



The Modernisation and Internationalisation of ICT Higher Education Through Gamified Design Thinking Approaches

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Abstract. The emerging complex problems of the 21st century regarding sustainability issues in the ICT sector represent a considerable common challenge for today's youth. Along with other similar initiatives worldwide, within the framework of The European Commission – Capacity Building for Higher Education action, the ICT-INOV project was co-funded. Involving research centres and universities from Europe and Asia, the project aims to modernise and internationalise ICT higher education through gamified design thinking to promote innovative and entrepreneurial thinking and empower students to turn ideas into action. The paper describes the results of the initial project phase, reporting on students' survey to examine their engagement and expectations for building innovation skills and the methodological framework built upon.

Research Contribution: The methodological framework based on gamified design thinking approach in higher education for building innovation skills.

Keywords: Innovation · Technology · ICT education · Design thinking

1 Introduction

Today's students, destined to act as professionals of tomorrow, will be challenged to address complex problems of the 21st century. In many ways these endeavours are connected to sustainability issues, as identified by the United Nations Environment Program [1], including clean and affordable energy, climate change, smart cities, quality education, health, poverty and responsible natural resources management.

These problems should essentially address the design problems where young professionals are expected to develop core knowledge and, most importantly, innovation capacity for designing viable and effective solutions that improve quality of life. This is true, above all, in the ICT sector, where the need for building design and innovation skills to address pressing world challenges is particularly evident since technological innovation is rapidly evolving and ubiquitously driving economic growth and well-being [2].

Therefore, universities must develop foundational knowledge and soft skills related to innovation, empowering young adults to adapt and innovate throughout their careers in a world that may be very different from today in a few years [3–6].

In this context, the ICT-INOV project (Code n. 618768-EPP-1–2020-1-EL-EPPKA2-CBHE-JP) aims to modernise and internationalise ICT higher education through gamified design thinking approach to promote innovative and entrepreneurial thinking and empower students to turn ideas into life. The initiative is co-funded by the European Commission in the framework of the Erasmus Plus – Capacity Building for Higher Education action, which involves research centres and universities from Greece, Malaysia, Vietnam, Pakistan, Nepal, Portugal, Italy and Estonia.

The paper describes the first results achieved during the research process and the methodological framework built upon.

2 Method

The project deploys an innovative methodology, generally used in big business companies, namely design thinking [7]. It is increasingly becoming a valid development model to address the challenges of the ongoing digital transformation. For example, the Sprint Design methodology [8] proposed by Google Ventures has allowed the generation of a methodology to support digital product development. In recent years, the areas of Design Thinking uses have multiplied, and a new way of making innovation has emerged. A way that combines quantitative methodologies and techniques with more synthetic and intuitive inference processes [9].

Design thinking is a highly human-centred design approach that introduces solutions to complex problems, even if none appears to exist at first sight [10]. It follows a process of empathy, problem statement definition and re-definition, brainstorming, prototyping, and evaluation to look at problems from the user's perspective and address real as opposed to perceived needs [11]. Important to note that once a class is exposed to all the core phases of the process, during a regular design thinking exercise, every single phase may be iterated in a random non-sequential manner.

On the other side, gamification is known to contribute to learners' motivation and long-term engagement with the learning process [12]. As a consequence, when gamification elements are linked to educational objectives, they may favour educational attainment [13]. Furthermore, gamification is a highly effective tool able to convey messages of various types, depending on the needs, and to induce active behaviour on the part of users, allowing them to achieve specific objectives, personal or business [14]. The user and his/her active involvement should always be placed at the centre of this approach [15]. Finally, being widely adopted in corporate training as well as digital learning platforms and services, its combination with design thinking can contribute to the development of innovation skills [16].

Thus, the innovation of the ICT-INOV project is in the gamification of the design thinking process through meaningful goals and clear missions and rewards for motivating student engagement in designing new solutions to a wide variety of problems. This promotes authentic "learning by doing", putting the students in the centre of their learning experience and making it meaningful by simulating interactive learning scenarios where students face open and concrete challenges. [17] In this direction, the students' learning becomes experiential, which, as stated by American psychologist David Kolb, is "the process by which knowledge is formed through the transformation of experience" [18].

Knowledge is, therefore, the result of a combination of understanding and transformation of reality.

