SHARING STRENGTHS TO IMPROVE INTERNATIONAL COLLABORATIVE LEARNING AND TEACHING PROCESSES IN HIGHER EDUCATION: THE NEXTGENG PROJECT

S. Satorres-Martínez[1], J.I. Jiménez-González[1], R. Dorado-Vicente[1], E. Muñoz-Cerón[1], A. Kakko[2], C. Lapusan[3]

[1]University of Jaén (SPAIN)
[2]JAMK University of Applied Sciences (FINLAND)
[3]Technical University of Cluj-Napoca (ROMANIA)

Abstract

This paper describes the goals and major features of the International Cooperation Framework for Next Generation Engineering Students (NextGEng) project. It is a recently granted Erasmus+ Cooperation partnership in higher education project that involves a consortium of six partners from European universities and companies. It aims to develop an international cooperation framework that promotes international team-teaching aligned with the European Education Area 2025 and labour market needs, including actions to support collaborative international and experiential learning in engineering. To achieve that end, NextGEng is based on three lines of action: a tailored training process for teachers, an international team-teaching pilot program and cases for experiential learning. Further details of such approaches and the potential impact of the project's actions will be discussed in the paper.

Keywords: International collaborative learning, University-Business cooperation, innovation, multidisciplinary.

1 INTRODUCTION

One of the main objectives of higher education is to provide its graduates with the skills needed to succeed in the labour market. This mission is especially challenging in the context of the sudden transformation in teaching and learning processes driven by the last pandemic. Digitalization has fostered the implementation of virtual learning methodologies, upgrading the existing materials and favouring collaborative work with an international approach [1], [2].

Regarding collaborative teaching or co-teaching, a simple definition found in reference [3] highlights that it is "the result of close collaboration between two or more instructors, who share responsibilities for a given group of students and subject(s)". There are different co-teaching approaches. For example, Cook and Friend [4] distinguish the following methods: one teaching/one assisting (there is an instructional leader and a students' assistant), station teaching (each lecturer responsible for different course contents), parallel teaching (same course for different students' groups), alternative teaching (one small group for practical instruction and one large group for theory) and team teaching (lecturers take turns as leader or assistant). Bauwens and Hourcade [5] consider three co-teaching ways: team teaching (sharing planning and instructional responsibility in different activities), complementary instruction (one lecturer teaches, other complements with practical activities), and supportive learning (one lecturer develops contents another reinforces the learning process).

According to Buckingham et al. [3], co-teaching is a common methodology to support the teaching of school-grade students with special needs and immigrants. Nowadays, it is in the spotlight of university scholars. Moreover, co-teaching in higher education can increase the lecturers' knowledge and expertise and better fit the learning process for students with specific needs [6].

Considering the previous discussion, co-teaching can enhance the learning process at the university level in an international context. Authors such as Wohlgemuth, Saulich, and Lehmann [7] agree that co-teaching is helpful when the lecturers have different backgrounds. Therefore, they claim its beneficial effect on training students on content and skills they can use in different countries.

Co-teaching is usually accomplished face to face, but due to travel costs, sharing instruction in an international context can only be afforded using Information and Communication Technology ICT tools. Besides conventional co-teaching drawbacks such as the consumed time and the lack of coordination [6], ICT tools face communication and missing trust problems [7].

This work explains the goals and main features of the International Cooperation Framework for Next Generation Engineering Students (NextGEng) project [8]. The project develops international cooperation actions that promote international team teaching aligned with the European Education Area 2025 and labour market needs, including actions to support collaborative international and experiential learning in engineering.

Because of its transnational character, the projects' actions are planned to develop: a tailored training process for teachers (co-teaching methods), an international team teaching pilot program (based on sharing the planning of different courses taught by the project members), and cases for experiential learning (defined considered previous experiences: [9]-[11]), that will be aided by ICT tools and complemented by several "face to face" activities following the lessons learned in previous projects ([12]-[13]).

The remainder of the paper is as follows: Section 2 presents the design of the NextGEng project, detailing the implementation work packages. Section 3 describes the expected results that should be reached at the end of the project. Finally, the conclusions are drawn in Section 4.

