ONLINE ENGINEERING MATHEMATICS COURSE – DEVELOPMENT AND IMPLEMENTATION OF A SUCCESSFUL PROJECT

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Abstract

According to the New UNESCO global survey studying the effect of Covid-19 on higher education (2021) the pandemic has had an impact on higher education systems in terms of access and quality of teaching and learning. Covid-19 has caused the suspension and cancellation of teaching activities and its major impact on teaching and learning is the increase in online education.

The Engimath - Mathematics on-line learning model in engineering education - was successfully carried out at the very right moment, as in recent two years there has been a significant increase in demand for a 100% online mathematics course with interactive learning materials and largescale practicing opportunities as well as for a mathematics online assessment model. This project has successfully developed a high-level online course as a basis for offering output-oriented education in engineering mathematics.

Some of development stages, that led this project – EngiMath - to an outstanding successful end, will be presented in this paper. These go from the educational needs' analysis to its implementation and use, even allowing an open and live test.

Keywords: Innovation, Technology, Research Projects, Interactive Learning Materials, Higher Education, Online Learning, Distance Learning, Engineering Education.

1 INTRODUCTION

The unpredictable, and even unthinkable, appearance of the Covid 19 pandemic that led to the worldwide declaration of a state of emergency, with general and compulsory confinement all over the world, has deeply impacted people's lives and health (according to the World Health Organization (1), until April 26, 2022, there is a record of more than 507 million cases and 6.2 million deaths, reported globally).

In a more specific frame, the pandemic has also transformed the landscape of education in almost every country and higher education was no exception. As stated in the UNESCO report [1], most universities around the world prepared for safe and effective learning environments, altering their normal schedules and organization at the institutional and national levels. In this sense, the first key finding pointed in this report concerns the "Mode of teaching and learning", referring as the major impact of COVID-19 on teaching and learning the increase of online education, being the hybrid teaching mode the most popular form.

The concept of online education is far from being new; in fact, the first completely online course was launched more than 40 years ago, in 1981 [2]. Nonetheless, online education, as we currently recognize it, is only possible given more recent technologic developments as online Learning Management Systems (LMS), high-speed internet and global digital connections. However, an important date can be pointed for paradigm shift [3]: 2008, with the introduction of the Massive Open Online Course (MOOC), which promoted general public access to higher education. As the field of online education has grown in popularity, numerous resources and materials have been produced and, as already mentioned, this was pushed further by the COVID outbreak, which prompted educational institutions all around the world

(1) https://covid19.who.int/

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to shift their activities to an almost complete online structure. This exponential growth in the demand for online courses and educational support materials, preferably open and with certified scientific and pedagogical quality, was directly in line with the work being developed by the Erasmus+ Project - EngiMath, which benefited from this purely casuistic opportunity.

EngiMath – Mathematics On-Line Learning Model in Engineering Education is a shared Erasmus+ Project under the Key Action – "Cooperation for innovation and the exchange of good practices" (reference 2018-1-EE01-KA203-047098), that was launched in November 2018 having its predetermined closure, in terms of financial support, in August 2021. This project was embraced by 6 highly skilled Higher Education Institutions: TTK University of Applied Sciences (Coordinator - Estonia), Letterkenny Institute of Technology (Ireland), Polytechnika Koszalinska (Poland), Polytechnic Institute of Porto - Porto Accounting and Business School/ISCAP (Portugal), Technical University of Cluj-Napoca/TUC (Romania) and University of the Basque Country/UPV/EHU (Spain). During the project unfolding the Spanish partner was replaced with Universitat Politècnica de Catalunya - Barcelona TECH (UPC).

As its name transmits, EngiMath worked within the bounds of engineering mathematics fundamentals, having a specific and special focus on the student engagement inside an open online learning environment. This was the cornerstone for the Engimath Project's pedagogical approach: the development of an open, centralized core system of open educational resources (OER) and methodologies (theoretical, practical, and assessment), created with a clear purpose of offering maximum support to students and academics. This is completely in line with the OER definition, as stated by UNESCO 2012 Paris Declaration ([4], pp. 1), as "*teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions*". Here, the critical necessity of OER is outlined and some guidance to governments and educational institutions throughout the world is provided, which subsequently led to the creation of other guiding documents towards sustainable development in education.

