1 – undergraduate" in the year 2007/2008 and all the start-up weekends. In the course "Entrepreneurial Project 1" in the year 2007/2008, six students from the Faculty of Architecture and five students from the Faculty of Mechanical Engineering joined the 70 students from FELU. In the mandatory start-up weekend in the year 2013/2014, for example, 72 students from FELU and 22 students from the Faculty for Natural Sciences took part. In other words: students from economics and from other faculties do not yet learn and work together in a considerable scope. The following barriers to implementation of multi-disciplinarity in the DT courses were identified:

- Geographical distance: Other faculties are located far away from FELU, as for example, the Electro-Technical Faculty (more than 5 km).
- Professional culture: Engineering students were described as looking down on students of economics, which makes teamwork difficult.
- Resource limitations: Financial funding for prototyping rooms and human resources in terms of teaching capacity is limited at the moment.

11.4.2 Laws, statutes and codes

Legal barriers for students to act entrepreneurially

As regards the implementation of DT and EE in general, the interviewees mentioned several legal barriers in Slovenia influencing the students' mindsets and behaviour and consequently, the work of the academic unit. The barriers were seen as key factors in reducing students' entrepreneurial intention and motivation throughout the courses.

A major barrier to student entrepreneurship in Slovenia is that **students lose their privileges when they start and register their own business**. This is independent of the income they earn. Students' privileges comprise, for example, low taxes for student work and low cost board and lodging. Apart from these obstacles, the students also have to pay extra taxes as soon as they are legally registered as a "solo entrepreneur". In the interviews, a possible workaround was mentioned: if a student wants to avoid losing

privileges, his or her father or mother can formally be the owner of the firm, employing the student.

There are also legal barriers for testing ideas in the real world, which is highly relevant when applying DT. If students test their business ideas by trying to sell them to real customers, "they start to break the law very quickly", because **selling a product without having a company is prohibited**. The students sometimes refuse to sell their prototypes due to this reason. Therefore, the EE team at FELU is discussing to set up a legal organisation for this purpose. Students would then be allowed to sell their prototypes in a legal way, invoicing it to the organisation.

11.4.3 Mindsets and attitudes

Socio-cultural issues hampering entrepreneurial mindsets

According to the interviewees, Slovenia does not have a pronounced entrepreneurial culture. Post-socialist mindsets are still very prevalent, especially among the students' parents. They prefer a career of working in public administration, state-owned organisations or large enterprises. Entrepreneurship still has a negative connotation due to the country's history, including the times of system change after 1989 when so-called "entrepreneurs" took advantage of a corruptive environment.[16] Furthermore, it was mentioned that profit is often seen as negative and failure has a strong negative connotation in Slovenia.

On the other hand, as described above, the enthusiasm of many students in EE courses, the large number of participants in voluntary entrepreneurial workshops, and the interest among pupils to become involved in entrepreneurial projects indicate a mindset change among young people in Slovenia.

11.5 Outreach to external stakeholders of entrepreneurship education

After the civil war, an **infrastructure of entrepreneurship** was built up in Ljubljana, including incubators, venture capital providers, and GEA College, a privately owned business school specialised in teaching entrepreneurship. They are all working closely together with FELU. Prof. Petrin played a significant role in helping to set up this infrastructure.

Prof. Vahčič used his networks with **companies** for starting projects in the entrepreneurial project courses: up to ten practitioners per course were involved presenting companies' challenges, which the students solved using DT. Today, the students work more on their own projects, since in the past, the companies' problems were sometimes too narrow for a group project, according to one interviewee. Working on practitioners' and real companies' challenges is therefore now only a part of two courses, "Technological Entrepreneurship" at graduate level, and the MBA course "Business Design".

Yet, **guest speakers** from practice regularly complement the EE classes. For example, in the course "Entrepreneurship" at undergraduate level, four to five practitioners are

[16] It was said that there were a lot of "stories in the media".

involved per semester. Even in the theoretical course “Theory of Entrepreneurship”, Prof. Petrin always invited three to four guest speakers from start-ups, from existing ventures or social entrepreneurs.

