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ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ В НАВЧАЛЬНОМУ ПРОЦЕСІ

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ENTREPRENEURSHIP BAROMETER AND E-LEARNING IN TECH STARTUPS CONTEXT

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This paper seeks to understand students' attitude towards entrepreneurship, their intentions to start their own companies, and then to propose improvements in the educational process or university infrastructure in order to develop students' entrepreneurial behaviour, give them the opportunity to gain experience as startupers. The work is based on the experience of implementing e-learning as a practical part within the course "Innovation and Entrepreneurship in IT", which is taught to undergraduate students in the department of Electronics and Computer Technology at Ivan Franko National University of Lviv, Ukraine. As an underlying method, the"A4 approach" for designing virtual learning environments (Attention, Actualisation, Attraction and Action) was used. An interactive online system "Entrepreneurship Barometer" was developed to monitor students' knowledge about entrepreneurship and their entrepreneurial mindset.

Our results highlight the importance of project-based e-learning in Tech Startup context as key components in developing entrepreneurial competences, also, for improving students' attitudes towards entrepreneuring, the value of inter-disciplinary teams during all startup growth phases.

Keywords: e-learning, tech startup, entrepreneuring, entrepreneurship barometer, virtual learning environment.

1. Introduction

Never before has it been so easy to start and run a company (startup) using information technology (IT) and Internet infrastructure. There are a few global platforms that many startups use to build their venture on, for example *Google, Amazon, Apple, Alibaba, Facebook.* These platforms can enable a small startup to gain access to clients, to the necessary investment, to resources in order to build their product or service, but they are also useful for distribution, hosting, sales, etc.

IT opens a gateway for startups, and IT advancements and a significant reduction in the cost of market entry have led to dynamic entrepreneurial movements even in the face of uncertainty or ambiguity. Creativity and adaptability, willingness to migrate and achieve quick gain allow the entrepreneurs in a '*startup boat*' to open new '*islands'* for their markets or to disrupt the existing ones.

It has become relevant to learn more about the entrepreneurial climate in the academic sector and about the willingness and readiness of university graduates to start their own

business, that is, to be prepared for takeoff. The task was to understand students' attitude towards entrepreneurship, their intentions to start their own enterprises, and then to propose improvements in the educational process or university infrastructure in order to develop students' entrepreneurial behaviour, give them the opportunity to gain experience as startupers. It was decided to conduct the study among 75 undergraduate students of the Department of Electronics and Computer Technology of the Ivan Franko National University of Lviv, having developed a special online system for monitoring the entrepreneurial climate and a Tech Startup workshop. It was expected that the results of such studies should help shine a light on what needs to change in the university environment, which will contribute to the development of entrepreneurial culture and the willingness of graduates to start their own companies.

In the last 8th semesters we invite undergraduate students to set out on a virtual journey from idea to the market – as innovators who create new values for those who need them and as entrepreneurs who bring these values onto the market. In order to act as an entrepreneur, we offer students the **4A** approach (Attention, Actualisation, Attraction, Action), which is successfully applied for designing virtual learning environments, and is a journey toward creating a startup with elements of immersion and flow [1] in analysing a situation and solving problems, when synthesising and evaluating solutions, acquiring new knowledge and skills, as well as forming a personal attitude to entrepreneurship and acting with velocity and agility.

Learning goes through the following four phases that correspond to the four stages of establishing a startup:

Attention to the problem(s), which leads to irritation; and that irritation really stems from the fact that we strongly believe that something needs to be done very differently than how it is going on now, and this is viewed as an opportunity (on the one hand, a chance to solve this problem, and on the other hand, to commercialize the technology);

Actualisation by goals and expected results: focus on a high-priority issue and conceptual solution for creating a new value;

Attraction through the elaborated effective business model and formed unique team;

Action to demonstrate the ability to meet customers' needs with implemented technology and developed product, and validate a business model, try to sell the product and your vision as soon as possible, and adjust the business strategy as needed.

2. Entrepreneurship Barometer: are you ready to be an entrepreneur?

"Entrepreneurship Barometer" is an interactive online system, which consists of two parts: a self-test and a questionnaire. Each student can take a self-test to check their knowledge and understanding of "what entrepreneurship is", and a questionnaire helps determine the generalized attitude to entrepreneurship, identifying and evaluating the entrepreneurial intention, needs in specific knowledge and competences, current approaches and a context for practicing entrepreneur*ing* [2]. The Barometer allows a university to understand what and how to be done in order to develop the entrepreneurial mindset and support the entrepreneurial activities among all university actors (students, faculty staff, researchers, and administration), as well as it actualises the need for expanding interdisciplinary networks both within the university infrastructure and outside it, by spreading them beyond the university into various industries [3, 4].