To complete this Project framing, it must be mentioned that EngiMath proved to be in direct compliance with the Sustainable Development Goals (SDGs) as pointed in the Indicative Strategies of UNESCO Target 4.3 of the SDG4-Education 2030, as it has straightened "*international cooperation in developing cross-border tertiary and university education and research programmes, including within the framework of global and regional conventions on the recognition of higher education qualifications, to support increased access, better quality assurance and capacity development*" ([5], pp. 42).

2 PROJECT DEVELOPMENT ACTIVITIES

EngiMath has successfully developed a high-level engineering mathematics online course as a basis for offering output-oriented education in the fundamental area to engineering mathematics understanding – Linear Algebra – using skills developed in a new ethos of placing the student at the centre of the on-line process.

For achieving the outputs, certain activities and tasks had to be performed. Each intellectual output (IO) was led by a certain partner who was responsible for achieving the planned results. For this, every IO was divided into activities and tasks needed to be performed to reach the planned result. Every partner led the elaboration of intellectual output, coordinated the work of different partners in the framework of the activities, monitored achievement of the results, kept deadlines, etc. Beside the IO leader, activity leaders were made responsible for some of the activities (for example, regarding IO2, the Portuguese partner was responsible for creating theoretical materials and the Estonian partner for practical and assessment tests).

The project was based on the action research methodology that needs both qualitative and quantitative methods for collecting, analysing and integrating data. Project monitoring and evaluation has been done using questionnaires, peer-reviews, by weekly/monthly Skype meetings and site analytics implemented during the whole duration of project implementation.

In order to achieve project results, the existing situation regarding undergraduate engineering and business mathematical education in the partner countries was examined. The collected information and materials enabled the creation of an online course and mathematics online assessment model.

EngiMath Project plan presented three major results (Intellectual Outputs) to be met during the three-year duration of the project and are presented in the following subsections.

The best practices, novel approaches in education, needs of partner countries' institutions, possibilities and competences of partner educational organizations have been considered in development of all these intellectual outputs.

2.1 Educational needs analysis (IO1)

The educational needs analysis in this project was due to the development, testing and deployment of a novel paradigm in the technology enhanced learning mediated environment in six geographically, socially, and culturally separate higher education institutions. Research prior to the submission of the project found no literature guiding educational needs analysis for joint-shared initiatives relating to socially, culturally, or geographically separate locations. Therefore, this output pointed out several important issues to consider when designing multinational educational projects as well as other international connections made in education.

Needs analysis and data gathering of partner countries and institutions were carried out, along with the analysis of the mathematic on-line assessment systems, identifying the differences in every partner country as well as its pedagogical features. For more detailed information please see [6].

2.2 A new innovative online course in engineering mathematics in seven languages (IO2)

IO2 was led by UPV/EHU (Spain) until September 2020 and after that by UTC (Romania). The 3 ECTS "On-line course on engineering mathematics" constituted one of the main IOs of the project, which aimed at providing a structured basis, and developments of analyzing and creating materials, for students and teachers across Europe.

The activities developed in the IO2 frame were:

- A1 Analysis of subject in partner`s institutions
- A2 Development of theoretical materials
- A3 Development of practical materials
- A4 Development of assessment materials
- A5 Development of guidelines
- A6 Translation of materials
- A7 Training for teachers
- A8 Conducting on-line course
- A9 Data collection and analysis of student perceptions and feelings
- A10 Revising the on-line course

The analysis of the mathematical online assessment (A1) was carried out through the joint effort of all partners with extensive data gathering. The IO leader UPV/EHU collected all the data from the partners and created the report on this analysis. The needs analysis was extensively discussed during the second project transnational meeting, held in Letterkenny. The particularities in the educational systems of each partner country and institutions were outlined. A consensus was reached regarding the common subjects that the course should include as well as the course of action for implementing the project activities [6].

The development of theoretical and assessment materials (A2, A3 and A4) was a very laborious task. All materials that have been created have been uploaded to a Moodle platform hosted by the TTK UAS (Estonia). The materials have been peer reviewed by all partners and the suggestions were implemented. Because of the differences in cultures and educational systems, partners had to find common ground. For creating interactive theoretical materials an iSpring server license was acquired. This posed further problems in the installation and use of the program that caused some delays in the initial timeline. In the end, the resulting theoretical materials are of high quality and the team is satisfied with the outcome. The team of P.PORTO (Portugal) created all the theoretical materials – 26 lectures in animated sequential PowerPoint presentations with iSpring extension [7] while the team of TTK UAS developed the practical materials. A large (more than 2000 questions) logical structured bank of questions has been created containing several different types of questions, all with a step-by-step proposed solution. Moreover, most of the questions are open-ended, supported by exhaustive feedback.

