University of Maribor

Faculty of Natural Sciences and Mathematics

SITUATION ANALYSIS REPORT no. 3

A pilot project NATURAL SCIENCES AND MATHEMATICS CONTENTS IN THE DEVELOPMENT OF DIGITAL COMPETENCES

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GENERAL DATA

The pilot project "Natural Sciences and Mathematics Content in the Development of Digital Competencies," part of the Plan for recovery and resilience: Reform of higher education for a green and resilient transition to Society 5.0, is being implemented at the Faculty of Natural Sciences and Mathematics (FNM UM) and the Faculty of Civil Engineering, Traffic Engineering, and Architecture (FGPA UM) at the University of Maribor. The project spans from September 1, 2022, to August 31, 2025.

The following activities are planned within the pilot project:

A1) Analysis of the situation;

A2) Comprehensive planning for the development of competences for the digital and green transition;

A3) Comprehensive implementation for the development of competences for the digital and green transition and lifelong learning;

A4) Evaluation.

The situation analysis, completed in 2023, is publicly available in both Slovenian and English via a provided link. The report compares related study units across pairs of study programs: (i) Civil Engineering VS and Civil Engineering UN, (ii) Physics UN and Educational Physics (Subject Teacher), and (iii) Mathematics UN and Educational Mathematics (Subject Teacher). In this analysis, we examined the teaching content, methods, study outcomes, evaluation techniques, and the integration of digital and natural science competencies, as well as algorithmic, logical, and abstract thinking skills, and energy literacy. This fulfilled Indicator K1: Situation Analysis.

The second interim report, which presents the results of activities under A2, is also available in both languages at the provided link. Among other elements, it details findings from semi-structured interviews and results from surveys of freshmen and graduates, who self-assessed their competency levels achieved during their studies. This formed the basis for creating a list of necessary content and skills and planning the associated workshops. The report includes Indicators K3: Comparative Analysis and K4: List of Contents and Skills.

The third interim report, covering project activities from January 1, 2024, to June 30, 2024, summarizes the key outcomes. The researchers involved in these activities are listed in Table 1.

Table 1. Members of the project team.

Member of the project team		Member	Period of employment	Role
Barbara	**Arcet**	FNM	1. 5.2023- 31. 8. 2025	researcher
Petra	**Cajnko**	FNM	1.10. 2022- 31. 8. 2025	pilot project coordinator, member of the project council
Daša	**Donša**	FNM	1. 1. 2023- 29. 2. 2024	researcher
Brigita	**Ferčec**	FNM	1.11. 2022- 31. 8. 2025	researcher
Katja	**Hanžič**	FGPA	1. 1. 2023- 31. 8. 2025	researcher
Arbresha	**Hölbl**	FNM	1. 11. 2022- 31. 8. 2025	researcher
Irena	**Hrastnik Ladinek**	FGPA	1. 10. 2022 – 31. 8. 2025	researcher
Veno Jaša	**Grujić**	FNM	1. 10. 2022- 31. 8. 2025	researcher
Eve	**Klemenčič**	FNM	1. 9. 2022- 31. 8. 2025	project manager, member of the project council
Borut	**Macuh**	FGPA	1. 1. 2023- 31. 8. 2025	researcher
Matej	**Mencinger**	FGPA	1. 10. 2022- 31. 8. 2025	member of the project council, researcher
Robert	**Repnik**	FNM	1. 9. 2023 – 31. 8. 2025	member of the project council, coordinator of FNM-FGPA
Polona	**Repolusk**	FNM	1.1.2023- 31.8.2025	researcher
Mitja	**Slavinec**	FNM	1. 9. 2022- 31. 8. 2025	researcher
Leon	**Vratar**	FNM	12.6.2023- 31.8.2025	expert
Jan	**Zmazek**	FNM	1.10.2022- 30. 9. 2025	researcher

SHORT OVERVIEW OF THE WORKFLOW BY SUBACTIVITIES

During the reported period, we continued working on Activity A2.2: Determining the Competence Development Level of Graduates from Selected Study Programs, while also focusing on Activity A3: Comprehensive Implementation for the Development of Competencies for the Digital and Green Transition and Lifelong Learning. Activity A3 is divided into four sub-activities, listed in Table 2. These sub-activities do not proceed in a linear sequence.

Table 2. Subactivities A3

mark	*activity*
A3	**Comprehensive implementation for the development of competences for the digital and green transition and lifelong learning**
A3.1	Preparation of workshops
A3.2	Promotion of workshops
A3.3	Implementation of workshops
A3.4	Workshop evaluation

In January and February 2024, we planned and hosted two roundtable discussions with representatives from both faculties' management, students, and university teachers. The goals of these roundtables were to familiarize participants with the project work, share the results of the survey questionnaires, and discuss potential changes to the pedagogical process to support the digital and green transition. These roundtables were key inputs for Activity A3, particularly in planning workshops for students, graduates, higher education teachers, and colleagues.

In February and March 2024, we focused on Sub-activities A3.1: Workshop Preparation and A3.2: Workshop Promotion. Between March and June 2024, we held six workshops and evaluated them in real-time (Subactivities A3.3 and A3.4). Through this work, we are progressing toward achieving the following indicators:
K5: Number of Conducted Workshops/Courses/Trainings,
K6: Number of Participants, and
K7: Micro-Credentials.
We expect to meet these indicators by January 2025.

To support the workshops and ensure the sustainability of project results, we purchased computer equipment during this period. This equipment will be available to project researchers and workshop participants, and we also upgraded the practical equipment for conducting laboratory exercises. These actions ensure the sustainability of the project's outcomes and contribute to the digital and green transition.

In June 2024, based on insights from the roundtable discussions and workshop feedback, we resumed Activity A2.2. We prepared instruments to assess the required level of digital competencies and began drafting a competence framework for energy literacy, sustainability, and the green transition. This work aligns with Indicator K2: Definition of the Level of Digital Competence and Energy Literacy for Graduates, which will be a key outcome in the fourth interim report.

In parallel, we are actively disseminating project results through Activity A4.2. In addition to preparing interim reports and organizing events, we participated in six conference presentations (Figure 1) at international scientific conferences and published four scientific papers:

- KLEMENČIČ, Eva, MENCINGER, Matej, REPNIK, Robert. Enhancing digital competences through the integration of simulations and physics . In: GÓMEZ CHOVA, Louis (ed.), GONZÁLEZ MARTÍNEZ, Chelo (ed.), LEES, Joanna (ed.). *EDULEARN24: conference proceedings : 16th International Conference on Education and New Learning Technologies: Palma, (Spain), 1-3 July, 2024* . Valencia: IATED Academy , cop. 2024. P. 2898-2905.
- CAJNKO, Petra, KLEMENČIČ, Eva. Introduction of the emotions model in teaching process. In: GÓMEZ CHOVA, Louis (ed.), GONZÁLEZ MARTÍNEZ, Chelo (ed.), LEES, Joanna (ed.). *EDULEARN24: conference proceedings: 16th International Conference on Education and New Learning Technologies: Palma, (Spain), 1-3 July, 2024*. Valencia: IATED Academy , cop. 2024. P. 2639-2646.
- MENCINGER, Matej, CAJNKO, Petra, REPNIK, Robert. The effectiveness of digital tools in enhancing double integral learning: a comparative study. In: GÓMEZ CHOVA, Louis (ed.), GONZÁLEZ MARTÍNEZ, Chelo (ed.), LEES, Joanna (ed.). *EDULEARN24: conference proceedings: 16th International Conference on Education and New Learning Technologies: Palma, (Spain), 1-3 July, 2024*. Valencia: IATED Academy , cop. 2024. P. 2030-2035.
- CAJNKO, Petra, GOMBOC, Timi. Empowering individuals: a catalyst for personalized career counselling. In: WORTLEY, David (ed.). *Proceeding book: 10th International New York Conference on Evolving Trends in Interdisciplinary Research & Practices: June 1-3, 2024, Manhattan, New York City*. [Ankara]: IKSAD Publishing House, 2024. Pp. 203-210.
- CAJNKO, Petra, GOMBOC, Timi. Harnessing coaching skills for children 's mental health and well - being. In: *ICMS & ICSS 2024: 11th International Conference on Management Studies and Social Sciences: Istanbul, Turkey, August 10, 2024* . Ankara: EUROKD, 2024. Pp. 50.
- REPNIK, Robert, SUVAJAC, Mitja. High- speed video analysis of subharmonics oscillations for physics education. In: SKALA, Karolj (ed.). *MIPRO 2024: 47th ICT and Electronics Convention: May 20-24, 2024, Opatija, Croatia: mipro proceedings*. Rijeka Croatian Society for Information, Communication and Electronic Technology - MIPRO, cop. 2024. P. 737-739.
- KLEMENCIC, Eva, CAJNKO, Petra, OSRAJNIK, Damjan, ROBIČ, Dominik, REPNIK, Robert. Gamification as Support in Teaching Physics and Mathematics for Developing Digital and Sustainable Competences. Conference Proceedings ICPAE 2024, 30th August – 31st August, Zrenjanin, Serbia, Technical Faculty "Mihajlo Pupin", Zrenjanin & Faculty of Sciences and Mathematics, Nis .

Figure 1. Participation in the EDULEARN24 international conference with the presentation of three contributions related to project work with a focus on current challenges and opportunities in education.

COMPETENCES ON SELECTED STUDY PROGRAMS

Methodology and preparation of instrumentation

The methodology for conducting sub-activities within A2: Comprehensive Planning for the Development of Competencies for the Digital and Green Transition involved document analysis, carried out in the following steps:

1. Selection of document sources
2. Collection and organization of documents
3. Review and interpretation of documents
4. Summary of relevant information

We developed instrumentation, that is an Excel spreadsheet (Appendix 1), to provide an overview of the fundamental goals and competencies of the study programs: Physics UN, Mathematics UN, Subject Teacher (Educational Physics and Educational Mathematics), Civil Engineering VS, and Civil Engineering UN. Our focus was on the extent to which these goals and competencies relate to digital competencies, natural science competencies, algorithmic, abstract, and logical thinking competencies, and energy literacy. We also examined whether these goals and competencies are sufficiently developed across the learning units of the study programs.

Additionally, we prepared an instrument (Appendix 2) to record the achieved and required levels of digital competencies for graduates, using the DigComp 2.2 digital competence framework. The findings will be presented in the 4th interim report. For Indicator K2, we also aimed to capture the required level of energy literacy, although a formal competence framework for this area is still under development. To address this, we reviewed the following accessible documents on energy literacy, sustainability competencies, and the green transition:

- National Energy Education Development Project. (2013). Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education. U.S. Department of Energy.
- F. Janžekovič. (2023). Macroecology: Analysis of Biodiversity Data. University of Maribor, University Press. Available via the link.
- Institute of the Republic of Slovenia for Education. (2023). European Framework of Competences for Sustainability.
- UNESCO. (n.d.). Sustainable Development. UNESCO.

The insights from these documents, along with expert discussions following the workshops, will contribute to the development of a competence framework, which will be detailed in the 4th interim report. The basic structure of this framework is expected to include 12 competencies, organized into five areas, with each competence developed across three levels: basic, medium, and advanced.

Findings of the Core Objectives and Competencies Review

Appendix 3 contains the instrument detailing the fundamental goals and competencies of the selected study programs at FNM UM, classified under digital competencies, natural science competencies, algorithmic, abstract, and logical thinking competencies, and energy literacy.

In the **Physics** study program, all general and subject-specific competencies of the graduates, as well as the program's fundamental goals, can be linked to one of the three selected competencies or to energy literacy. The vast majority (90%) of these competencies develop natural science competence, which aligns with the specific focus of the study program. A significant portion (57%) of the fundamental goals and competencies are also related to algorithmic, logical, and abstract thinking. However, only 10% are connected to digital competencies, and even fewer (5%) are linked to energy literacy. It is important to note that all fundamental goals and competencies are integrated within the learning units of the program.

In the **Mathematic**s study program, none of the basic objectives, general competencies, or subject-specific competencies are related to energy literacy. Consistent with the program's focus, the majority of goals and competencies (88%) develop natural science competencies, as well as algorithmic, logical, and abstract thinking. Digital competencies are represented in a smaller proportion, accounting for 59% of the graduate's basic goals and competencies. We did not find a connection to the selected competencies for two of the program's general competencies. However, all fundamental goals and competencies are represented within the program's learning units.

In the **Subject teacher** study program (Unified Master's), we analyzed the general and subject-specific competencies of graduates in both Educational Physics and Educational Mathematics tracks. In the program's general competencies, 56% are associated with the development of digital competencies, while 52% are linked to algorithmic, logical, and abstract thinking. A smaller proportion (19%) relates to natural science competencies, and none are connected to energy literacy. It is important to note that these percentages apply only to general competencies, not subject-specific ones. Additionally, some general competencies are not developed directly through learning units but are addressed indirectly via practical training.

For **the Educational Physics**, most subject-specific competencies are related to natural science competencies (60%), as expected for this field of study, and to digital competencies (55%). Competencies related to algorithmic, logical, and abstract thinking are somewhat less prominent (35%). Notably, energy literacy is present among the subject-specific competencies, representing the highest proportion (40%) across the studied programs. However, three subject-specific competencies are not explicitly developed through learning units, but through practical training and shared pedagogical subjects within the program.

In the **Educational Mathematics**, all recorded subject-specific competencies are connected to digital competencies, with the majority (75%) also linked to algorithmic, logical, and abstract thinking. Approximately one-third (38%) are related to natural science competencies. Energy literacy, however, is not represented among the subject-specific competencies.