So, first students are asked to take a self-test to find out their comprehension of "*What is an Entrepreneur? What are the components needed to succeed in entrepreneurship? What is a customer need and what are the main categories to choose an idea? What is a market gap and what are the important considerations in choosing a target customer market? Which is the*

preferred early market research method and a good question to ask a potential customer? What is the 80/20 rule applied to startups? When should you seek investment and what investor would like to see?" The results of this self-testing are shown in Figure 1 and demonstrate a very different level of knowledge of the audience about the basic principles of entrepreneurship.

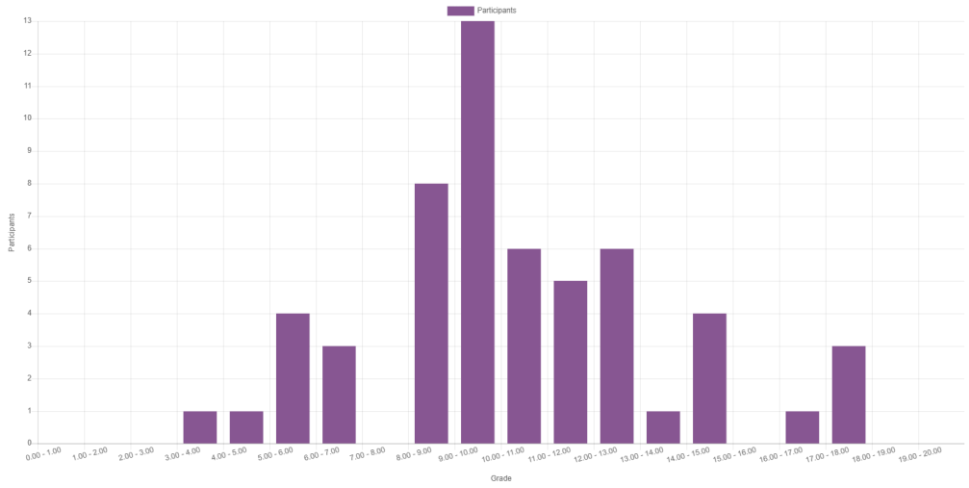

Fig. 1. Students' results of the self-test

Entrepreneuring (which means acting as an entrepreneur) is the art of application of marketing principles and human-centred design thinking to solve problems in the face of uncertainty and limitations, to create new values for specific target group, design innovative & sustainable business models, and as the process of creating a venture and its scaleup [5].

When students answers questions in the questionnaire, they demonstrate their attitude to entrepreneurship, intention to be an entrepreneur, and therefore to predict future behaviour as an entrepreneur. Annex 1 presents the results of this questionnaire.

As we can see, 21% of students are ready to become entrepreneurs, 70% are still postponing this decision until better times after graduation, while 7% are not interested in entrepreneurship at all. It should be noted that this 21% readiness for entrepreneurship is formed on the basis of the general positive attitude in society to IT entrepreneurs, and not on the basis of assessment of one's personal competencies, since the vast majority of those who answered '*yes'* to this question have no teamwork experience.

We observe that the audience is divided in half: one part is more focused on solving urgent problems, and the other – on developing a strategic vision and finding ways to achieve results. At the same time, they associate their success not with a unique technical proposal, but with personal openness to new things and a willingness to form a team that will give a competitive result (customise the product to the needs of customers). It should be specifically noted that only half of the students have experience of working in a team. We also see lack of confidence among students in communicating with both potential clients and investors. In the 21st century, our production capacity far exceeds our ability to know exactly what to produce. According to Eric Ries, "*The big question of our time is not Can it be built? but Should it be*

built?" The idea must be embodied in the real world as a technology or a product, amongst people, organisations, which interact based on economic principles, creating the market. That is, we have to know who needs what, what they expect and what they get, what the price is and what the demand exists. In his book Eric Ries [6] promotes the terms of *Continuous Innovation* and *Lean Startup* in product development under the conditions of uncertainty – by constantly communicating with potential customers about their expectations, by experimenting from a hypothesis – to developing products and elaborating a business model for the startup.