2 THE NEXTGENG PROJECT DESIGN

The NETXGENG project consist of three Higher Education Institutions (HEIs) and three company partners from three European countries form the project consortium. The first university in the consortium is the Technical University of Cluj-Napoca (TUCN), from Romania, acting as project coordinator. TUCN has strong academic and research experience, which covers a wide range of engineering and science fields with outstanding results in promoting multidisciplinary and transdisciplinary activities. The second partner, JAMK, is an applied science university from Finland pioneer of hybrid and virtual education and one forerunner of pedagogical methods in Europe. The last HEI partner is the University of Jaén (UJA). UJA is one of the most innovative HEIs in Andalusia (Spain), in terms of scientific production and teaching quality, collaborating in initiatives devoted to innovative, virtual methodologies for engineering.

In selecting the company partners, HEIs took into account the common interests in developing new educational activities and previous cooperation experience. The spin-off ISR, from Spain, has a high technological capacity within the context of Industry 4.0, with applications in mechanical design, manufacturing, electronic integrations, or collaborative robotics. The Finnish company Valmet is a global, leading supplier of process technologies, automation, and services for pulp, paper, and energy industries with vast variety of in-house expertise. The last partner in the consortium is the Bosch Company, a leading global supplier of technology and services. In collaboration with TUCN, the facility located in Romania has developed an Industry 4.0 laboratory and has collaborated on bachelor, working students, and junior management programs.

The partnership comprises a perfect variety of different types of organizations and professionals, which are involved in all the project Work Packages (WP) and activities.

Figure 1 shows the six work packages included in the project. The WP1 deals with the overall project management: provides guidelines, communicates with all partners, and periodically evaluates the project’s financial situation, ensuring that the activities are implemented on time and according to the project plan. The following three WPs: WP2, WP3, and WP4, are implementation work packages and are deeply detailed in the next subsections. Quality assurance and evaluation of the level of compliance with the objectives is a vital part of the project, and WP5 provides guidelines for this. Finally, WP6 focuses on the dissemination and exploitation of the NextGEng project’s activities and results.

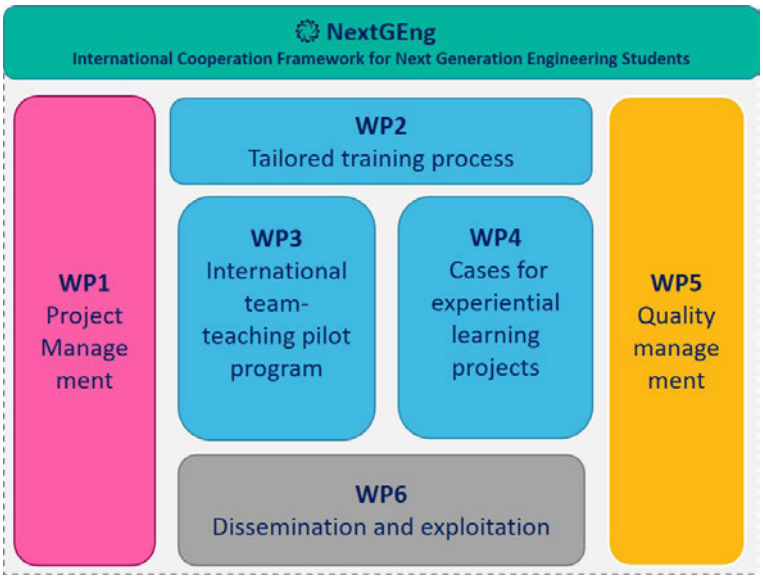

Figure 1. The NextGEng project design

2.1 Tailored training process

This work package (WP2) aims first to analyze and then improve the pedagogical tools used in each HEI partner. Through the analysis, lecturers become aware of methods used elsewhere, get help to evaluate their own ones, and are involved in creating and evaluating new cooperative international teaching methods.

The package intends to improve the sharing of information and resources among HEIs and enhance lecturers' teaching skills through a training process and a seminar about pedagogical methods.