Appendix 4 presents a detailed table outlining the various goals and competencies, both general and subject-specific, and their alignment with digital competencies, natural science competencies, algorithmic, logical, and abstract thinking competencies, and energy literacy within the UN Construction and VS Construction study programs. The analysis includes 11 teaching units from the UN program and 11 teaching units from the VS program. These units predominantly cover mathematical and natural science content, computer science, and a smaller proportion of professional subjects. It is important to note that not all subjects from the study programs are represented in this analysis.

Students in the UN Civil Engineering program undertake 37 or more courses during their studies, depending on their selection of elective courses in the final year (based on ECTS points). Similarly, students in the VS Civil Engineering program complete 41 or more courses, again depending on their choice of subjects. Therefore, this analysis covers a maximum of 30% of the total subjects in the UN program and 27% of the total subjects in the VS program. The analysis reveals that specific types of competencies are emphasized, while certain goals and competencies are not covered in this research. It is assumed that students achieve the missing competencies through (professional) courses that were not part of this analysis.

In **UN Civil Engineering** program, digital competencies are included in 38% of general and subject-specific competencies. This reflects the growing importance of digital tools in the modern construction industry, particularly for design and implementation. Natural science competencies are represented in 62% of the competencies, indicating the critical role of scientific knowledge in understanding the physical and mathematical foundations necessary for analyzing data and synthesizing information, which is essential for developing technical and analytical skills in construction. Algorithmic, logical, and abstract thinking is present in 57% of the competencies, playing a key role in solving complex technical problems and designing structures. Energy literacy is represented in 38% of the general and subject-specific competencies, particularly in areas focused on energy-efficient building design. Although energy literacy is less prevalent, its significance is growing due to the increasing focus on sustainability in modern construction practices.

In the **VS Construction program**, digital competencies are represented in 50% of the competencies, highlighting their crucial role in the program. This focus reflects the program's preparedness to incorporate modern technology, essential for effective design and construction management. Natural science competencies are strongly represented at 67%, aligning with the fundamental nature of civil engineering studies, which require a solid foundation in physics, mathematics, and materials science to solve engineering problems. These competencies are essential for students, as civil engineering is heavily reliant on an understanding of physical and mathematical principles. Algorithmic, logical, and abstract thinking is present in 61% of the competencies, indicating the importance of logical and algorithmic thinking in this program. Energy literacy, while not as prominent (22%), is included in subjects focusing on energy efficiency and sustainable construction, even though these subjects were not analyzed in this research. While energy literacy and sustainability are increasingly important in the construction industry, it appears that the program currently places less emphasis on these topics.

PREPARATION OF WORKSHOPS

When preparing the workshops, we adhere to the defined content and skills for competence development, which were designed and presented in the 2nd interim report. These were based on the findings from the situation analysis, including insights from semi-structured interviews and the analysis of survey questionnaires completed by freshmen and graduates. Additionally, we incorporate the outcomes of the round table discussions into the workshop preparation.

Roundtables

The first roundtable took place on February 19, 2024, at FNM UM (see picture 2). The moderator was Prof. Dr. Robert Repnik, coordinator of the collaboration between FGPA UM and FNM UM, a researcher, and a member of the project board for the NOO project. As an introduction to the round table, project leader Asst. Prof. Dr. Eva Klemenčič presented the project and its results to date. Following this, Asst. Dr. Barbara Arcet and Asst. Dr. Jan Zmazek shared the findings from surveys conducted with freshmen (sample size: 38) and graduates (sample size: 135).

The roundtable discussion included contributions from Asst. Prof. Dr. Eva Klemenčič (project manager), Prof. Dr. Matej Mencinger (project council member), Asst. Prof. Dr. Borut Macuh (substitute project council member), Prof. Dr. Nataša Vaupotič (head of the Physics 1st degree study program and chair of the Quality Assessment Commission), and Mitja Suvajac (Vice Dean for Student Affairs, FNM).

Key conclusions from the roundtable:

1. Asst. Prof. Dr. Eva Klemenčič highlighted that the document analysis revealed differences in the inclusion of competencies: natural science competencies are well-represented, but digital competencies and energy literacy are included to a lesser extent.
2. Prof. Dr. Matej Mencinger pointed out that while FGPA UM and FNM UM share the same goals and methodology, their approaches differ. At FNM, the focus moves from theory to practice, while at FGPA, the reverse is true. He suggested the potential for enhancing both by incorporating more practical applications at FNM and more theoretical content at FGPA.
3. Prof. Dr. Nataša Vaupotič stressed that it is ineffective to change curricula if educators do not implement the changes in practice. She recommended reviewing which competencies are already accredited within the programs and identifying which courses cover these competencies. She also suggested providing guidelines for educators or encouraging them to consider incorporating the competencies into their teaching units.
4. Asst. Prof. Dr. Borut Macuh emphasized the reluctance of FGPA UM course providers to engage in surveys. However, the survey revealed an important finding: most teaching units do develop competencies, though they are not formally included in the curricula.

5. Mitja Suvajac noted that students can express their preferences and concerns through student polls and the student council. He also proposed organizing a workshop for students focused on digital competencies and artificial intelligence.
6. Prof. Dr. Robert Repnik argued that not everything needs to be formally documented in the curriculum but stressed the importance of raising awareness about these competencies. He suggested that the situation analysis had already impacted the work of educators and proposed further training for them.

Figure 2. Highlights from the first-round table at FNM UM.

The second roundtable took place on February 21, 2024, at FGPA UM (see Figure 3), moderated by Asst. Prof. Dr. Borut Macuh, alternate member of the project council. The meeting began with a presentation by the project manager, Asst. Prof. Dr. Eva Klemenčič, who introduced the NOO project, its achievements to date, and its main objectives. Following this, Lecturer Irena Hrastnik Ladinek presented the results of surveys conducted with freshmen (sample size: 104) and graduates (sample size: 21). Participants of the round table included Prof. Marko Jaušovec (Vice Dean for Educational Activity), Prof. Robert Repnik (NOO Project Council member), Asst. Prof. Dr. Eva Klemenčič (Project Manager), and Živa Doberšek (Vice Dean for Student Affairs).

The conclusions of the round table are as follows:

1. Asst. Prof. Dr. Eva Klemenčič emphasized that the involvement of FGPA members in the NOO project at FNM enables the exchange of best practices and facilitates the transfer of theoretical knowledge into practical applications.

2. Prof. Dr. Robert Repnik explained that competencies encompass knowledge, skills, and attitudes. He elaborated on the distinctions between the three key competencies (digital competencies, algorithmic, logical, and abstract thinking competencies, and natural science competencies) and clarified the difference between energy and energy literacy. He also stressed that micro-credentials should not replace formal education, urging a holistic view of the entire study program rather than focusing on individual study units. He proposed considering a more appropriate timeframe for increased practical experience.
3. Živa Doberšek highlighted the benefit of addressing subjects individually and emphasized the importance of formally integrating competencies into curricula to ensure commitment from educators. She noted that students desire external experts for specific skill development and have shown significant interest in earning micro-credentials, as demonstrated by the strong response to workshops.
4. Prof. Dr. Marko Jaušovec supported the formal updating of curricula and underscored the advantages of FGPA's pragmatic study approach, where students engage extensively with hands-on, practical work. However, he pointed out a lack of interdisciplinarity that still needs to be addressed. He also stressed the importance of using artificial intelligence appropriately. He concluded that micro-credentials will gain more significance if they can be linked with other (economic) institutions.

Figure 3. Highlights from the second round table at FGPA UM.

Planned workshops

In the calendar year 2024, we have planned a total of 12 workshops, with 6 taking place between January 1, 2024, and June 30, 2024. These workshops will be conducted in a hybrid format, with live sessions held at FNM UM and remote participation via Microsoft Teams. Each workshop will last for two school hours. Participants will receive a certificate of participation upon completing the workshop. In line with this, we have also designed a certificate of participation for the project (see Figure 4).

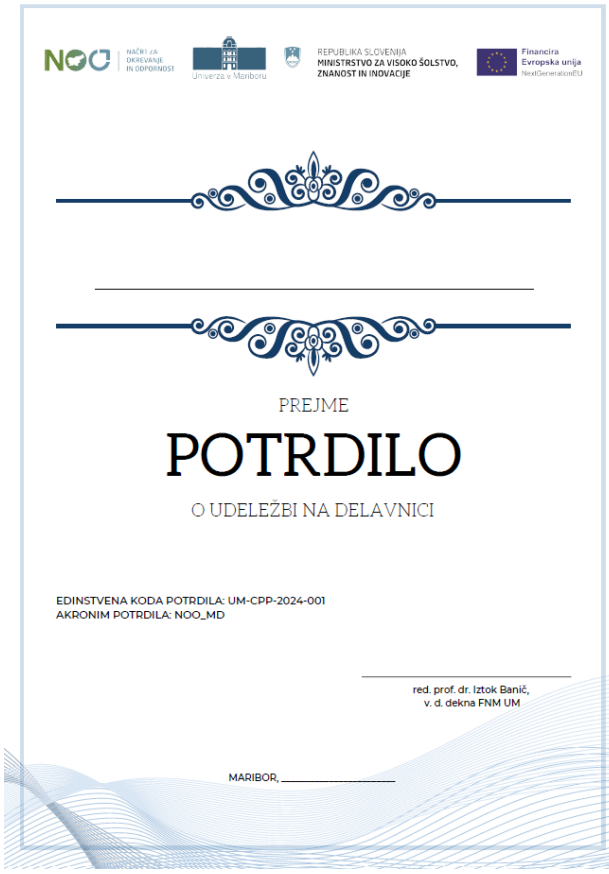

Figure 4. Formed certificate of participation in the workshop.

We have roughly divided the planned workshops into four areas, namely:

1) Development of digital competences
2) Pedagogical approaches for competence development
3) Algorithmic, logical and abstract thinking skills
4) Contents for the development of energy literacy for the green transition

Table 3 presents the workshops in 2024, the implementation date and the area on which the workshop focuses.

Table 3. Overview of planned workshops in calendar year 2024.

LECTURER	WORKSHOP	AREA	IMPLEMENTATION DATE
prof. Mitja Slavinec	Youth research work	2	9. 4. 2024, at 2 pm
prof. Matej Mencinger	The power of proof and the development of algorithmic thinking in engineering students	3	23. 4. 2024, at 2 pm
prof. Marko Marhl	A systemic approach to addressing energy literacy	4	7. 5. 2024, at 2 pm
prof. Franc Janžekovič	What and why is happening to biodiversity	3	28. 5. 2024, at 2 pm
res. asst. Petra Cajnko	Developing modern pedagogical approaches	2	11. 6. 2024, at 2 pm
asst. prof. Rene Markovič and res. asst. Barbara Arcet	How to create an AI model?	4	18. 6. 2024, at 2 pm
asst. prof. Eva Klemenčič	Digital tools for problem solving	1	10. 9. 2024, at 2 pm
asst. prof. Borut Macuh	Construction, energy, environment	4	24. 9. 2024, at 2 pm
prof. Robert Repnik	Challenges and opportunities of involving external stakeholders in the pedagogical process	2	22. 10. 2024, at 2 pm
prof. Robert Repnik	A flipped classroom to support the development of science and digital competences	1	29. 10. 2024, at 2 pm
prof. Robert Repnik	Digital competences	1	12. 11. 2024, at 2 pm
asst. prof. Vladimir Grubelnik	Development of systems thinking and modeling of system dynamics using artificial intelligence	3	26. 11. 2024, at 5 pm

WORKSHOP PROMOTION

Promotion as part of the NOO project at FNM UM is carried out systematically, incorporating various strategies aimed at raising awareness and engaging different stakeholders. The key elements of the promotion system are as follows:

1. **Digital presence**:
    - **Website**: FNM UM and UM use their official website to publish information about projects, news and tenders, which also includes projects within the NOO (UM.si) (FNM).
    - **Social networks**: We actively use the Facebook platform.
2. **Events and workshops**:
    - Organization of various events, such as conferences, round tables and workshops, where we present the project and the results of the project. This enables direct communication and exchange of ideas between researchers, students and the public (FNM).
3. **Media and public appearances**:
    - The university cooperates with the media to promote its projects. This includes press conferences, interviews and publications in newspapers and online portals (UM.si).
4. **Internal communication**:
    - Promotion within the FNM UM via the intranet, internal news and e-mail notifications, which ensures that all employees and students are aware of the progress and results of the projects (FNM).
5. **Reports**:
    - Preparation and distribution of reports and other documents detailing the project and its impact, which contributes to greater transparency and public information (FNM).

These strategies ensure wide availability of information and enable the involvement of various stakeholders, which is crucial for the successful promotion of the project.

Until June 17, 2024, we issued 50 announcements at FNM UM, accounting for 26.5% of the total 189 announcements made across the University of Maribor. A graphical representation of these activities is provided in the form of a bar chart and a pie chart (see Figures 5 and 6).