3. Tech Startup workshop – prepare for takeoff

Tech Startup workshop is project-based e-Learning in Tech Startup context where students actively chase problems and explore challenges, externalise creativity, generate ideas, use critical thinking, discover opportunities, acquire specific knowledge in innovation management, develop prototype and business models, collaborate, communicate, and learn how to form and lead startup teams.

Students enter the first phase '*Attention*' of our '4A virtual engine' when they get irritated that they cannot do their job, or cannot accomplish what they want, when they are dissatisfied with the state of things around, feel their own or someone else's '*pain'*, and they see it as a problem.

Assignment 1. Identifying the Problem.

Find something in your everyday life that 'annoys' you. *What is the real underlying issue you see in this situation? What contradiction do you observe? Can you use your creativity to imagine how everything should ideally be? What needs to be changed in the first place, and what hinders this? Who faces this problem first of all? How do you know that they would really like to have this problem solved? Are you really eager to solve this problem for this target group? Why do you feel passionate about this? Are you ready to dedicate time and effort to solve it right now?* - Students are asked to write answers to these questions in the box and submit for general review by all students.

To exit this phase successfully, every student has to formulate the question properly of *WHY* this problem exists in this target group, and *WHY* this problem has got into the field of their attention. Besides, students have to ask themselves: *Do I believe in my strength, am I able to assemble a team to solve this problem, and do I want to devote a part of my life to meet the needs of these clients?* If they feel that the answers to all these questions are positive, then they have every chance to succeed.

The second phase '*Actualisation'* deals with *HOW* students are going to solve the determined problem, and *HOW* the target group is going to behave exhibiting the need in the solution.

In this phase, we turn to the idea generation: finding an approach, technique, product that can demonstrate that the problem can be solved now; that is, it can meet the needs of one's defined customers. To search for alternative solutions, students are offered an interactive matrix as a way to think about problems, identify conflict situations and receive advice on the most likely solutions.

When ideas are generated, students in their teams discuss all the options and choose the most promising solutions that meet customers' needs and expectations. The solution to the problem must be more economical than living with this problem. Another key aspect is that the solution must be unique enough to provide a competitive edge. How do the solution and its advantages differ from what competitors offer?

Assignment 2. Defining Solution and Benefits.

Now you know who has the problem (set of problems) and what needs exist. *Can you use your own creativity to imagine some approach/solution to solve this problem and satisfy the needs? What value do you offer? Explain, what benefits will the potential customers get from using your approach? Are there any alternative approaches to solve this problem? Who are your competitors, and what are the advantages of your solution?* - Students are asked to create teams up to 5 persons each and write their team answers to these questions in the box.

The third phase is '*Attraction*'. This practical part is built around the development and validation of a business model for a startup. Students can use the popular business model canvas outlined by A. Osterwalder, Y. Pigneur, and C. L. Tucci [7].

Students are advised to go out and talk to their potential customers about their approach, technology, and product. They have to think about the following questions: *What is your experience of communicating with potential customers about? If they think the idea is good, are they willing to pay the first check, which you give them very soon? Were they interested in any specific features of your product, and have they asked to add or remove something?*

The task at this point is to model how their company will be organised. Moreover, the business model itself will be a value of their company; it can be one that differentiates them from their competitors and one that will attract customers and investors.

Students also need to consider the potential risks that they have to address in the business model description. By naming them here, students demonstrate their ability to deal with them (overcome or avoid them). Students should not be afraid of resistance; it will help them take off.

Then students are asked to try and sell their vision. As we know, investors today do not fund solutions that work – they fund business models that work. So a business model, not a solution, is the product to be developed in this phase.

Assignment 3. Developing a Business Model.

You already know who will be in your team, who will become your partner. *How can you distribute the created value to those who need it? Are those who use your value at the same time your customers? How much do you think the customers are willing to pay, and how? How will you work with your customers while they are using your product? How will you 'develop' your customers, what is the plan for expanding your business? What are the key activities? What is the cost of operating your business, and how will you receive revenue?* - Students should answer these questions in separate boxes, and the system will help with design of a business model.

The fourth phase '*Action* ' is a set of actions that show that the business model works, that one is ready to sell a product and the customer is ready to buy it.

Assignment 4. Now students in a team have to develop a project concept for their startup and submit it for peer review using a special plugin, that is, the same grade is distributed among all students in a team based on peer ratings from students from other teams. Project concept should include: team description, the problem they focus on and needs of their target group, approach to meeting these needs, benefits for their target group when using such approach, their competitors and their advantages compared to them, business model (how they are going to collect money and find investor(s)), marketing plan and their scale-up strategy.