The UPV/EHU team created some practical and assessment tests until September 2020. After that the TTK UAS team continued with the practical and assessment tests. LYIT team oversaw proofreading. For more details please see [7] and [8].

All teams translated the materials in their own languages (A6). All materials were uploaded to the TTK UAS Moodle platform, in seven separate courses.

In parallel with material development, the pilot courses were run between November 2019 and March 2020. Each partner took a selection of the materials developed, translated into their national language and used them to run the pilot course. Each course was run in a different period depending on the academic schedule of each institution. After each pilot course, feedback was collected from the students by the use of a questionnaire that was developed with the input of all the partners.

The students' feedback on the pilot courses were aggregated and analyzed. The results were encouraging as students found the material to be easy to use, the aesthetics of the course as pleasant and found the course useful overall. Nevertheless, some important lessons were drawn from this pilot course. The students felt the need for more examples and exercises. The results of the pilot course survey as well of all the detailed steps and options taken in the IO2 development were described in several articles that were submitted and presented in distinct conferences and meetings (INSTEAD IV [9], [10], SEFI Annual Conference [11], INTED2020 [7], ICL2020 [12], T2P International Scientific Conference [13], INTED2021 [8], etc).

Between January and July 2021, the guidelines for the teachers were created (A5) with input from all the partners, trainings were held (A7) for a total of 72 teachers.

The partners also ran the definitive course (A8). At the end of the course, student feedback was collected (A9) and analyzed. Students enjoyed the course and gave overall positive feedback on the materials and the format of the course. Some mistakes were identified and promptly corrected. The UPC made a proposal to make the assessment system more stepwise, considering individual achievements of students, and the assessment system was adjusted. After collecting the students' and teachers' feedback the final version of the online courses was validated (A10).

Thus, IO2 was successfully finished, all activities were completed and all results were achieved. Even more than planned was achieved, as the pilot course was conducted in Basque and Spanish and the definitive course in Catalan and Spanish, testing was carried out on a wider scale than originally planned. The online courses (in seven languages) developed in the project are open and free to use (more detailed information in section 3).

2.3 Mathematics Online Learning Model (IO3)

This "Learning model" highlights the process and explains the design model employed and adapted to meet the needs of students and academics as several studies have shown that frequently students still don't feel comfortable when being pushed towards e-learning models where they feel the absence of personal support [14]. The model of on-line mathematical pedagogy was developed within IO3 using partners' experience combined with the activities in IO2 to provide a paradigm that may be used by academics in the development of engaging and interactive educational experiences and used an ADDIE (Analysis of Design Development Implementation and Evaluation) model [15]. This is a systematic instructional design model, which represents a dynamic and flexible guideline for building effective teaching and learning tools. The model consists of 5 stages, namely (1) Need analysis; (2) Design; (3) Development; (4) Implementation; (5) Evaluation. In addition to this schematic line of work the project has adapted the PAR (Present, Apply, Review) model for online learning [16]. The PAR model has been adapted within the project to include an element of Teacher Presence to support online learners. This induced the sequential structure of each lesson by presenting new subjects, allowing the student to apply the concepts, in an interactive way, followed by a review and practical applications. This structure may be utilized several times within a lesson to maximize the learning potential.

In a more detailed way, the activities that were planned for IO3 were: A1 Literature review and A2 creating of the mathematics online Learning Model, giving special attention to the development of a framed assessment model.

The literature review was conducted to support the development of the teaching model by the other research results. On completion of the literature research, each partner produced a supporting review of the literature: Ireland's primary theme was that of Teacher Presence, Portugal's primary theme was the presentation of learning resources, Estonia's primary theme was assessment. Poland's primary theme was activities. Romania's primary theme was Course Management & Quality Assurance. Spanish team was involved in reviewing. The reviews were collated by Ireland and the final model report was compiled. Extra work was done as a very large number of new articles appeared during the Covid-19 pandemic, in addition to forms of learning that were not particularly useful earlier, such as hybrid and remote learning.

