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LEARNING DESIGN FOR ENTREPRENEURSHIP AND INNOVATION IN CHALLENGING TIMES

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***Abstract**: Entrepreneurship and innovation are key factors for the development of the economy. We present in this paper the evolution of the "Computing Innovation for Technology Entrepreneurship" project developed by University POLITEHNICA of Bucharest (UPB) from Romania and Østfold University College (ØUC) from Norway, in the framework of the Education, Scholarships, Apprenticeships and Youth Entrepreneurship Programme in Romania Financed by the EEA Grants 2014-2021. The project aims to develop the capabilities for entrepreneurship and innovation in the ICT domain for the master students at UPB. The project contained included from the very start a methodology including lean development and collaborative writing, but had to adapt to the Coronavirus Pandemic in both attaining the goals and also in changing them from developing face to face courses to online or hybrid ones. This paper focuses on new insights into the challenges facing the academic environment since almost all teaching and learning activities were moved online. There are presented some the general changes advocated by the Coronavirus Pandemic and the adaptation of a standard laboratory to an online one. Operating with digital/ online materials gives to the students the expertise to use both online and offline materials and the digital or physical instruments, as well as the skill to work in teams, from distance or from nearby.*

***Keywords:** online learning; learning design; innovation; entrepreneurship.*

INTRODUCTION

Even if entrepreneurship has started to be followed intensively in the last years in Romania, it is rarely performed at institutional level and insufficiently as an academic discipline. There is a critical need for it to be acquired in the right environment by the spot-on learners which will strengthen the opportunity driven entrepreneurship in Romania.

One of the pioneers in this field is Prof. Mark Harris, former Director of the Intel® Higher Education & Research Programs for the EMEA Region. While at Intel, Prof. Harris built Intel's global Technology Entrepreneurship program together with UC Berkeley California's Lester Center for Entrepreneurship [4]. He initiated and held the lecture of Technology Entrepreneurship, antecedent of [5], from 2006 to 2012, at the Master program of Business Administration and Engineering (MBAE) at Faculty of Engineering in Foreign Languages (FILS), University POLITEHNICA of Bucharest (UPB). For his dedication and generous contribution, he obtained the title of Doctor Honoris Causa from the UPB.

We will address in this paper the educational side of the project CITE [6], part of the efforts to increase the entrepreneurship and innovation results in Romania by education at post-secondary levels, and the changes induced by the Coronavirus pandemic, which imposed effective and unforeseen components, related to the on-line learning.

I. CITE PROJECT

In Romania, there are just a few master programs in Entrepreneurship or in Entrepreneurship and Business Administration and some others for which the Entrepreneurship is a discipline proposed to the students. Technology Entrepreneurship is given as a subject in just two of them, the Master in Business Administration and Engineering (given in English) and the Nachhaltige Geschäfts Exzellenz und Leadership in der Industrie (given in German) from FILS, UPB. They are the continuation of the efforts described in [4] and the students from FILS study them since 2006. There are exemplary results each year (sponsorships, awards, successful startups, etc..), but not in a consistent way, and because almost all of them are related to Information and Communications Technology (ICT), we tried to focus the entrepreneurship subject to this area. Because of the success of these programs (large number of candidates, general recognition) and of the Technology Entrepreneurship subject (successful companies launched, awards taken, successful research projects, entrepreneurship Hub initiated) we wanted to extend the initiative in the place where it was the most successful – in the IT segment.

That lead to the advance of the project proposal "Computing Innovation for Technology Entrepreneurship" – CITE [6], which was successful and it is financed through the Education, Scholarships, Apprenticeships and Youth Entrepreneurship Programme (ESAYEP), 2014-2021, part of the European Economic Area (EEA) and Norway Grants [7]. The project is developed by UPB from Romania and Østfold University College (ØUC) from Norway and is about the creation of education for Information and Communications Technology Entrepreneurship and Innovation, aiming to increase the development of new businesses, based on innovation and new technologies.

FILS is the faculty from UPB which tries to establish the formation of bilingual and multilingual specialists in engineering with a wide area of expertise, capable of filling the needs of Romanian companies with foreign partnerships and external enterprises established in Romania. FILS was the promoter in Romania of disciplines like Programming in Java, Programming of Mobile Systems and its students have a large opening to the news in technology and to adapting them to business. Østfold University College (OUC), created in 1994, is a modern higher education institution in Norway and will act as the Donor State Partner in this project. Faculty of Computer Sciences in Østfold University College offers bachelor and master courses in the area of computer science, including the master of applied computer science, considered one of the top three master programs in computer science in Norway.

The applicant identified at UOC a rare combination of specific knowledge and experience in the domain of ICT-based Innovation, E-Business, Software Project Management which will help it to introduce two new closely related subjects: "Information and Communications Technology Entrepreneurship" (ICTE) discipline for management and engineering master programs and "Information and Communications Technology based Innovation" (ICTI) for the computer science programs.