Once the teams have submitted assignments, every student has to provide feedback to 3 other students' projects. Within this plugin a teacher can set up criteria (Table 1) for the Project Concept Evaluation.

Table 1. Criteria for the Project Concept Evaluation

#	*Criteria for evaluation*	*0*	*1*	*2*
1	Name, slogan, description of the team			x
2	Problems, needs		x	
3	Idea, technology, solution			x
4	Prototype; what has been done by the team to develop a solution to meet the needs			x
5	Benefits, product scalability			x
6	Market, target groups, loyalty programme			x
7	Competitors; how your solution and its advantages differentiate you from competitors'			x
8	Price, method of payment		x	
9	Validation of product through customer interviews (know exactly what they need, how much they are ready to pay and in which way)			x
10	Marketing and fundraising plans		x	
11	Sale and revenue		x	
12	Production activity		x	
13	Cost – risk – partners			x
	TOTAL	*21*		

Rating received by a project team is calculated as the average of each grade received, and in this case with 13 criteria, the maximum grade is 26.

The teacher gives students his/her option on their anonymous feedback and comments. When students provide feedback, the teacher assesses how specific, helpful, and kind such feedback is (the maximum grade is 14).

As a result, all students involved in the project submission and in the assessment process receive a total grade of up to 40, and each team receives more feedback. We can say that we have come to create a learning community.

During this phase students also need to develop and practise their skills in so-called '*elevator pitching'*, that is, they present very briefly, during the Startup Battle (through video conference) in front of the audience, the need, solution and benefit, business model and potential for scaling up – In order to receive instant feedback and recommendations from potential clients, partners, and investors.

Below are the names and short descriptions of the startup projects that were presented by the teams during the final Startup Battle:

1. Smart Bottle (measure what you want) – a smart bottle is contactless technology of measuring liquid level.
2. Event Hub – for finding useful information about an event that is interesting to YOU by spending less than 10 minutes.
3. DIWHYNOT – a website platform designed specifically for buying and selling handmade things.

4. Look Pro (Fresh decision) – to make one's life easier by creating a single application that combines appropriate outfits for every day.
5. Halera (Found your boat) – a service that helps to find specialists in the field of programming, create team and start working together.
6. Team A – an online service kit for creating a CV is an indispensable assistant in compiling a correct and competent CV.
7. SOCIAweb – an app for uniting persons of similar interests by enabling them to organise, arrange, assemble and pay off small and medium gatherings in social standings with inclusion of current restrictions, including social distancing and basic rule setting in times of pandemic.
8. L&P (Luck and Programming) – a voice assistant that executes certain commands (opening sites, TV channels, programs, controlling voice search through Google, reading text on a web-site or in a file), which help the user to interact with the device using voice commands.
9. Water Searchers – to give people a source of positive emotions and ways to relax.
10. Zupa (Help small restaurants shine) – a management solution for small restaurants (table reservations and ordering).
11. Snap Tips – an application (service) that helps amateur photographers to view a short guide (advice) when they have some free time ≈ 1 minute.
12. UniWatch 3000 – a user-friendly and stylish watch with the ability to customise the product using the classifier of options on the site.
13. Start Trip – a service for easy planning and managing of one's journey that allows to keep all travel stuff in one place.
14. Schedule Assistant – an application that allows to quickly monitor the schedule of classes and navigate in it, find the right audience and teachers.
15. Emoji Marketplace – to connect designers with chat platforms.
16. Hand Of Help – to provide high quality and timely psychological care services anywhere and anytime.

Here is some students' feedback on the Startup Battle and pitching:

- *presenting our project to real investors is the invaluable experience, I have learned what they might be mostly interested in;*
- *public speaking is the best experiment on oneself;*
- *we can see the true gauge of our strength;*
- *we got acquainted with well-known representatives of local IT industry;*
- *frankly, I could not think it would be such a cool and exciting assignment and event!*
- *Thank you for the modern approach to learning. I have got here the faith in myself and inspiration. It was cool, interesting and valuable!*

When students go through all 4 phases, they can decide whether to take off with such a business model, or to change their strategy by focusing on another problem, proposing a different solution or changing the client.