In summary, the IO3 A2 modified the PAR model of constructivist teaching to the needs for online teaching. The model for online teaching of mathematics was being developed to demonstrate best practice, student engagement, replication of teacher presence and motivation. Automated assessment only considers the product of assessment and not the process. The lessons learned from IO1, IO2 and IO3 were being fed into the research evaluation for the model of best practice. The findings provide crucial information regarding priorities for the pedagogical design of the shared program materials. Working within the boundaries of mathematics and addressing social, language, cultural and national concerns within a shared, collaborative program, the partners focused on student interaction within the learning environment as the foundation for the pedagogical model.

This model is available for teachers in compulsory-age education and third-level education. Regarding its assessment features, a detailed study was carried out by all project partners and it was published in the end of 2021 [17]. The impact of the model is enhanced awareness of teaching and designing online mathematic programs. The model is transferable between other education domains of learning. In Covid19 pandemic conditions, the upgraded model has a great importance.

2.4 Students' Competition (SC)

A Students' Competition (SC) was programmed as a Learning/Teaching Activity and was created to enable the application of the acquired knowledge and skills in solving real-world tasks, as well as to improve communication skills and networking cooperation.

This student competition aimed to increase student motivation, support possible student exchanges, help to understand the connection between the fields of mathematics and engineering, use and consolidate the knowledge gained from the online course.

SC was held from June 28 to July 2, 2021 with great success. Having student's safety as a priority, this SC could not to be held on-site as expected, due to Covid-19, it was moved to a fully virtual format. This meant a reorganization of the whole competition, while the competition fulfilled its original purpose and additionally enabled the development of students' digital skills.

SC was a problem-solving competition of a logical-mathematical nature, aimed at the three best students enrolled in the on-line course project. It was developed on-line through the presentation of a set of Challenges/Problems, using several features available in the on-line learning course in Moodle. ICT, such as collaborative workspaces, live streaming, video conferencing, social media, among others, were used to prepare, support and follow up the students. The problems, presented and solved in English, involved areas of Algebra, Analysis and Combinatorics.

SC developed student's digital competences, increased communication and feedback between students and teachers, and between students from different countries because they had to find a way to interact with each other. Students were encouraged to share their thinking with peers and to examine different problem-solving strategies. These critical reflection moments helped them gain insight into their strengths and weaknesses as learners. All in all, the students highly appreciated the event and were ready for further cooperation. For a more detailed explanation of all the SC features please see [18]. A formal institutional participation certificate was given to all the competitor students as a recognition for all the work developed. In addition, prizes and respective winner certificates were given to each country's best students and a global institutional Competition certificate for the top three students. An award ceremony was held at ISCAP magnum auditorium with direct online connection to all Project Partners and participants.

2.5 Multiplier Events (ME)

Of the six programmed MEs, 3 were performed face to face, 2 virtually and 1 in mixed format. The MEs results far exceeded the initial expectations, because virtually conducted MEs made it easier to participate and make it more widespread. Mixed format allowed, for instance, Estonian partner to reach an even wider audience involving participants from all over the country, from different educational institutions and different specialists (secondary and tertiary level teachers, educational specialists, private teachers, etc.).

Mathematics teachers were invited to attend MEs to evaluate the content of the course and educational technologists were invited to assess the suitability of the course for e-learning. A total of 298 persons participated in the MEs that were organized in each country separately.

Feedback from the MEs participants has been collected and analyzed. Participants liked the contents of the course and some even had ideas of how to implement something similar in their own classes and they found it interesting that a course can be entirely online. Participants showed their desire to use the presented materials in their own classes.

2.6 Project Monitoring

Quality assurance was led by TUC partner. Quality indicators and objectives were set by them and agreed upon at the beginning of the project in the quality assurance plan.

- The project timetable, budget, activities, etc, were constantly monitored by the lead partner and management activities were regularly evaluated (every 6 months) through questionnaires applied to partners.
- The quality of the events (teacher trainings, multiplier events, student competition) was assessed through feedback forms applied to participants.
- The progress of the work on the project results was monitored through shared documents in the project document common platform and the quality of deliverables (reports, course materials, mathematical model) was assessed through partners peer review.
- The students that took part in the course runs (pilot and definitive) were asked for feedback on the course, both through surveys and interviews. Any shortcomings were discussed and corrected and the materials were improved by partners based on their feedback.

Project monitoring took place at the following levels:

1 Lead partner level: project coordinator monitored project activities, keeping the deadlines, achieving the results and quality of results at least once in a month and budget usage on project level and single partner level once every six months.