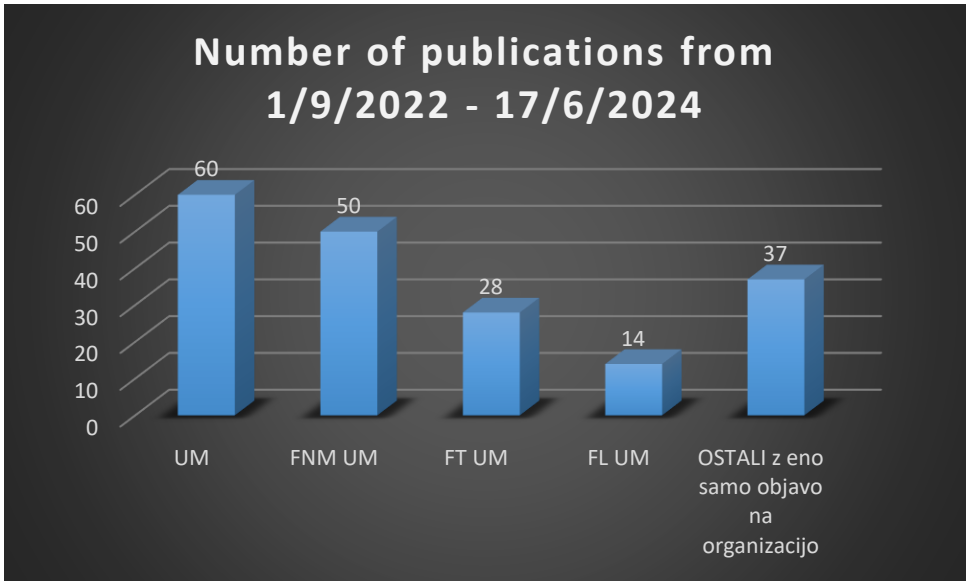

Figure 5. Number of publications in the period from September 1, 2022 to June 17, 2024.

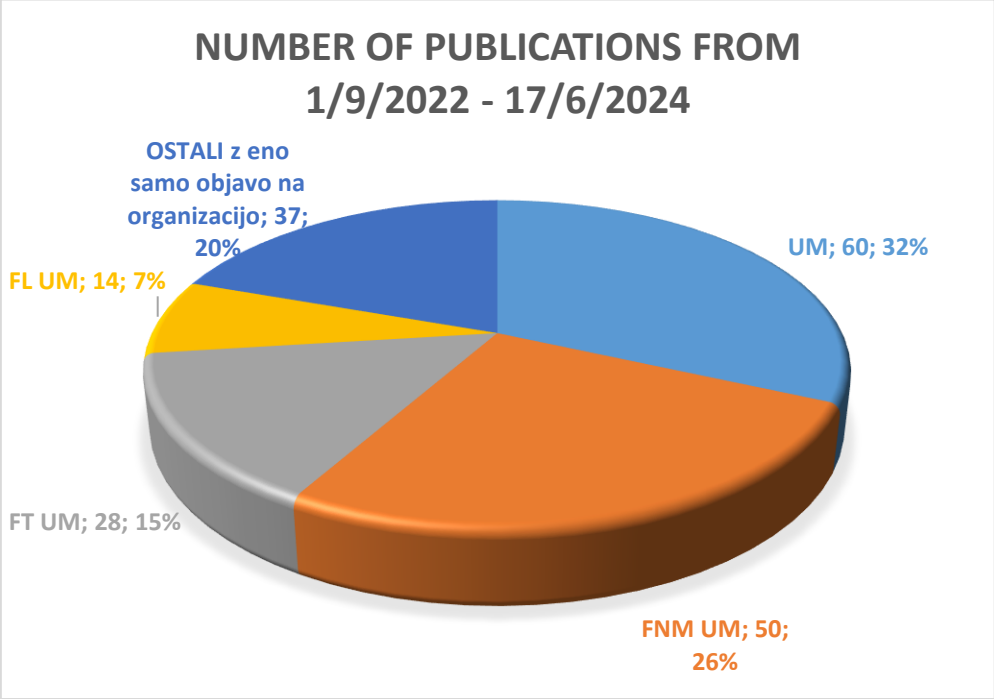

Figure 6. Number of publications in the period from September 1, 2022 to June 17, 2024.

In the future, we are planning even more activities to further promote the project and increase the reach of our communication efforts.

Members of the project council also attended the Pilots to Pilots conference, which took place on May 8, 2024 at Brdo pri Kranju. At the conference, project activities were presented on the project market (Figure 7).

Figure 7. NOO project manager, asst. prof. Eva Klemenčič at the Pilots to Pilots conference.

IMPLEMENTATION OF WORKSHOPS

Youth research work

The workshop was held on Tuesday, April 9, 2024, at 2 p.m. in lecture room 0/103 at FNM UM and remotely (Figure 8).

Lecturer: prof. Mitja Slavinec

Summary of the workshop:

Youth research work in Slovenia is well-organized and widespread, occurring across primary and secondary schools throughout the country. With the support of their mentors, students prepare research papers, which they present at regional meetings. The most successful papers are showcased at a national meeting. In our workshop, we will explore topics related to mentoring young researchers.

Achievements for Participants:

- Understanding the Process: Participants will gain a comprehensive view of the mentoring process, from the initial idea to the final implementation.
- Networking Opportunities: Attendees will have the chance to meet fellow mentors and exchange best practices.
- New Methods and Techniques: Participants will learn about innovative methods and techniques to enhance their mentoring practices.
- Increased Motivation: The workshop aims to boost motivation for encouraging research among young people, thereby contributing to the improvement of education quality and the research culture in schools.

Figure 8. Highlights from the workshop Youth research work, lecturer prof. Mitja Slavinec.

The power of proof and the development of algorithmic thinking in engineering students

The workshop was held on Tuesday, April 23, 2024, at 2 p.m. in lecture room 0/103 at FNM UM and remotely (Figure 9).

Lecturer: prof. Matej Mencinger

Summary of the workshop:

The workshop will focus on the significance and techniques of mathematical proof and the development of algorithmic thinking within the context of technical sciences. Through interactive presentations and hands-on exercises, participants will delve into fundamental concepts of mathematical proof, including induction, deduction, proof by contradiction, and the use of statistical tests. We will also examine how these methods and ways of thinking are applied to solve concrete technical problems in areas such as construction, dynamic systems, and data analysis. The workshop aims to foster discussions on effective teaching methods for these concepts to engineering students, enhancing their understanding and practical application.

Achievements of participants:

- Enhanced Understanding: Gain a deeper insight into the concepts of mathematical proof.
- Development of Algorithmic Thinking: Improve skills in algorithmic reasoning and problem-solving.
- Application of Theory: Connect theoretical concepts with practical examples.
- Teaching Methodologies: Engage in discussions on effective methods for teaching these concepts to engineering students.

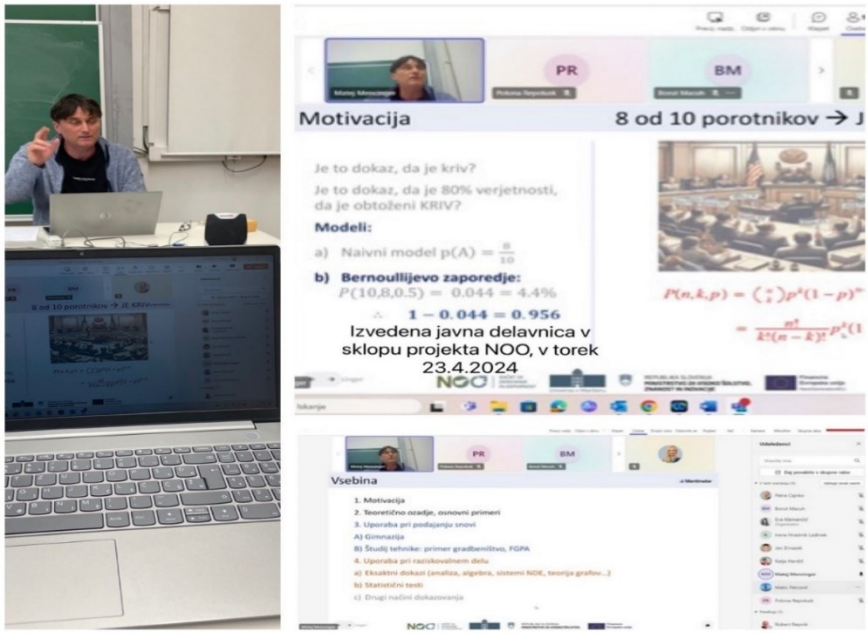

Figure 9. Highlights from the workshop Power of proof and development of algorithmic thinking in engineering students, lecturer prof. Matej Mencinger.

A systemic approach to addressing energy literacy

The workshop was held on Tuesday, May 7, 2024, at 2 p.m. in lecture room 0/103 at FNM UM and remotely (picture 10).

Lecturer: prof. Marko Marhl

Summary of the workshop:

Energy literacy is crucial for general awareness and foundational knowledge, significantly impacting the development of individuals from early education through to university. This workshop will explore domestic and international efforts to enhance energy literacy, with a particular focus on the Slovenian association EN-LITE, which is dedicated to advancing and reinforcing energy literacy (https://www.en-lite.si). We will highlight key achievements of EN-LITE, including organized events, interviews, media publications, books, infographics, and videos.

The workshop will emphasize a systems approach to energy literacy, which promotes analytical, critical, and creative thinking among students by understanding the dynamics of systems. We will place this approach within the context of the Slovenian education system, showcasing how energy literacy is integrated from elementary school through various study programs.

Examples will include: Energy and Energy Flows: Content taught in Natural Science for 6th and 7th grades. Complex Systems and Energy: Coverage in Systems Thinking and Modeling of System Dynamics for Physics students at the Faculty of Natural Sciences and Mathematics, University of Maribor. System Dynamics: Courses in Classroom Teaching and Doctoral Studies at the Faculty of Education.

Achievements of participants:

- Understanding energy literacy.
- Overview of domestic and international trends.
- Presentation of state and local efforts.
- Systems approach and analytical thinking.
- Examples of content in the educational system.
- Interactive activities.

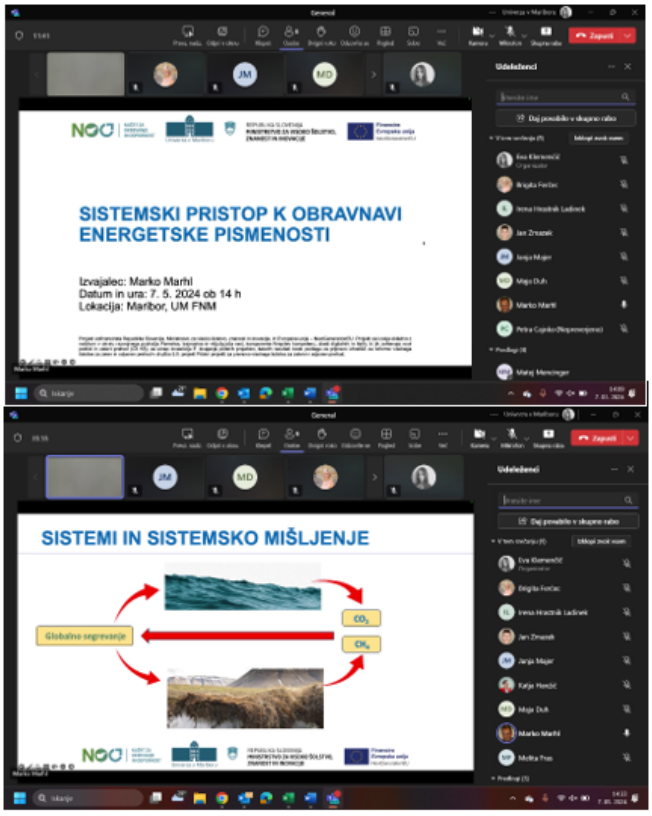

Figure 10. Highlights from the workshop Systemic approach to dealing with energy literacy, lecturer prof. Marko Marhl.

What and why is happening to biodiversity

The workshop was held on Tuesday, May 28, 2024, at 2 p.m. in lecture hall 0/103 at FNM UM and remotely (picture 10).

Lecturer: prof. Franc Janžekovič

Summary of the workshop:

The evolutionary process on Earth involves the creation of new species and the increase in biodiversity, but it also includes the extinction of species. Currently, the rate of species extinction has risen significantly due to factors such as habitat degradation and destruction, the introduction of alien species, unsustainable population use, pollution, and climate change. This workshop will address how the global community is responding to the decline in biodiversity, the actions being taken by the EU, and what is being done at the national level in Slovenia to preserve biodiversity. Additionally, we will explore the role of the NOO project in this context and discuss how we can green-transform higher education to support biodiversity conservation.

Achievements of participants:

- Understanding the evolutionary processes and mechanisms that affect Earth's biodiversity.
- Identifying the main causes of species extinction in modern times.
- An overview of measures taken by the global community to protect biodiversity, including EU measures and national policies.
- Understanding the role of non-governmental organizations (NGOs) in biodiversity conservation.
- Discussion on ways to green transform higher education and contribute to the preservation of biodiversity and sustainable development.
- Demonstrating awareness of the connection between energy policy and biodiversity conservation.

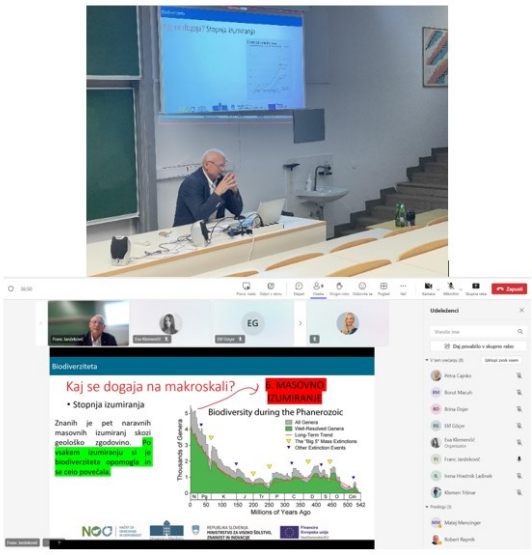

Figure 10. Highlights from the workshop What and why is happening to biodiversity, prof. Franc Janžekovič.