External stakeholders are also involved in the **Board of the Faculty of Economics**. It consists of 28 members, all of them prominent persons from the business world. In former times, only large companies were represented in the Board. Through the initiative of Prof. Tea Petrin, two directors from two smaller high-tech and biotech ventures are now included: Ivo Boscarol (Pipistrel, light aircrafts[17]) and Dr. Aleš Štrancar (Bia Separations, biotech separation materials[18]). The Board discusses FELU’s programmes including the EE programme and the qualification of students from Slovenian universities.

11.6 Impact and lessons learned

11.6.1 Measuring impacts of entrepreneurship education

Impact evaluation methods applied

At FELU, impacts of entrepreneurship education in general and of applying the Design Thinking approach in particular are measured in course feedback. Course evaluation happens through a standardised survey of the University at the end of each course. According to one interviewee, for detailed course feedback, especially with regard to the application of DT, the survey does not provide enough information. In order to gain additional feedback, DT teachers conduct either an additional written survey or a feedback discussion in one class. However, the additional feedback is not standardised: each DT teacher organises it in his or her own way.

The suitability and the impact of the DT method can to some extent be concluded from examples in this case study: students create valuable business ideas; a high share of unemployed people participating in a DT course finds a job; DT has been successfully tested in primary schools; and external stakeholders are interested in developing the approach further. One of the most valuable business ideas, for example, may be a mountable set which can transform any bicycle into an electrical bike at rather low cost.[19]

FELU does not as yet keep track of graduate start-ups and does not follow the students’ careers after they leave the university.

Start-ups evolving from DT at the University of Ljubljana

The case study identified three examples where teaching EE with the DT method was applied particularly effectively for starting and growing new ventures. In these companies, DT was also applied as a way of thinking and leading a business.

The first company, **KIBUBA**[20]**,** sells outdoor equipment and is owned by FELU teacher Dr. Rok Stritar. The company was founded in 2005 and opened an internet shop two years before DT was introduced at FELU. Since it sold only over the internet, its revenues

[17] See http://www.pipistrel.si/.

[18] See http://www.biaseparations.com/.

[19] The case researcher tested the prototype.

[20] See: http://www.kibuba.com/.

were low. The company then followed with opening additional retail shops. This proved to be a successful strategy. Since finding the right location for a shop is difficult, the company opened 13 shops in Slovenia and closed eight of them again in a trial and error process. For Rok Stritar "it's a success" as the remaining five shops are running very well. Today, KIBUBA is the second largest company in Slovenia in this market and the only company growing in the industry.[21] Three competitors went bankrupt. With regard to DT, he stated that for him personally, it was a parallel process in developing as "a design thinker" in the university and in his company. According to him, the most important aspects of DT helping the company to succeed are: a deep understanding of the customer, related to challenging the key assumptions of the company's offers, the "bias toward action instead of thinking" and the iterative trial and error process in building the shops, while losing as small amounts of money as possible.

The creation of two other companies, **Printbox** and **Optiprint**[22], resulted from DT in one of FELU's entrepreneurial project courses. Printbox and Optiprint are based on the same technology but have different business models. The problem that both ideas solve is the high costs of colour printing: a box with a sufficient amount of ink is installed in a printer, which lowers the printing cost significantly as the ink itself is very cheap. However, the innovation was not mainly in the technology but in the business models, which evolved in applying DT in several rounds, such as asking potential customers and understanding the real needs and problems beyond costs. Printbox now offers public printers where people can print at a low cost.[23] Optiprint rents printers including the ink-box to companies and schools, offering flat rate printing at a certain price per month. Optiprint was found to have been very successful: revenues increased from 3,430 euro in 2009 to 766,334 euro in 2013. Optiprint employs approximately 20 people in Ljubljana and has seven more franchises in Slovenia, one in Croatia, and one in Bosnia.