Thus, the theoretical framework was built as the first step in developing a full-fledged platform aimed at deploying the combined approach. Based on the results of a survey (an online questionnaire with 23 items covered in the next section) addressed to students, it aims to introduce a holistic approach to facilitate the adoption of innovation-building activities in higher education. With the revealed audience insight regarding its perception of combining design thinking, gamification and experiential learning, the article further describes the digital learning platform developed by the consortium and covers its basic functionality.

3 Findings and Discussion

The survey sample comprised 368 students from Greece, Portugal, Estonia, Italy, Malaysia, Pakistan, Nepal, and Vietnam. It also included a small percentage of foreign students (7,61%). Most of the respondents (73,1%) are 18–25 years and are completing or have completed their Bachelor's studies (65,55%), mainly in the ICT sector (51,26%).

The investigation focused on two aspects: the first is the perception and attitude of students toward “innovation”, and the second is the learning and teaching approach currently used in higher education institutions for innovation skills development.

3.1 The Perception and Attitude of Students Towards “Innovation”

The students provided six definitions of “innovation” to help the consortium understand students' ideas about “innovation”. The results show that most of them agree with the statement of “innovation” made by the American Society for Quality, which is “...the successful conversion of new concepts and knowledge into new products, services or processes” [19, 20] as shown in the following Fig. 1.

The data shows that all the respondents agree that the word “innovation” contains all the aspects defined in each definition provided because each element emphasises one or more aspects lacking to be exhaustive. Therefore, it is a permanent transformation from status to something new.

From the other side, as the results outline, only a small percentage of students are involved in activities for building innovation skills, such as a new product realisation;

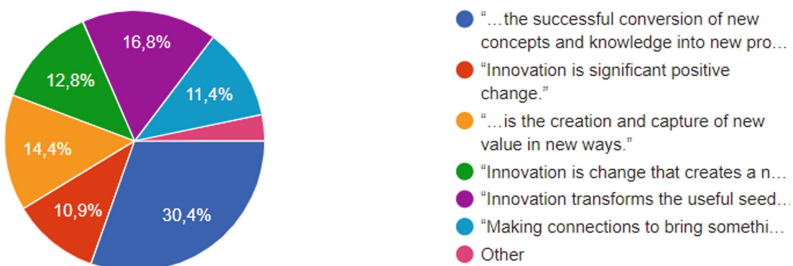


Fig. 1. Students' sample distribution according to their opinion about innovation.

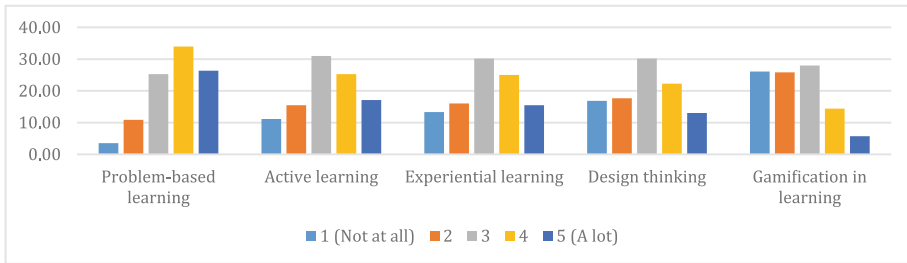


Fig. 2. The learning methods used in students' practice.

implementation of new solutions; participation in events, seminars, contexts focused on innovation; learning new skills; innovative teaching methodology applications; involvement in innovative processes, while 70,7% don't.

In addition, there are some specific skills considered essential for the students for innovation like creative thinking (76,90%), problem-solving (70,40%), thinking out of the box (59,20%), and analytical thinking (54,90%). However, most of the students consider these innovation skills as appropriate addressing the actual industry and society needs (52,7% very important, 37,2% important against a further slight increase (+0,8%) of the students placed at neutral positions).

3.2 The Learning and Teaching Approach Currently Used in Higher Education Institutions for Innovation Skills Development

The second part of the survey aimed to define which learning and teaching approaches are used mostly in higher education institutions to support innovation skills building. The results showed that problem-solving is the most diffused learning approach used in higher education institutions (73,4%) compared to active, experiential, design thinking and gamification in learning (Fig. 2).

