Building the Innovative and Entrepreneurial University

Peter Stanchev
Computer Science Department
Kettering University
Flint, Michigan, USA
IMI-BAS
Sofia, Bulgaria
pstanche@kettering.edu

ABSTRACT

How can entrepreneurship be taught? The positive feedback loop at the Massachusetts Institute of Technology for spirit & skills which creates the successful entrepreneurial ecosystem.

Innovation and entrepreneurship organization in higher education: KEEN a network of thousands of faculties, working to unleash undergraduate students so that they can create personal, economic, and societal value through the entrepreneurial mindset; DECA – an international association of high school students and teachers of marketing, management and entrepreneurship in business, finance, hospitality and marketing sales and services.

Innovation and entrepreneurship at Kettering University: The T-space to transforming their mindset to "think, tinker, and thrive"; facture two, built on the idea that learning, sharing, and creating are empowering and transformative forces which can open doors and revolutions both perceptions and realities; innovation and entrepreneurship minor at the school of management; Kettering Entrepreneurship society.

How can entrepreneurship be including in the curriculum? Teaching the Entrepreneurial Mindset in Computer Science classes.

CCS CONCEPTS

• K.3.2 Computer and Information Science Education

KEYWORDS

Entrepreneurship, Entrepreneurial Mindset, Entrepreneurial Understanding, Teaching Techniques, Education, Project-Based Learning, Team-Based Learning, KEEN, DECA, Kettering University

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1 Introduction

In the United States the process of introducing entrepreneurial training at colleges and universities started in the seventies of the 20th century. It is estimated that currently more than 80% of all U.S. colleges and universities implement such programs. According to the report of the U.S. Department of Commerce "The Innovative and Entrepreneurial University, Higher Education, Innovation & Entrepreneurship in Focus" [10]: "Colleges and universities are investing heavily in the development of their students' entrepreneurial skills. While many students dream of starting the next Facebook® or Twitter® (both of which were started by students), universities are more focused on the pedagogical value of entrepreneurship as a set of skills that can be applied across professional environments and activities to supplement the students' classroom experience. Universities are investing both in formal programs as well as in extra-curricular activities to channel students' interest in solving global problems through entrepreneurship."

Thinking of entrepreneurship teaching as a toolbox is a fundamental feature for educators, because these tools may help improve the way we are currently teaching entrepreneurship in universities as well as enable students to practice entrepreneurial skills through creative thinking and reflection. An entrepreneurship educator, can help students develop entrepreneurial skills such as: entrepreneurial thinking, creativity and innovation, learning from failure, and reflection. Some basic ideas are given in [5].

Kettering University participates in the initiative to develop the Kern Entrepreneurship Education Network (KEEN) (http://keennetwork.org/). The goal of KEEN is to make entrepreneurship education opportunities widely available at institutions of higher learning, and to instill an action-oriented

entrepreneurial mindset in engineering, science, and technical undergraduates.

2 How Entrepreneurship can be Taught?

"Entrepreneurship is a skill that can be learnt. You don't have to be born an entrepreneur to run a successful business. You can become one by developing an entrepreneurial mindset and skills. As Europe needs more entrepreneurs creating jobs, it's necessary to support this type of education in all EU countries. The main objective of the European Commission is to promote entrepreneurship education and stress its importance at all levels from primary school to university and beyond" [4]. Entrepreneurship, like any skill or field of study, is taught [1]. The future of research on entrepreneurial intentions is described in [2]. While some people are autodidacts, everyone still learns from doing.

Some basic tenets of entrepreneurship in education, focusing on what it is, why it is relevant to society, when it is applied or not and how to do it in practice are outlined in [6]. The textbook [3] is used in MIT and shows how to create a successful startup by developing an innovative product. It breaks down the necessary processes into an integrated, comprehensive, and proven 24-step framework that any industrious person can learn and apply. Disciplined Entrepreneurship changes the way you think about starting a company.