11.6.2 Lessons learned

Summary of lessons learned from this case

Implementing DT at the University of Ljubljana, primarily in the Faculty of Economics, had positive impacts on entrepreneurship education. Several downsides of more traditional EE approaches, e.g. a focus on writing business plans and teaching in an ex-cathedra way, could mostly be overcome:

- Applying DT can **trigger creativity**. It was mentioned that DT also fosters creativity in students who usually do not think creatively or do not have the opportunity to engage in a creative way.
- DT helps **exploring real problems of real customers**. DT may change potential entrepreneurs' behaviour from pursuing "their idea", which may lead to failure towards identifying customers' problems up front or at least matching the initial idea with early customer feedback. The iterative process with the involvement of customers at different stages can be regarded as suitable for achieving a fit between

[21] KIBUBA's official revenues increased from 552,000 euro in 2009 to 1,282,000 euro in 2011 to 1,625,000 euro in 2013.

[22] See http://www.optiprint.si/.

[23] The German newspaper "Die Welt" labelled it as one the most interesting innovations at the CeBIT. See http://www.welt.de/wirtschaft/webwelt/article138468928/Das-sind-die-originellsten-Gadgets-der-Cebit.html.

customer needs and a business solution, as shown by the company example Optiprint.

- DT can represent the **practical component in EE**. In applying DT, students have to work in a practical way, such as communicating with customers and through building and testing prototypes. They "think with hands", which can be regarded as helpful if not a necessary complement in EE as it reveals new insights during the development process. Additionally, students learn a set of practically relevant skills and methods and an overarching way of combining them. Those skills may be relevant not only for start-ups but also for innovation management in established companies. With regard to the practical component of EE, one lecturer stated that the need to develop a prototype can be seen as the "most powerful aspect of the DT approach". Students mention that finally they can "do something" after sitting in classrooms for several years, which might be interpreted as a factor for increasing student motivation.
- DT can support the **generation of valuable business ideas**. DT projects can also add tangible social value when the projects and solutions target, for example, local community problems. This was the case of FELU's DT project with primary schools.
- DT may help to **attract business practitioners** to engage in EE, as for example, Slovenian entrepreneur Sandi Češko, or the companies working with students in the entrepreneurial project courses.
- DT can lead to a **shift in the mindset** of students, teachers, pupils and unemployed people. DT can help them to feel capable and self-confident. A part of them might apply DT as a general philosophy, also in their everyday lives.

As regards course contents, several offers at the University of Ljubljana may be considered as exemplary:

- The **start-up weekend** was found to be a suitable activity with regard to diminishing the problem of motivation and achieving multi-disciplinarity. It may be a good way to integrate students and teachers from different departments and disciplines.
- Having group work and individual work on **real entrepreneurial projects** (or on projects from external companies) applying DT may be a successful approach.
- The "**Three Euro Challenge**", i.e. developing and selling products and services with an initial investment of 3 euros may constitute a suitable activity to experience entrepreneurial behaviour in real life.
- The application of **DT for unemployed people and in primary schools** may be a good example to foster entrepreneurial mindsets.

Limitations and challenges of the DT approach

However, the implementation of DT at FELU also revealed limitations and challenges of the DT approach. Several interviewees mentioned that DT should not be considered as a "religion", "being better than any other method in the world". Some mentioned it should rather be considered as a method that is hand-in-hand with other methods.

The **motivation of students is critical** in applying the DT approach intensively because the DT approach is based on self-motivation. Students who do not have an entrepreneurial mindset or entrepreneurial intentions and who just want to pass the course can be difficult to motivate, especially when DT is applied in several courses and events.

To avoid or to at least diminish this effect, a **high level of teacher involvement and trust building is important**, especially for undergraduate students and in the initial classes applying DT. According to one teacher, a course would ideally have three instructors for 50 students. Applying DT in courses with a high number of students is a challenge, as the free rider problem increases and "many students get away without having real exposure to the methods". However, using DT in a mandatory course to all students of economics at a large faculty, which is the case with the course "Entrepreneurship" at FELU, may be a good way to introduce the method to all students, even those without a specialisation in entrepreneurship.