The training will be organized by one of the HEI partners, the JAMK University from Finland. JAMK is a forerunner in developing student-centered, competency-based education, digital learning, and lifelong learning, and reforming work-related pedagogy and teacher training. The instructors involved in this WP will be trained in team teaching, problem-based learning, flipped learning, and student-centered learning methods.

The participants will choose the most suitable methods and their combinations to be implemented in the following work package activities (WP3 and WP4).

2.2 International team-teaching pilot program

The main objective of this work package, WP3, is to develop a pilot program that implements international team teaching as part of the educational process in all HEI partners for the engineering courses in their curricula.

Six joint courses will be upgraded, combining contents from all HEI partner subjects. The selected joint courses cover fundamental and advanced ones. For each course, an international co-teaching team is created that includes HEIs instructors and company experts working together to develop new teaching materials and teaching methods. As part of the pilot program, the upgrading process starts in the first implementation year with four courses (C1, C2, C3, C4), and annually two new courses are added to the program (C5 and C6 in the second year). Figure 2 shows the six upgraded courses.

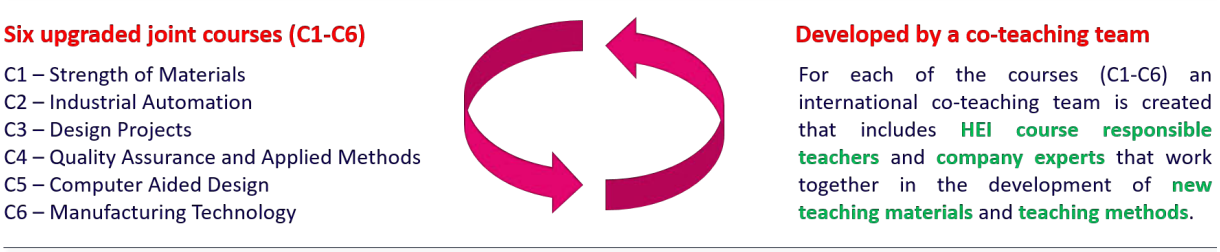

Figure 2. Joint courses chosen for the international team-teaching pilot program

For the selected joint courses, new content is developed that facilitates team teaching with an international focus through modularity of contents and levels. Course modules are defined, facilitating in this way the team teaching process and allowing flexible content implementation of each course in all HEIs.

Teaching and learning methods will be shifted to student centered-learning approaches so that instructors and experts' efforts will focus on identifying and applying specific teaching methods and developing content that puts students at the centre of the learning process, while experiential learning is stimulated through study cases and experiments developed in collaboration with industry partners. In addition, new eco-friendly concepts are integrated into the course content that aim to raise students' awareness of the influence/impact on the environment based on their decisions in the development and life cycle of a certain engineering product.

The content of the new joint courses is delivered to the students in two rounds, starting from the second project implementation year. All co-teaching members participate in the first round (joint courses C1 to C4). In these courses, the company experts deliver tailored seminars/laboratory work that applies the theoretical principles presented in courses to real-life examples from the company activity. Then, in the second implementation round, all joint courses (C1 to C6) are used in the learning process.

2.3 Cases for experiential learning

Cooperation and collaboration between HEIs and companies reach their highest peak through the implementation of Cases for Experiential Learning (CEL) projects. These projects bring students, HEIs researchers, and company experts the challenge of solving a case study proposed by a company or by a research group. The basis for the CEL projects is the Real-Life Problem Solving (RLPS) method, created in the RePCI project [13] and later improved in the HEIBus project [12]. All these types of projects follow an experiential learning methodology, where students learn by doing in an international and multidisciplinary environment. The main differentiating characteristic of CEL projects is the subject, which a company or an HEI research group can propose. In this way, students not only develop entrepreneurial skills but also, they are involved in a research-based learning approach.

WP4 performs the implementation of two rounds of CEL projects. Figure 3 shows the procedure for implementing a CEL project. In every CEL project implementation, three teams of students compete against each other in solving the given problem. It starts with one intensive week at the hosting HEI, where tailored lectures based on the project's needs and topic are given by company representatives and/or HEI experts. Distance project work is done during the semester. At the end, the project results are presented, and the company or research group representative chooses the winner.