3 Innovation and Entrepreneurship Organizations in Higher Education

Some of the organization that facilitate entrepreneurship in high education are:

3.1 KEEN (http://keennetwork.org/)

Students with an entrepreneurial mindset can recognize opportunities, evaluate markets, and learn from mistakes to create value for themselves and others. KEEN specifically outlined seven student outcomes pertaining to the entrepreneurial mindset. A student should be able to:

1. Effectively collaborate in a team setting (teamwork).
2. Apply critical and creative thinking to ambiguous problems (problem solving).
3. Construct and effectively communicate a customer-appropriate value proposition (customer awareness).
4. Persist through and learn from failure to learn what is needed to succeed (persistence).
5. Effectively manage projects and apply the commercialization process within respective disciplines (project management).
6. Demonstrate voluntary social responsibility (social responsibility).
7. Relate personal liberties and free enterprise to entrepreneurship (free enterprise).

3.2. DECA (https://www.deca.org/about/)

DECA prepares emerging leaders and entrepreneurs for careers in marketing, finance, hospitality and management in high schools and colleges around the globe.

4 Innovation and Entrepreneurship at Kettering University

Some of the entrepreneurship initiatives available for the Kettering students are:

4.1 The T-Space (www.kettering-t-space.com)

The T-space is constantly evolving its mission and offers. It provides students with access to 3D printing, laser cutting, soldering and other utilities to work on small electric and mechanical prototypes. Kettering students now have the necessary T-space to transform their mindset to "think, tinker, and thrive".

4.2 Factory Two (https://factorytwo.org/)

Factory Two is a community makerspace located in the heart of downtown Flint, Michigan. Factory Two is built on the idea that learning, sharing, and creating are empowering and transformative forces which can open doors and revolutionize both perceptions and realities. Making items as delicate as jewelry, or as durable as iron worked on a coal fired forge. Their members are small business owners, students, artists, emerging entrepreneurs, crafters, neighbors, retirees and more.

4.3 100 K ideas (https://www.100kideas.org/)

Housed in Flint, Michigan, this is a non-profit organization with a mission to relieve the innovator of the entrepreneurial burden. As a community of student professionals, they vet entrepreneurial ideas to provide a helping hand in business development to anyone regardless of their prior experience or background. 100K Ideas is a community of hobbyists, thinkers, and inventors with a mission to help passionate innovators create products/services and startups of their own through mentorship.

4.4 American's Small Business Development Center (SBDC) (https://sbdcmichigan.org/)

The Michigan SBDC offers expert assistance at no cost to entrepreneurs looking to start or grow a business. It answers questions such as: I want to start a business; I have started a business; I want to grow my business; I have an advanced tech business.

4.5 Kettering Entrepreneurship Society (KES) (http://newb.kettering.edu/wp/i2e-au/kettering-entrepreneur-society/)

KES seeks to promote the sharing of ideas; encourage an entrepreneurial mindset; provide an environment for peer mentorship; serve as a resource for student-owned businesses; propel learning opportunities with seed-funding support.

4.6. Flint soup (https://d.facebook.com/FlintSOUP/)

Founded in 2012, Flint soup is a project of the United Way of Genesee County and has managed more than 30 business competitions, where creators and entrepreneurs can obtain small amounts of financial support for their projects. While the program is designed to support business ideas, it simultaneously fosters community engagement and resident participation, which are needed after the water crisis.

5 Teaching the Entrepreneurial Mindset in Computer Science Classes

The developed methodology is based on Project-Based Learning (PBL) and Team-Based Learning (TBL) [8, 9]. The methodology proposed teaches students to acquire entrepreneurial skills through development of a new software system and services for the purpose of the University needs [7[. The students come with their own ideas to help Kettering University students and they follow entrepreneurship steps to design, develop and implement the system or service in industrial settings. The outputs of the application of the methodology are database systems or services, with the documentation, which are proposed to be included in the Kettering University web portal.