2 Every partner level: Each partner nominated a team leader. Monthly Skype meetings took place during the project. Team leaders were responsible for reporting, budget control and monitoring of the tasks performed by the partner, keeping the time schedule and making proposals for changes if needed. Reporting to lead partner and monitoring of budget took place according interim reports of project by Mobility Tool. Keeping time schedule and monitoring of achievement of tasks took place once a month by the partner's team leader. Monthly time-sheets were used to monitor work of employees working with intellectual outputs. Project transnational meetings took place at least once in every six months where activities and tasks were detailed, responsibilities were determined as well as monitored realization of the activities and quality of outputs. All partners were involved in the activities and had the opportunity to make suggestions for improvement of the outputs.

3 Representatives of all partners took place of project transnational meetings. If necessary, additional calls by Skype were made with the team leaders of the partners when it was necessary to discuss project activities or intellectual outputs.

2.7 Project Dissemination

Following the EngiMath dissemination plan, a project website(2) was set up and constantly updated with information about the project, including project events, papers and reports.

Information was also spread through social media platforms such as Facebook(3), Instagram(4) and Twitter(5). All pages had a constant flow of information about the progress of the project. A series of advertising materials were developed with activities, results and successes of the project, including reports, videos promoting course content and information about new publications and participation in conferences, ensuring that as many people as possible would benefit from the Project. Additionally,

(2) https://sites.google.com/tktk.ee/engimath/home

(3) https://www.facebook.com/engimath

(4) https://www.instagram.com/engimath2019/

(5) https://twitter.com/EMath2019

information and links were uploaded to the ResearchGate[6], one good informative channel about the EngiMath publications and results.

Several other project activities were directly connected with its dissemination plan as, for instance: teachers' trainings; multiplier events; on-line courses and students' competition; participation in local and international conferences, seminars and workshops; promotional videos on YouTube; publications on conference proceedings and journals, among others.

2.8 Development Difficulties

Two main difficulties arose during the project's execution: a) the Covid-19 pandemic and b) the disruption in initial Spanish partner collaboration.

a) The work within each partner team was affected by the Covid-19 outbreak situation. Every partner had to do extra work, unpredictable and unrelated to the project, that put pressure on the team members and their involvement in the project. In some cases, the activities were greatly affected, like in the case of the Irish partner, where staff illness severely affected work. The work plan was adapted to accommodate and the needs of the project were successfully caught up. The Covid-19 outbreak has also reduced team's mobility and as a result, limited face-to-face interaction with the other partners. One very important aspect for the achievement of the outputs has been the communication among partners, in a virtual but continuous way (via Skype meetings, emails and Fleep - Free Team Messenger). In order to improve communication, Skype meetings were held twice a month instead of once a month.

During the project, Covid-19 also caused a lot of organisational problems, because the whole new situation and changing rules involved a lot of extra work when transforming on-site events into virtual ones. The changes required flexibility from all partners. The changes were made according to the situation by mutual agreement of all the main partners. It must be mentioned another difficulty that came from the strong reduction in the initial budget when moving face-to-face events to virtual environment. Organizing events in virtual form took unpredictable extra time and sometimes extra financial costs. For example, the prizes of the student competition were increased to motivate students to be engaged in the summer break, after a difficult academic year. Here, a positive commitment from the project partners' side of attending (and exceeding) the proposed aims of the project.

b) Other pre-defined work development difficulties were experienced regarding the collaboration of the first Spanish partner. These problems arose when this team was faced with the different approach to teaching and lack of comparative quality of the lessons developed by them (four of the twenty-six). These differences, pointed out by the team members from other countries during almost half a year, were reduced in some specific moments, but this comparative quality was far from being fulfilled. In this case, having, the Estonian team already developed all the practical tests, there was a general negative reaction from the other project partners regarding the efficiency and effectiveness of the evaluation tests developed – not constructive in terms of difficulty level, lack of logical sequence, etc. It became apparent shortly after the beginning of the project that the Spanish partner was not as committed as the other partners through their reluctance to engage with the main communication tool – Fleep. Other small issues seemed to also cause problems and some Skype meetings became tense. Their decision to leave the project came suddenly and it was a shock because there was very little reasoning and no dialog to solve the issues at hand. Consequently, all the remaining partners had to deal with and manage all the tasks assigned to this partner. This workload was distributed among the remaining partners as follows: the Romanian partner became the new leader of IO2, the Portuguese partner was responsible for creating theoretical materials, Estonian partner for the remaining practical quizzes and all the assessment tests and Estonian and Romanian partner for the guidance for teachers. With the help of the Polish partner, a new Spanish partner was inserted in the Project. This new Spanish partner inspired all the other partners and helped us to reach our goals. This issue caused a serious reflection about the Project progress and group achievements but, at the end, all planned outcomes were achieved and even exceeded.