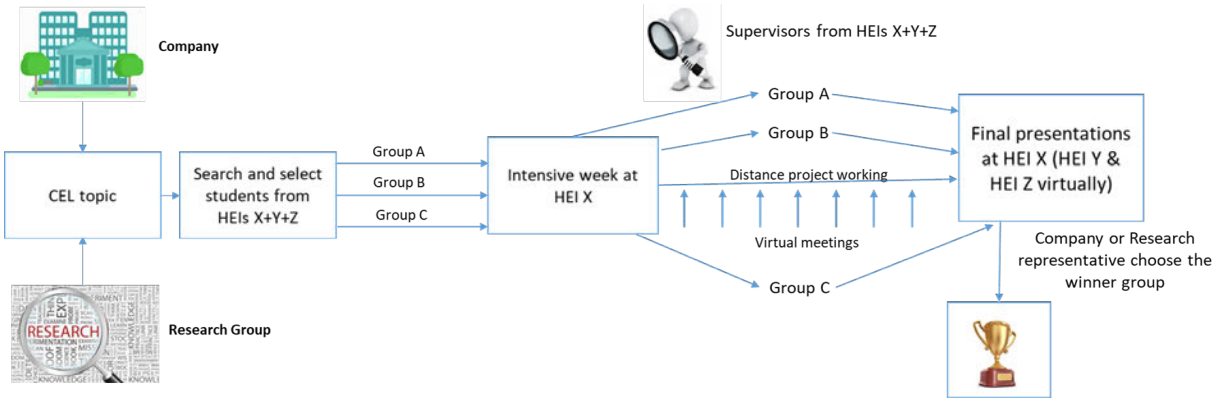

Figure 3. The design of Cases for Experiential learning (CEL projects)

Every CEL project involves 18 students, 6 staff members from 3 different HEIs (3 different countries), and company or research group representatives. The first three CEL projects will be implemented in the spring semester of 2024, and the other three in the same semester of 2025. At the end of the implementations, a total of 150 participants will benefit from this kind of collaboration.

3 RESULTS

The NextGEng project started at the end of the year 2022. The kick-off meeting was held on November 28th and 29th. So far, most of the activities have been focused on WP1, WP2, WP5, and WP6. Creating

the consortium cooperation agreements, planning and supervising the project activities, and facilitating efficient communication between consortium members have been the results of the WP1. Regarding implementation packages, only activities from WP2 have been done during these months. Specifically, information has been gathered on the teaching methods used in the selected courses. The teachers' training seminar has been planned for the last week of January 2023. WP5 has also had a significant workload. During these first months, the project quality plan and the evaluation and risk plan have been defined. Finally, the communication toolkit, layouts of the project's website, brochure, roll-up, social media platforms and templates have been created as a result of WP6.

After completion of the project, the expected results of the implementation work packages should be:

- Development of a pedagogical tailored training program for sustaining the skill improvement of HEIs partners through workshops and guidance material.
- Development of an international team teaching pilot program for upgrading a number of six joint courses belonging to the HEI partners' curricula.
- Implementation of six CEL projects where international teams of students are involved in solving research or an industrial challenge in direct collaborations with HEI researchers and company experts.

In the light of the expected results, the NextGEng project represents a safe and feasible opportunity to foster the transformation of engineering degrees in line with the aims of the European Education Area.

4 CONCLUSIONS

The International Cooperation Framework for Next Generation Engineering Students project, NextGEng, is an international consortium with the aim of creating new international teaching models in close collaboration with companies. NextGEng follows the guidelines contemplated by the European Education Area rethinking the teaching methodologies to produce upgraded courses, featuring a student-centered approach in cooperation with other international institutions and companies.