The project is innovative on this segment, since there is definitely no "Information and Communications Technology Entrepreneurship" subject in Romania and very few in Europe. The "Information and Communications Technology based Innovation" subject exists in several universities, including OUC, and the Romanian side will benefit plenary from this circumstance. The project will add a strong ICTE component to the entrepreneurship development, while using proven methodologies like lean startup for the business side. Depending on the results of this subject and of the master programs that will foster it, the next step would be to launch a master program in IT Entrepreneurship, which exist in just a few places of most developed regions from the IT perspective.

Learning Design is the context that accommodates the learning experiences and it refers to the right steering of the education process. It concerns the methodical alternatives about what, when, where and how to teach. When a new discipline is proposed, a precise selection is performed about the content, structure, timing, pedagogical strategies, sequence of learning activities, and the type and frequency of assessment in the course, as well as the nature of technology used to support learning [8]. Learning design is centered on the learner and it has to adapt the learning process to the changes imposed by challenging periods, like switching to online learning because of a contagious disease. The exploration of the opportunities offered by such an experience is presented in the next sections.

II. LEARNING DESIGN IN CHALLENGING TIMES

2.1 First sub-chapter of the second chapter

The CITE project started in October 2019 for a period of two years. The Coronavirus pandemics delayed its mobilities program and it was necessary to extend the project timeline with one year. The major component of the program is the development of the two new aforementioned courses/disciplines – ICTE and ICTI, dedicated respectively to the master students from the "Engineering and Management" and from the "Computers and Information Technology" domains. The subjects of Entrepreneurship and Innovation are synergetic [9,10], so the first 4 lectures are common ones, as shown in Table no. 1.

No.	Lecture
1	Technology, Innovation and Entrepreneurship – Instruments for Growth and Wealth
2	Models of Innovation
3	Innovation and Knowledge Driven Entrepreneurship
4	Innovation and Technology Transfer for Business Development

Table no. 1. Common lectures from the CITE project

Some of the educational aspects of the project are shown in [11-13]. Because the domain is multidisciplinary, lectures are developed in a collaborative way, by academic staff from IT and economic/ management domains, each one developing one or two subjects in his domain of expertise [12]. Beside collaboration, the lean startup framework [11] and particularly lean course development actions [13] were performed in the process of preparing the new lectures.

The courses development was performed mainly in an online environment, with online discussions and meetings. The potential conflicts between the project management team and the authors [14] were minimal, even if there were repeated changes due to the lean methodology. The Coronavirus pandemics affected in a lower degree the learning design process, but had shaken generally the learning process worldwide, by driving the didactic activities to online, with different degrees of success. Unfortunately, these procedures were applied late and scarce in Romania. Compared with 2019 before the pandemic, the share of people doing online courses or using online learning material in 2021 increased in all Member States, except for Romania where it decreased to 10% [15] (figure 4).

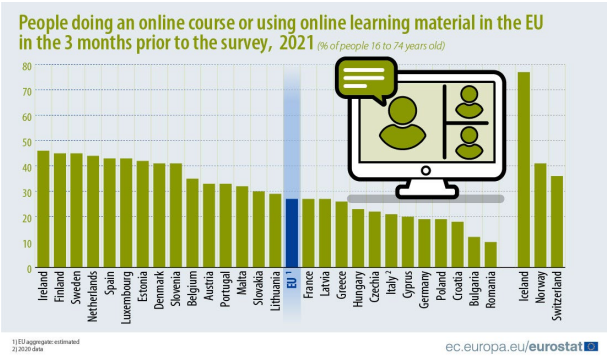

Figure no. 4. Online learning in 2021, during the Coronavirus Pandemics [15]

The people from this project recognized the challenges raised by these times while adapting their regular lectures to online and tried to design the new ones adapted for eLearning [16] and hybrid learning, in order to take the benefits of this approach and to be prepared for similar incidents. We will present in section 2.2 some the general changes advocated by the Coronavirus Pandemic and in section 2.3 the particular changes for a given laboratory work.

2.2 Adaptation to online learning

An online course tends to be a complex, structured and rich learning environment, carefully developed by a team of highly qualified experts on the subject content, pedagogy, and ICT [17]. There are a lot of articles related to the adaptation to online learning [18] and specifically to this process performed during the Coronavirus pandemics [18-21]. We will consider some of the major issues from [16, 17] for the adaptation to online learning and we will present their influence for the project.

Am important subject for collaborative development of online learning is the collaboration between the faculty members (experts/ lecture developers) and the instructional designer. Since the collaborative development was set as a necessity from the start, his potential drawback was solved when the project team was set. The project manager is helped by a team that is made of an educational component specialist/manager as well as two specialists/managers dedicated respectively for the ICTE and ICTI components. The Norwegian side is responsible for the second evaluation of the materials, after the initial one which is done in the group. The third evaluation is performed by the master students one year before the proposal of the courses. A continuous evaluation will be done when the courses will start to function as optional academic topics.

The target audience and the learning goals were determined during the courses analysis stage, performed before proposing the CITE project. They are master students from UPB, most of them employed, with a dominant part of the occupations related to IT. This type of audience welcomes the online learning [22] and is opened to subjects related to innovation and entrepreneurship. They hold promising IT related positions in companies and are pretty selective to the information they are about to acquire. For this reason, the lectures will be oriented to learning and not to teaching. Feedback from the students will be welcome and they will be asked to name things from lectures and even lectures they would change, for a lean adaptation.