Developing modern pedagogical approaches

The workshop was held remotely on Tuesday, June 11, 2024, at 2 p.m. (Figure 11).

Lecturer: res. asst. Petra Cajnko

Summary of the workshop:

In this workshop, participants will gain insight into modern methods and techniques designed to enhance the educational process. Attendees will explore various approaches to teaching that foster active learning, critical thinking, and creativity. Through interactive sessions and practical exercises, you will acquire new strategies for effectively transferring knowledge, addressing contemporary educational needs and challenges. This workshop is tailored for teachers, lecturers, and anyone interested in improving their pedagogical practices and elevating the quality of learning and teaching across different contexts.

Achievements of participants:

- Understanding of modern teaching methods and techniques.
- Practical strategies for effective knowledge transfer.
- Development of skills to promote critical thinking and creativity.
- Increasing self-confidence in pedagogical practice.
- The ability to adapt to modern needs and challenges in education.

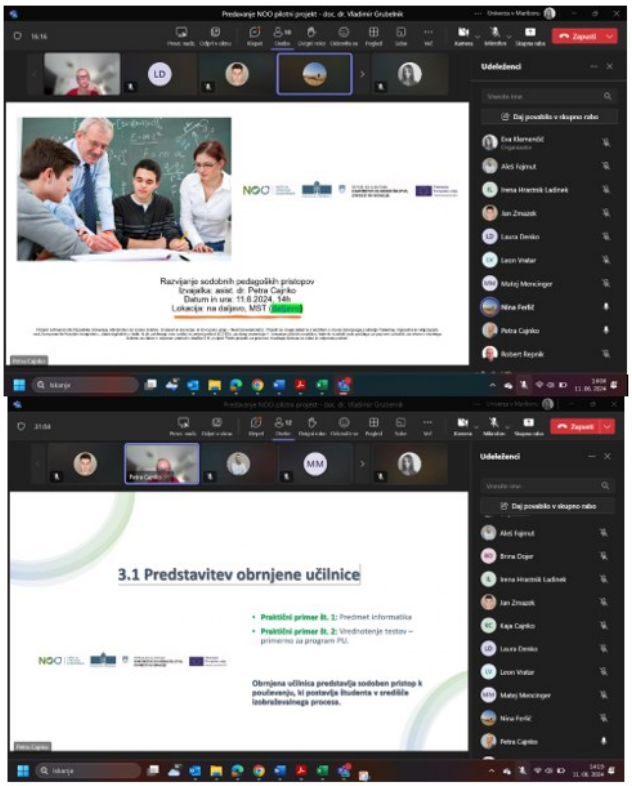

Figure 11. Highlights from the workshop Developing modern pedagogical approaches, res. asst. Petra Cajnko.

How to create an AI model?

The workshop was held on Tuesday, June 18, 2024, at 2 p.m. in lecture hall 0/103 and remotely (picture 12).

Lecturer: res. asst. Barbara Arcet and asst. prof. Rene Markovič

Summary of the workshop:

You are invited to a 90-minute workshop titled "How to Create an AI Model?" In this hands-on session, you will have the chance to learn the fundamentals of artificial intelligence and build your own AI model. Please bring a laptop, tablet, or smartphone for programming. We will start with a brief overview of the theoretical background and key concepts needed to understand AI. Following this, we will collaboratively develop an AI model and explore machine learning through practical exercises. Whether you have prior experience or are new to the field, this workshop offers a valuable opportunity to dive into artificial intelligence and gain practical programming skills. Join us and discover how to create your own AI model!

Achievements of participants:

- Understanding the basics of artificial intelligence and machine learning.
- Hands-on experience in programming AI models.
- Ability to develop own AI models.
- Deep exploration of machine learning.
- Improving programming skills.

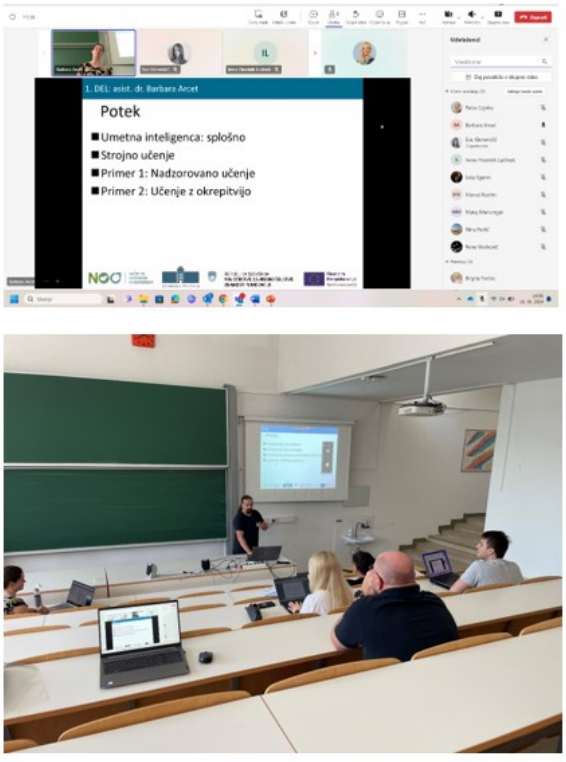

Figure 12. Snapshots from the workshop How to create an AI model?, res. asst. Barbara Arcet and asst. prof. Rene Markovič.

EVALUATION OF WORKSHOPS

Evaluation form

For the evaluation of the workshops, we have prepared an evaluation form in Microsoft Forms (Appendix 5). The evaluation form is filled in by the participants after the workshop, it is anonymous and helps us organize future workshops.

In the evaluation form, we collect information about the participant's workplace or status (university teacher, university associate, professional associate, student, graduate, young researcher, "other") and employment or faculty of study. We ask the participants about their satisfaction with the information, namely how they found out about the workshop and how they would like to be informed about the workshop in the future.

We ask the participants to what extent they agree with the statements about the organization of the workshop on a scale from 1 (do not agree at all) to 5 (completely agree). The claims are as follows:

- The selection of the workshop date was appropriate.
- The length of the workshop was adequate.
- The description of the workshop is consistent with the implementation.
- After the workshop, I would like to be able to self-evaluate the acquired knowledge.
- The workshop would require separate basic and advanced levels.

The following are statements about the content and implementation of the workshop on a scale from 1 (do not agree at all) to 5 (completely agree), with an additional option of "not relevant". The claims are as follows:

- The content was presented clearly and comprehensibly.
- I developed my digital competences through the workshop.
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking.
- Through the workshop, I developed natural science competences.
- I developed energy literacy through the workshop.
- The workshop influenced my understanding of the topic under discussion.
- The workshop motivated me to continue working in this field.
- I will use the acquired knowledge or competences in my work or studies.

At the end, participants have the opportunity to write down suggestions, comments, praise.

Findings

1. Feedback Analysis: YOUTH RESEARCH WORK

Lecturer: prof. Mitja Slavinec

Implementation of the event: 9 April 2024

Event duration: 90 min

Event structure: pedagogical approaches and teaching methods

n = 13

VU = 6, VS = 3, assistant = 1, student = 3

Average score for each statement:

- The selection of the workshop date was appropriate: 5:00
- The length of the workshop was adequate: 4.85
- The description of the workshop is consistent with the implementation: 4.77
- After the workshop, I would like to be able to self-evaluate the acquired knowledge: 3.23
- The workshop would require a separate basic and advanced level: 1.77
- The content was presented clearly and comprehensibly: 4.92
- I developed my digital competences through the workshop: 2.92
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 3.31
- Through the workshop, I developed natural science competences: 3.31
- I developed energy literacy through the workshop: 3.17
- The workshop influenced my understanding of the topic: 4.31
- The workshop motivated me to continue working in this area: 4.08
- I will use the acquired knowledge or competences in my work or studies: 4.50

Proportion of "strongly agree" for each statement:

- The selection of the workshop date was appropriate: 92.31%
- The length of the workshop was adequate: 76.92%
- The description of the workshop is consistent with the implementation: 69.23%
- After the workshop, I would like the possibility of self-evaluation of the acquired knowledge: 46.15%
- The workshop would require a separate basic and advanced level: 46.15%
- The content was presented clearly and comprehensibly: 76.92%
- I developed my digital competences through the workshop: 76.92%
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 76.92%
- Through the workshop I developed natural science competences: 61.54%
- I developed energy literacy through the workshop: 46.15%

- The workshop influenced my understanding of the subject: 76.92%
- The workshop motivated me to continue working in this field: 69.23%
- I will use the acquired knowledge or competences in my work or studies: 76.92%

Analysis:

- Most of the participants agree that the selection of the workshop date was appropriate, but there is some disparity in the evaluations regarding the length of the workshop and the consistency of the description with the implementation.
- The self-evaluation of the acquired knowledge and the separate level of the basic and advanced part of the workshop are seen as areas for possible improvement.
- The content of the workshop is mostly rated well, but energy literacy received lower ratings.
- Nevertheless, the workshop mostly has a positive effect on the development of competences and motivation for further work in this field .

2. Feedback Analysis: The power of proof and the development of algorithmic thinking in engineering students

Lecturer: prof. Matej Mencinger

Implementation of the event: 23/04/2024

Event duration: 90 min

Event set: computational

n = 7

VU = 1, VS = 5, student = 1

Average score for each statement:

- The selection of the workshop date was appropriate: 4.08
- The length of the workshop was adequate: 4.69
- The description of the workshop is consistent with the implementation: 4.15
- After the workshop, I would like to be able to self-evaluate the acquired knowledge: 4:00
- The workshop would require a separate basic and advanced level: 4.00
- The content was presented clearly and comprehensibly: 4.23
- I developed my digital competences through the workshop: 4.00
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 4.00
- I developed natural science competences through the workshop: 4.00
- I developed energy literacy through the workshop: 3.62
- The workshop influenced my understanding of the topic under discussion: 4.00
- The workshop motivated me to continue working in this area: 4.08
- I will use the acquired knowledge or competences in my work or studies: 4.15

Proportion of "strongly agree" for each statement:

- The selection of the workshop date was appropriate: 76.92%
- The length of the workshop was adequate: 84.62%
- The description of the workshop is consistent with the implementation: 76.92%
- After the workshop, I would like the possibility of self-evaluation of the acquired knowledge: 53.85%
- The workshop would require a separate basic and advanced level: 53.85%
- The content was presented clearly and comprehensibly: 84.62%
- I developed my digital competences through the workshop: 76.92%
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 76.92%
- Through the workshop I developed natural science competences: 61.54%
- I developed energy literacy through the workshop: 46.15%
- The workshop influenced my understanding of the topic: 76.92%
- The workshop motivated me to continue working in this field: 69.23%
- I will use the acquired knowledge or competences in my work or studies: 76.92%

Analysis:

- The selection of the workshop date was rated as appropriate by the majority of participants, while the ratings on energy literacy were somewhat lower.
- Most participants agreed that the length of the workshop was appropriate and that the content was presented clearly.
- The possibility of self-evaluation of the acquired knowledge and the separate level of the basic and advanced part of the workshop received slightly lower marks, which indicates a possible area for improvement.
- The participants showed a high level of motivation for further work in this area, which is a positive sign for the success of the workshop.

3. Feedback Analysis: A systems approach to addressing energy literacy.

Lecturer: prof. Marko Marhl

Implementation of the event: 7/5/2024

Event duration: 90 min

Event set: green and energetic

n = 6

VU = 3, VS = 3

Average score for each statement:

- Selection of workshop dates: 5 (100%)

- Workshop length: 5 (100%)
- Workshop description: 5 (100%)
- Possibility of self-evaluation of acquired knowledge: 1 (25%)
- The workshop would require a separate basic and advanced level: 1.5 (37.5%)
- The content was presented clearly and comprehensibly: 5 (100%)
- I developed my digital competences through the workshop: 3.6
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 4.1
- Through the workshop I developed natural science competences: 4.1
- I developed energy literacy through the workshop: 5
- The workshop influenced my understanding of the topic: 4.7
- The workshop motivated me to continue working in this area: 4.7
- I will use the acquired knowledge or competences in my work or studies: 4.7

Proportion of "strongly agree" for each statement:

- Selection of the workshop date: 100%
- Length of workshop: 100%
- Workshop description: 100%
- Possibility of self-evaluation of acquired knowledge: 0%
- The workshop would require a separate basic and advanced level: 0%
- The content was presented clearly and comprehensibly: 100%
- I developed my digital competences through the workshop: 66.7%
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 73.3%
- Through the workshop I developed natural science competences: 80%
- I developed energy literacy through the workshop: 100%
- The workshop influenced my understanding of the subject: 86.7%
- The workshop motivated me to continue working in this field: 93.3%
- I will use the acquired knowledge or competences in my work or studies: 86.7%

Analysis:

- The analysis of the feedback shows that the majority of participants are very satisfied with the selection of the date and length of the workshop, as well as the consistency between the description and implementation. This shows good planning and execution of the event.
- Considering the high scores regarding the clarity and comprehensibility of the content and the development of various competencies, it seems that the basic structure and implementation of the workshop is effective.
- It is also important to note that the majority of participants expressed a desire to continue working in the field under consideration and to use the acquired knowledge in their work or studies, which indicates the positive impact of the workshop on their knowledge and motivation.