The project started at the end of the year 2022. In the first implementation months, the developed activities focused on creating the framework that will facilitate the implementation of the proposed activities and ensure the development of high quality project results (ex. creation of project management plan, quality plan, dissemination plan, exploitation plan etc.). First steps have been done also in one of the implementation work packages, the tailored training process. This initial training for teachers ensures the pedagogic feasibility of changes to be made in the upgraded courses. Previous collaboration experiences between HEI partners have led to the update and use of an experiential learning model implemented in other European projects. The updated model takes shape with the cases for experiential learning projects, which boost the cooperation between HEIs and companies.

Through the developments to be carried out in the project, inter-connected higher education systems enriched by cooperation with companies are promoted. It also stimulated innovative learning and teaching practices strengthening the role of experiential learning in engineering by implementing actions of different natures and extent in courses and projects.

ACKNOWLEDGEMENTS

This work has been developed within the framework of the "International Cooperation Framework for Next Generation Engineering Students - NextGEng" project, co-funded by the European Union, with reference 2022-1-RO01-KA220-HED-000088365.

REFERENCES

[1] Vincent-Lancrin, S., et al. (2019). Measuring Innovation in Education 2019: What Has Changed in the Classroom?. Educational Research and Innovation, OECD Publishing, Paris, https://doi.org/10.1787/9789264311671-en.

[2] Visvizi, A., et al. (2018). The Future of Innovation and Technology in Education: Policies and Practices for Teaching and Learning Excellence. ISBN: 978-1787565562.

[3] Buckingham, L. R., López-Hernández, A., & Strotmann, B. (2021). Learning by Comparison: The Benefits of Co-Teaching for University Professors' Professional Development. In Frontiers in Education (Vol. 6, p. 776991). Frontiers Media SA.

[4] Cook, L., & Friend, M. (1995). Co-teaching: Guidelines for creating effective practices. Focus on exceptional children, 28.

[5] Bauwens, J., Hourcade, J. J., & Friend, M. (1989). Cooperative teaching: A model for general and special education integration. Remedial and Special education, 10(2), 17-22.

[6] Dehnad, A., Jalali, M., Shahabi, S., Mojgani, P., & Bigdeli, S. (2021). Students' view on supportive co-teaching in medical sciences: a systematic review. BMC Medical Education, 21(1), 1-13.

[7] Wohlgemuth, V., Saulich, C., & Lehmann, T. (2019). Internationalising education–Cross-country co-teaching among European higher education institutions. In 5th International Conference on Higher Education Advances (HEAd'19) (pp. 1035-1042).

[8] International Cooperation Framework for Next Generation Engineering Students (NextGEng) project [on line] www.nextgeng.eu . Last access in January 2023.

[9] Satorres Martínez, S., Éstevez, E., Kakko, A., Matilainen, J., Gómez Ortega, J., Gámez García, J. (2019). Bridging the gap between Higher Education Institutions and companies. The HEIBus cooperation models. Proceedings of the 13th International Technology, Education and Development Conference, INTED2019, pp. 8114-8122. ISBN: 978-84-09-08619-1.

[10] Torres Jiménez, E., Bolaños Jiménez, R., Dorado Vicente, R., García Collado, A., Gutiérrez Montes, C., Jiménez González, J.I. (2019). Company mentoring program for engineering students. Proceedings of the 13th International Technology, Education and Development Conference, INTED2019, pp. 5084-5091. ISBN: 978-84-09-08619-1.

[11] Martínez, S. S., Gila, D. M., Marchal, P. C., Kakko, A., Ortega, J. G., & García, J. G. (2020). Real life Problem solving: a Successful Model for HEI student-company cooperation. In INTED2020 Proceedings (pp. 289-294). IATED.

[12] Kakko, A., Matilainen, J., Satorres Martínez, S. (2017). Smart HEI-business collaboration for skills and competitiveness. Proceedings of the 45th SEFI Annual Conference 2017 - Education Excellence for Sustainability, SEFI 2017, pp. 331-338, Azores (Portugal).

[13] Kakko, A. (2016). Reshaped Partnerships for Competitiveness and Innovation Potentials in Mechanical Engineering. Proceedings of the 44th SEFI Annual Conference 2017 - Education Excellence for Sustainability, SEFI 2016, Tampere (Finland).