The technology goals are: first to learn better the objectives of the course, second to implement their own ideas following all necessary steps, third to turn the project into a real marketing product. Following these steps the students are competent to tell their new-product story in business terms. They are prepared to negotiate organizational management obstacles by effectively collaborating in a team setting. They effectively manage their projects and think to apply the commercialization process.

Working on the project gives the students the ability to recognize opportunities that have a technical solution. They construct and effectively communicate a customer-appropriate value proposition. They are able to apply critical and creative thinking to solving ambiguous problems, an ability to recognize an unmet need and to act on an opportunity, creating and delivering new customer value. As a result of developing their projects the students are also better prepared for the Entrepreneurial Mindset outcome: Productive Collaboration, Resolute Integrity, Illuminating Communication, Multidimensional Problem Solving, and Enterprising Attitude.

The proposed technique was implemented at Kettering University. The students were given Database system, Web technology, Software engineering, Product Planning and Development, Identifying Customer Needs, Business plan and Marketing plan handouts. By the end of the term, the students made presentations in front of faculty and administration. The Vice President of Instructional, Administrative, and Information Technology, the Director of Sponsored Research, the Director of the Center for Excellence in Teaching & Learning also took part.

In Table 1 the goals and techniques used during the course are given.

	Goals	Techniques
week 1	Individual ideas	Attribute listing; Brainstorming; Delphi technique; Think, Share, Group
week 2	Project description	Requirements analysis Is It Real? Can We Win? Is It Worth Doing?
Week 3	Detail Project description	Need, Approach, Benefit, and Competition
Week 4	Creating Project Planning and Development plans	Project Planning and Painstorming
Week 5	Define the project	Software engineering
Week 6	Define the project Web pages	Web design tools
Week 7	First realization step	Gallery walk
Week 8	Second realization step	Software engineering
Week 9	Presenting the prototype	Marketing plan
Week 10	Product	Service summary

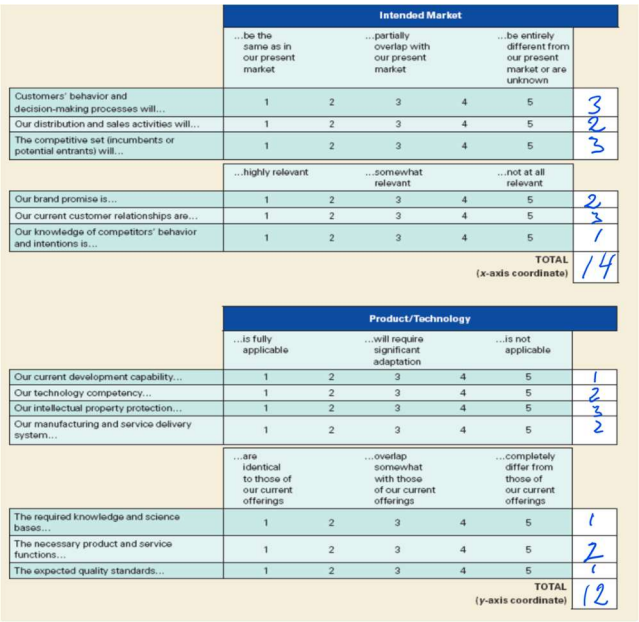
Table 1: Week goals and technologies used

5.1 Examples of the Technologies Used

Some results of techniques used are shown. For the "Kettering Mobile" an Android application designed to be used by the current students of Kettering University. The application offers the ability to retrieve all mainstream information provided by the current students' tab of the Kettering website. The poster prepared for gallery walk is shown in Figure 1.