4. Feedback Analysis: What and why is happening to biodiversity

Lecturer: prof. Franc Janžekovič

Implementation of the event: 28.5.2024

Event duration: 90 min

Event set: green and energetic

n = 7

VU = 3, VS = 3, student = 1

Average score for each statement:

- The selection of the workshop date was appropriate: 4.86
- The length of the workshop was adequate: 4.86
- The description of the workshop is consistent with the implementation: 5.00
- After the workshop, I would like to be able to self-evaluate the acquired knowledge: 3.29
- The workshop would require a separate basic and advanced level: 2.71
- The content was presented clearly and comprehensibly: 5.00
- I developed my digital competences through the workshop: 3.20
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 4.17
- I developed natural science competences through the workshop: 5.00
- I developed energy literacy through the workshop: 3.67
- The workshop influenced my understanding of the topic: 4.57
- The workshop motivated me to continue working in this area: 4.14
- I will use the acquired knowledge or competences in my work or studies: 4.29

Proportion of "strongly agree" for each statement:

- The selection of the workshop date was appropriate: 85.71%
- The length of the workshop was adequate: 85.71%
- The description of the workshop is consistent with the implementation: 100.00%
- After the workshop, I would like the possibility of self-evaluation of the acquired knowledge: 0.00%
- The workshop would require a separate basic and advanced level: 0.00%
- The content was presented clearly and comprehensibly: 100.00%
- I developed my digital competences through the workshop: 20.00%
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking: 33.33%
- Through the workshop, I developed my natural science competences: 100.00%
- I developed energy literacy through the workshop: 86.67%
- The workshop influenced my understanding of the topic: 71.43%
- The workshop motivated me to continue working in this field: 42.86%

- I will use the acquired knowledge or competences in my work or studies: 57.14%

Summary of the analysis:

- The workshop received very high average scores (close to or equal to 5) for statements related to the selection of the term, the length of the workshop, the consistency of the description with the implementation, the clarity of the presented content and the development of natural science competences.
- The statement regarding the desire to self-evaluate the acquired knowledge after the workshop received the lowest average score (3.29) and did not have any "5 (completely agree)" score.
- The need to separate basic and advanced levels also received low ratings, indicating possible mixed opinion or general satisfaction with the current format.
- A high percentage of "5 (strongly agree)" responses was found for clarity of content and consistency with implementation (both 100%), while lower percentages were observed for statements about the development of digital competences.

5. Feedback Analysis: Developing modern pedagogical approaches.

Lecturer: res. asst. Petra Cajnko

Implementation of the event: 11.6.2024

Event duration: 90 min

Event structure: pedagogical approaches & teaching methods

n = 10

VU = 4, VS = 3, student = 1, graduate = 1, professional associate = 1

Average score for each statement:

- The selection of the workshop date was appropriate. - Average rating: 5
- The length of the workshop was adequate. - Average rating: 4.5
- The description of the workshop is consistent with the implementation. - Average rating: 4.6
- After the workshop, I would like to be able to self-evaluate the acquired knowledge. - Average rating: 2.9
- The workshop would require separate basic and advanced levels. - Average grade: 2.6
- The content was presented clearly and comprehensibly. - Average grade: 4.3
- I developed my digital competences through the workshop. - Average grade: 4.1
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking. - Average rating: 4
- Through the workshop, I developed natural science competences. - Average rating: 3.8
- I developed energy literacy through the workshop. - Average grade: 2.5
- The workshop influenced my understanding of the topic under discussion. - Average grade: 4.4

- The workshop motivated me to continue working in this field. - Average grade: 4.2
- I will use the acquired knowledge or competences in my work or studies. - Average grade: 4.1

Proportion of "strongly agree" for each statement:

- The selection of the workshop date was appropriate. - Share of "completely agree": 100%
- The length of the workshop was adequate. - Share of "completely agree": 90%
- The description of the workshop is consistent with the implementation. - Share of "completely agree": 92%
- After the workshop, I would like to be able to self-evaluate the acquired knowledge. - Share of "completely agree": 52%
- The workshop would require separate basic and advanced levels. - Share of "completely agree": 40%
- The content was presented clearly and comprehensibly. - Share of "completely agree": 86%
- I developed my digital competences through the workshop. - Share of "completely agree": 82%
- Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking. - Share of "completely agree": 80%
- Through the workshop, I developed natural science competences. - Share of "completely agree": 76%
- I developed energy literacy through the workshop. - Share of "completely agree": 20%
- The workshop influenced my understanding of the topic under discussion. - Share of "completely agree": 88%
- The workshop motivated me to continue working in this field. - Share of "completely agree": 84%
- I will use the acquired knowledge or competences in my work or studies. - Share of "completely agree": 82%

Summary of the analysis:

- A summary of the analysis shows that the majority of workshop participants expressed high satisfaction with most aspects of the workshop. The selection of the term, the length of the workshop and the consistency of the description with the implementation received high marks, with more than 90% of the participants fully agreeing with these statements.
- Challenges that need to be addressed for possible improvements in future workshops include the need for self-evaluation of the acquired knowledge and the possibility of separate basic and advanced levels.
- Most of the participants expressed that through the workshop they developed their digital competences, algorithmic, logical and abstract thinking skills and that they are ready to use the acquired knowledge or competences in their work or studies. This shows the positive impact of the workshop on the participants and confirmation of the success of the implementation.

6. Feedback Analysis: HOW TO CREATE AN AI MODEL?

Lecturer: res. asst. Barbara Arcet and asst. prof. Rene Markovič

Implementation of the event: 18.6.2024

Event duration: 90 min

Event set: computational

n = 10

VU = 4, VS = 2, student = 2, graduate = 1, young researcher = 1

Average score for each statement:

- Selection of the workshop date: 5.0
- Length of the workshop: 5.0
- Workshop description: 5.0
- Self-evaluation: 1.75
- Basic and advanced level: 3.75
- Visual and comprehensible content: 4.5
- Digital competences: 5.0
- Algorithmic Thinking: 5.0
- Natural science competences: 4.5
- Energy literacy: 2.5
- Impact on perceptions: 4.5
- Motivation for learning: 4.5
- Application of acquired knowledge: 4.5

Proportion of "strongly agree" for each statement:

- Selection of the workshop date: 100%
- Length of workshop: 100%
- Workshop description: 100%
- After the workshop, I would like the possibility of self-evaluation: 0%
- The workshop would require a separate basic and advanced level: 25%
- Visual and comprehensible content: 75%
- Development of digital competences: 100%
- Development of algorithmic thinking competences: 100%
- Development of science competences: 75%
- Development of energy literacy: 0%
- Impact on perceptions of the topic under discussion: 100%
- Motivation for further learning: 100%
- Application of acquired knowledge in practice: 100%

Summary of the analysis:

- All participants fully agreed that the selection of the workshop date was appropriate, which indicates a successful adaptation of the time frame to their needs.
- A high proportion (100%) of the participants confirmed that the length of the workshop was appropriate, which indicates good planning and adaptability in view of the complexity of the discussed topic.
- The majority of participants (75%) assessed that the content of the workshop was presented clearly and comprehensibly, which is the key to successful communication and understanding between the participants.
- All participants expressed motivation for further learning (100%), which indicates the positive impact of the workshop on personal development and professional growth.

POTENTIAL PROBLEMS

During this period, the project activities have been running according to the original plan, and no major problems have been detected. Activity A2 is still ongoing and is expected to be completed by January 2025.

CONCLUSIONS

The interim report summarizes the findings of the project activities conducted from January 1, 2024, to August 31, 2024. During this period, significant focus was placed on sub-activities A3.1 (preparation of workshops), A3.2 (promotion of workshops), A3.3 (execution of workshops), and A3.4 (evaluation of workshops).

We held seven workshops, attended by a total of 136 participants, and issued 75 certificates of participation. An evaluation form was prepared for the workshops, and evaluations are conducted in real-time to enable prompt responses to participant feedback.

To gather as much relevant information as possible for defining the required level of competence development for graduates of selected study programs (A2.2), we upgraded the document analysis. We reviewed the subject-specific competencies and fundamental goals of the selected study programs and found that some subject-specific competencies are related to digital competencies, with an average of 49% across all study programs. It is anticipated that the UN Mathematics study program will emphasize algorithmic, logical, and abstract thinking competencies, while the UN Physics program will focus on natural science competencies. Energy literacy is less prevalent among competencies and goals, except in the Educational Physics subject teacher program.

During this period, the project council members are also developing a competence framework to define the levels for competencies in energy literacy, sustainability, and the green transition. This framework will be presented in the next interim report, which will also include findings on the achieved and required levels of digital competences.

Appendices 3, 4 and 5 are machine translated by Google.

APPENDICES

APPENDIX 1: INSTRUMENTARY FOR REVIEWING THE FUNDAMENTAL OBJECTIVES AND COMPETENCES OF THE SELECTED STUDY PROGRAMS

Subject teacher – general competences

General competences	digital competences	natural science competences	computational competences	energy literacy	corresponding study units
1. Ability to communicate, collaborative/team work.					
2. Synthetic, analytical, creative thinking for solving problems.					
3. Flexible use of knowledge in practice.					
4. Autonomy, (self) criticism, (self) reflexivity, ability to (self) evaluate and strive for quality.					
5. General knowledge, ability to communicate with experts from other professional and scientific fields.					
6. Initiative/ambitiousness, value of continuous personal development and professional training.					
7. Information literacy.					
8. Time management skills, self-preparation and planning, self-control of the implementation of plans.					
9. Communicating in a foreign language.					
10. Knowledge and understanding of social systems (especially processes in education).					
11. Sensitivity/openness to people and social situations.					
12. Knowledge and understanding of developmental laws, differences and individual needs.					
13. Knowledge of educational and educational concepts, their philosophical and historical foundations.					
14. Knowledge and understanding of institutional work frameworks (requirements, legislation, documentation					
15. Use of information and communication technology in education.					
16. Understanding individual values and value systems, mastering professional-ethical issues.					
17. Knowledge, understanding, orientation towards inclusive, non-discriminatory work, multiculturalism.					
18. Knowledge of the content and methodology of the field.					
19. Understanding and application of curricular theories and general and didactic knowledge in the subject area.					
20. Interdisciplinary linking of contents.					
21. Use of special pedagogical skills to work with children with special needs.					
22. Organizational skills for pedagogical management of a class and/or group.					
23. Ability to organize active and independent learning, training students for effective learning.					
24. Ability to check and evaluate students' knowledge and achievements, as well as form feedback.					
25. Communicating with experts from various educational fields.					
26. Cooperation with parents.					
27. Forming a comprehensive assessment of the individual's needs or groups, their strong and weak areas, taking into					

Educational physics

Subject specific competences	digital competences	natural science competences	computational competences	energy literacy	corresponding study units
1. Developing the ability to logical thinking, knowledge of basic facts and laws of nature.					
2. Knowledge and understanding of fundamental physical concepts and their use in the interpretation of natural phenomena and events in the environment.					
3. Knowledge of the connection of physical systems with other systems in nature and society.					
4. Knowledge and understanding of the influence of physics on the development of technique and technology.					
5. Understanding and solving basic subject-specific professional (physical, information-communication, media) and educational problems on a qualitative and quantitative level.					
6. Use the approaches of natural science thinking for the quantitative treatment of problems in nature, environment and society.					
7. Connecting the macroscopic and microscopic interpretation of phenomena.					
8. Basic understanding of environmental issues and the importance of physics in preventing and reducing pollution.					
9. Theoretical and experimental-technical skills for solving problems.					
10. Mastery of basic and more demanding measurement methods of subject-specific professional and educational fields.					
11. Use of information and communication technology in theoretical and experimental work.					
12. Organizing project, group and laboratory work.					
13. Qualification for safe experimentation or laboratory work, the ability to assess work hazards, knowledge of safety regulations and compliance with them.					
14. Mastery of field work skills.					
15. Theoretical and practical knowledge for effective integration of information and communication technologies in subject-specific professional and educational fields.					
16. Knowledge of the maintenance and management procedures of audio-visual or media technologies.					
17. Knowledge of maintenance and management procedures of information and communication technologies.					
18. Competence for managing interesting activities in natural sciences, technology and computer science.					
19. Knowledge of the procedures for establishing, maintaining and managing e-education systems of small, medium and large systems (companies, educational institutions...).					
20. Knowledge of the procedures for establishing, maintaining and managing distance education systems of small, medium and large systems (companies, educational institutions...).					

Educational Mathematics

Subject specific competences	digital competences	natural science competences	computational competences	energy literacy	corresponding study units
1. Professional mastery of curricula, contents and concepts of elementary and secondary school mathematics to create such learning conditions in which students are enabled to build quality knowledge (sustainability, transferability, integrity).					
2. Competence in formulating goals, planning and implementing lessons, and evaluating knowledge in mathematics lessons for the balanced development of students' mathematical skills (conceptual, procedural, problem and communication skills).					
3. Independent evaluation, selection and use of existing teaching materials, didactic aids and ICT in mathematics lessons (graphics calculators, mathematical programs, interactive whiteboards, internet...).					
4. The ability to provide students with appropriate professional literacy in mathematical language.					
5. Inclusion of professional terminology from professional-theoretical subjects also in mathematics lessons in secondary school.					
6. Sovereign mastery of specific organizational forms of mathematics lessons: designing project days, leading groups (mathematics, logic, recreational mathematics), mentoring in research tasks.					
7. The ability to plan and implement cross-curricular lessons together with teachers of other subjects.					
8. Sovereign dealing with modern didactic knowledge and the integration of current approaches to learning (e.g. combined education): critical and thoughtful integration of innovations into teaching practice.					