The educational technology to be used includes the Moodle learning management system [23], present at https://curs.upb.ro/, the Microsoft Teams platform [24] for UPB and online applications, like the one presented in the section 2.3. There is no problem of adaptation for the professors or for the students to this technology.

The presentation slides prepared for the face-to-face courses were adapted for intensive and in-depth discussions. Because on-line lectures can get stuck into a lack of participation, quizzes were prepared for the lectures. Flipped classroom and flipped laboratory are proposed for some subjects in order to increase the level of engagement. For example, at the “Advanced driver-assistance systems and autonomous vehicles” from the ICTI course, the students will search for ideas (hardware, software or business) and will present them in the class, insisting on the practical and on the innovative aspects.

The grading on such multidisciplinary subjects was set from the very beginning to be on reports made on subjects related to the lectures and to the labs. The students will prepare as homework three reports / business plans for their favorite subjects. One of those will be improved and will be used for a pitch presentation to the class as the final examination.

2.3 Business Model Canvas laboratory

The Business Model Canvas (BMC) is a tool used to describe, design and analyze a business model using a visual representation on a single page [25]. The BMC can be printed on a large surface so that groups of students can jointly start sketching and discussing business model elements with post-it notes or board markers. This tool highlights the role that markets and customers play in business growth and alleviates the understanding and analysis for both innovation [26-27] and entrepreneurship [28-29] by debate and creativity. The BMC includes nine basic building blocks and visualizes a logic for how an organization creates, delivers and captures value, covering the four main areas of a business: customers, value offer, infrastructure, and financial viability (figure 5). It can be used as a tool, where groups of students are using a BMC template [30] to study the business model for an entrepreneurial activity or for the process of asserting innovation.

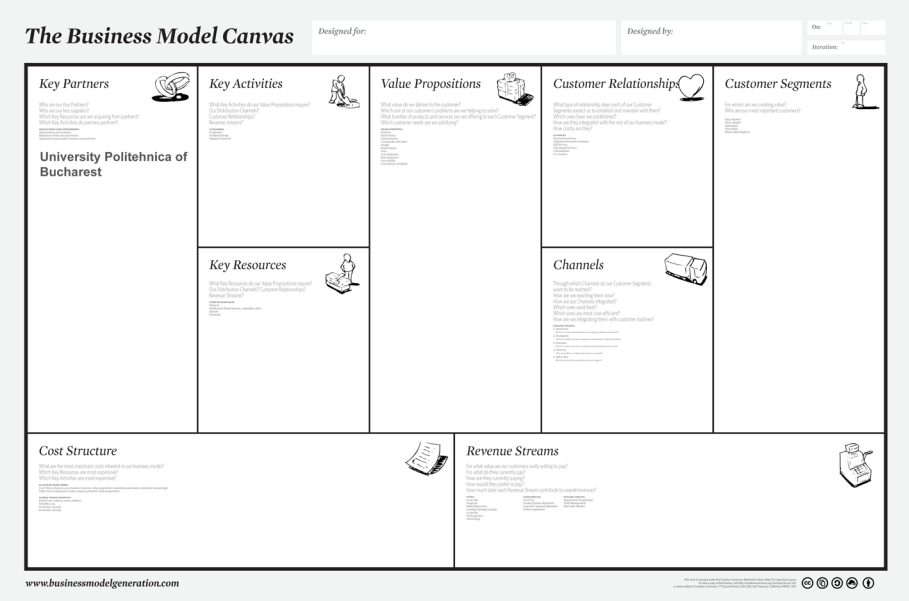

Figure no. 5. The standard Business Model Canvas

During the pandemics, Microsoft Teams [24] was used for online learning by many Romanian Universities, including UPB. It allows teamwork on shared projects, when many students can edit collaboratively the same file. One such document can be the Microsoft Powerpoint template for BMC [31] and the results of collaboration are better than for the standard BMC, because the group has more freedom for searching and testing ideas because of the connection to digital tools.

Another option is to create instruments or to find free tools for collaborative online learning. A dedicated application like Canvanizer [32] let the users edit collaboratively the same BMC, based on a shared canvas. The main advantage of BMC is that it provides a structure for ideation, provides a holistic view of the problem and allow you to concentrate on your value proposition. Online BMCs come with several advantages – they are faster to complete, permit more freedom at work, allow online and offline (continuous) activity and provide directly a document to be used anytime.

Operating with digital/ online materials gives to the students the expertise to use both online and offline materials and the digital or physical instruments, as well as the skill to work in teams, from distance or from nearby.

III. CONCLUSIONS

In this paper we presented some aspects regarding the adaptation of the learning design for multidisciplinary subjects to the online environment. They are related to the educational side of the project CITE, aimed to increase the entrepreneurship and innovation results in Romania by education at post-secondary levels, and the changes induced by the Coronavirus pandemic, which imposed unforeseen but effective components, related to the on-line learning.

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