Figure 1: "Kettering Mobile" poster

For Carpool - a system helping exchange students' daily life. In Kettering, some students don't have cars especially exchange students, but they need to use them sometimes. On the other hand, some students have cars and there are many free seats going to waste. We solve this problem effectively. The result of applying "Is It Real? Can We Win? Is It Worth Doing?" technique for this project is shown in Figure 2. The technique manages the risk and reward in an innovation portfolio. Is the opportunity REAL? A real market with a product, size, scale potential, available technology, etc. Can you WIN with this opportunity? Can you have a sustainable competitive advantage, can you patent or brand the idea, are you more capable of execution than competitors? Is the opportunity WORTH IT financially? Do you have the resources needed, confident that the investment will be rewarded with appropriate returns?



Intended Market	...be the same as in our present market		...partially overlap with our present market		...be entirely different from our present market or are unknown	
Customers' behavior and decision-making processes will...	1	2	3	4	5	3
Our distribution and sales activities will...	1	2	3	4	5	2
The competitive set (incumbents or potential entrants) will...	1	2	3	4	5	3
	...highly relevant		...somewhat relevant		...not at all relevant	
Our brand promise is...	1	2	3	4	5	2
Our current customer relationships are...	1	2	3	4	5	3
Our knowledge of competitors' behavior and intentions is...	1	2	3	4	5	1
					TOTAL (x-axis coordinate)	14

Product/Technology	...is fully applicable		...will require significant adaptation		...is not applicable	
Our current development capability...	1	2	3	4	5	1
Our technology competency...	1	2	3	4	5	2
Our intellectual property protection...	1	2	3	4	5	3
Our manufacturing and service delivery system...	1	2	3	4	5	2
	...are identical to those of our current offerings		...overlap somewhat with those of our current offerings		...completely differ from those of our current offerings	
The required knowledge and science bases...	1	2	3	4	5	1
The necessary product and service functions...	1	2	3	4	5	2
The expected quality standards...	1	2	3	4	5	1
					TOTAL (y-axis coordinate)	12

Figure 2: Applying "Is It Real? Can We Win? Is It Worth Doing?" technique for the "Carpool" application

5.2 Student Performances

As the completion of the project approaches, the students are asked to answer several questions and make some comments about them. We measure: the student's skill improvement, obtaining the course objectivities, obtaining the entrepreneurial objectives, the student's involvement in the project development, the student's improvement for real life problems. Some of the results are giving in Figure 3 and 4.

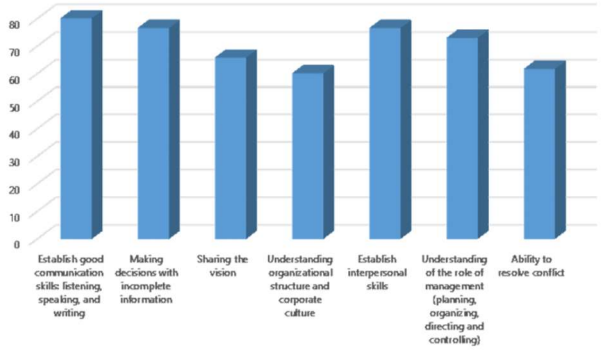


Figure 3: Obtaining the entrepreneur objectives

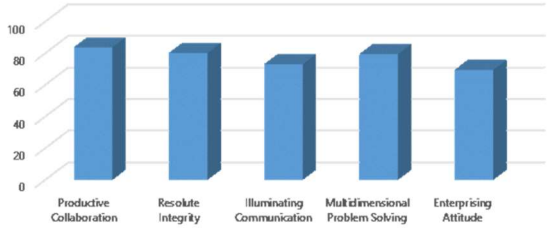


Figure 4: Student's improvement for real life problems

6 Conclusions

Using PBL and TBL the students are able to improve their enterprising behavior such as developing a business plan, case analysis, class presentation and discussion. They successfully incorporate: the written and oral presentations; individual self-assessment and team assessment tools; student progress reports and documentation. Working on the project is a good experience, but requires a lot of work. The students learned a lot about computer science and at the same time developed an Entrepreneurial Mindset.

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