Several students stated that their universities don't have any instruments to support innovation skills building. Therefore, the best way for them is to find an individual path to work on. The critical issue is that most curricula are more focused on theoretical learning and the practical applications are very limited.

4 Gamified Design Thinking Platform

Based on the results, the ICT-INOV team developed a gamified design-thinking platform allowing students to engage in design thinking anywhere and anytime (Fig. 3). In addition, the platform promotes team collaboration, brainstorming, building on each other's ideas, and evaluation prototypes through gamification elements that encourage student engagement.

ICT-INOV platform, accessible from the project website (<http://ictinov-project.eu/>), is designed to authentically reproduce the Design Thinking process and methods and help the users to interact and exchange under the supervision of an instructor in a role

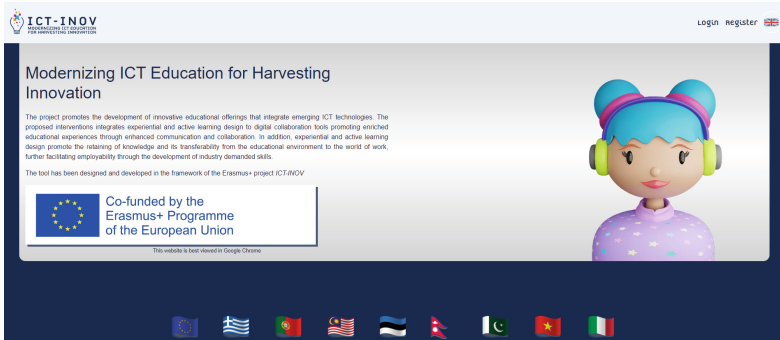


Fig. 3. The ICT-INOV gamified design-thinking platform.



Fig. 4. The activities inside the ICT-INOV gamified design-thinking platform.

of a supporter. In Design Thinking, and hence in ICT-INOV, students are organised in teams, and the teacher acts as a facilitator/enabler of the process.

The problems the students work on are called activities and are at the heart of the platform's design. The activities are presented as boxes piled up on the screen (Fig. 4). Each box corresponds to one activity defined by its name and a short description.

The activities are segmented into levels, which might fit exactly the usual five steps definition of Design Thinking (Empathise, Define, Ideate, Prototype, Test).

Each level is presented as a digital corkboard on which digital post-it notes can be inserted. Those notes can be plain text, enriched text, images or video. The instructors, who create or prepare the activity's content, can describe to the students the current level by putting a host of explanatory notes on the board, containing information about the matter at hand and questions to facilitate the teams' work (Fig. 5).

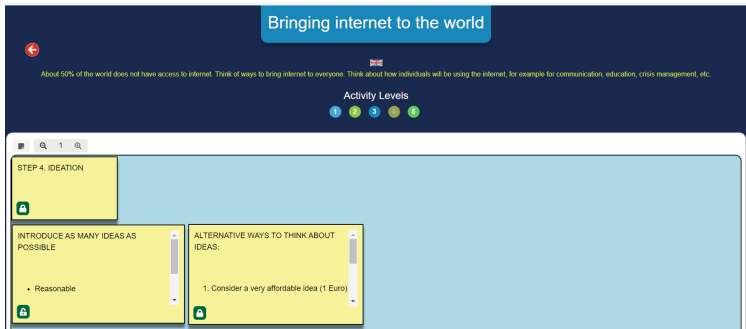


Fig. 5. One example of the level in the activity “Bring internet to the world”.

5 Conclusion

In conclusion, ICT-INOV aims to facilitate the adoption of innovation-building activities in higher education, mainly through the following basic actions:

1. Developing physical infrastructures, particularly labs focused on the methodology proposed;
2. Setting a digital learning platform for collaboration in design, innovation and digital educational activities inspired by real-world problems;
3. Building the capacity of educators to integrate innovation skill development in their classrooms through instructor training and community-building events.

To favour and support this methodological innovation in higher education, the process requires implementing a specific learning framework based on the gamified design thinking combination to build a highly skilled ICT workforce with specialised knowledge.

Currently, through the developed platform, the project team is engaged to organise the instructors’ training on using the methodology and tools specifically designed and developed to test them with the students in all partner countries.

For innovation skills being transversal, the future evolution of the methodology and instruments developed, once worked out during the consecutive phases of the project, is presumed in their adoption and eventual adjustments in the departments different from ICT.

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