4. Conclusion.

Detailed monitoring of the learning process using the Entrepreneurial Barometer and assessment system showed that a project-based approach to the organisation of eLearning in

the context of Tech Startp using the 4A virtual engine was quite effective and allowed students to acquire:

- understanding of the startup stages and try to go through them in a relatively short time from the idea to the business model validation;
- ability to use various interactive creativity techniques to generate ideas when solving problems;
- experience of forming a team and convincing it that the project is promising, and that we need simple and point-to-point solutions to local problems that can be found everywhere;
- experience of responsible teamwork aimed at achieving results (collective decision making or business model development); a lesson was learnt that no concessions should be made when assembling a team, because sometimes the success of the whole project can depend on one bad team member who procrastinates or displays a bad attitude;
- ability to solve set tasks in a timely manner with the help of clearly defined deadlines, course calendar and reminder system;
- experience in preparing a startup project concept for peer review and expert evaluation of project concepts of other teams;
- experience of collectively creating presentations to participate in the Startup Battle and presenting a team project to representatives of the academic and business sectors, including investors from different countries present online.

It should be noted that all students who have completed this virtual journey in the learning community demonstrate a positive attitude towards entrepreneurship because "*entrepreneurship is a good way to earn money, and overall it is interesting because you do what you want*". Although some students who at the beginning of the course were already planning to become entrepreneurs but at that time had no experience of teamwork, postponed this option until better times after graduation from the university.

Percentage of those who want to become an entrepreneur has increased, although only by 10 per cent. A detailed analysis showed that this is due to the fact that many 4-year students have already got their jobs in companies, are satisfied with their current position and are unlikely to think about becoming entrepreneurs.

They have learned certain steps to promote their own startup, so in the future, when they want to create their own product, they already know where to start. After all, creating startups, solving interesting tasks, teamwork are important and necessary skills.

Therefore, in order to get a higher percentage of those who want to become an entrepreneur, the proposed «Innovation and entrepreneurship in IT" course should be conducted for students in the 3rd-4th semesters, when they have mastered basic programming skills and are interested in developing and striving for high goals, not just filling a vacant position with a company.

It is necessary to continue working on the entrepreneurship curriculum and ecosystem for startups, which will enable students to:

- think differently and view things from a different perspective;
- gain confidence in their ability to change something;
- exercise initiative, be proactive, create the desired project responsibly and carefully, paying attention to the details;

- keep contacts with people in various fields, which can facilitate the implementation of their plans and projects;
- encourage thinking on a larger scale, not just within the IT industry;
- identify technology potential for new values creation and commercialisation;
- evaluate their own idea in terms of how the solution can fit current needs;
- build a team that is working on transforming an idea into a real business project, learn how to work in a team, and demonstrate creativity and leadership skills;
- test a business models and demonstrate their intention to start their own business (startup).

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Annex 1. Entrepreneurship Barometer

1. Intention:

1.	I am ready to become an entrepreneur	21%
2.	I am ready to connect my career with entrepreneurship later, sometime in the future	70%
3.	I am not interested in it	7%

2. Problem (challenging situation) analysis:

1.	you determine the cause of the problem: what exactly is wrong? why didn't it work?	56%
2.	you see the perfect situation: what should it look like ideally? what are the opportunities for improvement here, and how could this work?	42%

3. Attention and irritation:

		no	50/50	yes	
1.	the services they provide to you do not meet your expectations, or even just disappoint you	5%	31%	64%	2.6
2.	certain groups of people are not satisfied with the services	12%	40%	48%	2.4
3.	some services are not accessible to certain groups, although they need them and are willing to pay for them	10%	26%	64%	2.5

4. I am and entrepreneur:

		no	50/50	yes	
1.	I can offer something better, cheaper and more efficient to meet the demand	12%	62%	26%	2.1
2.	I will develop my business in a growing industry where the market is accessible	5%	38%	57%	2.5
3.	I am confident that my team and I will deliver the expected and perhaps even better result (new value) to our potential customers	0%	31%	69%	2.7
4.	I see a large market for possible scaleup	10%	57%	33%	2.2

5. The key to entrepreneurial success is:

1.	uniqueness of the solution (great idea)	21%
2.	the ability to customise the product to the needs of customers and their priorities	77%

6. Experience of working in a team that has developed a solution and shown a good result:

1.	Yes	57%
2.	No	43%

7. Convincingly and creatively demonstrate a vision of business development (i.e. making a pitch):

		no	50/50	yes	
1.	mission, scale of the problem you are solving, market demand, need for new approaches, and how your approach will work, the benefits of its implementation, indicating your strengths and what others (competitors) will not be able to do so easily (effectively)	14%	57%	29%	2.1