3 PROJECT RESULTS

EngiMath compromise was to build an inclusive online teaching/learning model in Mathematics - developing, testing and implementing a flexible and modular course, along with the development of

[6] https://www.researchgate.net/project/ERASMUS-project-Mathematics-on-line-learning-model-in-engineering-education-EngiMath

relevant and high-quality skills and competences, in an open education framework taking advantage of innovative practices in a digital era.

A flexible and modular course which will develop students' (and teachers') mathematical communication, digital skills and competencies was developed. Trying to use innovative pedagogy this course is now available in seven languages and it is open for everyone to use and share. The creation of this new online course enabled the development of a Europe-wide comparable teaching standard. This course, in its seven distinct languages, can be accessed through the project coordinator Moodle – TTK (https://moodle.tktk.ee/), using the following credentials:

- **Username**: lovelace
- **Password**: MathEng123?

The direct links to each of the courses can be accessed via EngiMath site[7], using the credentials above:

- Link to the Course in **English**; **Catalan**; **Estonian**; **Polish**; **Portuguese**; **Romanian** and **Spanish**.

All these courses can be downloaded and inserted into any online course in a Moodle platform. This can be done by uploading the following backup files, available in the EngiMath site[7]:

- Course Backup in **English**, **Catalan**, **Estonian**, **Polish**, **Portuguese**, **Romanian** and **Spanish**.

A Feedback form is also provided in the EngiMath website to gather all the information and opinions of all the users. Project partners do appreciate your feedback: **Feedback form**[8].

In this innovative project, specific and interactive materials were created based on the deep and insightful research of each partner's members and level of teaching as well cultural background. Materials are specific and dedicated to engineering students including several practical applications (to explain to students how they can use this knowledge in their professional life) so this was an innovative and attractive part for students and teachers. Practical tests come from an exhaustive question bank that allow one to practice almost indefinitely. Students were very engaged and enthusiastic during each part of the project: both groups that took part in the pilot course and groups who took part in the definitive course.

Also, the student competition was a great success, even after changing it to a virtual version. Students were very active and dedicated to interacting with forms of competition and it was a very special experience for them, including the fact of international cooperation in groups, as well as the encouragement of the official recognition by their universities in a European project of this magnitude.

4 FINAL COMMENTS

The new innovative engineering mathematics online course was developed and teaching/learning materials enabled its use Worldwide, involving transparent and comparable training standards. The intellectual outputs and results are universal and usable for all partners, considering the needs of different countries and cultures and more general international practices and therefore enable to disseminate, exploit and expand the results also outside project partners.

The project fulfilled its purpose to a very large extent, especially thanks to the increased communication between teachers of all the partner universities (teacher training), partner universities (Skype and transnational meetings) and other educational institutions (multiplier events). This will facilitate cooperation in the future as well, as a positive end result will generate new ideas regarding writing new projects. This project significantly increased cooperation with students who are willing to continue cooperating with teachers and foreign students.

It must be mentioned that all the following qualitative indicators were met: EngiMath Project was accomplished according to the project application; all reporting to the coordinator national agency took place in time; all reporting by partners to lead partner took place in time (quarterly); actual project costs responded to the project budget; collaboration between project partners was effective and all the communication channels were used.

One of the most significant indirect impacts of the project was the rise of international cooperation between universities and higher qualification of the workforce of the participating institutions.

[7] https://sites.google.com/tktk.ee/engimath/results/results-of-io2

[8] https://forms.gle/uWEfbVYHMUr8wr3R6

As stated by the European project assessors' feedback: "*All objectives of the project initially pursued were achieved and, in some cases even overfulfilled. The project was able to successfully address the original objectives and priorities of the programme as well as the topics chosen. It addressed the main needs of the participating organisations and target groups in the way it was initially planned. Project's outputs are innovative in their nature (online course in engineering mathematics) as well as in their form/approach. The mathematics online assessment model gives automatic feedback to the students involved into the course, which is a novelty. International cooperation was essential for the successful implementation of the project, project's results couldn't have been achieved without this cooperation*".

The Project partners are glad with the results accomplished in these three years of hard but amazing team work!

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