

# The modernisation and internationalisation of ICT higher education through gamified design thinking approaches

M Tramonti<sup>1</sup>, A M Dochshanov<sup>1</sup>

<sup>1</sup> European Training and Research for a Cooperation Key to business (EU-Track), Terracina, Italy

E-mail: [m.tramonti@eu-track.eu](mailto:m.tramonti@eu-track.eu)

**Abstract.** The emerging complex problems of the 21st century regarding sustainability issues in the ICT sector represent a common considerable challenge and for today's youth in particular. Along with other similar initiatives around the world, within the framework of The European Commission – Capacity Building for Higher Education action, 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 a 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 the 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 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 generating a methodology to support the development of digital products. In recent years, the areas of use of Design Thinking 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 re-definition, brainstorming, prototyping, and evaluation to look at problems from the user's perspective and address real as opposed to perceived needs.[11]

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 design. 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 [12]. The user and his active involvement should always be placed at the centre of this approach.[13]

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. [14] 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." [15] Knowledge is, therefore, the result of a combination of understanding and transformation of reality.

Therefore, the theoretical framework, built on the results of a survey (an online questionnaire with 23 items) addressed to students, combining design thinking, gamification and experiential learning, introduces a holistic approach that facilitates the adoption of innovation-building activities in higher education.

## **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 process" [16] [17] as shown in the following Figure 1.



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

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

### 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 (Figure 2).

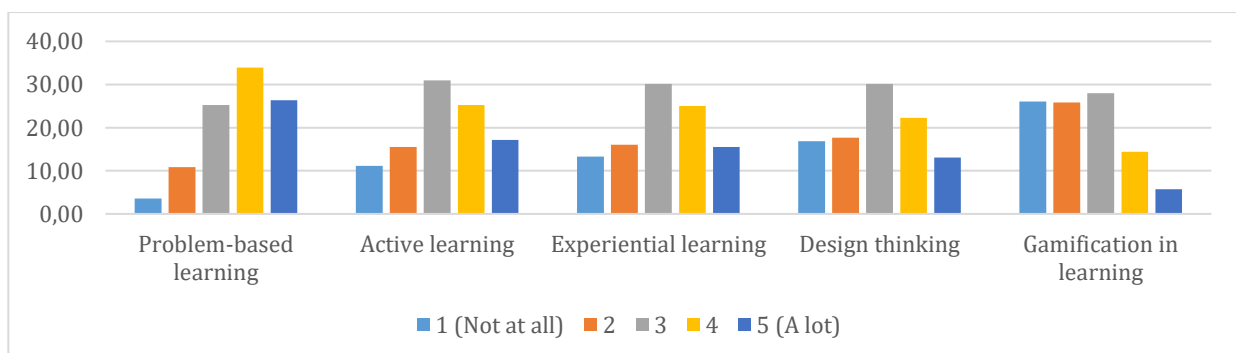


Figure 2. The learning methods used in students' practice.

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 (Figure 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.



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

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 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 (Figure 4). Each box corresponds to one activity defined by its name and a short description.



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

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.



Figure 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 three 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, 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.

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

## REFERENCES

- [1] "UN Environment Program," <https://wedocs.unep.org/bitstream/handle/20.500.11822/32022/ESSFEN.pdf?sequence=1&isAllowed=y>.
- [2] M. B. Bulturbayevich, and M. B. Jurayevich, "The impact of the digital economy on economic growth," *International Journal of Business, Law, and Education*, vol. 1, no. 1, pp. 4-7, 2020.
- [3] J. Brennan, S. Broek, N. Durazzi et al., "Study on innovation in higher education," Publications Office of the European Union, Luxembourg, 2014.
- [4] A. Mongelli, "Lifelong learning and innovation," *Italian Journal of Sociology of Education*, vol. 2, no. 3, 2010.
- [5] E. Aykan, G. Karakuş, and H. Karakoç, "The effect of university students' individual innovation and lifelong learning trends on entrepreneurship orientation," *Sustainability*, vol. 11, no. 22, pp. 6201, 2019.
- [6] S. Biggs, L. Carstensen, and P. Hogan, "Social capital, lifelong learning and social innovation," *Global Population Ageing: Peril or Promise?*, pp. 39, 2012.
- [7] L. Portnoy, *Designed to learn: Using design thinking to bring purpose and passion to the classroom*: ASCD, 2019.
- [8] R. Banfield, C. T. Lombardo, and T. Wax, *Design sprint: A practical guidebook for building great digital products*: "O'Reilly Media, Inc.", 2015.
- [9] J. Liedtka, "Perspective: Linking design thinking with innovation outcomes through cognitive bias reduction," *Journal of product innovation management*, vol. 32, no. 6, pp. 925-938, 2015.
- [10] G. Melles, N. Anderson, T. Barrett et al., "Problem finding through design thinking in education," *Inquiry-based learning for multidisciplinary programs: a conceptual and practical resource for educators*: Emerald Group Publishing Limited, 2015.
- [11] D. Shetty, and J. Xu, "Strategies to address "Design thinking" in engineering curriculum."
- [12] I. Caponetto, J. Earp, and M. Ott, "Gamification and education: A literature review." p. 50.
- [13] M. Prensky, "Fun, play and games: What makes games engaging," *Digital game-based learning*, vol. 5, no. 1, pp. 5-31, 2001.
- [14] M. Pivec, and P. Kearney, "Games for learning and learning from games," *Informatica*, vol. 31, no. 4, 2007.
- [15] D. A. Kolb, *Experiential learning: Experience as the source of learning and development*: FT press, 2014.
- [16] N. Radziwill, "The Executive Guide to Innovation: Turning Good Ideas into Great Results," *The Quality Management Journal*, vol. 21, no. 1, pp. 59, 2014.
- [17] S. Bisgaard, "The future of quality technology: From a manufacturing to a knowledge economy & from defects to innovations," *Quality control and applied statistics*, vol. 58, no. 4, pp. 321-322, 2013.