Physics

General Competences	digital competences	natural science competences	computational competences	energy literacy	corresponding study units
the ability of systems thinking, which enables the graduate to join interdisciplinary groups for dealing with complex systems in various fields in the natural sciences, banking, insurance, solving environmental problems,					
the ability to analyze complex systems, which is the basis for understanding the functioning of systems in nature, the environment and society,					
knowledge of the structure and operation of physical systems and the application of this knowledge to other areas,					
the ability to apply knowledge in practice,					
solving professional and work problems by finding sources of knowledge and using scientific methods,					
cooperation and teamwork.					
Subject specific competencies					
knowledge and understanding of physical systems,					
knowledge and understanding of basic physical concepts and their use in the interpretation of natural phenomena and events in the environment,					
knowledge of the connection of physical systems with other systems in nature and society,					
understanding and solving basic physical problems on a qualitative and quantitative level,					
to use the approaches of natural science thinking for the quantitative treatment of problems in nature, the environment and society,					
competence for safe field and laboratory experimentation, the ability to assess work hazards, knowledge of safety regulations and compliance with them,					
display and interpretation of experimental data and their connection with theory, assessment of the accuracy of measured quantities,					
developing computational skills for solving problems and the ability to estimate the order of magnitude and units of results,					
the ability to participate in project, group and laboratory work,					
planning project, group and laboratory work, connecting macroscopic and microscopic interpretation of phenomena,					
knowledge and understanding of the influence of physics on the development of technique and technology,					
basic understanding of environmental issues and the importance of physics in preventing and reducing pollution.					
Goals					
the ability to think logically					
identifying problems and approaches to solving them					
able to work with the support of modern communication, information and computer systems.					

Mathematics

General Competences	digital competences	natural science competences	computational competences	energy literacy	corresponding study units
The ability to think analytically and understand					
Knowledge of basic mathematical areas and					
A critical assessment of developments in the field					
Solving professional and work problems by					
Development of communication skills.					
Autonomy in professional work.					
Cooperativeness and teamwork.					
Subject-specific competences					
Understanding and solving basic mathematical					
Ability to describe a given situation using					
Ability to explain their understanding of					
Solve mathematical (and other) problems using					
Use an algorithmic approach: Develop an algorithm					
Develop the ability to analyze a given problem					
Be able to deduce new logical conclusions from					
Confidently face a given mathematical problem and					
Use the approaches of natural science thinking for					
Knowledge and understanding of the influence of					

Civil Engineering VS

General competences	digital competences	natural sciene competences	computational competences	energy literacy	corresponding study units
The qualification that, on the basis of acquired basic knowledge of basic natural sciences, informatics, geodesy, engineering ethics, basic sciences of the construction profession and basic professional knowledge of the construction profession, they will be able to design and implement construction works in terms of appropriate quality and price, and to carry out an independent expert assessment of construction problems on based on scientific and professional analysis and synthesis.					
The ability to anticipate solutions and consequences.					
Mastery of the basics of research methods, procedures and processes, as well as the ability to make critical and self-critical judgments.					
Communication abilities and skills in the domestic and international environment					
Autonomy in professional work					
Ethical reflection and commitment to professional ethics.					
Ability to apply knowledge in practice.					
Ability and sense to solve practical problems.					
Cooperativeness for working in groups in a domestic and international environment					
Qualification of creative work in a team of construction designers and contractors.					
Ability to connect the basics of engineering economics and the issue of environmental protection with the issue of designing building structures and building products.					
Creativity and innovation as a result of interdisciplinary study.					
Subject-specific competences					
Knowledge in the field of design, organization, management and management of construction works and construction production, construction informatics, ecology, urban planning and environmental policy.					
Understanding the construction profession from the point of view of historical development					
Communicating within the organization and externally with partners and customers (subjects Construction, Economics in construction, Organization of construction works...).					
The ability to solve individual (less demanding) work problems using professional knowledge and the application of scientific methods and procedures.					
The graduate is qualified to independently and creatively perform normal professional tasks in the field of construction, is able to perform individual more demanding tasks within the group, and to assist in the management of existing technological procedures in the first indent of the activities described and their updating.					
The graduate will be able to dimension construction elements and design entire buildings, which are defined by the ZGO-I for such a profile and level of education, and the graduate can achieve increased independence and legal responsibility for demanding work with appropriate practice as defined by the ZGO-I.					

Civil Engineering UN

General competences	digital competences	natural sciene competences	computational competences	energy literacy	corresponding study units
Qualification that, on the basis of acquired fundamental knowledge of basic natural sciences, informatics, geodesy, engineering ethics, basic sciences of the construction profession and basic professional knowledge of the construction profession, they will be able to design and implement construction works in terms of appropriate quality and price, and to carry out independent technical judgment based on scientific analysis and synthesis.					
On the basis of acquired basic knowledge of professional construction subjects, the qualification of creative work in a team of construction designers and contractors.					
Ability to connect the basics of engineering economics and the issue of environmental protection with the issue of designing building structures and building products.					
Greater creativity and innovation as a result of interdisciplinary studies.					
Ability to apply knowledge in practice.					
Ability to analyze, synthesize and anticipate solutions and consequences.					
Mastering the basics of research methods, procedures and processes, developing critical and self-critical judgment.					
Development of communication abilities and skills, including communication in an international environment.					
Ethical reflection and commitment to professional ethics.					
Cooperativeness, working in a group, both in an interdisciplinary and international environment.					
Subject-specific competences					
Knowledge in the field of design, organization, management and management of construction works and construction production, construction informatics, ecology, urban planning and environmental policy.					
Knowledge and understanding of the rationale and historical development of construction science (subject "Introduction to construction").					
Communicating within the organization and externally with partners and customers (subjects "Ethics and Engineering", "Construction Organization").					
Ability to solve individual (less demanding) work problems using scientific methods and procedures.					
The graduate is capable of independent dimensioning of construction elements, but does not yet connect them into wholes (objects), and therefore is not capable of designing entire objects.					
The graduate is qualified to independently and creatively perform certain (less demanding) tasks in the field of construction, is able to perform individual more demanding tasks within the group, and to assist in the management of existing technological procedures in the activities described in the first indent and their updating.					
Coherent mastery of fundamental knowledge (science, mathematics, informatics, mechanics, building materials) and the ability to connect knowledge from different fields and their applications.					
The use of information and communication technology and systems in the fundamental and basic professional field.					
The ability to place new information and interpretations in the context of the underlying discipline.					
Understanding the general structure of the core discipline and the connection between its sub-disciplines.					
Development of skills and abilities in the application of knowledge in a specific professional field.					

APPENDIX 2: INSTRUMENTARY FOR RECORDING THE ACHIEVED AND REQUIRED LEVEL OF DIGITAL COMPETENCES

	completed study program					
	FIZ UN	MAT UN	PU IZO FIZ	PU IZO MAT	GRADB UN	GRADB VS
1. INFORMATION AND DATA LITERACY						
FILTERING DATA, INFORMATION AND						
INFORMATION AND DIGITAL CONTENT						
CONTENT MANAGEMENT						
2. COMMUNICATION AND COLLABORATION						
TECHNOLOGIES						
TECHNOLOGIES						
DIGITAL TECHNOLOGIES						
TECHNOLOGIES						
2.5 ONLINE ETIQUETTE						
2.6 DIGITAL IDENTITY MANAGEMENT						
3. CREATION OF DIGITAL CONTENTS						
CONTENTS						
DIGITAL CONTENT						
3.3 COPYRIGHTS AND LICENSES						
3.4 PROGRAMMING						
4. SECURITY						
4.1 CARE FOR DEVICE SAFETY						
AND PRIVACY						
4.3 CARE FOR HEALTH AND WELFARE						
4.4 ENVIRONMENTAL PROTECTION						
5. PROBLEM SOLVING						
5.1 SOLVING TECHNICAL PROBLEMS						
DEFINITION OF TECHNOLOGICAL						
TECHNOLOGY						
COMPETENCES						

APPENDIX 3: OVERVIEW OF FUNDAMENTAL OBJECTIVES AND COMPETENCES - FNM UM

PU - general competences	0 or 1				
General competences	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMICALLY, LOGICALLY, ABSTRACT THINKING	ENERGY LITERACY	The analyzed learning units in which the latter develops
1. Ability to communicate, collaborative/team work.	1	1			Didactics of secondary school mathematics, Didactics of elementary school mathematics, Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Seminar, Online applications v to education, Mathematics in the interdisciplinary innovation process, New approaches to teaching mathematics
2. Synthetic, analytical, creative thinking for solving problems.	1	1	1		Algebraic structures, Analysis, Differential equations in context, Selected chapters from analysis, Creative solving mathematical problems, Combinatorics and probability, Basics of analysis, Matrix calculus, Basics of theory
3. Flexible use of knowledge in practice.	1	1	1		Didactics of secondary school mathematics, Didactics of primary school mathematics, Differential equations in context, Selected chapters from analysis, Creative solving of mathematical problems, Combinatorics and probability, Basics graph theory, Statistics in education, Introduction to mathematics, Selected chapters from algebra, Mathematical curves, Newer Approaches to Teaching Mathematics, Computer Practicum
4. Autonomy, (self-)criticism, (self-)reflexivity, ability to (self-)evaluate and strive for quality.	1		1		Didactics of secondary school mathematics, Didactics of primary school mathematics, Differential equations in context, Selected chapters from analysis, Creative solving of mathematical problems, Combinatorics and probability, Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Seminar, Introduction to Mathematics, Financial Mathematics, New Approaches to Teaching Mathematics
5. General knowledge, ability to communicate with experts from other professional and scientific fields areas.		1			desire: through all subjects
6. Initiative/ambitiousness, value of continuous personal development and professional training.					
7. Information literacy.	1		1		Didactics of secondary school mathematics, Didactics of elementary school mathematics, Seminar, Online applications in to education, Mathematics in the interdisciplinary innovation process, New approaches to teaching Mathematics, Operations Research, Basics of Combinatorial Optimization, Software for Mathematics, Computer practicum, User software in education
8. Time management skills, self-preparation and planning, self-control of the implementation of plans.	1		1		Didactics of secondary school mathematics, Didactics of primary school mathematics, Creative solving of mathematical problems assignments, Basics of graph theory, Metric spaces, Basics of combinatorial optimization, Computer practical
9. Communicating in a foreign language.					foreign literature
10. Knowledge and understanding of social systems (especially processes in education).			1		Creative solving of mathematical problems
11. Sensitivity/openness to people and social situations.					through common subjects (pedagogical module)
12. Knowledge and understanding of developmental laws, differences and individual needs.					through common subjects (pedagogical module)
13. Knowledge of educational and educational concepts, their philosophical and historical foundations.					through common subjects (pedagogical module)
14. Knowledge and understanding of institutional work frameworks (requirements, legislation, documentation needs, legal aspects of educational work).	1				Didactics of secondary school mathematics, Didactics of elementary school mathematics
15. Use of information and communication technology in education.	1		1		Didactics of secondary school mathematics, Didactics of elementary school mathematics, Practical training for teaching mathematics 1, Plane and space geometry, Practical training for teaching mathematics 2, Statistics in education, Seminar, Differential equations in context, Combinatorics and probability, Matrix calculus, Number theory, Introduction to mathematics, Algorithms and data structures, Financial mathematics, Geometry, Fractals, Educational programming languages, New approaches to teaching mathematics, Basics of Combinatorial Optimization, Software for Mathematics, Computer Lab, User software in education
16. Understanding individual values and value systems, mastering professional-ethical ones questions.					through common subjects (pedagogical module)
17. Knowledge, understanding, orientation towards inclusive, non-discriminatory work, multiculturalism.					through common subjects (pedagogical module)
18. Knowledge of the content and methodology of the field.	1	1	1		All items?
19. Understanding and application of curricular theories and general and didactic knowledge on the subject area.	1		1		Didactics of secondary school mathematics, Didactics of elementary school mathematics, Practical training for teaching mathematics 1, Practical training for teaching mathematics 2
20. Interdisciplinary linking of contents.	1		1		Didactics of secondary school mathematics, Didactics of primary school mathematics, Creative solving of mathematical problems assignment, Plane and spatial geometry, Seminar, Number theory, Algorithms and data structures, Geometry, Selected chapters from algebra, Online applications in education, Educational programming languages, Mathematical curves, Metric spaces, Mathematics in the interdisciplinary innovation process, Operational research, Basics of combinatorial optimization, User software in education, History mathematics
21. Use of special pedagogical skills to work with children with special needs.	1		1		Newer Approaches to Teaching Mathematics
22. Organizational skills for pedagogical management of a class and/or group.	1		1		Didactics of secondary school mathematics, Didactics of elementary school mathematics, Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Mathematics v interdisciplinary innovation process, Operational research
23. Ability to organize active and independent learning, training students for effective learning.	1		1		Didactics of secondary school mathematics, Creative solving of mathematical problems, Basics of graph theory, Newer approaches to teaching mathematics, Software for mathematics

24. Ability to check and evaluate students' knowledge and achievements, as well as create feedback information.	1		1		Didactics of secondary school mathematics, Practical training for teaching mathematics 1, Practical training to teach mathematics 2, Operations Research
25. Communicating with experts from various educational fields.					through practice and performances
26. Cooperation with parents.					through practice and performances
27. Forming a comprehensive assessment of the individual's needs or groups, their strong and weak areas at consideration of environmental factors (physical, social, cultural).					through practice and performances
percentage of objectives covering a specific competency:	**56%**	**19%**	**52%**	**0%**	

Most of the goals include the development of digital competences, half of them the development of computational competences, to a lesser extent the general goals are related to natural science competences. We do not recognize energy literacy in any goal. Some goals are not developed concretely through subjects, but indirectly through the practical training of students.