A key means to increase the motivation of the participants is their **own selection of customers, problems and ideas** to work on. The participants feel more involved with their individual ideas and projects. Imposing problems or topics to work on might be suitable at the beginning to explain the method, but very likely lowers motivation. Up-front idea generation and self-grouping before the course with the help of organised market places may be a suitable means to support the students' self-selection. Offering elective courses is also a possibility to use self-selection to exclude unmotivated students, especially at a later stage in the curriculum. Personally encouraging students to try and test their ideas was found to be important.

"Overdoing" should be avoided, as several DT courses with comparable learning objectives might annoy students. If more courses use DT, they have to be co-ordinated to align learning outcomes. FELU distinguishes, for example, between being introduced to DT, focusing on exploring customer problems, solving companies' problems, and building one's own business. It is important, however, that several opportunities with DT courses are offered for motivated students, also to help them progress with their own projects.

Human and financial resources are critical to DT success. Teachers have to take the role of coaches, being able to help students at the point when they have a problem. This requires a broad set of skills and a different behaviour compared to traditional teaching. Ensuring a high number of teachers in a DT class and working with the students intensively requires a larger number of staff at the academic unit. However, the FELU case shows how DT classes with a higher number of students can also be managed.

Limited **human resources** also hinder the spreading of DT to other faculties and institutions if deemed useful. Applying DT in interdisciplinary teams, not only among students but also among teachers, may be beneficial but can be organisationally complex and costly. With the location of FELU and the distance to other faculties, it is difficult to organise interdisciplinary teams.

As regards **financial resources**, the case study found that prototyping facilities are needed to effectively use DT, despite the possibility of applying it without any prototyping room and material. Installing "pragmatic" prototyping facilities in universities, high schools and elementary schools might be a valuable investment. One interviewee made a tentative calculation for the rollout of DT and prototyping rooms across the country. He estimated an investment of 10,000 – 25,000 euro for a prototyping room and a sum of 25 – 30 million euro for the whole country, for all faculties in universities, approximately 250 high schools and 750 primary and elementary schools in the whole country.

Transferability to other universities

The DT approach can be supportive for EE due to its orientation towards customers and problems, the triggering of creativity, the need for prototyping and the insightful trial and

error process. As a hands-on methodology with an iterative learning process oriented toward practice, the DT approach or a similar method could also be applied at other universities, at least as a complement to EE. The **main preconditions** are, on one hand, **human and financial resources,** as usually a relatively high number of teachers is required in a DT course, and prototyping facilities. On the other hand, **the will and the capabilities of the teachers to act as a coach to support the students**, instead of teaching them, can be regarded as an important precondition. The required mind-set and the capabilities of the DT teachers might pose a challenge when introducing DT into a “traditional”, ex-cathedra teaching environment.

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Annex

Prototyping facility at FELU

Two prototyping rooms for project work in the DT courses are located in the basement of FELU.

List of teachers at the academic unit of entrepreneurship at FELU

Status: end of 2014

- Prof. Dr. Mateja Drnovšek, head of academic unit / teaching with DT method
- Prof. Dr. Boštjan Antončič, full professor
- Prof. Dr. Jaka Lindič, assistant professor
- Prof. Dr. Anja Nabergoj, assistant professor / teaching with DT (also in Stanford)
- Dr. Patricia Kotnik, teaching assistant
- Dr. Rok Stritar, teaching assistant, entrepreneur (Kibuba) / teaching with DT
- Dr. Alenka Slavec, teaching assistant
- Blaž Zupan, MSc., teaching assistant, entrepreneur (Optiprint) / teaching with DT
- Lidija Brščič, MSc, teaching assistant
- Prof. Dr. Tea Petrin (retired as of July 2014), full professor
- Prof. Dr. Aleš Vahčič (retired as of July 2014), full professor, initiated DT at FELU