8. Your traits that are important for success:

		no	50/50	yes	
1.	acceptance of change and openness to the new	0%	24%	76%	2.8
2.	persistence, firmness, steadfastness in intentions	2%	36%	62%	2.6
3.	focus, knowledge of the process and of how to get the result	5%	38%	57%	2.5
4.	efficiency, diligence and discipline	5%	24%	71%	2.7
5.	Adaptability and ability to balance (resilience and flexibility)	0%	31%	69%	2.7
6.	ability to bring people together and create a professional team that believes in success and where you 'feel at home'	0%	29%	71%	2.7
7.	ability to 'sell' yourself and the gained result	5%	21%	74%	2.7

9. Attraction:

1.	you make sure that the development of the desired solution is technically feasible for you, and start by creating a prototype	30%
2.	you assess the need for your solution for a specific target group (demand), and start by developing a business model	67%

10. Ability to:

		no	50/50	yes	
1.	quickly sell the product to first customers	33%	52%	14%	1.8
2.	agree, validate business model with potential customers, suppliers, investors to form partnerships (networking)	12%	57%	31%	2.2
3.	convince the investor by selling your vision of business sustainability and prospect of its scaling-up	12%	64%	24%	2.1
4.	help prepare the business for scaleup (e.g. through loyalty programs or capturing new markets)	12%	52%	36%	2.2

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ПІДПРИЄМНИЦЬКИЙ БАРОМЕТР ТА ЕЛЕКТРОННЕ НАВЧАННЯ В КОНТЕКСТІ ТЕХНОЛОГІЧНИХ СТАРТАПІВ

І. Катерняк

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Ця стаття представляє результати вивчення за допомогою сучасних управлінських навчальних рішень ставлення студентів до підприємництва та їх намірів відкрити власні компанії, щоб після завершенні проведених досліджень зробити пропозиції щодо вдосконалення навчальних програм чи університетської інфраструктури розвитку підприємницької поведінки студентів, відкриття можливостей для набуття ними досвіду як стартаперів. Робота базується на досвіді впровадження електронного навчання – практичної частини курсу «Інновації та підприємництво в ІТ», який читається для студентів бакалаврату на факультеті електроніки та комп'ютерних технологій Львівського національного університету імені Івана Франка, Україна. Як основний метод для проєктування Tech Startups майстерні – віртуального навчального середовища – був використаний «4А підхід» (Увага, Актуалізація, Залучення та Дія), фази якого співпадають з етапами зростання стартапів. Для моніторингу знань студентів про підприємництво та їх ставлення до нього було розроблено і використано інтерактивну он-лайн систему «Підприємницький барометр».

Протягом досить короткого часу 13 студентських команд визначилися з рішеннями, які задовольняють потреби потенційних клієнтів, розробили прототипи продуктів на основі ІТ, бізнес-моделі і підготували концепції проєктів своїх стартапів для взаємооцінювання. Крім того, кожен студент отримав можливість анонімно, за визначеними викладачем критеріями, виставити бали трьом проєктам і написати свої рекомендації щодо їх удосконалення. Як результат, всі проєкти були автоматично проранжовані, і кожна команда отримала цінні поради перед презентацією своїх стартапів перед потенційними інвесторами на відеоконференції «Битва стартапів», що сприяло створенню віртуальної навчальної спільноти з присутністю представників бізнесу.

Наші результати підкреслюють важливість та ефективність електронного навчання на основі проєктів у контексті технологічних стартапів для розвитку підприємницьких компетенцій, а також необхідність успішної практики презентації проєктів студентськими командами перед потенційними клієнтами, партнерами чи інвесторами для покращення ставлення студентів до підприємництва, значення міждисциплінарних команд на всіх етапах зростання стартапів.

Незважаючи на те, що з розвитком Інтернет-інфраструктури є досить багато різних глобальних платформ для започаткування і ведення бізнесу, лише 10 відсотків випускників курсу забажали стати підприємцями, а всі інші відклали започаткування власної справи до кращих часів після завершення університету. Аналіз показав, що на 4-му курсі багато студентів вже знайшли свої місця у компаніях, і навряд чи задумаються про те, щоб стати підприємцями. Тому, щоб отримати більше процентне співвідношення тих, хто бажає стати підприємцем, такий курс потрібно проводити для студентів у 3-4 семестрах, коли вони вже освоїлись із базовими навичками програмування і їм цікаво розвиватись і прагнути до високо поставлених цілей, а не просто потрапити на вакантне місце у компанію.

Ключові слова: електронне навчання, підприємництво, підприємницький барометр, віртуальне навчальне середовище.

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