PU EDUCATIONAL PHYSICS	0 or 1				
Subject specific	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMICALLY, LOGICALLY, ABSTRACT THINKING	ENERGY LITERACY	The analyzed learning units in which the latter develops
1. Developing the ability of naturalistic thinking, knowledge of fundamental facts and laws of nature.		1			Computational physics, Mechanics, Electromagnetism, Physical experiments 1, Oscillations and waves, Physical experiments 2, Thermodynamics, Modern physics, Physical experiments 3, Complex systems, Physical experiments 4, Physical measurements, Environmental physics, Applied physics, Didactics of astronomy, Astronomical observations, Didactics of physics 1 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Modeling of system dynamics, Numerical methods in physics, Mathematical methods in physics, Introduction to photonics, Fluid physics, Acoustics, Analytical mechanics, Mechanics of continuums, Physics in medicine, Dynamics of games, Nonlinear dynamic systems, E-education and information technology in physics, Development of competences in teaching physical content, Structure of formal physics education, Informal education of physical content and youth research work, Scientific and research work in physical education with the basics of pedagogical statistics.
2. Knowledge and understanding of fundamental physical concepts and their use in the interpretation of natural phenomena and events in the environment.		1		1	Computational physics, Mechanics, Electromagnetism, Physical experiments 1, Oscillations and waves, Physical experiments 2, Thermodynamics, Modern physics, Physical experiments 3, Complex systems, Physical experiments 4, Physical measurements, Environmental physics, Applied physics, Didactics of astronomy, Astronomical observations, Didactics of physics 1 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Modeling of system dynamics, Numerical methods in physics, Mathematical methods in physics, Introduction to photonics, Fluid physics, Acoustics, Analytical mechanics, Mechanics of continuums, Physics in medicine, Dynamics of games, Non-linear dynamic systems, E-education and information technology in physics, Development of competences in teaching physics content, Structure of formal physics education, Informal education of physics content and youth research work.
3. Knowledge of the connection of physical systems with other systems in nature and society.		1		1	Mechanics, Electromagnetism, Physical Experiments 1, Oscillations and Waves, Physical Experiments 2, Thermodynamics, Modern Physics, Physical Experiments 3, Complex Systems, Physical Experiments 4, Physical Measurements, Environmental Physics, Applied Physics, Didactics of Astronomy, Introduction to Photonics, Physics in of medicine, Nonlinear dynamical systems, Structure of formal physics education.
4. Knowledge and understanding of the influence of physics on the development of technique and technology.	1	1		1	Computational physics, Mechanics, Electromagnetism, Physical experiments 1, Oscillations and waves, Physical experiments 2, Thermodynamics, Modern physics, Physical experiments 3, Complex systems, Physical experiments 4, Physical measurements, Environmental physics, Applied physics, Didactics of astronomy, Astronomical observations, Didactics of physics 1 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Modeling of system dynamics, Introduction to photonics, Acoustics, Analytical mechanics, Physics in medicine, Nonlinear dynamical systems, E-learning and information technology in physics, The structure of formal physics education.
5. Understanding and solving basic subject-specific professional (physical, information-communication, media) and educational problems on a qualitative and quantitative level.	1		1	1	Computational physics, Mechanics, Electromagnetism, Physical experiments 1, Oscillations and waves, Physical experiments 2, Thermodynamics, Modern physics, Physical experiments 3, Complex systems, Physical experiments 4, Physical measurements, Environmental physics, Applied physics, Didactics of astronomy, Astronomical observations, Didactics of Physics 1 with practicum, Didactics of Physics 2 with practicum, Practical Training for Teaching Physics 1, Practical Training for Teaching Physics 2, System Dynamics Modeling, Numerical Methods in Physics, Introduction to Photonics, Physics of Fluids, Acoustics, Analytical Mechanics, Continuum Mechanics, Game dynamics, Non-linear dynamic systems, E-education and information technology in physics, Development of competences in the teaching of physics content, Structure of formal physics education, Informal education of physics content and youth research work, Scientific research work in physics education with the basics of pedagogical statistics.

6. To use the approaches of natural science thinking for the quantitative treatment of problems in nature and the environment and society.	1	1	1	1	Computational physics, Mechanics, Electromagnetism, Physical experiments 1, Oscillations and waves, Physical experiments 2, Thermodynamics, Modern physics, Physical experiments 3, Complex systems, Physical experiments 4, Physical measurements, Environmental physics, Applied physics, Didactics of astronomy, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Modeling of system dynamics, Mathematical methods in physics, Introduction to photonics, Fluid physics, Acoustics, Analytical mechanics, Mechanics continuums, Physics in medicine, Dynamics of games, Nonlinear dynamical systems.
7. Connecting macroscopic and microscopic interpretation of phenomena.		1	1	1	Computational physics, Mechanics, Oscillations and waves, Thermodynamics, Modern physics, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Modeling of system dynamics, Analytical mechanics, Physics in medicine.
8. Basic understanding of environmental issues and the importance of physics in preventing and reducing pollution.		1	1	1	Mechanics, Environmental Physics, Astronomical Observations, Didactics of Physics 1 with practicum, Didactics of Physics 2 with practicum, Practical Training for Teaching Physics 1, Practical Training for Teaching Physics 2, E-learning and Information Technology in Physics.
9. Theoretical and experimental-technical skills for solving problems.	1	1	1		Computational physics, Mechanics, Electromagnetism, Physical experiments 1, Physical experiments 2, Thermodynamics, Physical experiments 3, Physical experiments 4, Physical measurements, Didactics of astronomy, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical teaching training Physics 1, Practical Training for Teaching Physics 2, Modeling System Dynamics, Numerical Methods in Physics, Introduction to Photonics, Physics of Fluids, Acoustics, Analytical Mechanics, Continuum Mechanics, Physics in Medicine.
10. Mastery of basic and more demanding measurement methods of subject-specific professional and educational fields.	1	1	1		Computational physics, Mechanics, Electromagnetism, Physics experiments 1, Physics experiments 2, Thermodynamics, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Modeling of system dynamics, Introduction to photonics, Physics in medicine, Structure of formal physics education.
11. Use of information and communication technology in theoretical and experimental work.	1				Computational physics, Mechanics, Electromagnetism, Physics experiments 1, Physics experiments 2, Physics experiments 3, Physical measurements, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2 , Modeling of system dynamics, Numerical methods in physics, Mathematical methods in physics, Introduction to photonics, Physics in medicine, Dynamics of games, Nonlinear dynamic systems, E-learning and information technology in physics, Competence development in teaching physics content, Structure of formal physics education , Informal education of physical content and youth research work, Scientific research work in physical education with the basics of pedagogical statistics.
12. Organizing project, group and laboratory work.		1			Didactics of physics
13. Qualification for safe experimentation or laboratory work, the ability to assess work hazards, knowledge of safety regulations and conduct in 14. Mastering the skills of		1	1	1	Mechanics, Electromagnetism, Physics experiments 1, Physics experiments 2.
field work.		1			Didactics of physics, Physics of the environment

15. Theoretical and practical knowledge for effective integration of information and communication technologies in subject-specific professional and educational fields.	1				Computational physics, Mechanics, Electromagnetism, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Physics in medicine, E-learning and information technology in physics, Development of competences in the teaching of physical content.
16. Knowledge of the maintenance and management procedures of audio-visual or media technologies.	1				Mechanics, Physics in medicine.
17. Knowledge of maintenance and management procedures of information and communication technologies.	1				Mechanics, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Physics in medicine.
18. Competence for managing interesting activities in natural sciences, engineering and computer science.					practical training
19. Knowledge of the procedures for establishing, maintaining and managing e-education systems of small, medium and large systems (companies, educational institutions...).	1				Mechanics, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Physics in medicine, E-learning and information technology in physics.
20. Knowledge of the procedures for establishing, maintaining and managing distance education systems of small, medium and large systems (companies, educational institutions...).	1				Mechanics, Astronomical observations, Didactics of physics 1 with practicum, Didactics of physics 2 with practicum, Practical training for teaching physics 1, Practical training for teaching physics 2, Physics in medicine, E-learning and information technology in physics.
percentage of objectives covering a specific competency:	**55%**	**60%**	**35%**	**40%**	

ALL OBJECTIVES COVERED. To a lesser extent, competences are related to computational competences, most of them are related to natural science and digital competences. More than a third of competencies are related to energy literacy.

PU EDUCATIONAL MATHEMATICS	0 or 1				
Subject specific	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMICALLY, LOGICAL, ABSTRACT THINKING	ENERGY LITERACY	Analyzed learning units in which the latter develops
1. Professional mastery of curricula, contents and concepts of elementary and secondary school mathematics to create such learning conditions in which students are enabled to build quality knowledge (sustainability, transferability, integrity).	1		1		Creative solving of mathematical problems, Selected chapters from analysis, Analysis, Basics of analysis, Number theory, Plane and spatial geometry, Combinatorics and probability, Matrix calculus, Differential equations in context, Statistics in education, Fractals, Geometry, Mathematical curves, Didactics of primary school mathematics, Didactics of secondary school mathematics, Metric spaces
2. Competence in formulating goals, planning and implementing lessons, and evaluating knowledge in mathematics lessons for the balanced development of students' mathematical skills (conceptual, procedural, problem and communication skills).	1	1	1		Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Didactics of primary school mathematics, Didactics of secondary school mathematics
3. Sovereign evaluation, selection and use of existing teaching materials, didactic aids and ICT in mathematics lessons (graphics calculators, mathematical programs, interactive whiteboards, internet...).	1		1		Matrix calculus, Mathematical modeling, Plane and spatial geometry, Algebraic structures, Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Didactics of primary school mathematics, Didactics of secondary school mathematics, Online applications in education, Educational programming languages, Newer approaches to teaching mathematics , Software for mathematics, Computer lab, User software in education
4. The ability to provide students with appropriate professional literacy in mathematical language.	1	1	1		Introduction to mathematics, Matrix calculus, Selected chapters from analysis, Number theory, Combinatorics and probability, Analysis, Basics of analysis, Plane and spatial geometry, Creative solving of mathematical problems, Basics of graph theory, Differential equations in context, Statistics in education, Theory of sets, Continued Fractions, History of Mathematics
5. Inclusion of professional terminology from professional-theoretical subjects also in mathematics lessons in secondary school.	1		1		Introduction to mathematics, Creative solving of mathematical problems, Selected chapters from analysis, Analysis, Fundamentals of analysis, Number theory, Plane and spatial geometry, Combinatorics and probability, Matrix calculus, Didactics of secondary school mathematics, Differential equations in context, Statistics in education, Fractals, Geometry, Mathematical curves, Mathematics in the interdisciplinary innovation process, Metric spaces
6. Sovereign mastery of specific organizational forms of mathematics lessons: designing project days, leading groups (mathematics, logic, recreational mathematics), mentoring in research tasks.	1				Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Seminar
7. The ability to plan and implement cross-curricular lessons together with teachers of other subjects.	1				Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Didactics of primary school mathematics, Didactics of secondary school mathematics, Mathematical curves, Mathematics in the interdisciplinary innovation process, Operations research, Basics of combinatorial optimization, Computer practicum, History of mathematics
8. Sovereign dealing with modern didactic knowledge and the integration of current approaches to learning (e.g. combined education): critical and thoughtful integration of innovations into teaching practice.	1	1	1		Practical training for teaching mathematics 1, Practical training for teaching mathematics 2, Mathematical modelling, Didactics of primary school mathematics, Didactics of secondary school mathematics, Statistics in education, Plane and spatial geometry, Online Applications in Education, Educational Programming Languages, Newer Approaches to Teaching Mathematics, Operations Research, Software for Mathematicians, Basics of Combinatorial Optimization, Computer Lab, User Software in Education
percentage of objectives covering a specific competency:	100%	38%	75%	0%	

ALL OBJECTIVES COVERED. All goals include the development of digital competences, the vast majority of computational competences, and to a lesser extent naturalistic competences. Energy literacy is not represented among the basic goals/competencies of the graduate. All goals can be linked to any of the four competencies.

UNIVERSITY OF PHYSICS	0 or 1				
General competences	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMICALLY, LOGICALLY, ABSTRACT THINKING	ENERGY LITERACY	The analyzed learning units in which the latter develops
the ability of systems thinking that enables the graduate's inclusion in interdisciplinary groups to deal with complex systems on different fields in natural sciences, banking, insurance, solving environmental problems, the ability	0	1	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
to analyze complex systems, which is the basis for understanding the functioning of systems in nature, environment and society,	0	1	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
knowledge of the structure and operation of physical systems and the application of these skills to other areas,	0	1	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
the ability to apply knowledge in practice,	0	1	1	0	UF, FO, M, NV, E1-E4, RF, FM
solving professional and work problems with searching for sources of knowledge and using scientific methods,	0	1	0		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
cooperation and teamwork.	0	1	0	0	
Subject-specific competences					
knowledge and understanding of physical systems,	0	1	0		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
knowledge and understanding of basic physics concepts and their use in the interpretation of natural phenomena and events in the	0	1	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
environment, knowledge of the connection of physical systems with others systems in nature and society,	0	1	1	0	UF, FO, M, NV, MF, FM
understanding and solving basic physics problems on a qualitative and quantitative level,	0	1	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
apply the approaches of naturalistic thinking to quantitative treatment of problems in nature, environment and	0	1	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
society, training for safe field and laboratory work experimentation, ability to assess hazards work, knowledge of safety regulations and behavior in according to	0	1	0	0	E1-E4, FM
them, display and interpretation of experimental data and their connection to theory, assessment of accuracy measured quantities,	1	1	1	0	UF, M, NV, E1-E4, RF, FM

developing computational skills for solving of problems and the ability to estimate the order of magnitude and units of results,	0	1	0		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
the ability to integrate into project, group and laboratory work,	0	1	0	0	E1-E4, RF, FM
planning project, group laboratory work, connecting and macroscopic and microscopic explanations of	0	1	1	0	M, NV, E1-E4, RF, MF, FM, T, EM
phenomena, knowledge and understanding of the influence of physics on development techniques and	0	1	0	0	
technologies, basic understanding of environmental issues and the importance of physics in prevention and reduction pollution.	0	1	0	1	UF, FO, T
additionally from the basic objectives					
the ability to think logically	0	0	1		UF, FO, M, NV, E1-E4, RF, MF, 0 FM, T, EM
recognition of problems and approaches to solving them, capable of	0	1	0	0	UF, FO, M, NV, E1-E4, RF, MF, FM, T, EM
working with the support of modern communication, information and computer systems.	1	0	1	0	UF, M, NV, E1-E4, RF, FM, EM
percentage of objectives covering a specific competency:	**10%**	**90%**	**57%**	**5%**	

ALL OBJECTIVES COVERED - developed through learning units. Most of the goals are related to natural science competences, most computational competences, to a lesser extent digital competences, very little energy literacy. All goals can be linked to any of the four competencies.

MATHEMATICS UN	0 or 1				
General competences	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMIC, LOGICAL, ABSTRACT THINKING	ENERGY LITERACY	The analyzed learning units in which the latter develops
The ability to think analytically and understand more complex systems that enable about the graduate's involvement in various interdisciplinary groups.	1	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and matrices, Linear algebra, Fundamentals of computing and informatics, Plane and spatial geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Knowledge of basic mathematical areas and applications transfer of knowledge to other fields.	1	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and matrices, Linear algebra, Introduction to differential equations, Fundamentals of computer science and informatics
Critical assessment of developments in the field of mathematics.					
Solving professional and work problems by finding sources of knowledge and using scientific methods.	1	1	1	0	Mathematical modeling
Development of communication skills.	0	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Autonomy in professional work.					THESIS
Cooperativeness and teamwork.	1	1	1	0	Mathematical modeling
Subject-specific competences					
Understanding and solving basic mathematical problems on a qualitative and quantitative level.	0	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Ability to describe a given situation using mathematical symbols and notation correctly.	0	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Ability to explain their understanding of mathematical concepts and principles.	0	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Solve mathematical (and other) problems using modern technology.	1	1	1	0	Basics of computing and informatics, Plane and spatial geometry, Statistics, Mathematical modeling
Use an algorithmic approach: Develop an algorithm to solve a given problem.	1	1	1	0	Basics of computing and informatics, Mathematical modeling

Develop the ability to analyze a given problem numerically, graphically and algebraically.	1	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Be able to deduce new logical conclusions from given data.	0	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Face the given math with confidence problem and find its solution.	1	1	1	0	Mathematical principles, Number sets and sequences, Analysis 1, Analysis 2, Analysis 3, Analysis 4, Vectors and Matrices, Linear Algebra, Plane and Spatial Geometry, Discrete Mathematics 1, Probability, Number Theory, Statistics, Introduction to Differential Equations, Mathematical Modeling, Geometry
Use the approaches of natural science thinking for the quantitative treatment of problems in nature, environment and society.	1	1	1	0	Basics of computing and informatics, Statistics, Mathematical modeling, Introduction to differential equations, Analysis 3
Knowledge and understanding of the influence of mathematics on the development of other sciences. percentage of objectives covering a specific competency:	1 59%	1 88%	1 88%	0 0%	Basics of computing and informatics, Statistics, Introduction to differential equations, Analysis 3

Most of the goals are related to natural science competences and computational competences, and the vast majority also to digital competences. Energy literacy is not represented among the basic goals/competencies of the graduate.

1 OBJECTIVE NOT COVERED BY THE LEARNING UNIT. All goals can be linked to any of the four competencies.

APPENDIX 4: OVERVIEW OF FUNDAMENTAL OBJECTIVES AND COMPETENCES - FGPA UM

CONSTRUCTION VS	0 or 1				
General competences	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMICALLY, LOGICALLY, ABSTRACT THINKING	ENERGY LITERACY	The analyzed learning units in which the latter develops
The qualification that, on the basis of acquired basic knowledge of basic natural sciences, informatics, geodesy, engineering ethics, basic sciences of the construction profession and basic professional knowledge of the construction profession, they will be able to design and implement construction works in terms of appropriate quality and price, and to carry out an independent expert assessment of construction problems on based on scientific and professional analysis and synthesis.	1	1	1	1	PHYS , GF, GMC, UVM, MVG, JK, LK, BK, Tem 1
The ability to anticipate solutions and consequences.		1	1	1	GF, JK, LK, BK, Tem 1, RiInf
Mastery of the basics of research methods, procedures and processes, as well as the ability to make critical and self-critical judgments.		1	1		MAT 1, UVM, MVG, JK, LK, BK, Tem 1, RiInf
Communication abilities and skills in the domestic and international environment					
Autonomy in professional work	1	1	1		JK, LK, BK, Tem 1
Ethical reflection and commitment to professional ethics.					
Ability to apply knowledge in practice.	1	1	1		MAT 1, GMC, UVM, JK, LK, BK, RiInf, MVG
Ability and sense to solve practical problems.	1	1	1	1	PHYS , GF, JK, LK, BK, Tem 1
Cooperativeness for working in groups in a domestic and international environment					
Qualification of creative work in a team of construction designers and contractors.	1	1	1		JK, LK, BK, Tem 1

Ability to connect the basics of engineering economics and the issue of environmental protection with the issue of designing building structures and building products.		1	1		JK, LK, BK, Tem 1
Creativity and innovation as a result interdisciplinary study.					
Subject-specific competences					
Knowledge in the field of design, organization, management and management of construction works and construction production, construction informatics, ecology, urban planning and environmental policy.	1	1			GMC
Understanding the construction profession from the point of view of					
historical development Communicating within the organization and externally with partners and customers (subjects Construction, Economics in construction, Organization of construction works...).					
The ability to solve individual (less demanding) work problems using professional knowledge and the application of scientific methods and procedures.	1	1	1		GMC, JK, LK, BK, Tem 1
The graduate is qualified to independently and creatively perform usual professional tasks in the field of construction, is able to perform individual more demanding tasks within the group, and to assist in the management of existing technological procedures in the activities described in the first indent and their updating.	1	1	1		JK, LK, BK, Tem 1
The graduate will be able to dimension building elements and design entire buildings, which are defined by the ZGO-I for such a profile and level of education, and the graduate can achieve increased independence and legal responsibility for demanding work with appropriate practice as defined by the ZGO-I.	1	1	1	1	GF, PHYSICS , MAT 1, GMC, JK, LK, BK, Tem 1
percentage of objectives covering a specific competency:	**50%**	**67%**	**61%**	**22%**	

CONSTRUCTION OF THE UN					
General competences	DIGITAL COMPETENCES	NATURAL SCIENCES COMPETENCES	ALGORITHMICALLY, LOGICALLY, ABSTRACT THINKING	ENERGY LITERACY	The analyzed learning units in which the latter develops
Qualification that, on the basis of acquired fundamental knowledge of basic natural sciences, informatics, geodesy, engineering ethics, basic sciences of the construction profession and basic professional knowledge of the construction profession, they will be able to design and implement construction works in terms of appropriate quality and price, and to carry out independent technical judgment based on scientific analysis and synthesis.	1	1	1	1	FIZ, GF, MAT A, MAT B, GMO, GRM, JK, LK, BK, Tem
On the basis of acquired basic knowledge of professional construction subjects, the qualification of creative work in a team of construction designers and contractors.	1	1		1	GMO, GRM, BK, Tem
Ability to connect the basics of engineering economics and the issue of environmental protection with the issue of designing building structures and building products.	1	1	1	1	GMO, GRM, JK, LK, BK, Tem
Greater creativity and innovation as a result of interdisciplinary studies.			1		MAT B
Ability to apply knowledge in practice.	1	1	1		MAT A, MAT B, FIZ, GF, GMO, 1 JK, LK, BK, Tem
Ability to analyze, synthesize and anticipate solutions and consequences.		1	1		MAT A, MAT B, JK, LK, BK, Tem
Mastering the basics of research methods, procedures and processes, developing critical and self-critical judgment.		1	1	1	MAT A, MAT B, FIZ, GF, GRM, JK, LK, BK, Tem
Development of communication abilities and skills, including communication in an international environment.					
Ethical reflection and commitment to professional ethics.					
Cooperativeness, working in a group, both in an interdisciplinary and international environment.					

Subject-specific competences					
Knowledge in the field of design, organization, management and management of construction works and construction production, construction informatics, ecology, urban planning and environmental policy.	1	1			GMOs,
Knowledge and understanding of the rationale and historical development of construction science (subject "Introduction to construction").					
Communicating within the organization and externally with partners and customers (subjects "Ethics and Engineering", "Construction Organization").					
Ability to solve individual (less demanding) work problems using scientific methods and procedures.	1	1	1		MAT A, MAT B, FIZ, GF, GMO, JK, LK, BK, Tem
The graduate is capable of independent dimensioning of building elements, but does not yet connect them into wholes (objects), so he is not capable of designing entire objects.	1	1	1		GMO, JK, LK, BK, Tem
The graduate is qualified to independently and creatively perform certain (less demanding) tasks in the field of construction, is able to perform individual more demanding tasks within the group, and to assist in the management of existing technological procedures in the activities described in the first indent and their updating.					
Coherent mastery of fundamental knowledge (natural sciences, mathematics, informatics, mechanics, building materials) and the ability to connect knowledge from different fields and their applications.	1	1	1		MAT A, MAT B, FIZ, GF, GMO, 1 JK, LK, BK, Tem
The use of information and communication technology and systems in the fundamental and basic professional field.					
The ability to place new information and interpretations in the context of the underlying discipline.		1	1	1	JK, LK, BK, Tem
Understanding the general structure of the core discipline and the connection between its sub-disciplines.		1	1		JK, LK, BK, Tem
Development of skills and abilities in the application of knowledge in a		1	1	1	JK, LK, BK, Tem
specific professional field. percentage of objectives covering a specific competency:	38%	62%	57%	38%	

APPENDIX 5: EVALUATION FORM

The power of proof and the development of algorithmic thinking in engineering students

Performer: ord. prof. dr. Matej Mencinger, FGPA UM, April 23 2024

Completing the evaluation form is anonymous and will help us organize workshops in the future.

* Mandatory

1. Job position / status: *

- ◯ College teacher
- ◯ Higher education associate
- ◯ Professional associate
- ◯ A student
- ◯ A graduate
- ◯ Young researcher
- ◯ Other

2. Employment / study at the faculty: *

3. **Information**
How did you find out about the workshop? *

- ◯ By publication on the website of the faculty
- ◯ On social networks
- ◯ By e-mail
- ◯ Other

4. **Information**
How would you like to be informed about workshops in the future?

5. **Organization of the workshop** On a scale from 1 (do not agree at all) to 5 (completely agree), mark the statements below regarding the organization of the workshop. *

	1 (do not agree at all)	2	3	4	5 (strongly agree)
The selection of the workshop date was appropriate.	◯	◯	◯	◯	◯
The length of the workshop was adequate.	◯	◯	◯	◯	◯
The description of the workshop is consistent with the implementation.	◯	◯	◯	◯	◯
After the workshop, I would like to be able to self-evaluate the acquired knowledge.	◯	◯	◯	◯	◯
The workshop would require separate basic and advanced level.	◯	◯	◯	◯	◯

6. **Content and implementation of the workshop** On a scale from 1 (do not agree at all) to 5 (completely agree), mark the statements below regarding the organization of the workshop. *

	1 (do not agree at all)	2	3	4	5 (strongly agree)	not relevant
The content was presented clearly and understandable.	◯	◯	◯	◯	◯	◯
I developed my digital competences through the workshop.	◯	◯	◯	◯	◯	◯
Through the workshop, I developed the competencies of algorithmic, logical and abstract thinking.	◯	◯	◯	◯	◯	◯
Through the workshop, I developed natural science competences.	◯	◯	◯	◯	◯	◯
I developed energy literacy through the workshop.	◯	◯	◯	◯	◯	◯
The workshop influenced my understanding of the topic under discussion.	◯	◯	◯	◯	◯	◯
The workshop motivated me to continue working in this field.	◯	◯	◯	◯	◯	◯
I will use the acquired knowledge or competences in my work or studies.	◯	◯	◯	◯	◯	◯

7. Suggestions, comments, compliments: