Univerza v Mariboru

Faculty of Natural Sciences and Mathematics

SITUATION ANALYSIS REPORT no. 5

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

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GENERAL INFORMATION

The pilot project NATURAL SCIENCES AND MATHEMATICS CONTENTS IN THE DEVELOPMENT OF DIGITAL COMPETENCES as part of the "Recovery and Resilience Plan, Higher Education Reform Project for a Green and Resilient Transition to Society 5.0" is being implemented at the Faculty of Natural Sciences and Mathematics University of Maribor (FNM UM) and at the Faculty of Civil Engineering, Transport Engineering and Architecture University of Maribor (FGPA UM), in the period from 1 September 2022 to 31 August 2025.

The pilot project includes the following activities:

A1) Situation analysis;

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 findings and results of the project work are collected in a status analysis report and three interim reports. All reports are publicly available in Slovenian and English:

- KLEMENČIČ, Eva, CAJNKO, Petra, HANŽIČ, Katja, MACUH, Borut, REPNIK, Robert, MENCINGER, Matej. *Natural science and mathematical content in the development of digital competences: pilot project: report on the analysis of the situation* . Maribor: Faculty of Natural Sciences and Mathematics, 2024. 1 online source (1 PDF file ([78] pages)), tables. https://www.fnm.um.si/index.php/2024/02/16/porocilo-o-analizi-stanja-projekta-noo/ .
- KLEMENČIČ, Eva, ARCET, Barbara, GRUJIĆ, Jaša Veno, HANŽIČ, Katja, HRASTNIK LADINEK, Irena, HÖLBL, Arbresha, MENCINGER, Matej, REPNIK, Robert, REPOLUSK, Polona, SLAVINEC, Mitja, CAJNKO, Petra. Natural science and mathematical content in the development of digital competences: pilot project: study: interim report no. 2. Maribor: Faculty of Natural Sciences and Mathematics, 2024. 1 online source (1 PDF file ([214] pages)), illus ., tables. https://www.fnm.um.si/index.php/2024/04/22/drugo-porocilo-o-analizi-stanja-projekta-noo/
- KLEMENČIČ, Eva (author, project leader), MENCINGER, Matej, REPNIK, Robert, CAJNKO, Petra. Natural science and mathematical content in the development of digital competences: pilot project: study: interim report no. 3. Maribor: Faculty of Natural Sciences and Mathematics, 2024. 1 online source (1 PDF file (61 pages)), illus ., tables. https://www.fnm.um.si/wp-content/uploads/2024/09/NOO_V3_objava-sep-24.pdf .
- KLEMENČIČ, Eva (author, project leader), MENCINGER, Matej, REPNIK, Robert, CAJNKO, Petra. *Natural science and mathematical content in the development of digital competences: pilot project: study: interim report no. 4.* Maribor: Faculty of Natural Sciences and Mathematics, 2025. 1 online source (1 PDF file (77 pages)), illus ., tables. https://www.fnm.um.si/wp-content/uploads/2025/02/000_POROCILO-PROJEKTA-V4_slo-_fin.pdf .

The fifth interim report collects summaries and the main results of project activities in the period from 1 January 2025 to 30 June 2025. The researchers listed in Table 1 participated in the project activities.

Table 1. Project team members.

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, 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
Eva	**Klemenčič**	FNM	1.9.2022-31.8.2025	project manager, project board member, researcher
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, researcher
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	professional associate

DESCRIPTION OF THE WORKFLOW BY SUBACTIVITIES

In the reporting period, we completed activity *A2.2 Defining the level of competence development of graduates of selected study programs.* We analyzed survey questionnaires of students in the final years of selected study programs, based on which we provide findings on the achieved level of digital competence and competences in energy literacy, green transition and sustainability. We also conducted a comparative analysis of the results of FNM UM and FGPA UM students and linked them to the demands on the labor market.

We continued the activity *A3 Comprehensive implementation for the development of competences for the digital and green transition and lifelong learning* and invited external experts to conduct workshops. We hosted a foreign expert, Assoc. Prof. Dr. Snježana Babić, from the Faculty of Informatics in Pula, who conducted a public workshop on the topic of digital competences in education. Dr. Damjan Osrajnik, principal of the Radlje ob Dravi Primary School, presented in more detail the opportunities for the development of digital competences within the framework of primary education. Mojca Drevenšek and Dr. Uroš Kerin prepared a workshop on the topic of energy literacy.

As part of the *A4 Evaluation activity*, we continued with ongoing workshop evaluations, dissemination of project work results and public information. The leader and coordinator of the pilot project attended the Pilots to Pilots conference - Renovation of higher education professional study programs, where they participated in the discussion as part of the workshops *Interdisciplinarity and integration in the modernization of the Higher Education Professional Program* and *Connection of the Higher Education Professional Program with the labor market and practice* (Figure 1).

Figure 1. Participation in the Pilots to Pilots conference.

Researchers attended the international scientific conference The 10th IAFOR International Conference on Education in Hawaii (IICE2025), which took place from January 3 to 7, 2025 (Figure 2).

Figure 2. Researchers at the IICE 2025 conference.

By presenting five contributions, we highlighted innovative approaches in the field of education and sustainable competences (Figure 3):

- CAJNKO, Petra, MENCINGER, Matej, REPNIK, Robert, MACUH, Borut, KLEMENČIČ, Eva. **Effectiveness of career counseling in primary school schools** . In: *The 10th IAFOR International Conference on Education in Hawaii (IICE2025) [and] the 5th IAFOR International Conference on Arts & Humanities in Hawaii (IICAH2025) : January 3-7, 2025, Honolulu, Hawaii , USA, and online : program & abstract book* . [Nagoya]: IAFOR, [2024]. p. 51. https://iafor.org/archives/conference-programmes/iice/iice-programme-2025.pdf .
- MENCINGER, Matej, CAJNKO, Petra, REPNIK, Robert, KLEMENČIČ, Eva, MACUH, Borut. **The efficiency of digital tools and enhancements foundational mathematics outcomes : a comparative study .** In: *The 10th IAFOR International Conference on Education in Hawaii (IICE2025) [and] the 5th IAFOR International Conference on Arts & Humanities in Hawaii (IICAH2025) : January 3-7, 2025, Honolulu, Hawaii , USA, and online : program & abstract book* . [Nagoya]: IAFOR, [2024]. p. 85. https://iafor.org/archives/conference-programmes/iice/iice-programme-2025.pdf

- MACUH, Borut, CAJNKO, Petra, KLEMENČIČ, Eva, MENCINGER, Matej. **Enhancing digital competences in civil engineering education through building information modeling (BIM) integration : a case study at University of Maribor** . In: *The 10th IAFOR International Conference on Education in Hawaii (IICE2025) [and] the 5th IAFOR International Conference on Arts & Humanities in Hawaii (IICAH2025) : January 3-7, 2025, Honolulu, Hawaii , USA, and online : program & abstract book* . [Nagoya]: IAFOR, [2024]. p. 52. https://iafor.org/archives/conference-programmes/iice/iice-programme-2025.pdf .
- REPNIK, Robert, OSRAJNIK, Damjan, SLAVINEC, Mitja, CAJNKO, Petra, KLEMENČIČ, Eva. **Gradual simulation integration in physics education : enhancing conceptual understanding and digital competences .** In: *The 10th IAFOR International Conference on Education in Hawaii (IICE2025) [and] the 5th IAFOR International Conference on Arts & Humanities in Hawaii (IICAH2025) : January 3-7, 2025, Honolulu, Hawaii , USA, and online : program & abstract book* . [Nagoya]: IAFOR, [2024]. p. 88. https://iafor.org/archives/conference-programmes/iice/iice-programme-2025.pdf .
- KLEMENČIČ, Eva, REPNIK, Robert, MENCINGER, Matej, CAJNKO, Petra. **Sustainability skills in education : a comprehensive competence framework** . In: *The 10th IAFOR International Conference on Education in Hawaii (IICE2025) [and] the 5th IAFOR International Conference on Arts & Humanities in Hawaii (IICAH2025) : January 3-7, 2025, Honolulu, Hawaii , USA, and online : program & abstract book* . [Nagoya]: IAFOR, [2024]. p. 52. https://iafor.org/archives/conference-programmes/iice/iice-programme-2025.pdf .

Figure 3. Presentations of papers at the IICE 2025 conference.

We also participated in the international IAFOR conference The Asian Conference on Education & International Development (ACEID2025), where Assist. Prof. Dr. Petra Cajnko presented the paper *The Implementation of Artificial Intelligence and Its Impact on Stress , Anxiety , and Burnout Levels Among Managers and Professors* (Figure 4).

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THE INTERNATIONAL ACADEMIC FORUM

international | intercultural | interdisciplinary

The Asian Conference on Education & International Development (ACEID2025)

Monday, March 24, 2025 to Saturday, March 29, 2025
Held in Toshi Center Hotel, Tokyo, Japan, and Online

Certificate of Presentation

This certificate signifies that

Petra Cajnko
(University of Maribor, Slovenia)

has presented the research entitled:

The Implementation of Artificial Intelligence and Its Impact on Stress, Anxiety, and Burnout Levels Among Managers and Professors

This is to confirm that Petra Cajnko, having presented the above research, actively participated in The Asian Conference on Education & International Development (ACEID2025), and thereby contributed to the academic success of the event.

On behalf of The Asian Conference on Education & International Development Programme Committee:

Dr Joseph Haldane
Chairman & CEO, IAFOR

The International Academic Forum (IAFOR),
Sakae 1-16-26 - 201, Naka Ward, Nagoya, Aichi, Japan 460-0008
International, Intercultural, Interdisciplinary

Figure 4. Certificate of participation in the ACEID2025 conference.

Prof. Robert Repnik gave an invited lecture at the 12th International Conference on Teaching Physics in High Schools, which took place between 28 and 30 March in Aleksinac, Serbia. He presented the paper: *Fostering Digital Competences and Energy Literacy through Physics Education,* authors prof. Robert Repnik, asst. dr. Damjan Osrajnik, asst. prof. dr. Eva Klemenčič (Figure 5).

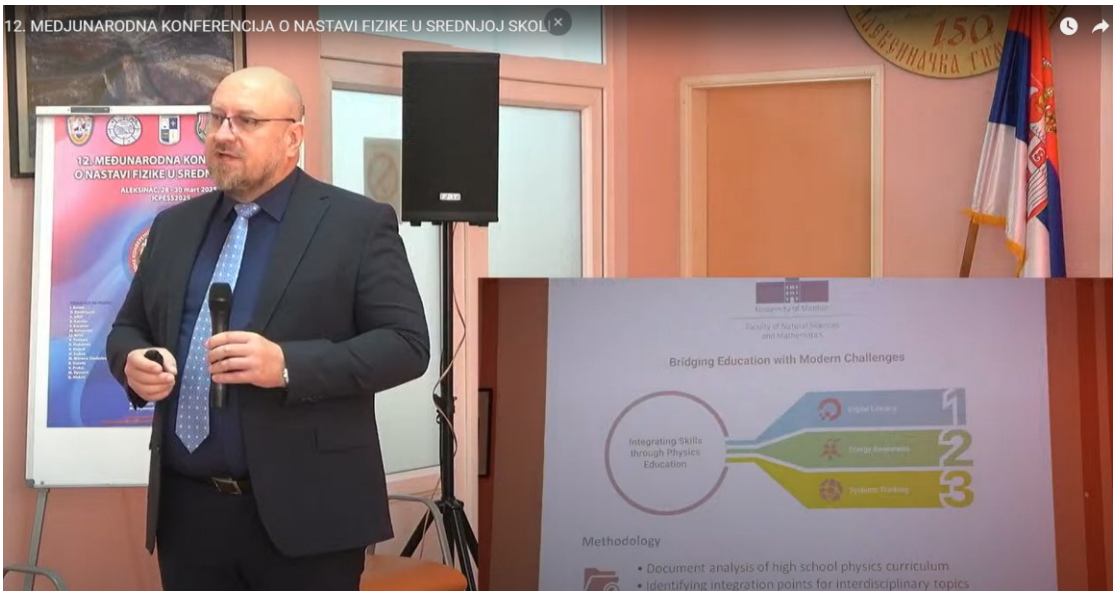


Figure 5. Screenshot of a lecture recording by Prof. Repnik, available at https://www.youtube.com/watch?v=EKQ2dxOoLZ4 .

We also attended the MIPRO conference (48th ICT and Electronics Convention) with the contribution *of Graduates Insights: Development of Digital and Computational Competences in Physics and Mathematics study programs at University of Maribor* , authors prof. dr. Robert Repnik, asst. dr. Petra Cajnko, asst. prof. dr. Eva Klemenčič and asst. dr. Damjan Osrajnik.

Two more papers are in preparation and will be presented at the 9th Annual International Symposium on the Future of STEAM (sciences , technology , engineering, arts) and mathematics) Education , which will be held from July 21 to 24, namely:

- Energy Literacy in STEM: Opportunities for Interdisciplinary Integration in Higher Education Education , authors Assoc. Prof. Eva Klemenčič, Prof. Robert Repnik, Prof. Matej Mencinger, Assoc. Prof. Petra Cajnko,
- Enhancing Sustainability Competence: A Case Study of Physics and Mathematics Curricula at the University of Maribor, authors: Assoc. Prof. Dr. Petra Cajnko, Prof. Robert Repnik, Prof. Matej Mencinger, Assoc. Prof. Dr. Eva Klemenčič.

DIGITAL COMPETENCES

The methodology and instruments are presented in the 4th interim report. The survey consisted of questions measuring students' digital competences, their habits, abilities and attitudes towards various aspects of the digital world. The questions were designed to cover a wide range of digital skills - from finding information, assessing the credibility of sources, using digital tools for communication and collaboration, to knowledge of online etiquette, security, creativity and solving technical problems. We took into account the European competence framework DigComp 2.2, which classifies digital competences into five areas, each competence can be developed at 8 levels.

Results

The summaries of the results of the survey questionnaire at the FNM UM and the FGPA UM are attached in Appendix 1 and Appendix 2. Below we present a qualitative analysis.

The first few questions concern the status of the students, their study orientation and previous education. This section serves as a basis for further analysis of digital competences according to different academic profiles.

A total of 15 students responded to the survey at FGPA UM: 12 1st year students of MAG Civil Engineering, 2 3rd year students of UN Civil Engineering and 1 3rd year student of VS Civil Engineering. Eight second-cycle students completed their first cycle at FGPA Maribor, four elsewhere. Six students completed UN Civil Engineering, one UN GING and one VS Civil Engineering. Four students completed their first-cycle studies at: FGPA UM, majoring in operational civil engineering, University of Maribor, majoring in construction and GFZG, majoring in construction.

At the Faculty of Natural Sciences and Mathematics, University of Maribor, 12 students responded to the survey, of which 4 students from the Physics study program, 2nd cycle, 2 students from the Mathematics study program, 3 students from the Physics study program, 1st cycle and 3 students from the unified Master's study program Subject Teacher (1 student from the Educational Mathematics and Educational Physics focus, 1 student from the Educational Mathematics and Educational Biology focus, 1 student from the Educational Mathematics and Educational Computer Science focus). All participating 2nd cycle students had previously completed their studies at the Faculty of Natural Sciences and Mathematics, University of Maribor.

The heads of the Civil Engineering and Civil Engineering study programs also responded to the survey.

Searching, evaluating and managing data, information and digital content

- How often do you browse, search, or filter data, information, and digital content? Rate on a scale from 1 (never) to 8 (several times a day).
  FGPA UM: Most responses are concentrated on the higher end of the scale (5–8), indicating that respondents frequently browse, search, or filter information and digital content. This is consistent with expectations for civil engineering students who rely on access to information for their studies and projects. Average score 6.13, with the heads of the 6th and 7th graders (Figure 6).
  FNM UM: Most students often search for information, the average is 7.1, 58% search for information several times a day. Most students often search for information, with an average score of 7.1. The latter indicates that students use digital resources in their studies and research work.

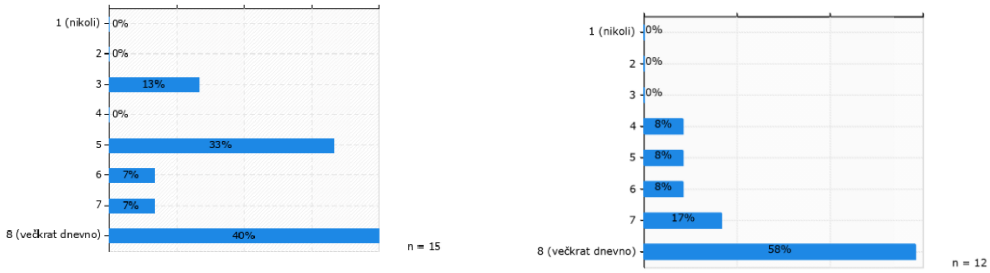


Figure 6. Information search: results of students' responses to the FGPA UM (left) and FNM UM (right).

- How would you rate your ability to evaluate the accuracy and reliability of information online? Think about your ability to analyze, compare, and critically evaluate the credibility and reliability of information sources and digital content. This includes identifying false or misleading information and checking the credibility of authors or sources. Rate on a scale from 1 (very poor) to 8 (excellent).
  FGPA UM: Most respondents rate their ability to evaluate the accuracy and reliability of information online as average to above average (5–7). There were no extreme scores at the lower (1–2) or upper end of the scale (8). This indicates that students are aware of their own capabilities and possible room for improvement. Average score 5.6, SP leaders 6 and 5.
  FNM UM: Most respondents rate their ability to evaluate the accuracy and reliability of information online as above average, with an average of 7.0. Half of them rate their abilities as high, which is crucial for scientific research work, where checking the reliability of data is essential (Figure 7).

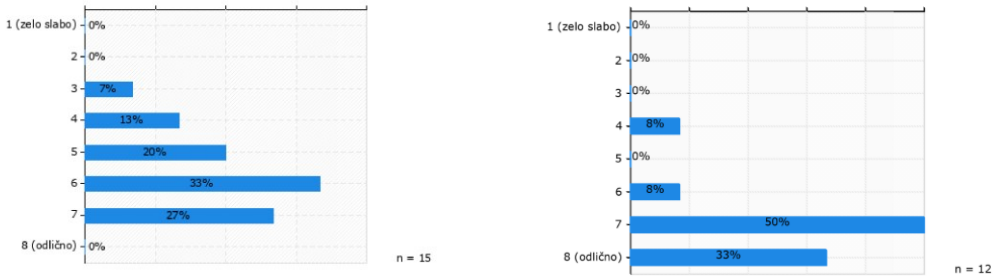


Figure 7. Information evaluation: results of students' responses to the FGPA UM (left) and FNM UM (right).

- How effectively do you manage data, information and digital content? Storing, organizing, deleting and processing for future use in digital environments, along with structuring and categorizing information. Rate on a scale from 1 (very ineffective) to 8 (very effective).
  FGPA UM: Most students rate their efficiency in data management as average to high (4–8). There is a noticeable concentration of responses at the higher end of the scale, which indicates that students have relatively well-developed skills in storing, organizing and processing data, and no one considers it to be very ineffective. Average score 6.13, head of the SP 5 and 7.
  FNM UM: Most students rate their effectiveness in managing data, information and digital content as high, with an average of 7.0. 42% store and process data effectively, indicating that students have developed skills in organizing research data and academic resources (Figure 8).

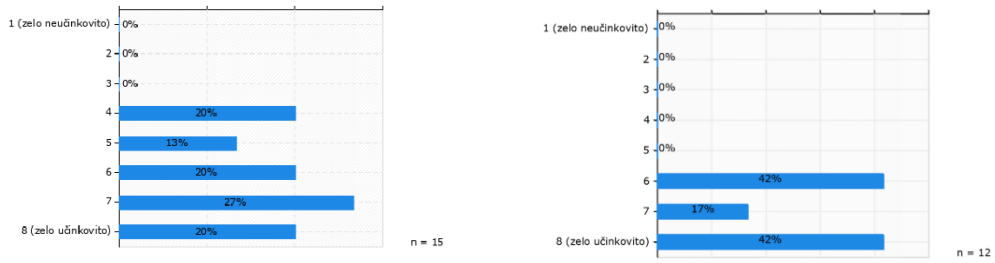


Figure 8. Digital content management: results of student responses to the FGPA UM (left) and FNM UM (right).

Collaboration and communication

- How often do you use digital technologies to communicate with others (e.g. email, social media)? Rate on a scale from 1 (never) to 8 (several times a day).
  FGPA UM: Data shows that many students (9 out of 15) regularly use digital technologies for communication, especially several times a day. Average score 7.07, heads of department 8 and 8.
  FNM UM: As expected, most students, 75%, use digital communication tools on a daily basis, the average is 7.5.

- How often do you share content via digital technologies (e.g. images, documents)? Rate on a scale from 1 (never) to 8 (several times a day).
  FGPA UM: The responses are relatively balanced, with five respondents who rated their frequency of content sharing with a score of 8. Most respondents rate their activity in the middle and lower range, indicating their moderate activity. Effective workshops on security and organization of digital content could help improve the use of digital technologies in the study process. Average score 6.07, with the heads of the Faculty of Social Sciences 7 and 6.
  FNM UM: Half of the surveyed students regularly share digital content. The average is 6.7, which is slightly lower than the use of digital technologies for communication and indicates an opportunity for improvement in the sharing of digital resources (Figure 9).

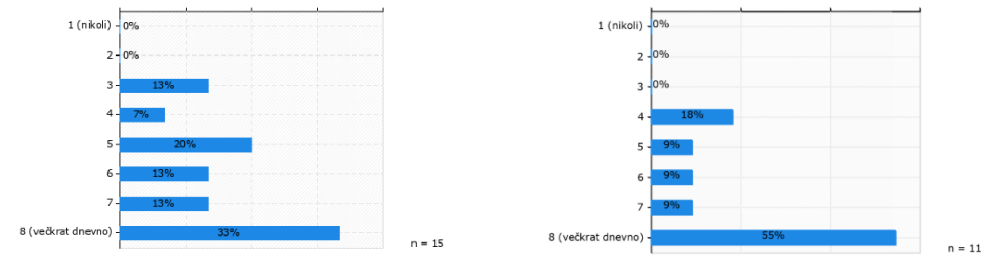


Figure 9. Sharing content via digital technologies: results of student responses to the UM FGPA (left) and UM FNM (right).

- Do you engage in civic activities through digital platforms? Participating in online petitions, commenting on political topics, participating in political debates, signing petitions for referendums, and similar activities that affect society. Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: The majority of students rated their participation in civic activities via digital platforms with low scores (1–4). Students generally rarely participate in political or social discussions, online petitions and other forms of digital citizenship. The most common scores are 1 (never) and 2 (very rarely), with only one score of 8. The average score is 3.33, the head of the SP 5 and 1.
  FNM UM: Respondents' responses are scattered, with an average rating of 4.4 with a standard deviation of 2.3. The most common rating is 4 (33%) and 1 – never (17%). The dispersion of responses indicates a generally low interest in political and social discussions via digital platforms (Figure 10).

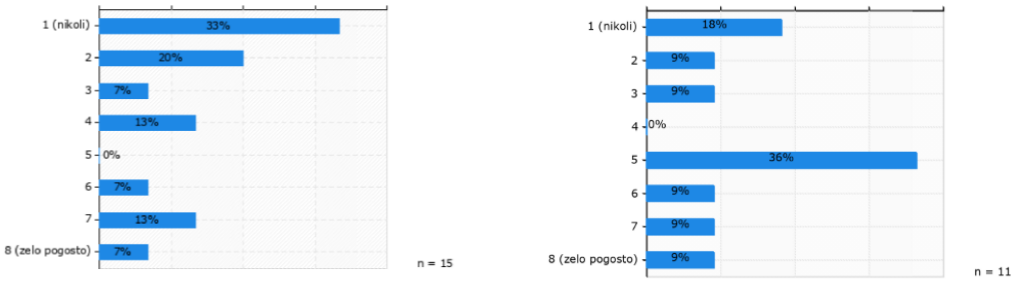


Figure 10. Involvement in civic activities: results of students' responses to the FGPA UM (left) and FNM UM (right).

- How often do you collaborate with others through digital technologies (e.g., teamwork, collaborative platforms)? Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: The answers are relatively evenly distributed across the different grades, indicating considerable diversity in the level of collaboration through digital technologies. Students often collaborate with others through digital platforms, but are not overly active, a grade of 8 is one. Average grade 5.33, SP leaders 6 and 5.
  FNM UM: The average score is 5.9 with a standard deviation of 2.6. Nevertheless, 45% indicated that they use digital technologies for collaboration very often (8). Given that most learning units use the Moodle online classroom and the Microsoft Teams application, which enables forums, chat, and collaboration in real-time work, students are less active in this area. Given the nature of study programs and employment in the labor market, which are often project-based, it would be good to consider incentives for students to participate in this type of collaboration (Figure 11).

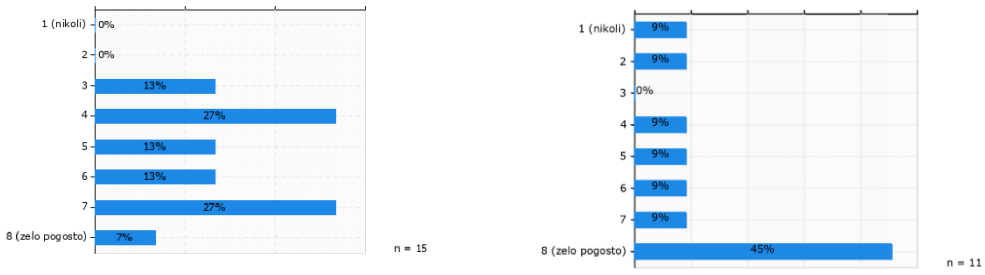


Figure 11. Collaboration using digital technologies: results of student responses to the FGPA UM (left) and FNM UM (right).

- How well do you know the rules of online etiquette when communicating online? The rules of friendly, respectful and responsible communication in digital environments, aware of cultural and generational differences. Rate on a scale from 1 (I don't know at all) to 8 (excellent).
  FGPA UM: Students assess that their knowledge of the rules of online etiquette is good. They have basic knowledge of online etiquette, but they believe that their understanding of this area could be improved. 1st year master's students are more attentive to this area, 3rd year students less so. The UN group has 2 answers with a score of 8, the MAG group 3. Average score 6.2, the SP leaders 8 and 7.
  FNM UM: Respondents estimate that they know the rules of online etiquette well, the average score is 6.8, only one student gave a score of 3. This indicates high digital literacy and awareness of respectful communication.

- How often do you follow the rules of online etiquette when communicating online? Friendly, respectful, and responsible communication in digital environments and consideration of cultural and generational differences. Rate on a scale from 1 (never) to 8 (always).
  FGPA UM: Most students (8 out of 15) follow the rules of online etiquette often (score 7 or 8). The general level of respect for online etiquette among all students is high, as high scores prevail. Average scores 6.4, 7 and 7 for the heads of the Faculty of Social Sciences.
  FNM UM: Most students follow the rules of online etiquette often; the average is 5.8 with a standard deviation of 2.4. One student wrote that he does not follow the rules of online etiquette.

- How well do you manage your digital identity? Control over your digital identity, protection of personal data, care for your public image and reputation online. Rate on a scale from 1 (not interested) to 8 (excellent).
  FGPA UM: Students generally show commitment to managing their digital identity, with the majority choosing grades in the lower half of the scale. Low grades (1–3) are not represented, which means that the topic of digital identity is at least to some extent important for all students. Average grade 6.33, SP leaders 7 and 5.
  FNM UM: Most students show interest in managing their digital identity (average 5.5), although some do not consider this area important. One student gave a score of 1 “not interested” (Figure 12).

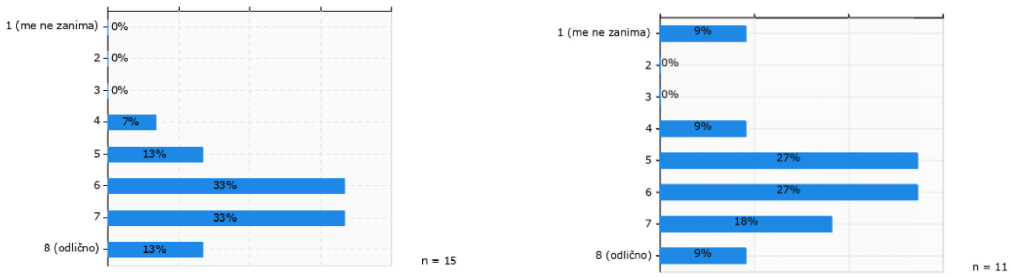


Figure 12. Digital identity management: results of student responses to the FGPA UM (left) and FNM UM (right).

Digital content creation

- How often do you create digital content (e.g., writing blogs, making videos, taking photos)? Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: Most students rarely create digital content, grades 1–3 appear in 12 out of 15 responses. MAG program students are more active, but still to a low to moderate extent, 3rd year students have very limited participation, with an emphasis on extremely low values. Average grade 2.6, SP leaders 6 and 4.
  FNM UM: The answers are scattered, no student creates digital content often (7 or 8), 2 students chose the answer "never". The average is 4, with a standard deviation of 1.8 (Figure 13).

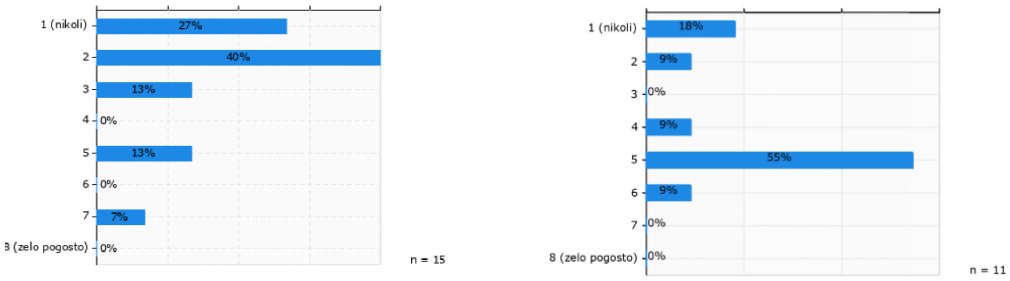


Figure 13. Digital content creation: results of students' responses to the FGPA UM (left) and FNM UM (right).

- How often do you adapt or recreate existing digital content? Editing and reworking photos, videos or texts. Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: Most students rarely adapt or recreate digital content. Most responses are concentrated at lower levels, with grades 1 and 2 being the most common, followed by moderate grades 3 and 4. No student gave the highest grade of 8. Average grade 3.33, with 7 and 3 for the head of the department.
  FNM UM: Similar to digital content creation, no student chose frequent re-creation or adaptation of digital content. The average is 4, with a standard deviation of 1.9, which indicates lower creative involvement.

- How well do you know copyright and licensing when using digital content? Understanding copyright law, licensing of digital content (e.g. Creative Commons Attribution-ShareAlike License) Commons), including understanding how to use content without violating the rights of others. Rate on a scale from 1 (not at all familiar) to 8 (extremely familiar).
  FGPA UM: Most students rate their knowledge of copyright as moderate (5) or slightly above average (6), which indicates a basic understanding of the topic. The MAG program has the largest dispersion of answers, which indicates different levels of knowledge of copyright among students in this program. 3rd year students rated their knowledge of copyright with grades in the middle of the scale. Average grade 4.27, teachers 7 and 7.
  FNM UM: All answers (from 1 to 8) are represented, which indicates that information about copyright is obtained mainly informally. Given the importance of copyright and the fact that students will be preparing final theses, the latter is of key importance and needs greater emphasis within the framework of formal education. The average score is 4.0.

- How often do you think about and consider copyright and licensing when using digital content? Copyright protection, licensing when using digital content without violating the rights of others (attribution when using images, texts, videos from the Internet). Rate on a scale from 1 (I don't care) to 8 (I always consider).
  FGPA UM: A total of 8 students marked grades between 4 and 6, indicating moderate awareness of the importance of copyright, very few students gave grades of 7 or 8, indicating that consistent compliance with copyright is still rare. No students gave a grade of 8, indicating the need for additional awareness of the correct use of copyright. Average grade 4.53, 7 and 7 for the heads of the SP.
  FNM UM: Here too, the answers are scattered, the average is low, i.e. 3.8. Higher scores were given by 2nd level students. This aspect should be given more attention within the framework of formal education (Figure 14).

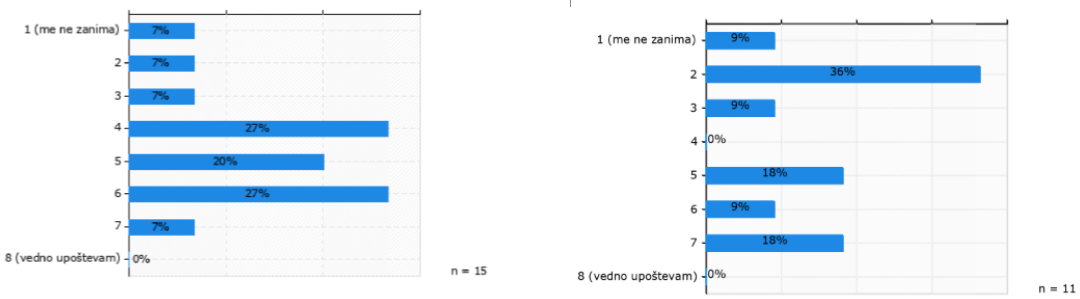


Figure 14. Respect for copyright: results of students' responses to the FGPA UM (left) and FNM UM (right).

Security

- How do you keep your devices secure (e.g., software updates, antivirus protection)? Rate on a scale from 1 (very poor) to 8 (very good).
  FGPA UM: Most students rate themselves as good or very good at taking care of device security. This is evident from the fact that the most responses are at a score of 6 (6 votes), which indicates a high level of security. Students who rate themselves as very good (scores 7 and 8) represent a minority, and there are also very few students who take poor care of device security, which indicates a basic awareness of the majority about the importance of security. Average score 5.47, SP leaders 7 and 7.
  FNM UM: Students gave relatively high scores, the average is 6.4 with a standard deviation of 1.2. No student chose answers 1, 2 or 3, which shows that students are aware of basic measures to ensure device security (Figure 15).

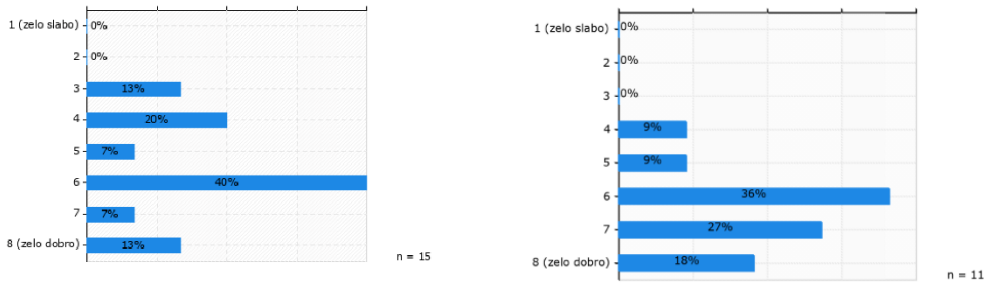


Figure 15. Concern for device security: results of students' responses to the FGPA UM (left) and FNM UM (right).

- Do you pay attention to protecting your personal information and privacy online? Think about your habits for protecting your personal information and ensuring privacy in the online environment, including the use of strong passwords and encryption. Rate on a scale from 1 (never) to 8 (always).
  FGPA UM: Most students answered with a score of 8 and 6. There were no answers for scores of 1 and 2, which shows that all students are at least to some extent aware of the importance of protecting personal data. In general, the scores indicate considerable concern for the protection of personal data. Average score 5.73, heads of the Faculty of Social Sciences 7 and 6.
  FNM UM: The average of 5.5 with a standard deviation of 1.8 indicates that students often pay attention to protecting personal data and privacy online. One student chose a score of 1 (never), and no students chose a score of 8 (often), which indicates that students should be further educated about online safety.

- How often do you consider health and well-being when using digital technologies? Frequency of breaks, adequate lighting, correct placement of devices, posture when using devices. Rate on a scale from 1 (never) to 8 (always).
  FGPA UM: The results indicate that most students often consider health and well-being when using digital technologies; the majority are in the middle to higher range of the scale. While some regularly take care of ergonomics, breaks and adequate lighting, there are individuals (especially in UN Construction) who do not pay enough attention to these factors. Average score 4.87, SP leaders 6 and 6.
- **FNM UM:** Most students chose average grades of 4 (17%), 5 (33%), and 6 (33%). No students chose the highest grades of 7 or 8 and the lowest grades of 2 and 3. The average grade is 4.8 with a standard deviation of 1.5.

- How important do you think environmental protection is when using digital devices? Energy efficiency of devices, recyclability of devices and their components. Rate on a scale from 1 (not important) to 8 (very important).
  FGPA UM: Score 5 (6 answers) and score 6 (3 answers) stand out as the most common, indicating that students consider environmental protection to be moderately to highly important. The extreme answers (1 and 8) represent a minority. Average score 5.08, SP leaders 7 and 8.
  FNM UM: The average score of 5.0 with a standard deviation of 2.0 indicates a dispersion of responses. Only two students find the latter very important, most students are aware of its importance but pay less attention to it.

- How well do you identify gaps in your digital competences and try to improve them? Awareness of the lack of knowledge about online safety, knowledge about creating digital content, knowledge about protecting digital content and digital devices, knowledge about managing your online image, etc. Rate on a scale from 1 (very poor) to 8 (very good).
  FGPA UM: Grades 3, 4 and 5 together collected 11 out of 15 possible answers, which indicates that most students analyze their technological needs moderately often. The rest take this area very seriously, and no one showed the lowest and highest engagement in this area. Average grades 4.73, 7 and 6 for the SP leaders.
  FNM UM: Most of the students' answers are in the upper half of the scale, no student chose answers between 1 and 3. Grades 8 (very good) and 7 were chosen by four students, and grade 6 by three students. The average of 6.0 indicates that students are good at identifying gaps and trying to eliminate them. It would therefore make sense to offer students opportunities to improve their digital competences (Figure 16).

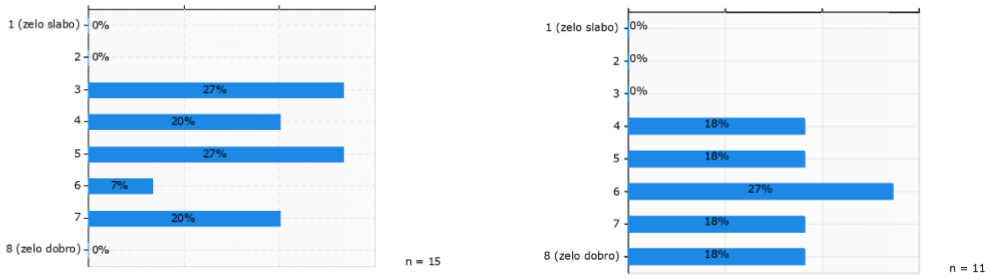


Figure 16. Identifying gaps: results of student responses to the UM FGPA (left) and UM FNM (right).

Problem solving

- How often do you use programming to create digital solutions? Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: Most students (9 out of 15) use programming rarely or never (grades 1 and 2). Programming is more widespread among 1st year MAG students, but still only to a limited extent (grade 5 represents the highest moderate use). 3rd year students hardly use programming, except for rare individuals. Average grade 3.27, SP leaders 1 and 8.
  FNM UM: 33% of students use programming very often (grades 7 and 8), a smaller proportion (25%) never. The average is 3.8 with a standard deviation of 2.8. The selected grades are expectedly higher in the non-pedagogical study programs Physics and Mathematics and lower in the pedagogical study program Subject Teacher (Figure 17).

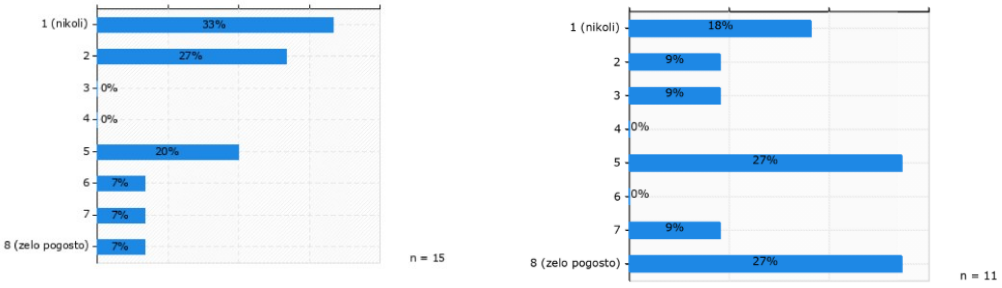


Figure 17. Creating solutions through programming: results of students' responses to FGPA UM (left) and FNM UM (right).

- Do you face any technical difficulties when using digital devices? Rate on a scale from 1 (I have insurmountable difficulties) to 8 (I have no problems at all).
  FGPA UM: First-year students of the master's program mostly do not have major technical problems, but some still face moderate challenges. Opinions are divided among the remaining students. The results are mostly on the higher end of the scale, indicating moderate to high confidence in solving problems. Average score 6.07, SP leaders 6 and 6.
  FNM UM: Most students chose answers with a high level of confidence (7 and 8), no student chose the option "I have insurmountable problems". The average is 6, the standard deviation is 1.3.

- Are you able to solve technical problems using digital devices yourself? Rate on a scale from 1 (I always need help) to 8 (I always solve problems myself).
  FGPA UM: Most answers were given at high values of 7 and 8, indicating that most respondents demonstrate high confidence in solving technical problems.
  Since there were no answers with lower values (1, 2, 3), we can conclude that none of the respondents report complete dependence on help in solving technical problems. Average score 6.33, SP leaders 6 and 7.
  FNM UM: Most students believe they can solve technical problems independently; the average is 6.1 with a standard deviation of 1.7. No student chose the option “I always need help”.

- How often do you analyze your technological needs and look for appropriate solutions? Thinking about your own needs when choosing software for work, upgrading hardware for better efficiency, or deciding to purchase a new device to meet your needs. Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: Most of the answers were collected at medium values (4 and 5), which means that most students estimate that they occasionally analyze their technological needs. Answers at higher values (6, 7, 8) indicate that only a smaller proportion of students perform these analyses more often. Only one answer "never" (1) and no 2 or 3 mean that most students are at least somewhat aware of their technological needs. Average score 5.13, SP leaders 6 and 7.
  FNM UM: Most of the answers are collected in the upper half (5, 6, 7 or 8), with an average of 5.7 and a standard deviation of 1.3. Only one student chose a score of 3, there were no lower scores (Figure 18).

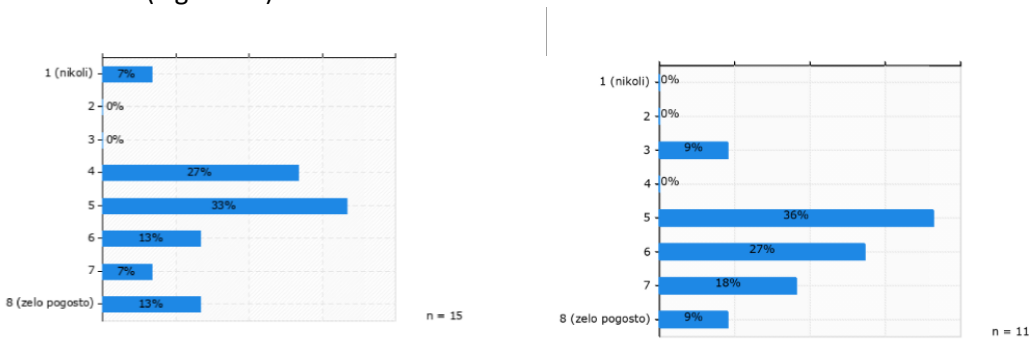


Figure 18. Analyzing technological needs and finding solutions: results of student responses to the UM FGPA (left) and UM FNM (right).

- How often do you use digital technologies in creative ways? Rate on a scale from 1 (never) to 8 (very often).
  FGPA UM: The highest number of responses was 6 (6 responses), which indicates that most respondents often use digital technologies creatively. The remaining scores are fairly evenly distributed, meaning that there are students who use digital technologies creatively to all degrees, from never to very often. The average score was 4.73, with the heads of the SPs scoring 6 and 7.
  FNM UM: Most students chose mid-range grades, with the most common grade being 6 (45%), followed by 5 (27%) and 7 (18%). No student chose the highest grade of 8 (very often), and only one student chose 1 (never.)

Conclusion

FGPA UM: Students have moderately developed digital competences, but there are clear opportunities for improvement, especially in the creative use of technologies, knowledge of copyright, data protection and programming. Additional training and workshops would be needed to promote these skills.

The results of the statistical analysis comparing the (average) responses regarding digital literacy competences of graduates (A) and the head of the study program (B) are as follows. The Pearson correlation coefficient between responses A and B is 0.442 and is statistically significant (p=0.03) for p=0.05, while the Spearman correlation coefficient is 0.322 and is not statistically significant, which means that there is a statistically significant moderate relationship between A and B. The results of the paired t-test for the difference AB are as follows: the average difference is -1.1367 (response A is on average 1. 1367 lower than response B). The value of the statistics is t=-4.436 (p-value <0.001, which means that the result is statistically significant). Therefore, there is a statistically significant difference between the assessment of AB, which means that students assess their acquired competences lower than expected by the head of the study program.

FNM UM: Students demonstrate a high level of digital literacy, especially in finding, evaluating and managing information. Their competences in creating digital content and respecting copyright are slightly lower, which represents an opportunity for improvements within the framework of formal education. Digital communication and collaboration are at a high level, but participation in civic activities is relatively low.

To assess the correlation between the responses between students and study program leaders or coordinators, we calculated the Pearson and Spearman correlation coefficients. The analysis showed a moderately strong and statistically significant positive correlation between the students' grades and the grades of the coordinator of the study program PU Educational Mathematics, the head of the study program Physics, and the coordinator of the study program Educational Physics. Pearson's correlation coefficients ranged between 0.577 and 0.672, and Spearman's between 0.552 and 0.674, which indicates that higher student grades coincide with higher grades of the leaders or coordinators. Smaller differences between the two types of coefficients may indicate slight deviations from a perfect linear relationship, but the direction and nature of the connections remain consistently confirmed. In addition to the correlations, we also checked whether the average grades of the coordinator of Educational Mathematics and the coordinator of Educational Physics differ statistically significantly. The results of the paired t-test showed that there was no significant difference between them – the average in educational mathematics was slightly higher, but the difference was not statistically significant. The most important finding is that there is a statistically significant difference between the ratings of the head of the non-pedagogical Physics program and the coordinator of the Educational Physics orientation, where the average rating of the head of the Physics study program is higher ($p = 0.028$, $d = 0.479$). Other examples of differences, including differences between the ratings of students and individual program leaders, did not reach statistical significance at the 5% level, although some indicate a moderate effect size.

COMPETENCES OF ENERGY LITERACY, GREEN TRANSITION AND SUSTAINABILITY

The competency framework, methodology and tools are presented in the 4th interim report. The survey questionnaires differed slightly. The survey questionnaire and summary with graphs for students at the FNM UM are in Appendix 3, and for students at the FGPA UM in Appendix 4. The competence framework consists of 12 specific competences, grouped into five thematic areas: systems thinking about energy systems, biodiversity, resource use, technological competences, policy and business awareness. For each specific competence, we defined three levels: basic level (fundamental understanding), intermediate level and advanced level (application, innovation). For each level, respondents could choose an answer from 1 (disagree) to 5 (strongly agree).

Results

At the Faculty of Civil Engineering of the University of Maribor, 1 civil engineering student, 1 civil engineering graduate, and 13 civil engineering students from the Faculty of Civil Engineering of the University of Maribor responded to the survey, making a total of 16 people. Of these, seven students graduated from the Faculty of Civil Engineering at the Faculty of Civil Engineering, three from the Faculty of Civil Engineering at the Faculty of Civil Engineering, and four from other faculties. The heads of the study programs construction UN and construction VS also responded to the survey.

At the Faculty of Natural Sciences and Mathematics, University of Maribor, 7 students responded to the survey, of which two were students of the 2nd-cycle Physics study program, one student of the 2nd-cycle Mathematics study program, three students of the 3rd year of the 1st-cycle Physics study program, and one student of the unified master's study program Subject Teacher, who studies to Educational Technology and Educational Biology. All 2nd-cycle students completed their undergraduate studies at the Faculty of Natural Sciences and Mathematics, University of Maribor.

Systems thinking about energy systems

- Understanding cause-and-effect relationships in environmental systems (1.1 - level 1)
  FGPA UM: Participants demonstrate a high level of awareness of cause-and-effect relationships and energy flows in nature. The average score is 3.8, the program leaders of UN Civil Engineering and VS Civil Engineering awarded scores of 4 and 3, respectively.
  FNM UM: The average response value is 4.3, the standard deviation is 0.8. The most common responses are "5 (I completely agree)" and "4" (three answers each). No respondent chose "1" or "2". This shows that most respondents highly assess their awareness of cause-and-effect relationships (Figure 19).

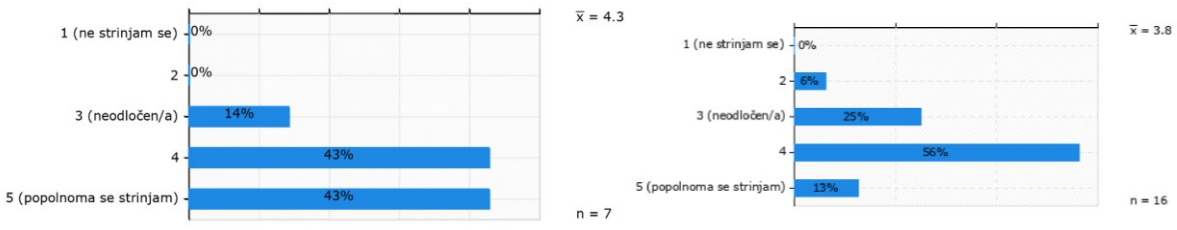


Figure 19. Identifying cause-and-effect relationships: results of students' responses to the FGPA UM (left) and FNM UM (right).

- Independent Analysis of Connections within Environmental Systems (1.1 - Level 2)
  FGPA UM: Most participants rate their ability as high, but some need additional support. The average score is 3.4, the program leaders assigned scores of 3 and 3.
  FNM UM: The average response value is 4.0, the standard deviation is 0.6. The most common response was "4" with four responses, followed by "5" with one response. This indicates that respondents have a relatively high level of confidence in analyzing environmental systems.

- Independent approach to solving environmental challenges with consideration of long-term sustainability (1.1 - level 3)
  FGPA UM: The answers indicate a readiness for sustainable solutions, but improvements in long-term planning are possible. The average score is 3.5, the program managers assigned scores of 3 and 4.
  FNM UM: The average response value is 3.5, the standard deviation is 0.5. The most common responses are "3" and "4", which indicates a divided opinion regarding the ability to solve sustainability challenges.

- Knowledge of basic physical concepts about energy and renewable energy sources (1.2 - level 1)
  FGPA UM: Most participants demonstrated a solid basic knowledge of energy and renewable resources. The average score is 4.3, with program leaders assigning scores of 5 and 4.
  FNM UM: All respondents selected "5 (I completely agree)" and no one selected lower values. This means that all participants have very good knowledge about the basics of energy and renewable sources.

- Explaining energy conversions, understanding the importance of different energy sources, different methods of producing and storing electricity (1.2 - level 2)
  FGPA UM: Participants have a good understanding of basic energy processes, but additional training would improve their confidence in explaining. The average score is 3.8, the program leaders assigned scores of 4 and 3.
  FNM UM: The average response value is 4.8, the standard deviation is 0.4. The most common response is "5", which indicates a high level of familiarity with these concepts.

- Identify and analyze the advantages and disadvantages of energy sources, their conversions, transport and storage (1.2 - level 3)
  FGPA UM: The answers indicate a deep knowledge of different energy sources and their properties. The average score is 4.1, the program leaders assigned scores of 4 and 3.
  FNM UM: The average response value is 4.7, the standard deviation is 0.5. The most common response is "5", which indicates a good understanding of these concepts.

- Understanding the Sun as a key source of energy for organisms and ecosystems and that the flow of matter requires an energy source (1.3 - level 1)
  FGPA UM: Knowledge about the role of the Sun in energy systems is generally accepted and well understood. The average rating is 4.3, with program leaders giving ratings of 5 and 3.

FNM UM: Most students are confident in their knowledge in this field, the average grade is 4.8.

- Understanding the impact of energy flows on the planet and knowing the most important energy sources for processes on Earth (1.3 - level 2)
  FGPA UM: High awareness of the impact of energy flows confirms the understanding of global ecological processes. The average score is 4.5, the program leaders assigned scores of 4 and 2.
  FNM UM: An average of 4.3 with a standard deviation of 0.8 indicates a high level of understanding, one student is undecided about his knowledge in this area.

- Explaining the impact of greenhouse gases on energy flows (1.3 - level 3)
  FGPA UM: Participants understand the importance of reducing greenhouse gases for maintaining the stability of energy flows. The average score is 4.0, the program leaders assigned scores of 5 and 3.
  FNM UM: The average response value is 4.0, the standard deviation is 0.9. The most common responses are "3", "4" and "5" (two answers each), with "1" and "2" not being selected. This indicates that knowledge about the impact of greenhouse gases is good, but with some differences between respondents.

- Understanding that the Sun is the primary source of energy for organisms and ecosystems and that food is a biofuel for organisms (1.4 - level 1)
  FGPA UM: The results on the scale show that most participants understand this crucial connection between the Sun, ecosystems and biofuels . The Sun as the primary energy source for photosynthesis is the foundation for entire food chains, which confirms the basic scientific literacy of the participants. The average score is 4.5, the program leaders assigned scores of 5 and 2.
  FNM UM: Most participants understand the connection, 83% chose 5 “strongly agree”. The average is 4.0 with a standard deviation of 0.9.

- Understanding energy flows in food chains (1.4 - level 2)
  FGPA UM: Most participants have a clear picture of energy flows in ecosystems. The average score is 3.9, the program leaders assigned scores of 4 and 2.
  FNM UM: The average of 3.8 shows that most students rate their knowledge of this field as good, 17% "completely agree" with the statement. 33% of students are undecided about their knowledge in this area.

- Human impact on ecosystem energy flows (1.4 - level 3)
  FGPA UM: Awareness of the impact of human activities is at a high level, which indicates responsibility towards the environment. The average score is 4, the program leaders assigned scores of 5 and 3.
  FNM UM: The answers are more scattered, the average is 3.8 with a standard deviation of 1.2 (Figure 20).

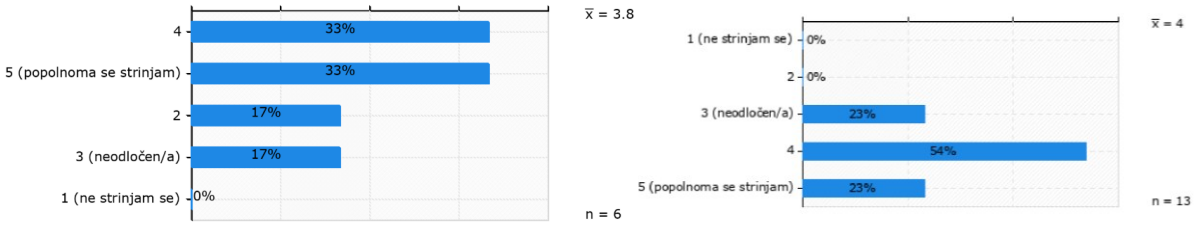


Figure 20. Human impact on ecosystem energy flows: results of student responses to the FGPA UM (left) and FNM UM (right).

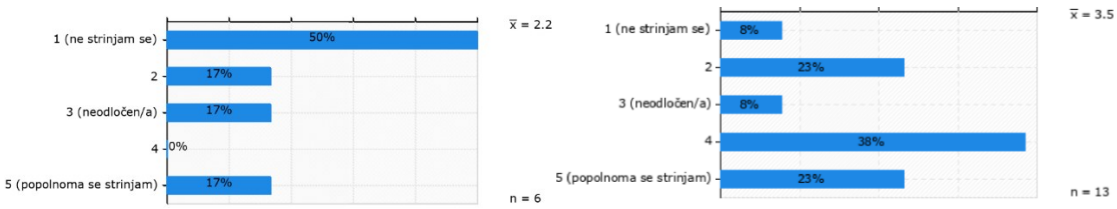
Biodiversity

- Knowledge of basic concepts of biodiversity (2.1 - level 1)
  FGPA UM: Basic knowledge of biodiversity is satisfactory, but it would be sensible to upgrade the practical aspects. The average grade is 3.5, the program leaders assigned grades of 5 and 2.
  FNM UM: The average of 3.0 with a standard deviation of 1.3 indicates that the responses are quite dispersed, meaning that some students have basic knowledge while others do not. This is crucial for science students, as biodiversity is the basis for ecological and environmental analyses.

- Analysis of factors of biodiversity and energy efficiency (2.1 - level 2)
  FGPA UM: Participants demonstrated analytical ability, but improvements are possible in in-depth studies. The average score is 3.3, the program leaders assigned scores of 3 and 2.
  FNM UM: The average score is 2.7 and the standard deviation is 1.4, which indicates slightly lower student confidence in analytical skills, which is important for understanding environmental impacts on systems.

- Biodiversity Strategy Development (2.1 - Level 3)
  FGPA UM: Most agree that they can develop strategies, which is a positive sign. The average score is 3.3, with program leaders given scores of 3 and 1.
  FNM UM: For the independent development of biodiversity conservation strategies, the average is 2.2 and the standard deviation is 1.3, which indicates weak student competence in biodiversity conservation strategies. This could affect their ability to solve environmental problems.

- Knowledge of principles of biodiversity management (2.2- level 1)
  FGPA UM: General knowledge of principles is satisfactory, but practical applications could be improved. The average score is 3.5, the program managers assigned scores of 4 and 2.
  FNM UM: The average score is 2.2, with a standard deviation of 1.6 indicating considerable variability in responses. Half of the respondents disagree with the statement that they know the basic principles of biodiversity management (Figure 21).



biodiversity management principles : results of students' responses to the FGPA UM (left) and FNM UM (right).

- Biodiversity management practices (2.2 - level 2)
  FGPA UM: The possibilities for integrating these practices into different contexts are promising. The average score is 3.5, with program leaders giving scores of 2 and 2.
  FNM UM: Student responses show that students rarely use biodiversity management practices , the average is low at 2.0 with a standard deviation of 1.3.

- Biodiversity Management Program Planning (2.2 - Level 3)
  FGPA UM: Results indicate the ability to plan basic programs, but more practical skills are needed. The average score is 3.2, the program leaders were given scores of 2 and 2.
  FNM UM: Students achieve a low average of 1.8 with a standard deviation of 1.0, which indicates a significant lack of skills and knowledge, or rather, the students have recognized that they lack such knowledge.

Management of Resources

- Understanding the importance of resource conservation (3.1 -level 1)
  FGPA UM: Participants are aware of the importance of conserving resources, which is the foundation for a sustainable future. The average rating is 4.8, with program leaders giving ratings of 3 and 5.
  FNM UM: All participants fully agree with the statement, which is key to sustainable development.

- Application of measures for sustainable resource management (3.1 -level 2)
  FGPA UM: Results indicate a high commitment to sustainable measures. The average score is 4.4, with program managers giving scores of 4 and 4.
  FNM UM: Average 3.7 with a standard deviation of 1.5, indicating good awareness, but still with some variability (Figure 22).

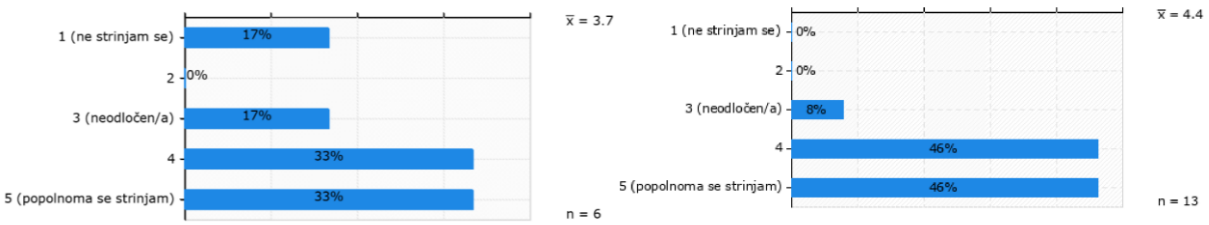


Figure 22. Identification and use of measures for sustainable resource management: results of student responses to the FGPA UM (left) and FNM UM (right).

- Independent analysis and optimization of measures for sustainable resource management (3.1 - level 3)

  FGPA UM: Most participants are confident in their analyses, but there is room for improvement in optimization. The average score is 3.8, and the program managers gave the scores 3 and 3.

  FNM UM: The average is 3.5, with half of the students confident in their knowledge and a third undecided. The standard deviation is 1.0.

- Knowledge of everyday energy activities and savings (3.2 - level 1)

  FGPA UM: Basic understanding is good, but more information could be added on advanced saving practices. The average rating is 4.2, with program managers giving ratings of 5 and 4.

  FNM UM: A high average of 4.5 means that students have a good understanding of the basics of energy consumption.

- Impact of innovations on energy consumption (3.2 -level 2)

  FGPA UM: Most understand the importance of innovations and measures for energy efficiency. The average rating is 4, the program managers gave ratings of 5 and 4.

  FNM UM: Students demonstrate a high level of understanding of the impact of social and technological innovations on energy efficiency, the average is 4.3 with a standard deviation of 0.8.

- Independent planning and development of methods for efficient energy use and optimization of energy processes (3.2 - level 3)

  FGPA UM: The ability to develop methods is present, but additional training would enable more innovative approaches. The average score is 3.7, the program managers were given scores of 3 and 3.

- **FNM UM:** An average of 3.5 with a standard deviation of 1.0 indicates an average level of competence. 33% are undecided about their competence in this area, while 17% completely agree with the statement.

- Knowledge of sustainable water use[1]
  Participants understand basic methods for sustainable water use, which indicates a readiness for sustainable solutions. The average rating is 4.4, with program managers giving ratings of 5 and 4.

- Water Management Systems Design [1]
  Most are capable of basic design, but complex projects are a challenge. The average score is 3.8, with program managers giving scores of 3 and 4.

- Wastewater management in larger projects [1]
  Knowledge in this area is less developed, requiring additional support. The average score is 3.6, with program managers giving scores of 2 and 2.

Technological competences

- Knowledge of the basics of renewable energy technologies (4.1 - level 1)
  FGPA UM: Most participants understand the operation of renewable technologies, which supports the green transformation. The average score is 4.1, the program leaders assigned scores of 5 and 4.
  FNM UM: The majority of participants (67%) completely agree with the statement. The average is 4.5 with a standard deviation of 0.8.

- Analysis of renewable energy technologies (4.1 - level 2)
  FGPA UM: Results indicate readiness for more in-depth analyses. The average grade is 3.8, with program leaders giving grades of 3 and 3.
  FNM UM: An average of 4.2 with a standard deviation of 0.8 means that students understand how these systems work (Figure 23).

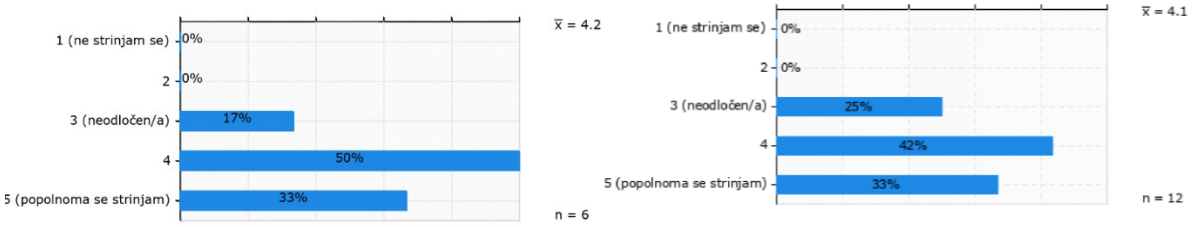


Figure 23. Analysis of renewable energy technologies: results of student responses to the FGPA UM (left) and FNM UM (right).

- Planning innovative solutions for the use of renewable energy sources (4.1 - level 3)
  FGPA UM: Participants express the need for additional support in developing innovative solutions. The average rating is 3.3, the program managers gave ratings of 2 and 2.
  FNM UM: No students completely disagree with the statement, half chose 4 (agree), half are undecided. The average is 3.5.

[1]Additional questions for FGPA UM students

- Knowledge of green technologies (4.2 - level 1)
  FGPA UM: Participants know basic green technologies and their advantages. The average score is 4.2, the program leaders assigned scores of 5 and 4.
  FNM UM: One student disagrees with the statement; the rest are confident in their knowledge of green technologies. The average grade is 3.8 with a standard deviation of 1.5.

- Analysis of the advantages and disadvantages of green technologies (4.2 - level 2)
- **FGPA UM:** The results indicate a good understanding of the advantages and disadvantages of these technologies. The average score is 3.4, with program managers giving scores of 4 and 4.
  FNM UM: One student is undecided about his/her abilities, but most rate them as good (33% chose the answer “completely agree”). The average is 4.3 with a standard deviation of 0.8.

- Independent planning, development and optimization of green technologies (4.2 - level 3)
  FGPA UM: Most respondents need additional knowledge for planning and optimization. The average score is 3.1, program managers assigned scores of 2 and 4.
  FNM UM: Most respondents do not agree that they are capable of independently planning, developing and optimizing green technologies. The average is 2.2 with a standard deviation of 1.3 (Figure 24).

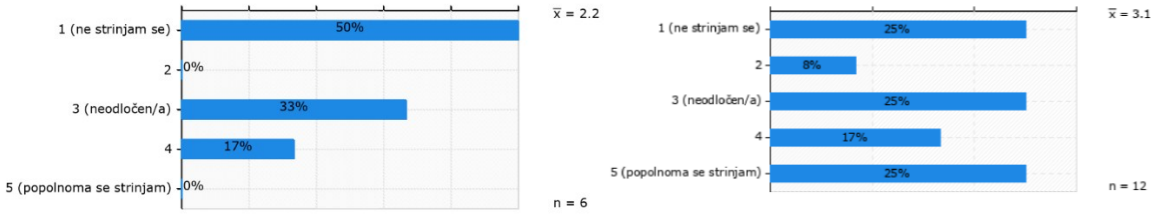


Figure 24. Independent planning, development and optimization of green technologies: results of student responses to the FGPA UM (left) and FNM UM (right).

- Sustainable building materials [2]
  Knowledge of sustainable materials is satisfactory. The average score is 3.8, the program managers gave scores of 5 and 5.
- Analysis of Building Materials [2]
  The ability to compare materials and their environmental impacts is good. The average score is 3.8, with program managers giving scores of 5 and 4.
- Life Cycle Analysis of Materials [2]
  Knowledge in this area shows potential for upgrading. The average score is 3.3, with program managers giving scores of 3 and 4.

[2]Additional questions for FGPA UM students

- Knowledge of energy efficiency standards [2]
  Participants know the basics of the standards, which indicates good preparation. The average score is 3, the program managers assigned scores of 5 and 3.
- Planning energy solutions for buildings [2]
  The ability to use software tools is solid, but additional workshops would improve confidence. The average score is 3.5, with program managers giving scores of 2 and 4.
- Advanced techniques for energy efficient building design [2]
  Knowledge of advanced techniques is limited, requiring more training. The average score is 3.3, with program managers giving scores of 4 and 3.
- Adaptation of building structures to weather conditions [2]
  The ability to adapt buildings is solid, but a better understanding of climate risks would be beneficial. The average score is 3.4, with program managers giving scores of 5 and 3.
- Climate Risk Assessment and Infrastructure Adaptation [2]
  Results indicate the need for additional training for complex adaptations. The average score is 3.1, with program managers giving scores of 3 and 3.
- Use of digital tools [2]
  The use of BIM and other tools is solid, but there is room for improvement. The average rating is 2.8, with program managers giving ratings of 3 and 3.
- Developing complex BIM models [2]
  Most need additional training to optimize building life cycles. The average rating is 3.7, with program managers giving ratings of 4 and 5.

Policy and business awareness

- Knowledge of environmental policy and regulation and awareness of the impact of decisions on quality of life (5.1 - level 1)
  FGPA UM: Policy understanding is at a high level, supporting sustainable planning. The average score is 3.4, with program managers scoring 4 and 3.
  FNM UM: The answers are scattered; the average is 3.2 with a standard deviation of 1.8. Equal shares of students (33%) “strongly disagree” and “completely agree” with the statement. The latter is a reflection, on the one hand of the different directions of study programs, and on the other hand, of the students' self-initiative in such topics.

- Explaining policies for the green transition (5.1 - level 2)
  FGPA UM: Most respondents recognize key aspects of the green transition. The average score is 3, with program leaders giving scores of 2 and 3.
  FNM UM: A third of students believe they lack the knowledge to explain green transition policies; a slightly smaller number are undecided. Half of the students feel confident in this area. The average is 3.0, standard deviation 1.7.

- Independent analysis and forecasting of factors influencing decisions on the exploitation of energy resources, and the design of environmental policy development (5.1 - level 3)

FGPA UM: Participants showed interest in designing environmental policies, but more practice is needed. The average score is 3.4, the program leaders assigned scores of 5 and 3.
FNM UM: The answers are scattered; the students have a clear position (they are not undecided). Half of them is confident in their abilities. The average is 2.8 (Figure 25).

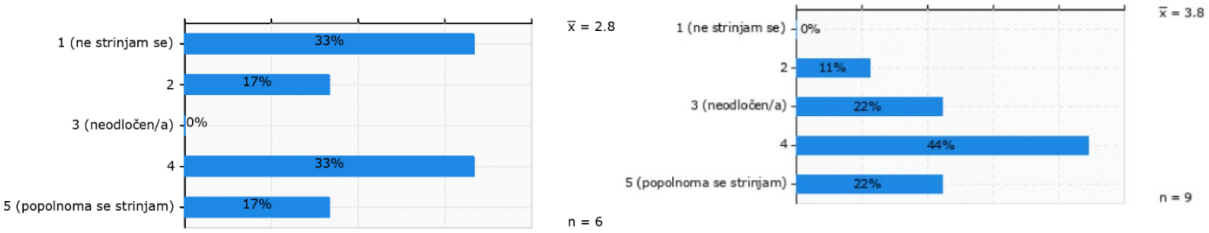


Figure 25. Independent analysis and design of environmental policy development: results of student responses to the FGPA UM (left) and FNM UM (right).

- Understanding the basics of green business and sustainable entrepreneurship (5.2 - level 1)
  FGPA UM: Participants understand the basic concepts of green business. The average score is 3.6, the program leaders assigned scores of 4 and 3.
  FNM UM: Clearly expressed position and shared opinion on understanding the basics of green business. The average is low 3.0 with a standard deviation of 1.5 (Figure 26).

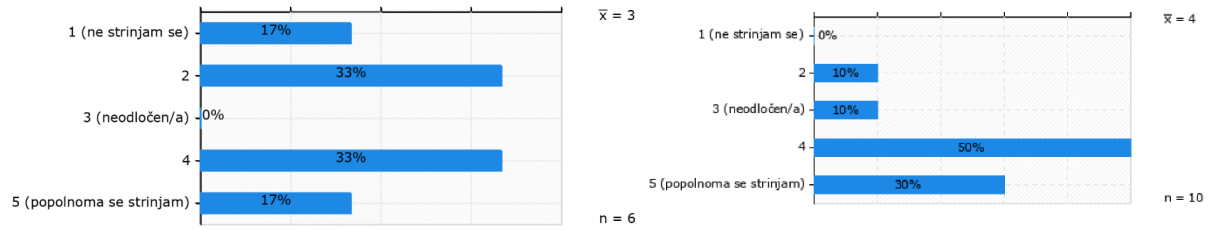


Figure 26. Understanding the basics of green business and sustainable entrepreneurship: results of students' responses to the FGPA UM (left) and FNM UM (right).

- Independent analysis of good practice examples of green business and sustainable entrepreneurship (5.2 - level 2)
  FGPA UM: Case analysis ability is satisfactory, but additional case studies would be useful. The average grade is 3.8, the program managers assigned grades of 2 and 2.
  FNM UM: Most students (67%) do not agree that they are capable of independent analysis, the average is low, i.e. 1.5 with a standard deviation of 0.8.

- Independent planning and development of strategies for green business and sustainable entrepreneurship (5.2 - level 3)
  FGPA UM: Results indicate the need for greater focus on practical cases. The average score is 4, with program leaders giving scores of 3 and 2.

FNM UM: No students chose a grade of 4 or 5, the majority disagree with the statement (67%). The average is 1.5, the standard deviation is 0.8.

- Understanding of sustainable practices [3]
  Most understand the importance of sustainable practices in everyday life. The average score is 3.9, with program managers giving scores of 2 and 2.

- Planning Sustainable Solutions [3]
  The results indicate a readiness to integrate sustainable solutions into practice. The average score is 3.6, with program managers giving scores of 2 and 1.

Conclusion

FGPA UM: Most participants demonstrate a high level of understanding of the basic concepts of sustainability, renewable energy sources, biodiversity and green technologies. Key areas include advanced analysis, complex solution design and the use of digital tools and technologies. Greater emphasis on practical training would contribute to improving self-confidence in implementing complex projects. The survey results confirm the willingness of participants to actively participate in the green transition and sustainable development.

The results of the statistical analysis comparing (average) responses regarding energy literacy competences of graduates (A) and study program leaders (B) at FGPA are as follows.

The Pearson correlation coefficient between answers A and B is 0.266 and is not statistically significant, while the Spearman correlation coefficient is 0.522 (with a p-value <0.001), which means that there is a statistically significant moderate to strong (probably non-monotonic) relationship between A and B. The results of the paired t-test for the difference AB are as follows: the average difference is -1.21 (answer A is on average 1.21 lower than answer B). The value of the statistic is t=-3.071 (p-value is 0.003, which means that the result is statistically significant). Therefore, there is a statistically significant difference between the AB scores, which means that students rate their acquired competences lower than expected by the head of the SP.

FNM UM: The results show that students have strongly developed competences in systems thinking about energy systems. In topics related to biodiversity, the answers are more scattered. Independently designing strategies for preserving biodiversity (2.2) and knowing the principles of its management (2.2) are areas where students show the lowest average scores. Students are fully aware of the importance of preserving resources but are less confident in applying concrete measures for sustainable resource management (3.7) and independently planning and optimizing energy processes (3.5). Their knowledge of green technologies is slightly lower (3.8) and quite scattered, but they still have a good understanding of the advantages and disadvantages of these technologies (4.3). Independently planning and optimizing green technologies is a challenge, as the average score is only 2.2. Understanding of environmental policy and regulation is scattered (3.2), which indicates different student attitudes. The same applies to their ability to explain policies for the green transition (3.0), with a third of students believing that they do not have enough knowledge. Independent analysis and

[3]Additional questions for FGPA UM students

design of environmental policies is not a strong point, as the average score is 2.8, and students are not undecided, but have a clear position. In the area of green business, students demonstrate a low understanding of the basics (3.0), with opinions being quite divided. Particularly notable is their low ability to independently analyze good practices of green business (1.5) and plan strategies for sustainable entrepreneurship, where the average is also 1.5, and most students do not agree with the statement that they can do this. When interpreting the results, it is important to consider that physics students, especially at the first level of study, are not expected to have in-depth knowledge in areas such as biodiversity, environmental policies and regulations. These are not topics that would be systematically included in their core curriculum. However, in the 3rd year, students can choose elective courses offered by other members of the University of Maribor, which allows them to expand their knowledge in these areas if they wish. In addition, physicists can participate in interdisciplinary groups, where they contribute primarily with their knowledge in the field of physics, which is crucial in solving complex sustainability challenges. We also analyzed the correlations between the average grades of students, the grades of the head of the Physics study program, the coordinator of the Educational Mathematics study program, and the coordinator of the Educational Physics study program. The highest correlation was detected between the grades of students and the head of the non-pedagogical Physics program, where the Pearson correlation is $r = 0.806$ ($p < 0.001$), and Spearman's $\rho = 0.799$, and the coordinator of Educational Physics ($r = 0.670$, $\rho = 0.735$). These results indicate a relatively consistent perception of the level of energy literacy of graduates between students and heads of study programs. The results show that statistically significant differences are present between the grades of students and both coordinators of pedagogical majors.

MODERNIZATION OF THE PEDAGOGICAL PROCESS TO SUPPORT THE DEVELOPMENT OF DIGITAL COMPETENCES

Example of supplementing a learning unit to support the development of digital competence and focus on labor market needs

As an example of an updated learning unit, we chose the elective course Acoustics, which is offered in several study programs that we analyzed (Physics, 1st level, Subject Teacher, Educational Physics specialization), and is also offered as an optional learning unit. The head of the learning unit is Prof. Dr. Robert Repnik, a member of the NOO project research team. The course covers a wide range of acoustic phenomena, including the basics and upgrading of knowledge about oscillations and waves, sound waves, room acoustics, and the use of modern computer technology for sound processing and analysis, such as electroacoustics and noise control. It introduces students to various aspects of acoustics, such as resonance, the Doppler effect, sound interference, characteristics of the human voice, noise measurement, and the operation of acoustic devices (microphones, amplifiers, loudspeakers). Within the course, students acquire theoretical and practical knowledge in the field of acoustic phenomena and skills in using modern methods for sound analysis.

Currently, the course uses outdated equipment that does not support modern methods of digital sound processing. Some devices are not compatible with modern computer systems, which limit the possibilities for experimental work and the use of new pedagogical approaches, or the quality of these devices is low, for example, the presence of noise. The goal is to develop the ability to qualitatively and quantitatively understand sound phenomena, plan and perform measurements, handle appropriate acoustic equipment and develop skills and abilities in this regard, and use software for processing sound recordings. The integration of electronic equipment and digital tools into the educational process significantly contributes to improving the understanding of natural science and mathematics content and the development of digital competences in students. In the field of acoustics, the use of tools for simulations, analysis of sound data and visualization of wave phenomena allows for a better connection of theoretical concepts, such as oscillations, waves, resonance and interference, with practical examples. Using sound analysis software, students can perform spectral analyses, measure acoustic properties, and interpret sound phenomena, facilitating the understanding of complex acoustic phenomena, while developing skills such as the use of specialized technical equipment, critical evaluation of experimental data, and problem-solving with the help of technology. Such an approach promotes interactive learning and adaptation of the learning process to individual needs, leading to more effective learning outcomes and a comprehensive understanding of the content.

To this end, we proposed the purchase of equipment to modernize the acoustics laboratory within the NOO project. The use of the equipment is directly related to specific learning activities and competences that students develop:

- **Mixing table**
  It will be used in exercises for connecting and processing multiple simultaneously captured audio signals, which develop competences in the field of digital acoustics and signal processing. The mixing console is a key connecting element that can be controlled with a tablet

computer. Using appropriate audio cables, it is connected to microphones, whose signals are amplified by amplifiers, and the output is connected to various speakers.

- **Microphones and speakers**
  They enable recording, analysis and comparison of acoustic phenomena, which strengthens the practical understanding of physical concepts. With several different microphones on appropriate stands, it is possible to study interesting physical phenomena based on the simultaneous capture of several sound signals, whereby it is important to know the acoustic characteristics of each microphone. We also need to know the acoustic characteristics of loudspeakers, whereby it is interesting to study the effects as a result of the position, directionality and settings of the loudspeakers.
- **Amplifiers**
  amplification effects and resonance phenomena, which is the foundation for direct experimental research by students.
- **Tablet computer**
  It enables the digitization of audio signals and data processing with specialized software. The most important role is to control and change the functions of the mixing console via wireless connections while capturing and playing audio signals. The wireless connection is crucial, as students can move around the room and perceive the effects of the sound system depending on their position in the room, especially the distance and direction relative to the centerline between the speakers.

The use of modern technology in education is crucial, as the integration of digital tools into lessons increases student engagement and improves the quality of teaching. The use of tablets and digital sound management through specialized applications allows students to acquire key skills, such as sound digitization, spectral analysis and audio signal processing. By simulating real-life situations, such as recording and processing sound for " podcasts " or scientific projects, students are encouraged to independently research and actively use digital tools, which contributes to better preparation for the challenges of modern research and professional work.

Similar equipment has been successfully used in other educational institutions to improve physics and acoustics lessons, confirming its effectiveness and contribution to better quality education. As part of the *Teaching project of the harmonics oscillator damped by a constant force* (American Journal of Physics, 2018) used acoustic tools to demonstrate analogies between mechanical and acoustic phenomena, allowing students to gain a deeper understanding of complex concepts through practical examples. Similarly, the research *Evaluating the effectiveness of physlet-based materials and supporting conceptual learning about electricity* (Journal of Science Education and Technology , 2017) showed how digital tools can improve the understanding of physics concepts, with these methods successfully transferring to the field of acoustics. The use of digital acoustic devices and sound analysis software is therefore already included in educational programs at other universities, where the results have shown increased student engagement and better learning outcomes. This confirms that the integration of modern technology significantly contributes to more effective teaching and better understanding of the subject matter.

CONDUCTED WORKSHOPS

Digital Competences for Education

The workshop was held on Thursday, February 6, 2025, at 2:00 PM in the PEF meeting room and remotely.

Lecturer: Assoc. prof. dr. Snjezana Babić

Workshop summary: In modern higher education, almost all teachers integrate digital technologies into their teaching, but the extent of their use varies depending on their digital competences and other factors in the educational environment. The purpose of this lecture was to motivate teachers to improve their digital competences and use e-learning more effectively, with a special focus on the hybrid teaching model, which has become the most commonly used approach in higher education institutions. In this context, the lecture introduced the concepts of digital competences of teachers through the European DigCompEdu framework and presented a conceptual framework for the use of e-learning in a hybrid learning environment. This framework connects teacher competences with theories and models of digital technology adoption and explains the three levels of integration of digital technologies in higher education teaching. The aim of the lecture was therefore to empower teachers to use digital technologies more effectively, thereby improving interactivity, personalization and the overall quality of higher education (Figure 27).

Achievements of participants:

- Improved understanding of digital competences.
- Practical knowledge of e-learning tools.
- Increased awareness of levels of technology integration.
- Increased confidence in using digital technologies.
- Developing skills for hybrid teaching.
- Recognizing the importance of a long-term digital strategy.
- Collaborative exchange of ideas.

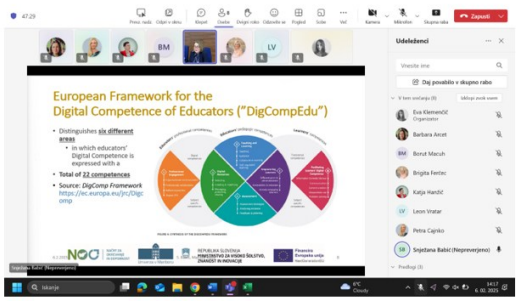


Figure 27. Snapshots from the Digital workshop Competences for Education , lecturer assoc. prof. dr. Snjezana Babić

Digital competences: Development of digital competences in education (with emphasis on elementary school)

The workshop was held on Tuesday, April 22, 2025, at 2:00 PM in the PEF meeting room and remotely.
Lecturer: Dr. Damjan Osrajnik

Workshop summary: The workshop will focus on digital competences in primary school from three perspectives. First, the competences of students will be presented. Although students can study computer science in elective subjects in the last triad and an optional subject in the second triad, not all of them choose to do so, which means that many are left without basic digital skills. Digital competences should also be acquired in all subjects, but this is not yet sufficiently established. The second aspect includes teachers, who must be digitally competent in managing pedagogical documentation, communication and lesson preparation. Their task is also to develop digital skills in students. The third aspect includes school management and administration, where digitalization enables effective documentation, communication and work organization. Participants will gain insight into the implementation of digital competences in schools and their role in pedagogical study programs.

Achievements of participants:

- Understanding the importance of digital competences.
- Learning about ways to integrate digital skills into different subjects.
- Upgrading one's own digital competences for the effective use of technology in pedagogical work, documentation and communication.
- Ability to plan concrete activities for the development of digital competences.
- Gaining insight into good practices for implementing digitalization in schools.
- The ability to critically reflect on the current state of digital competences in schools and prepare proposals for improvements.

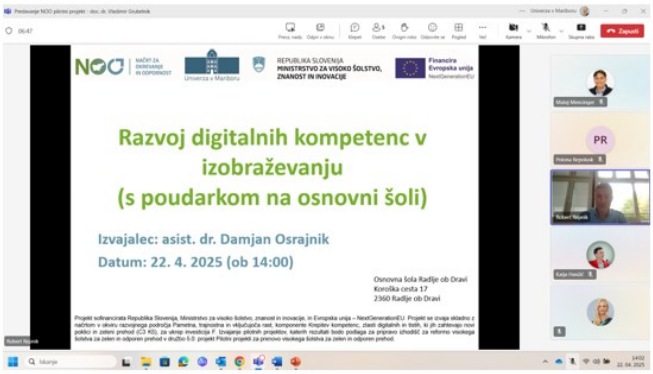


Figure 28. Snapshots from the lecturer's workshop ***Dr. Damjan Osrajnik***

Energy literacy

The workshop was held on Tuesday, June 3, 2025, at 2:00 PM in the PEF meeting room and remotely.
Lecturers: Mojca Drevenšek and Dr. Uroš Kerin

Workshop summary: The workshop emphasized the importance of a reliable energy supply for the normal functioning of modern society: individuals and households, industry, and the public sector. Based on the definition of energy literacy as understanding the properties and importance of energy and its supply, the ability to use knowledge about energy and energetics in practice, in making concrete decisions by individuals and communities, will be presented. The need for the active involvement of young people in co-shaping Slovenia's energy future and connecting formal and informal energy education will be highlighted.

The importance of promoting systemic thinking and interdisciplinarity and connecting different professions to strengthen energy literacy among young people was explained using concrete examples of collaborative activities with young people that take place within the framework of the Council for Research and Scientific Activity of ELES, doo, and the youth educational and awareness-raising activities of the ENLITE association. The concept of the EPIK online guide for the promotion of studies and professions in the field of energy was presented.

Participants were invited to an interactive discussion and co-creation of proposals for interdisciplinary cooperation to strengthen energy literacy of students at the University of Maribor. The aim of the discussion is to prepare a substantive draft of an interdisciplinary university course Energy Literacy, which would intertwine formal university education with expectations, needs and initiatives from the energy sector, and to identify the advantages and disadvantages (challenges) for implementing such a course.

Achievements of participants:

- Understanding the concept of energy literacy.
- Learning about the importance of interdisciplinarity for strengthening energy literacy.
- Getting to know the interests and expectations of young people regarding energy topics.
- Strengthening cooperation between providers of formal and informal energy education.
- Interactive discussion on energy topics in university programs.
- Familiarization with the possibilities of promoting UM studies in the EPIK online guide.
- Designing a draft of the interdisciplinary course *Energy Literacy* .

Figure 29. Snapshot from the workshop of lecturers Mojca Drevenšek and Dr. Uroš Kerin.

WORKSHOP EVALUATION

Findings

Feedback Analysis: Digital Competences for Education

Lecturer: Assoc Prof. Snježana Babić , Ph.D.

Event date: 6.2.2025

Event duration: 90 min

Event section: digital competences

n = 6

VU = 4, VS = 2

The average scores for each statement are:

- The choice of workshop date was appropriate: 5.0
- The length of the workshop was appropriate: 5.0
- The workshop description is consistent with the implementation: 5.0
- After the workshop, I would like the opportunity to self-evaluate the knowledge gained: 3.0
- The workshop would require separate basic and advanced levels: 2.5
- The content was presented clearly and understandably: 5.0
- Through the workshop I developed my digital competences: 4.6
- Through the workshop, I developed the competences of algorithmic, logical and abstract thinking: 4.4
- Through the workshop I developed scientific competences: 3.0
- The workshop influenced my understanding of the topic: 4.67
- The workshop motivated me to continue working in this field: 4.67
- I will use the acquired knowledge or competences in my work or studies: 4.83

Percentage of "strongly agree" for each statement:

- The choice of workshop date was appropriate: 100.00%
- The length of the workshop was appropriate: 100.00%
- Workshop description is consistent with implementation: 100.00%
- After the workshop, I would like the opportunity to self-evaluate the knowledge gained: 16.67%
- The workshop would require separate basic and advanced levels: 16.67%
- The content was presented clearly and understandably: 100.00%
- I developed my digital competences through the workshop: 80.00%
- Through the workshop, I developed the competences of algorithmic, logical and abstract thinking: 80.00%

- I developed scientific competences through the workshop: 25.00%
- The workshop influenced my understanding of the topic: 66.67%
- The workshop motivated me to continue working in this field: 66.67%
- I will use the acquired knowledge or competences in my work or studies: 83.33%

Summary of analysis:

- Most of the key questions were rated very positively, indicating a high level of satisfaction among participants.
- Participants particularly highlighted the clarity of the presentation and the professionalism of the lecturer, which indicates the high quality of the performance.
- The workshop had a positive impact on the understanding of the topic discussed, with most participants expressing a high level of agreement with key statements.
- Comments highlight the excellent presentation of the material, the high qualifications of the lecturer, and the overall positive experience.
- Some participants expressed a desire for additional opportunities for self-evaluation and a possible division of content into basic and advanced levels.

Feedback analysis: Development of digital competences in education (with a focus on primary school)

Lecturer: Assist. Dr. Damjan Osrajnik

Event date: 22.4.2025

Event duration: 90 min

Event section: digital competences

n = 8

VU = 3, VS = 3, student = 1, MR = 1

The average scores for each statement are:

- The choice of workshop date was appropriate: 4.62
- The workshop length was appropriate: 4.88
- The workshop description is consistent with the implementation: 4.75
- After the workshop, I would like the opportunity to self-evaluate the knowledge gained: 2.62
- The workshop would require separate basic and advanced levels: 1.5
- The content was presented clearly and understandably: 4.75
- I developed my digital competences through the workshop: 4.0
- Through the workshop, I developed algorithmic, logical and abstract competences.

opinions: 3.43

- Through the workshop I developed scientific competences: 3.0
- I developed energy literacy through the workshop: 2.14
- The workshop influenced my understanding of the topic: 4.12
- The workshop motivated me to continue working in this field: 3.88
- I will use the acquired knowledge or competences in my work or studies: 4.12

The proportion of "strongly agree" for each statement:

- The choice of workshop date was appropriate: 87.5%
- The length of the workshop was appropriate: 87.5%
- Workshop description is consistent with implementation: 75.0%
- After the workshop, I would like the opportunity to self-evaluate the knowledge gained: 12.5%
- The workshop would require separate basic and advanced levels: 0.0%
- The content was presented clearly and understandably: 75.0%
- I developed my digital competences through the workshop: 50.0%
- Through the workshop, I developed algorithmic, logical and abstract thinking competences: 28.6%
- I developed scientific competences through the workshop: 28.6%
- I developed energy literacy through the workshop: 14.3%
- The workshop influenced my understanding of the topic: 37.5%
- The workshop motivated me to continue working in this field: 37.5%
- I will use the acquired knowledge or competences in my work or studies: 50.0%

Summary of analysis:

- Overall, the results show that the workshop was **successful, professionally conducted** , and achieved **a high level of satisfaction among the majority of participants** , while also offering **guidelines for further content development** .

Feedback Analysis: Energy Literacy

Lecturers: Dr. Uroš Kerin and Mag. Mojca Drevenšek

Event date: 3.6.2025

Event duration: 90 min

Event theme: green and energy

n = 7

VU = 4, VS = 1, professional associate = 2

The average scores for each statement are:

- The choice of workshop date was appropriate: 4.86
- The length of the workshop was appropriate: 3.86
- The workshop description is consistent with the implementation: 4.43
- After the workshop, I would like the opportunity to self-evaluate the knowledge gained: 2.43
- The workshop would require separate basic and advanced levels: 2.14
- The content was presented clearly and understandably: 4.71
- I developed my digital competences through the workshop: 3.25
- Through the workshop, I developed the competences of algorithmic, logical and abstract thinking: 4.00
- Through the workshop I developed scientific competences: 4.20
- I developed energy literacy through the workshop: 4.86
- The workshop influenced my understanding of the topic: 4.57
- The workshop motivated me to continue working in this field: 4.43
- I will use the acquired knowledge or competences in my work or studies: 4.29

The proportion of "strongly agree" for each statement:

- The choice of workshop date was appropriate: 85.7%
- The length of the workshop was appropriate: 42.9%
- Workshop description is consistent with implementation: 57.1%
- After the workshop, I would like the opportunity to self-evaluate the knowledge gained: 14.3%
- The workshop would require separate basic and advanced levels: 0.0%
- The content was presented clearly and understandably: 71.4%
- I developed my digital competences through the workshop: 0.0%
- Through the workshop, I developed algorithmic, logical and abstract thinking competences: 14.3%
- I developed scientific competences through the workshop: 28.6%
- I developed energy literacy through the workshop: 85.7%
- The workshop influenced my understanding of the topic: 71.4%

- The workshop motivated me to continue working in this field: 57.1%
- I will use the acquired knowledge or competences in my work or studies: 57.1%

Summary of analysis:

- The results show that the workshop was successfully implemented and professionally prepared. Most participants expressed a high level of satisfaction, especially regarding the choice of term, clarity of content and development of energy literacy. Despite the generally positive assessment, the results also indicate opportunities for improvement – especially regarding the possibility of self-evaluation, differentiation of complexity and duration of the workshop.

Analysis of freshmen surveys

FGPA UM

A survey conducted among first-year FGPA students in the 2024/25 academic year offers interesting insights into motivation for choosing a study program, expectations regarding the study program, and the use of digital technologies.

1. Composition and participation in the survey

There were 71 respondents, representing 26% of all enrolled students (Figure 30). The highest proportion of respondents in terms of enrollment came from the UN Civil Engineering (38%) and UN Architecture (38%), while participation in the UN Industrial Engineering program was the lowest (4%).

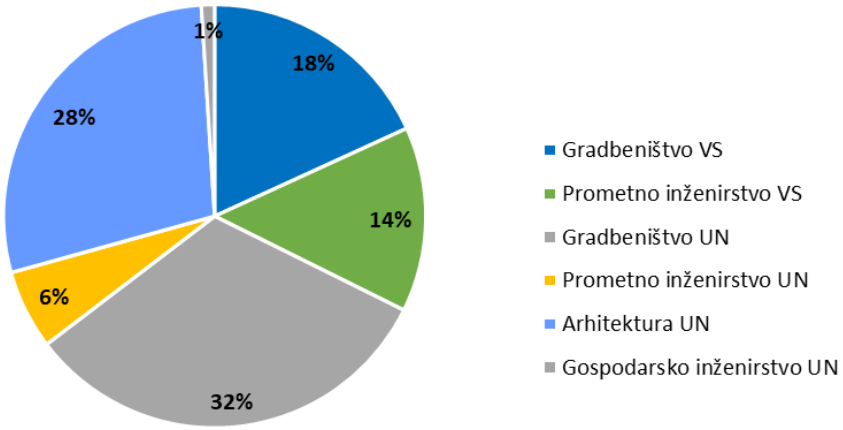


Figure 30. Composition of freshman respondents at FGPA

2. Decisions to study

Most students began to think about their studies in high school, most often in their third or fourth year. Interestingly, architecture students often made their decision earlier, some even in elementary school. The final decision on their choice of study was mostly made in the last year of high school or just before enrollment. Alternatives included fields of study such as mechanical engineering, economics, psychology, medicine, and even art programs (Figure 31).

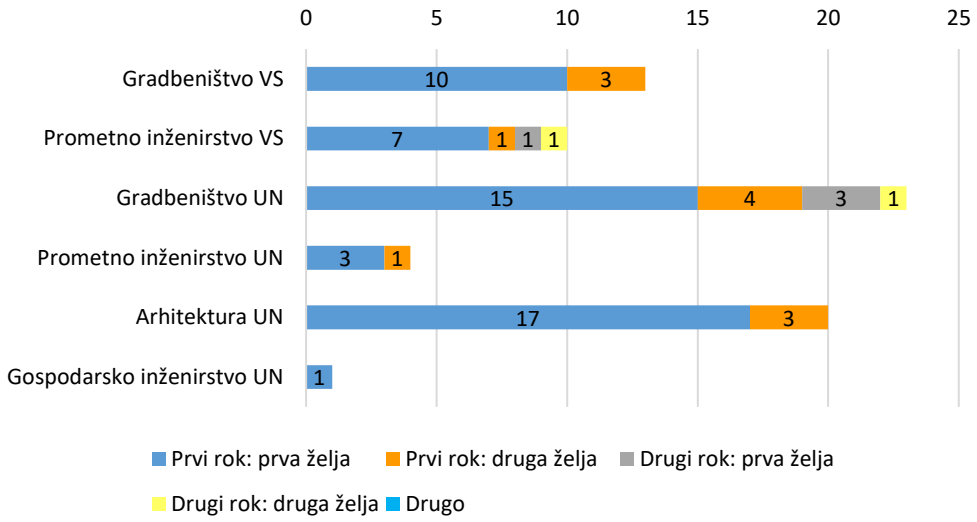


Figure 31. Method of enrolling freshmen at FGPA

3. Information Day – expectations and impressions

The information day was mostly attended by students of UN Architecture. The students mostly assessed that they received useful information on the information day, but some missed more concrete information about the curriculum, practical exercises and necessary equipment. There were some comments among foreign students about the lack of information in English. The second largest source of information is the FGPA website. The study is practically not promoted by FGPA representatives at secondary schools (Figure 32).

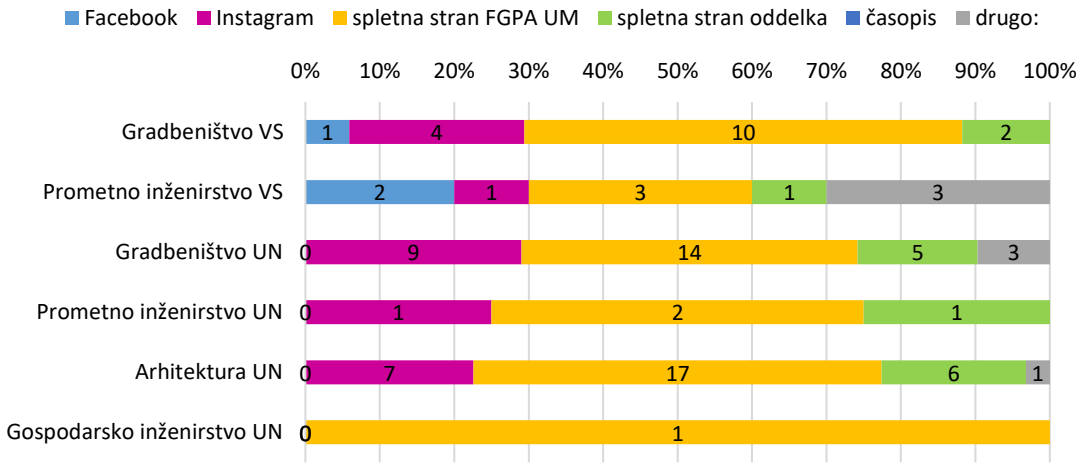


Figure 32. Source of information about studying at FGPA.

4. Study selection and influencing factors

The main reasons for choosing a study program are interest in the profession, employment opportunities and proximity to home. In architecture, flexibility of study is also an important factor. For the majority of students, the choice of study program was their own desire, with parents and friends having a significant influence on the choice. Students mostly want to acquire enough knowledge during their studies to be well prepared for the job market, and completing their studies as soon as possible is less important to them. Students in UN programs want to continue their studies at the 2nd Bologna level, while there are fewer such students in VS programs (Figure 33).

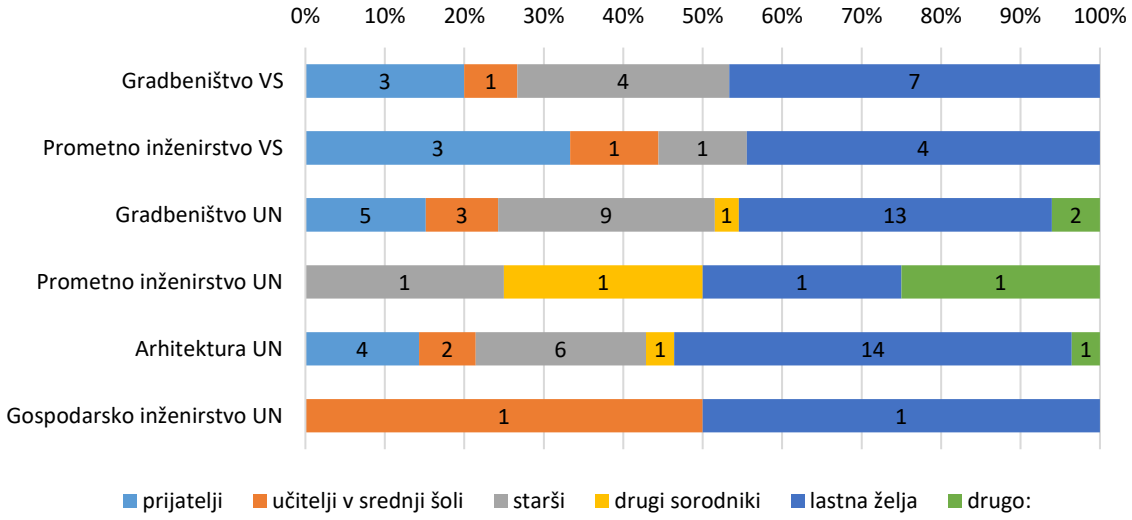


Figure 33. Influence on the decision to study at FGPA.

5. Use of digital technologies

Most students actively use digital technologies for communication and information retrieval. The average use of smart devices is between 4 and 6 hours per day. They spend most of their time on smartphones. Their digital literacy is generally high, especially in searching for information and using basic programs, but less so in programming and data protection. For the study itself, most students would still choose a printed textbook. One of the comments is the dispersion of digital platforms for delivering learning material, as some professors use Moodle , others MS Teams or email. Students proposed a unified system for better transparency and easier organization of the learning process.

6. Conclusion and recommendations

The survey provides valuable insight into students' choices and expectations, while also highlighting key challenges they face. The survey shows that students are generally satisfied with their choice of study, but expectations regarding the information day and study organization are partly unmet. The results can serve as a basis for improving study programs and work organization at the faculty, with an emphasis on better communication, a unified system for delivering materials, and greater flexibility for international students.

FNM UM

In the following analysis, we present the results of a survey conducted among freshmen physics students at the Faculty of Natural Sciences and Mathematics of the University of Maribor (FNM UM) for the academic year 2024/2025. The aim of the survey was to gain insight into the motivation, experiences and expectations of students upon entering the faculty.

1. General information about the survey

- **Number of students enrolled in the 1st year:** 20
- **Number of completed surveys:** 15 (75% response rate)

2. Survey results

Most students started thinking about studying physics in elementary school (40%), while 27% did so in the first two years of high school. A smaller proportion, 33%, decided in their senior years of high school (Figure 34).

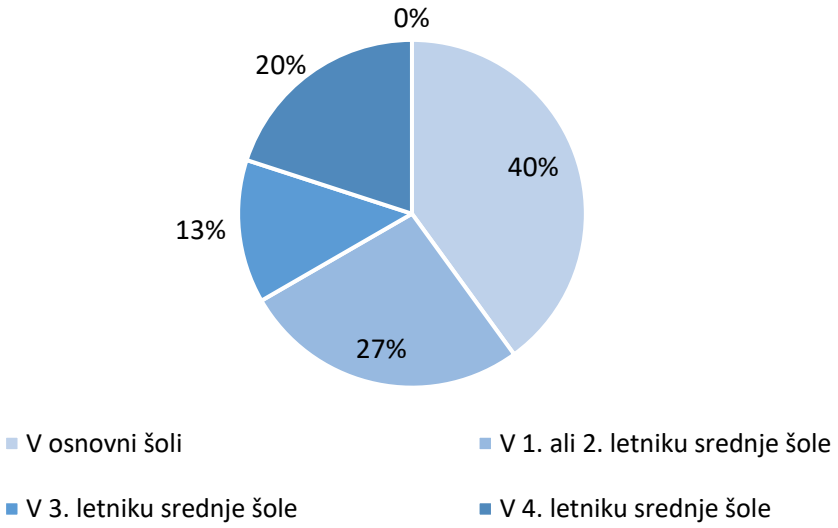


Figure 34. Decision to study physics (FNM).

The decision to study physics (Table 2) was made by most students in their third or fourth year of high school (47%). Some decided earlier, after an information day (13%), or transferred from their first chosen study program (13%).

Table 2. Results to the question "When did you decide with certainty to study physics?" (FNM UM).

Answer	Frequency	Percentage
After the information day	2	13%
Before submitting an application	1	7%
After an unsuccessful first study and transcript	2	13%
In the 3rd year of high school	4	27%
In the 4th year of high school	3	20%
Other	3	20%

The greatest influence on the decision was personal preference (80%), followed by the influence of friends (38%), high school teachers (23%), and parents (31%). A smaller proportion of respondents (13%) made their decision based on the faculty's presentation (Figure 35).

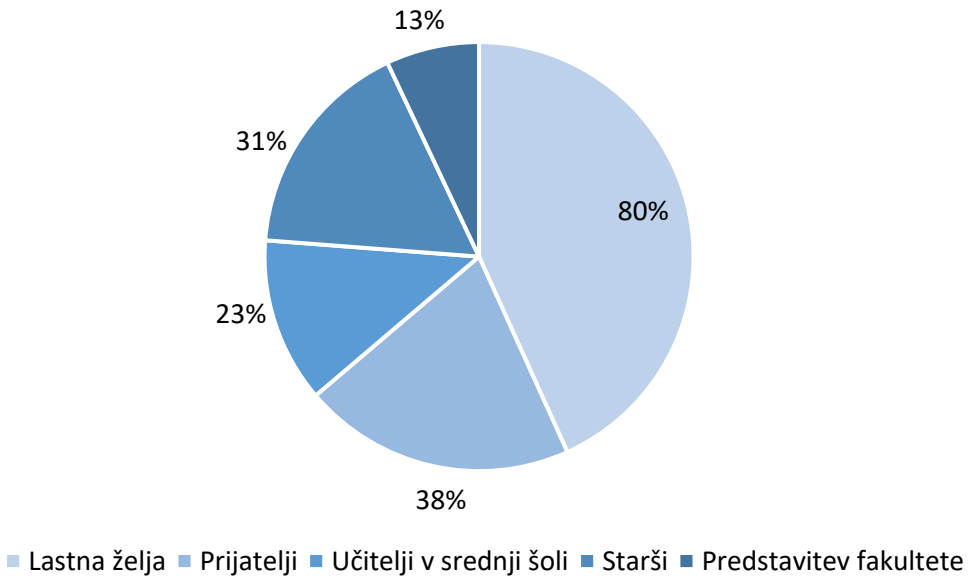


Figure 35. Influences on the decision to study physics (FNM).

Most students (60%) attended the information day, which means that they sought additional information about their studies before enrolling. Of those who attended the information day, 89% rated the information as useful, with only one student considering it only partially useful. Freshmen were primarily convinced to study at FNM UM by their professors and the location of their studies (Table 3).

Table 3. Results to the question "What information convinced you to study at the FNM UM?".

Information	Frequency	Percentage
Friendly professors	7	54%
Conversation with older students	6	46%
Place of study	7	54%
Syllabus or schedule	5	38%

We also asked Bruce about the level of education they want to achieve. Most students plan to continue their studies beyond the first Bologna cycle. As many as 47% want to achieve a doctorate, while 27% plan to complete the second Bologna cycle (Table 4).

Table 4. Results on the question "Desired level of education" of physics freshmen at the FNM UM.

Level	Frequency	Percentage
1st Bologna level	2	13%
2nd Bologna level	4	27%
Doctorate	7	47%

The majority of students (40%) use digital technologies for up to four hours a day. A smaller proportion use them for more than six hours, and only 13% use digital devices for more than eight hours a day (Figure 36).

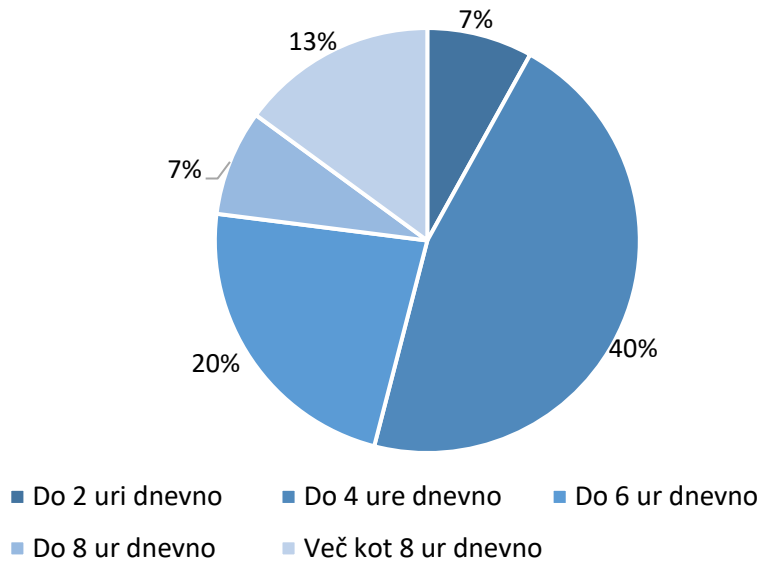


Figure 36. Use of digital technologies (FNM).

Physics students had solid grades in science subjects in high school, indicating good preparation for studies. The average grade in physics was 3.5, in mathematics 3.2, chemistry 3.2 and biology 3.4. The overall success in high school was estimated with an average of 3.1. The average grades are also shown in Table 5.

Table 5. Average final grades in high school.

Subject	Average rating	Standard deviation
Physics	3.5	1.0
Mathematics	3.2	1.1
Chemistry	3.2	1.0
Biology	3.4	0.8
Overall success	3.1	1.0

3. Conclusion

Analysis of the results shows that most students decide to study physics in high school, with personal interests and the influence of teachers being the biggest influence on the decision. Information days play an important role in confirming the choice of study, with the friendliness of professors, conversations with older students, and the structure of the curriculum being key factors.

The use of digital technologies is widespread among students, but most of them spend relatively little time on social media. The vast majority of students (47%) want to achieve a doctorate, indicating a high motivation for the academic path.

Average grades in high school show that physics students have solid prior knowledge in science subjects, which will help them in their further studies.

Based on the data analysis, we can highlight some interesting correlations and potential gaps:

Correlations

- **Time of decision and influencing factors:**
  Students who decided to study physics in high school (47% in their 3rd or 4th year) often cited teachers (23%) and friends (38%) as key influencing factors. This suggests that the high school environment is important in guiding students to study physics.
- **Information day attendance and study decision:**
  The majority of students who attended the information day (60%) rated the information as useful (89%), suggesting that information days play an important role in confirming study choices.
- **Education level and motivation:**
  As many as 47% of students aspire to obtain a doctorate, which is a relatively high proportion given the general trends in higher education. This could be linked to the fact that the majority chose their studies out of their own desire (80%), meaning that they are motivated individuals.
- **Digital technology use and study habits:**
  Students who use digital technologies for more than 6 hours a day (20%) may rely more on e-learning and digital knowledge resources. It is possible that these students are more technologically savvy, which could affect their learning style and academic performance.

Potential gaps and questions for further analysis

- **How do information days influence decisions?**
  Although most people found them useful, it would be worthwhile to investigate whether there are specific aspects (such as curriculum, study structure, student presentation) that have a greater impact on decisions.
- **Is the motivation for a PhD maintained?**
  Although 47% of students plan to pursue a PhD, it would be interesting to find out how many actually achieve this and what factors influence a possible change in decision.
- **The connection between digital habits and performance:**
  It would be worthwhile to analyze whether there is a connection between the amount of time spent on digital devices and academic achievement. Are more digitally active students more independent in their learning, or can excessive use be disruptive?

Comparative analysis of survey results of 1st year students of FGPA UM and FNM UM (2024/25)

Surveys conducted among freshmen at the Faculty of Civil Engineering, Transport Engineering and Architecture (FGPA UM) and the Faculty of Natural Sciences and Mathematics (FNM UM) offer insight into student motivation, their decisions and expectations upon enrollment, and the use of digital technologies. Below, we present a comparative analysis of key results for the 2024/25 academic year.

At FGPA, 71 first-year students (26% of all enrolled) completed the survey, while at FNM, 15 out of 20 enrolled students (75% of all enrolled) completed the survey. Key characteristics are presented in Table 6.

Table 6. Tabular comparison of key features

Aspect	FGPA UM	FNM UM
Number of respondents	71 (26% of enrolled)	15 (75% enrolled)
Study decision time	In high school, often in the 3rd or 4th year.	40% already in elementary school
Impact of the information day	Useful, but with missing information.	Very useful for 89% of students
Key selection factors	Interest in the profession, employment, location.	Own desire, friends, teachers
Continuing education	Most plan to pursue a master's degree, a few a doctorate.	47% want a doctorate, 27% a master's degree
Using digital devices	4–6 hours a day, digital distraction	Most up to 4 hours, lower activity on networks.
Organization of digital content	Distributed (Teams , Moodle , email).	No major problems have been identified.

Deciding to study – time and factors

There is a significant difference in the timing of the decision to study: FNM students often consider studying physics as early as elementary school, which indicates a long-term interest in science. Almost half of them made their final decision in the 3rd or 4th year of high school, but the first impulses to study often matured earlier. 13% switched from another study, meaning that after their initial choice, they found that physics suited them better.

At FGPA, most students start making their decision in high school, most often in their 3rd or 4th year. Architecture is a bit of an exception – some students report that they started to be interested in it in elementary school, which suggests that artistic and technical disciplines encourage long-term personal identification. For most, the decision is final only shortly before enrollment, which indicates greater prudence or uncertainty until the last moment.

Both groups largely made the decision independently, but for FNM, the strong influence of high school science teachers stands out, while for FGPA, practical reasons (proximity to college, employment after graduation, family influences) stand out more.

The role of the information day and access to information

The information day plays an important role for both faculties, but student responses vary:

- The FGPA had a high attendance, especially among future architects. Students assessed the information day as useful, but often not very specific. They mentioned a lack of information about the syllabus, practical exercises, equipment and expectations. It was also highlighted that foreign students lacked presentations in English, which means that the international component of information is weak.
- At FNM, 60% of freshmen attended the information day, of which 89% found the information useful. Personal contacts with professors, conversations with older students, and the location of study (Maribor) contributed most to the choice of faculty. They experienced the information day as a warm and motivating event, which indicates effective organization.

It is important to emphasize that FGPA students wanted uniform and structured information, which could increase satisfaction and reduce the feeling of being lost upon enrollment.

Influences on decision and motivation

At both faculties, the dominant motive for choosing a course of study is personal interest in the field.

At FGPA, the decision is often accompanied by very practical considerations – good employability, the possibility of continuing studies close to home, and program flexibility (e.g., in architecture). The influence of parents and friends is present, but in a supportive role.

At FNM, there is more emphasis on intellectual curiosity and academic ambition. Teachers have a significant influence, which indicates successful transmission of enthusiasm for science already in secondary school. A smaller role is perceived from parents, which indicates high intrinsic motivation of students.

Further education – ambitions and orientation

The difference between the two faculties is most pronounced in this aspect:

- At FGPA, most students plan to complete a master's degree, which corresponds to the professional structure of the fields (construction, architecture). A doctorate is not a widespread ambition upon enrollment. The emphasis is on the practical application of knowledge, not research.
- At the Faculty of Medicine, 47% of students aim for a PhD, an additional 27% for a Master's degree, and only 13% see themselves as pursuing only a first degree. This means that the majority of students have a strong research and academic ambition that goes beyond just studying for a profession.

These differences are important for designing support for students: FNM must support a research orientation, while FGPA can build programs on the connection between practice and theory.

Digital technologies and study approaches

Both groups of students are digitally literate, but they use technology in slightly different ways:

- At FGPA, most students use their smart devices for between 4 and 6 hours a day. Digital literacy is good, but students point out the fragmentation of platforms (e.g. Moodle , MS Teams , email), which makes transparency difficult. They often want a unified system that would make it easier to follow the study material. Despite the technological environment, many students still prefer to use printed textbooks.
- At FNM, most students spend less than 4 hours a day on digital devices, which may indicate higher focus and less dependence on technology. They use digital tools for learning and communication, social networks are not at the forefront. No organizational comments were detected regarding digital platforms, which may indicate that the system is more unified or easy to use.

Both groups still have room for improvement in better integrating digital resources, with FGPA particularly benefiting from the introduction of a centralized learning platform.

Conclusions and suggestions

Freshmen FGPA represent a group that decides to study later, often due to interest in the profession, but also due to practical aspects. Their expectations are focused on concrete knowledge and employment, and the academic path is rarely in the foreground. By better coordinating information and digital tools, FGPA could significantly improve the user experience of students, especially foreigners. Standardization of communication channels is one of the key needs.

FNM freshmen often decide to study early, their decision is firmly anchored in their own motivation and often includes research goals. The faculty offers them space for academic development, which must be nurtured through research opportunities and a personal approach. At FNM, freshmen perceive professors as accessible and dedicated. This environment is suitable for the further development of a young academic community.

Information and communication activities

We inform about project activities on the FNM UM website and the FNM UM Facebook page. During this time period, we made 11 announcements. The dates of the announcements, the type of media and the links are listed in Table 7.

Table 7. Summary of publications on various digital media

no	publication date	place of publication	connection
1	Wednesday, 8.1.2025	FNM UM website	https://www.fnm.um.si/index.php/2025/01/08/prispevki-raziskovalecve-in-clanov-projektnega-sveta-noo-fnm-fgpa-na-mednarodni-konferenci-iice2025/
2	Monday, 27.1.2025	FNM UM website	https://www.fnm.um.si/index.php/2025/01/27/vabilo-na-14-javno-delavnico-v-sklopu-projekta-noo-naravoslovno-matematicne-vsebine-pri-razvoju-digitalnih-kompetenc/
3	Tuesday, 4.2.2025	FNM UM website	https://www.fnm.um.si/index.php/2025/02/04/vodja-in-koordinatorka-projekta-noo-prisotni-na-konferenci-o-prenovi-visokosolskih-strokovnih-studijskih-programov/
4	Wednesday, 5.2.25	FNM UM website	https://www.fnm.um.si/index.php/2025/02/05/cetrto-porocilo-o-analizi-stanja-projekta-noo/
5	Friday, 7.2.25	FNM UM website	https://www.fnm.um.si/index.php/2025/02/07/izvedena-je-bila-14-javna-delavnica-v-sklopu-pilotnega-projekta-noo-6-2-2025/
6	Thursday, April 10, 2025	FNM UM website	https://www.fnm.um.si/index.php/2025/04/10/vabilo-na-15-javno-delavnico-v-sklopu-projekta-noo-naravoslovno-matematicne-vsebine-pri-razvoju-digitalnih-kompetenc/
7	Thursday, 24.4.2025	FNM UM website	https://www.fnm.um.si/index.php/2025/04/24/izvedena-je-bila-15-javna-delavnica-v-sklopu-pilotnega-projekta-noo-22-4-2025/
8	Wednesday, 28.5.2025	FNM UM website	Invitation to the 16th public workshop as part of the NOO project: Natural science and mathematics content in the development of digital competences | Faculty of Natural Sciences and Mathematics
9	Wednesday, 4.6.2025	FNM UM website	https://www.fnm.um.si/index.php/2025/06/04/izvedena-je-bila-16-javna-delavnica-v-sklopu-pilotnega-projekta-noo-3-6-2025/
10	Thursday, 12.6.25	FNM UM website	https://www.fnm.um.si/index.php/2025/06/12/vabilo-na-17-javno-delavnico-v-sklopu-projekta-noo-naravoslovno-matematicne-vsebine-pri-razvoju-digitalnih-kompetenc/
11	Thursday, 26.6.25	FNM UM website	https://www.fnm.um.si/index.php/2025/06/26/vabilo-na-zakljucno-okroglo-mizo/

POTENTIAL PROBLEMS

We did not detect any problems with the project.

CONCLUSIONS

In the fifth interim report, we presented the key achievements of project activities in the period from January 1 to June 30, 2025, and analyzed their results in the context of the development of digital competences and the competences of energy literacy, green transition and sustainability.

The analysis of the questionnaires reveals differences in the level of development of individual competences among students of different study programs, which confirms the importance of adapting content and approaches within the pedagogical process. Students of the FNM UM demonstrate a high level of digital literacy in the field of searching, evaluating and managing information, while there are still opportunities for improvement in content creation and knowledge of copyright. A moderate level of digital competences is detected at the FNM UM, with the need for additional content from the perspective of programming, creativity and protection of digital identity standing out. Compared to the assessments of study program leaders, students often rate their digital competences lower, which points to the need to further strengthen self-confidence and awareness of already developed skills. In the field of energy literacy and sustainability competences, students of both faculties demonstrated satisfactory knowledge of basic concepts, but here too there is a need for further deepening of knowledge and connection with real challenges and an interdisciplinary approach. Key challenges remain in advanced competences such as independent analysis of complex systems, planning sustainable solutions and understanding the connections between technology, policy and the environment. In this regard, further integration of interdisciplinary approaches and collaboration with practitioners is essential.

The successful implementation of workshops, the involvement of external experts and the active presence of the research group at international conferences with the publication of professional papers have significantly contributed to the greater visibility of the project and strengthened its impact in both the academic and wider social space. These achievements confirm the relevance and professional validity of the project activities, which successfully implemented the goals of the planned activities A2 to A4 in the period under review. In this way, the project directly contributed to the implementation of reforms in higher education and strengthening the readiness of students for the challenges of a digital, sustainable and resilient society of the future (Society 5.0).

In the future phases of the project, we will pay special attention to the further implementation of content that encourages the creative use of technology and to deepen the integration of sustainable development topics into curricula. It will also be crucial to develop and upgrade tools for self-assessment and reflection on competences, continue the dissemination of good practices and strengthen cooperation with the economy and other stakeholders. An important emphasis will also be placed on updating learning units, developing innovative didactic approaches and transferring successful solutions to the wider higher education space.

In this way, we will continue to pursue the central goal of the project: to strengthen the competences that will enable graduates to successfully integrate into the digital, green, and sustainably oriented society of the future.

APPENDICES

APPENDIX 1: Summary and graphs of the survey on digital competences of students at the Faculty of Natural Sciences and Mathematics, University of Maribor

ANALYSIS - Summary

Q1	I am a student .				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (Physics, 2nd level, 1st year or 2nd year)	4	33%	33%	33%
	2 (Mathematics, 2nd level, 1st year or 2nd year)	2	17%	17%	50%
	3 (Physics, 1st level, 3rd year)	3	25%	25%	75%
	4 (Mathematics, 1st level, 3rd year)	0	0%	0%	75%
	5 (Subject teacher, 5th year)	3	25%	25%	100%
Valid	Total	12	100%	100%	

Average	2.7	Std . deviation	1.6

Q 2	Directions (choose two answers):							
	Sub-questions	Units					Quotes	
		Frequencies	Valid	% - Valid	Appropriate	% - Corresponding	Frequencies	%
Q 2 a	Educational physics	1	3	33%	12	8%	1	100%

Q2b	Educational mathematics	3	3	100%	12	25%	3	300%
Q2c	Educational technique	0	3	0%	12	0%	0	0%
Q2d	Educational biology	1	3	33%	12	8%	1	100%
Q2e	Educational computing	1	3	33%	12	8%	1	100%
Q2f	Educational chemistry	0	3	0%	12	0%	0	0%
	TOTAL		3		12		1	100%

Q3	I graduated from the first level at				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (FNM UM)	6	50%	100%	100%
	2 (Second)	0	0%	0%	100%
Valid	Total	6	50%	100%	

Average	1.0	Std . deviation	0.0

Q4	I have completed my studies.				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (Physics, 1st level)	4	33%	67%	67%
	2 (Mathematics, 1st level)	2	17%	33%	100%
	3 (Other)	0	0%	0%	100%
Valid	Total	6	50%	100%	

Average	1.3	Std . deviation	0.5

Q5	Please enter the program and institution where you completed your undergraduate studies:

Q6	How often do you browse, search, or filter data, information, and digital content? Rate on a scale from 1 (never) to 8 (several times a day).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	1	8%	8%	8%
	5	1	8%	8%	17%
	6	1	8%	8%	25%
	7	2	17%	17%	42%
	8 (8 (several times a day))	7	58%	58%	100%
Valid	Total	12	100%	100%	

Average	7.1	Std . deviation	1.4

Q7	How would you rate your ability to evaluate the accuracy and reliability of information online? Think about your ability to analyze, compare, and critically evaluate the credibility and reliability of information sources and digital content. This includes identifying false or misleading information and checking the credibility of authors or sources. Rate on a scale from 1 (very poor) to 8 (excellent).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very bad))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	1	8%	8%	8%
	5	0	0%	0%	8%
	6	1	8%	8%	17%
	7	6	50%	50%	67%
	8 (8 (excellent))	4	33%	33%	100%
Valid	Total	12	100%	100%	

Average	7.0	Std . deviation	1.1

Q8	How effectively do you manage data, information and digital content? Storing, organising, deleting and processing for future use in digital environments, along with structuring and categorising information. Rate on a scale from 1 (very ineffective) to 8 (very effective).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very ineffective))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	0	0%	0%	0%
	5	0	0%	0%	0%
	6	5	42%	42%	42%
	7	2	17%	17%	58%
	8 (8 (very effective))	5	42%	42%	100%
Valid	Total	12	100%	100%	

Average	7.0	Std . deviation	1.0

Q9	% How often do you use digital technologies to communicate with others (e.g. email, social media)? Rate on a scale from 1 (never) to 8 (several times a day).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	1	8%	9%	9%
	5	0	0%	0%	9%
	6	1	8%	9%	18%
	7	0	0%	0%	18%
	8 (8 (several times a day))	9	75%	82%	100%
Valid	Total	11	92%	100%	

Average	7.5	Std . deviation	1.3

Q10	How often do you share content via digital technologies (e.g. images, documents)? Rate on a scale from 1 (never) to 8 (several times a day).				
	Answers	Frequency	Percentage	Valid	Cumulative

	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	2	17%	18%	18%
	5	1	8%	9%	27%
	6	1	8%	9%	36%
	7	1	8%	9%	45%
	8 (8 (several times a day))	6	50%	55%	100%
Valid	Total	11	92%	100%	

Average	6.7	Std . deviation	1.7

Q11	Do you engage in civic activities through digital platforms? Participating in online petitions, commenting on political topics, participating in political debates, signing petitions for referendums, and similar activities that affect society. Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	2	17%	18%	18%
	2	1	8%	9%	27%
	3	1	8%	9%	36%
	4	0	0%	0%	36%
	5	4	33%	36%	73%
	6	1	8%	9%	82%
	7	1	8%	9%	91%
	8 (8 (very common))	1	8%	9%	100%
Valid	Total	11	92%	100%	

Average	4.4	Std . deviation	2.3

Q12	How often do you collaborate with others through digital technologies (e.g., teamwork, collaborative platforms)? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	8%	9%	9%
	2	1	8%	9%	18%

	3	0	0%	0%	18%
	4	1	8%	9%	27%
	5	1	8%	9%	36%
	6	1	8%	9%	45%
	7	1	8%	9%	55%
	8 (8 (very common))	5	42%	45%	100%
Valid	Total	11	92%	100%	

Average	5.9	Std . deviation	2.6

Q13	How well do you know the rules of online etiquette when communicating online? The rules of friendly, respectful and responsible communication in digital environments, aware of cultural and generational differences. Rate on a scale from 1 (I don't know at all) to 8 (excellent).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I don't know at all))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	1	8%	9%	9%
	4	0	0%	0%	9%
	5	0	0%	0%	9%
	6	1	8%	9%	18%
	7	6	50%	55%	73%
	8 (8 (excellent))	3	25%	27%	100%
Valid	Total	11	92%	100%	

Average	6.8	Std . deviation	1.4

Q14	How often do you follow the rules of online etiquette when communicating online? Friendly, respectful, and responsible communication in digital environments and consideration of cultural and generational differences. Rate on a scale from 1 (never) to 8 (always).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	8%	9%	9%
	2	0	0%	0%	9%
	3	2	17%	18%	27%

	4	0	0%	0%	27%
	5	0	0%	0%	27%
	6	2	17%	18%	45%
	7	3	25%	27%	73%
	8 (8 (always))	3	25%	27%	100%
Valid	Total	11	92%	100%	

Average	5.8	Std . deviation	2.4

Q15	How well do you manage your digital identity? Control over your digital identity, protection of personal data, care for your public image and reputation online. Rate on a scale from 1 (not interested) to 8 (excellent).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (not interested))	1	8%	9%	9%
	2	0	0%	0%	9%
	3	0	0%	0%	9%
	4	1	8%	9%	18%
	5	3	25%	27%	45%
	6	3	25%	27%	73%
	7	2	17%	18%	91%
	8 (8 (excellent))	1	8%	9%	100%
Valid	Total	11	92%	100%	

Average	5.5	Std . deviation	1.9

Q16	% How often do you create digital content (e.g., writing blogs, making videos, taking photos)? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	2	17%	18%	18%
	2	1	8%	9%	27%
	3	0	0%	0%	27%
	4	1	8%	9%	36%
	5	6	50%	55%	91%
	6	1	8%	9%	100%
	7	0	0%	0%	100%

	8 (8 (very common))	0	0%	0%	100%
Valid	Total	11	92%	100%	

Average	4.0	Std . deviation	1.8

Q17	How often do you adapt or recreate existing digital content? Editing and reworking photos, videos or texts. Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	8%	9%	9%
	2	2	17%	18%	27%
	3	1	8%	9%	36%
	4	2	17%	18%	55%
	5	4	33%	36%	91%
	6	0	0%	0%	91%
	7	0	0%	0%	91%
	8 (8 (very common))	1	8%	9%	100%
Valid	Total	11	92%	100%	

Average	4.0	Std . deviation	1.9

Q18	How well do you know copyright and licensing when using digital content? Understanding copyright law, licensing of digital content (e.g. Creative Commons Attribution-ShareAlike License) Commons), including understanding how to use content without violating the rights of others. Rate on a scale from 1 (not at all familiar) to 8 (extremely familiar).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I don't know at all))	1	8%	9%	9%
	2	2	17%	18%	27%
	3	2	17%	18%	45%
	4	1	8%	9%	55%
	5	2	17%	18%	73%
	6	2	17%	18%	91%
	7	1	8%	9%	100%

	8 (8 (I know very well))	0	0%	0%	100%
Valid	Total	11	92%	100%	

Average	4.0	Std . deviation	1.9

Q19	How often do you think about and consider copyright and licensing when using digital content? Copyright protection, licensing when using digital content without violating the rights of others (attribution when using images, texts, videos from the Internet). Rate on a scale from 1 (I don't care) to 8 (I always consider).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (not interested))	1	8%	9%	9%
	2	4	33%	36%	45%
	3	1	8%	9%	55%
	4	0	0%	0%	55%
	5	2	17%	18%	73%
	6	1	8%	9%	82%
	7	2	17%	18%	100%
	8 (8 (always consider))	0	0%	0%	100%
Valid	Total	11	92%	100%	

Average	3.8	Std . deviation	2.2

Q20	How often do you use programming to create digital solutions? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	2	17%	18%	18%
	2	1	8%	9%	27%
	3	1	8%	9%	36%
	4	0	0%	0%	36%
	5	3	25%	27%	64%
	6	0	0%	0%	64%
	7	1	8%	9%	73%
	8 (8 (very common))	3	25%	27%	100%

Valid	Total	11	92%	100%	

Average	4.8	Std . deviation	2.8

Q21	How do you keep your devices secure (e.g., software updates, antivirus protection)? Rate on a scale from 1 (very poor) to 8 (very good).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very bad))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	1	8%	9%	9%
	5	1	8%	9%	18%
	6	4	33%	36%	55%
	7	3	25%	27%	82%
	8 (8 (very good))	2	17%	18%	100%
Valid	Total	11	92%	100%	

Average	6.4	Std . deviation	1.2

Q22	Do you pay attention to protecting your personal information and privacy online? Think about your habits for protecting your personal information and ensuring privacy in the online environment, including the use of strong passwords and encryption. Rate on a scale from 1 (never) to 8 (always).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	8%	9%	9%
	2	0	0%	0%	9%
	3	0	0%	0%	9%
	4	1	8%	9%	18%
	5	2	17%	18%	36%
	6	3	25%	27%	64%
	7	4	33%	36%	100%
	8 (8 (always))	0	0%	0%	100%
Valid	Total	11	92%	100%	

Average	5.5	Std . deviation	1.8

Q23	% How often do you consider health and well-being when using digital technologies? Frequency of breaks, adequate lighting, correct placement of devices, posture when using devices. Rate on a scale from 1 (never) to 8 (always).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	8%	9%	9%
	2	0	0%	0%	9%
	3	0	0%	0%	9%
	4	2	17%	18%	27%
	5	4	33%	36%	64%
	6	4	33%	36%	100%
	7	0	0%	0%	100%
	8 (8 (always))	0	0%	0%	100%
Valid	Total	11	92%	100%	

Average	4.8	Std . deviation	1.5

Q24	How important do you think environmental protection is when using digital devices? Energy efficiency of devices, recyclability of devices and their components. Rate on a scale from 1 (not important) to 8 (very important).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (unimportant))	1	8%	9%	9%
	2	0	0%	0%	9%
	3	1	8%	9%	18%
	4	2	17%	18%	36%
	5	3	25%	27%	64%
	6	2	17%	18%	82%
	7	0	0%	0%	82%
	8 (8 (very important))	2	17%	18%	100%
Valid	Total	11	92%	100%	

Average	5.0	Std . deviation	2.0

Q25	Do you face any technical difficulties when using digital devices? Rate on a scale from 1 (I have insurmountable difficulties) to 8 (I have no problems at all).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I have insurmountable problems))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	1	8%	9%	9%
	4	0	0%	0%	9%
	5	2	17%	18%	27%
	6	4	33%	36%	64%
	7	3	25%	27%	91%
	8 (8 (I have no problems))	1	8%	9%	100%
Valid	Total	11	92%	100%	

Average	6.0	Std . deviation	1.3

Q26	Are you able to solve technical problems using digital devices yourself? Rate on a scale from 1 (I always need help) to 8 (I always solve problems myself).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I always need help))	0	0%	0%	0%
	2	1	8%	9%	9%
	3	0	0%	0%	9%
	4	0	0%	0%	9%
	5	2	17%	18%	27%
	6	3	25%	27%	55%
	7	3	25%	27%	82%
	8 (8 (I always solve problems myself))	2	17%	18%	100%
Valid	Total	11	92%	100%	

Average	6.1	Std . deviation	1.7

Q27	How often do you analyze your technology needs and look for appropriate solutions? Thinking about your own needs when choosing software for work,

	upgrading hardware for better efficiency, or deciding to purchase a new device to meet your needs. Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	1	8%	9%	9%
	4	0	0%	0%	9%
	5	4	33%	36%	45%
	6	3	25%	27%	73%
	7	2	17%	18%	91%
	8 (8 (very common))	1	8%	9%	100%
Valid	Total	11	92%	100%	

Average	5.7	Std . deviation	1.3

Q28	How often do you use digital technologies in creative ways? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	8%	9%	9%
	2	0	0%	0%	9%
	3	0	0%	0%	9%
	4	0	0%	0%	9%
	5	3	25%	27%	36%
	6	5	42%	45%	82%
	7	2	17%	18%	100%
	8 (8 (very common))	0	0%	0%	100%
Valid	Total	11	92%	100%	

Average	5.5	Std . deviation	1.6

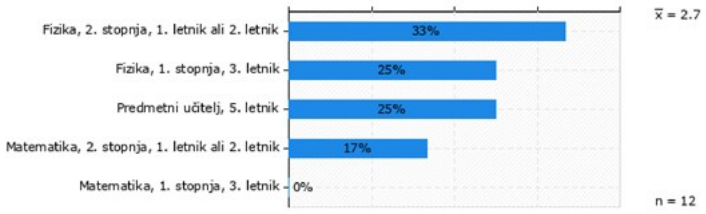
Q29	How well do you identify gaps in your digital competences and try to improve them? Awareness of the lack of knowledge about online safety, knowledge about creating digital content, knowledge about protecting digital content and digital devices, knowledge about managing your online image, etc. Rate on a scale from 1 (very poor) to 8 (very good).

	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very bad))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	2	17%	18%	18%
	5	2	17%	18%	36%
	6	3	25%	27%	64%
	7	2	17%	18%	82%
	8 (8 (very good))	2	17%	18%	100%
Valid	Total	11	92%	100%	

Average	6.0	Std . deviation	1.4

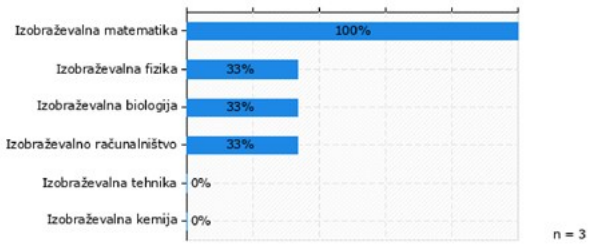
ANALYSIS - Graphs

I am a student (n = 12)



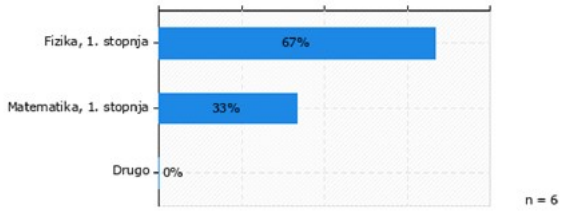
Orientations (choose two answers): (n = 3)

Multiple answers are possible.

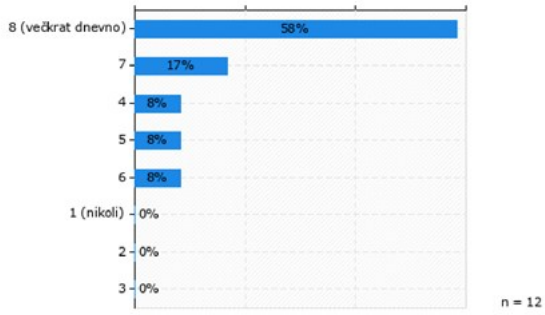


I graduated from (n = 6) at the first level.

I have completed my studies (n = 6)

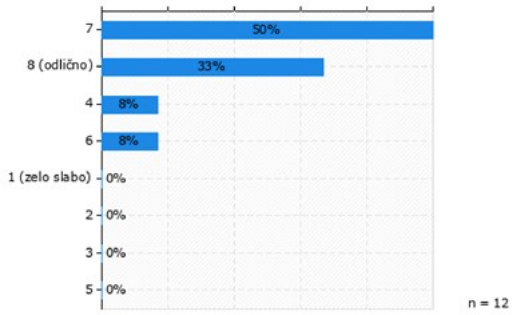


How often do you browse, search or filter data, information and digital content? Rate on a scale from 1 (never) to 8 (several times a day). (n = 12)

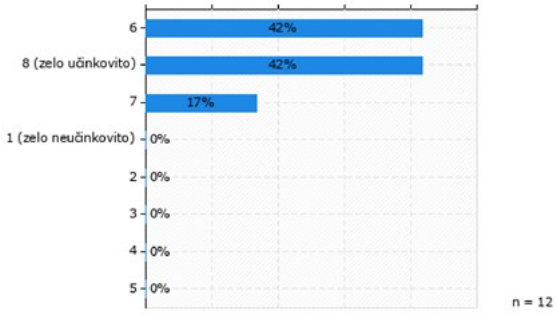


How would you rate your ability to evaluate the accuracy and reliability of information online? Think about your ability to analyze, compare, and critically evaluate the credibility and reliability of information sources and digital content. This includes identifying false or

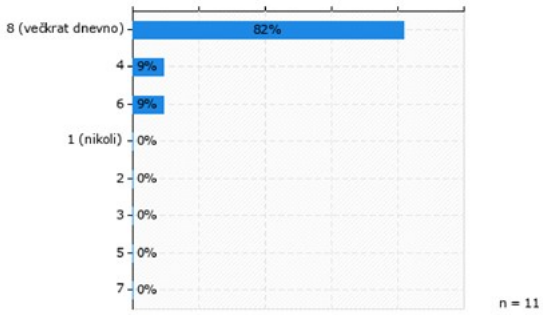
misleading information and checking the credibility of authors or sources. Rate on a scale from 1 (very poor) to 8 (excellent). (n = 12)



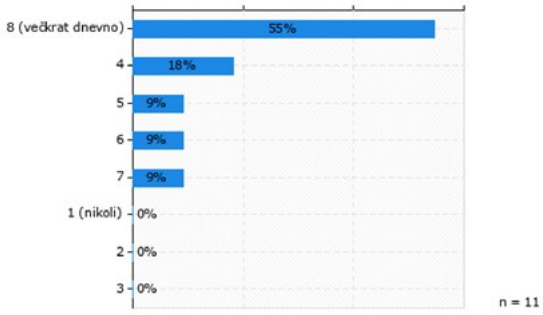
How effectively do you manage data, information and digital content? Storing, organising, deleting and processing for future use in digital environments, along with structuring and categorising information. Rate on a scale from 1 (very ineffective) to 8 (very effective). (n = 12)



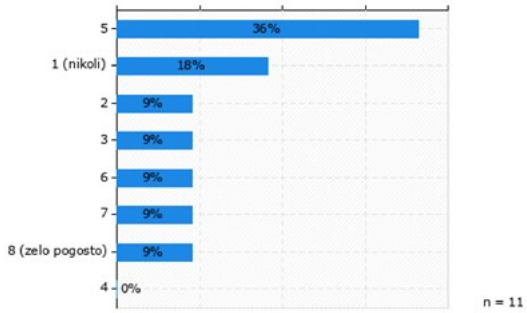
How often do you use digital technologies to communicate with others (e.g., email, social media)? Rate on a scale from 1 (never) to 8 (several times a day). (n = 11)



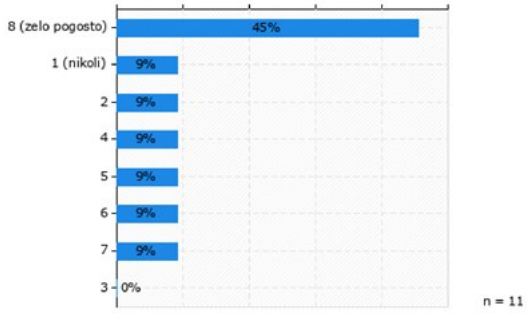
How often do you share content via digital technologies (e.g. images, documents)? Rate on a scale from 1 (never) to 8 (several times a day). (n = 11)



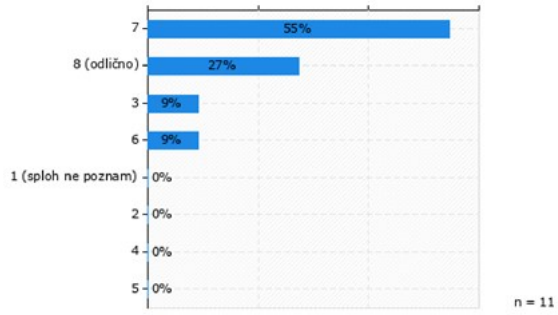
Do you engage in civic activities via digital platforms? Participating in online petitions, commenting on political topics, participating in political debates, signing petitions for referendums and similar activities that affect society. Rate on a scale from 1 (never) to 8 (very often). (n = 11)



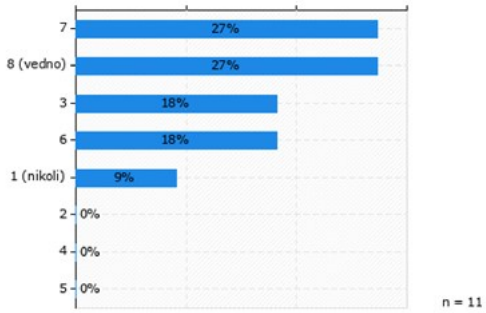
How often do you collaborate with others through digital technologies (e.g., teamwork, collaborative platforms)? Rate on a scale from 1 (never) to 8 (very often). (n = 11)



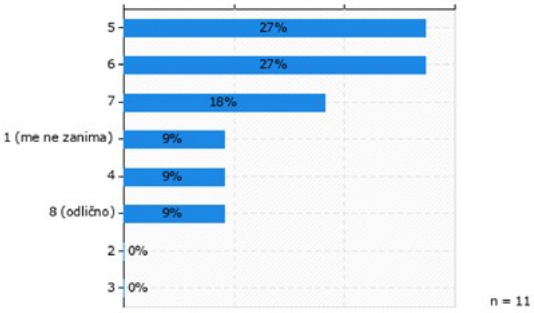
How well do you know the rules of online etiquette when communicating online? The rules of friendly, respectful and responsible communication in digital environments, being aware of cultural and generational differences. Rate on a scale from 1 (I don't know at all) to 8 (excellent). (n = 11)



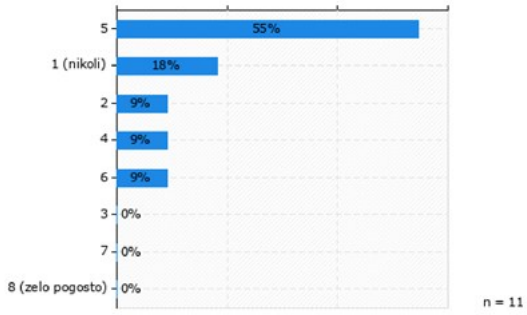
How often do you follow the rules of online etiquette when communicating online? Friendly, respectful, and responsible communication in digital environments and consideration of cultural and generational differences. Rate on a scale from 1 (never) to 8 (always). (n = 11)



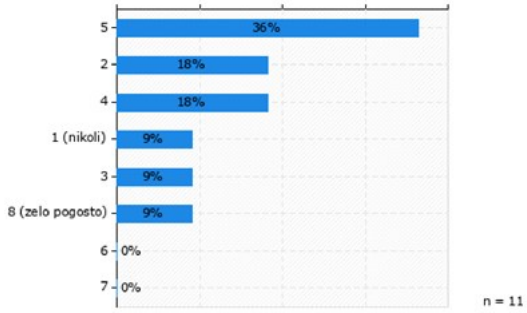
How well do you manage your digital identity? Control over your digital identity, protecting personal data, caring for your public image and reputation online. Rate on a scale from 1 (not interested) to 8 (excellent). (n = 11)



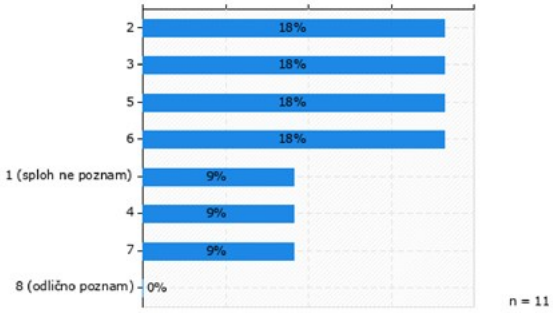
How often do you create digital content (e.g., writing blogs, making videos, taking photos)? Rate on a scale from 1 (never) to 8 (very often). (n = 11)



How often do you adapt or recreate existing digital content? Editing and reworking photos, videos or texts. Rate on a scale from 1 (never) to 8 (very often). (n = 11)

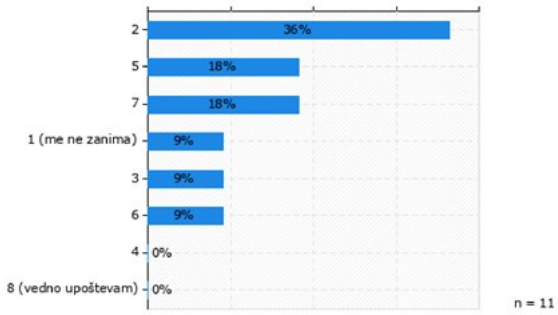


How well do you know copyright and licensing when using digital content? Understanding copyright law, licensing of digital content (e.g. Creative Commons Attribution-ShareAlike License) Commons), including understanding how to use content without violating the rights of others. Rate on a scale from 1 (not at all familiar) to 8 (extremely familiar). (n = 11)

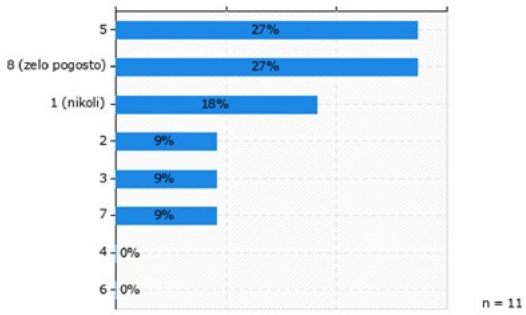


How often do you think about and consider copyright and licensing when using digital content? Copyright protection, licensing when using digital content without violating the rights of others (citing

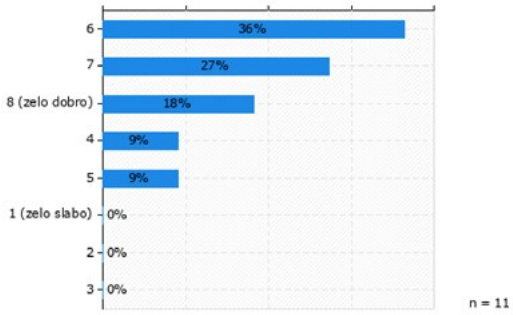
authors when using images, texts, videos from the Internet). Rate on a scale from 1 (I don't care) to 8 (I always consider). (n = 11)



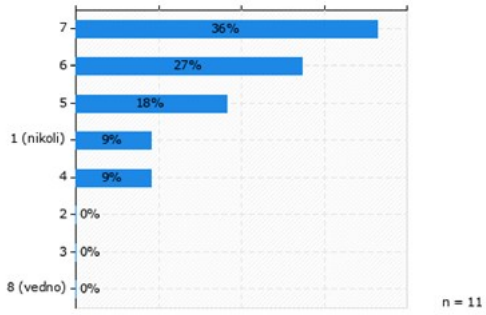
How often do you use programming to create digital solutions? Rate on a scale from 1 (never) to 8 (very often). (n = 11)



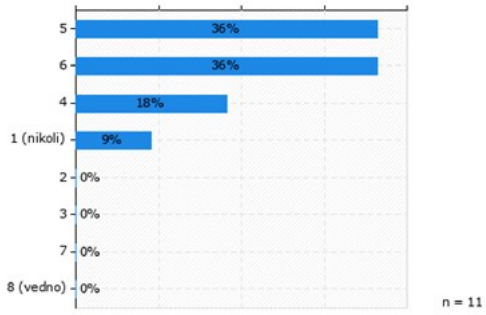
How do you keep your devices secure (e.g., software updates, antivirus protection)? Rate on a scale from 1 (very poor) to 8 (very good). (n = 11)



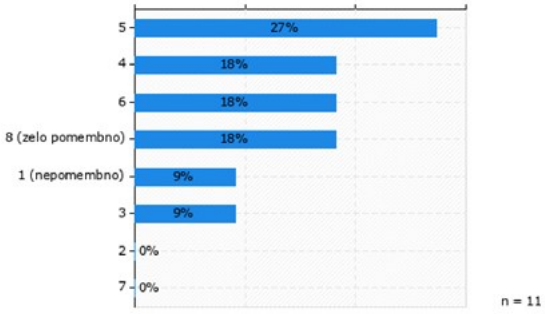
Do you pay attention to protecting personal information and privacy online? Think about your habits in protecting personal information and ensuring privacy in the online environment, including the use of strong passwords and encryption. Rate on a scale from 1 (never) to 8 (always). (n = 11)



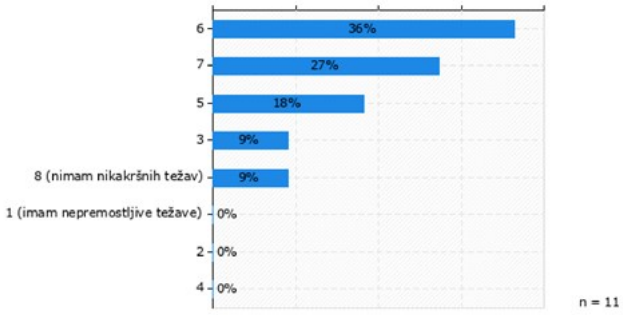
How often do you consider health and well-being when using digital technologies? Frequency of breaks, adequate lighting, correct placement of devices, posture when using devices. Rate on a scale from 1 (never) to 8 (always). (n = 11)



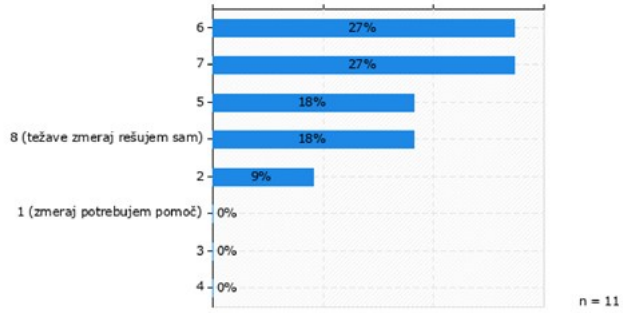
How important do you think environmental protection is when using digital devices? Energy efficiency of devices, recyclability of devices and their components. Rate on a scale from 1 (not important) to 8 (very important). (n = 11)



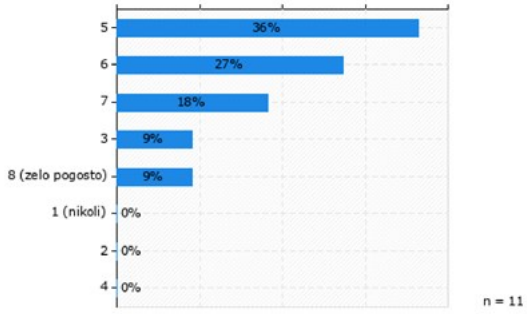
Do you face technical difficulties when using digital devices? Rate on a scale from 1 (I have insurmountable difficulties) to 8 (I have no difficulties at all). (n = 11)



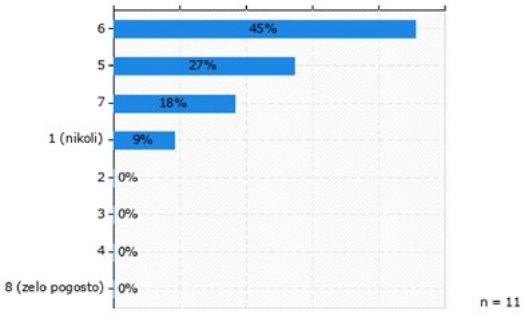
Are you able to solve technical problems when using digital devices yourself? Rate on a scale from 1 (I always need help) to 8 (I always solve problems myself). (n = 11)



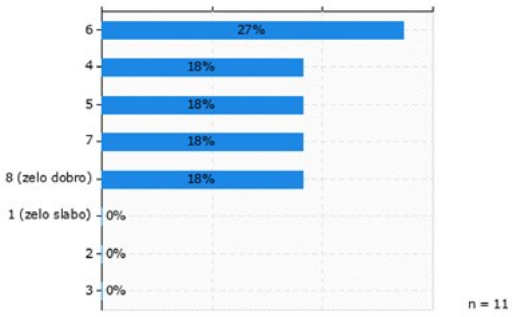
How often do you analyze your technology needs and look for appropriate solutions? Thinking about your own needs when choosing software for work, upgrading hardware for better efficiency, or deciding to purchase a new device to meet your needs. Rate on a scale from 1 (never) to 8 (very often). (n = 11)



How often do you use digital technologies in creative ways? Rate on a scale from 1 (never) to 8 (very often). (n = 11)



How well do you identify gaps in your digital competences and try to improve them? Awareness of the lack of knowledge about online safety, knowledge about creating digital content, knowledge about protecting digital content and digital devices, knowledge about managing your online image, etc. Rate on a scale from 1 (very poor) to 8 (very good). (n = 11)



APPENDIX 2: Summary and graphs of the survey on digital competences of students at the FGPA UM

ANALYSIS - Summary

Q1	I am a student .				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (MA Civil Engineering 1st year)	12	39%	80%	80%
	2 (UN Civil Engineering 3rd year)	2	6%	13%	93%
	3 (VS Civil Engineering 3rd year)	1	3%	7%	100%
Valid	Total	15	48%	100%	
		Average	1.3	Std . deviation	0.6

Q2	I graduated from the first level at				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (Faculties of Civil Engineering, Transport Engineering and Architecture, University of Maribor)	8	26%	67%	67%
	2 (Second)	4	13%	33%	100%
Valid	Total	12	39%	100%	
		Average	1.3	Std . deviation	0.5

Q3	I have completed my studies.				
	Answers	Frequency	Percentage	Valid	Cumulative

	1 (VS Construction)	1	3%	13%	13%
	2 (UN Construction)	6	19%	75%	88%
	3 (UN GING)	1	3%	13%	100%
	4 (VS Traffic Engineering)	0	0%	0%	100%
	5 (UN Traffic Engineering)	0	0%	0%	100%
	6 (UN Architecture)	0	0%	0%	100%
Valid	Total	8	26%	100%	
		Average	2.0	Std . deviation	0.5

Q4	Please enter the program and institution where you completed your undergraduate studies:
	gfzg , civil engineering , university
	university north , construction
	operational construction, FGPA UM

Q5	How often do you browse, search, or filter data, information, and digital content? Rate on a scale from 1 (never) to 8 (several times a day).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	2	6%	13%	13%
	4	0	0%	0%	13%
	5	5	16%	33%	47%
	6	1	3%	7%	53%
	7	1	3%	7%	60%
	8 (8 (several times a day))	6	19%	40%	100%
Valid	Total	15	48%	100%	

Average	6.1	Std . deviation	1.8

Q6	How would you rate your ability to evaluate the accuracy and reliability of information online? Think about your ability to analyze, compare, and critically evaluate the credibility and reliability of information sources and digital content. This includes identifying false or misleading information and checking the credibility of authors or sources. Rate on a scale from 1 (very poor) to 8 (excellent).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very bad))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	1	3%	7%	7%
	4	2	6%	13%	20%
	5	3	10%	20%	40%
	6	5	16%	33%	73%
	7	4	13%	27%	100%
	8 (8 (excellent))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	5.6	Std . deviation	1.2

Q7	How effectively do you manage data, information and digital content? Storing, organising, deleting and processing for future use in digital environments, along with structuring and categorising information. Rate on a scale from 1 (very ineffective) to 8 (very effective).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very ineffective))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	3	10%	20%	20%
	5	2	6%	13%	33%
	6	3	10%	20%	53%
	7	4	13%	27%	80%

	8 (8 (very effective))	3	10%	20%	100%
Valid	Total	15	48%	100%	
		Average	6.1	Std . deviation	1.5

Q8	How often do you use digital technologies to communicate with others (e.g. email, social media)? Rate on a scale from 1 (never) to 8 (several times a day).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	2	6%	13%	13%
	5	0	0%	0%	13%
	6	2	6%	13%	27%
	7	2	6%	13%	40%
	8 (8 (several times a day))	9	29%	60%	100%
Valid	Total	15	48%	100%	
		Average	7.1	Std . deviation	1.4

Q9	How often do you share content via digital technologies (e.g. images, documents)? Rate on a scale from 1 (never) to 8 (several times a day).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	2	6%	13%	13%
	4	1	3%	7%	20%
	5	3	10%	20%	40%
	6	2	6%	13%	53%
	7	2	6%	13%	67%

	8 (8 (several times a day))	5	16%	33%	100%
Valid	Total	15	48%	100%	
		Average	6.1	Std . deviation	1.8

Q10	Do you engage in civic activities through digital platforms? Participating in online petitions, commenting on political topics, participating in political debates, signing petitions for referendums, and similar activities that affect society. Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	5	16%	33%	33%
	2	3	10%	20%	53%
	3	1	3%	7%	60%
	4	2	6%	13%	73%
	5	0	0%	0%	73%
	6	1	3%	7%	80%
	7	2	6%	13%	93%
	8 (8 (very common))	1	3%	7%	100%
Valid	Total	15	48%	100%	
		Average	3.3	Std . deviation	2.5

Q11	How often do you collaborate with others through digital technologies (e.g., teamwork, collaborative platforms)? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	2	6%	13%	13%
	4	4	13%	27%	40%
	5	2	6%	13%	53%
	6	2	6%	13%	67%

	7	4	13%	27%	93%
	8 (8 (very common))	1	3%	7%	100%
Valid	Total	15	48%	100%	
		Average	5.3	Std . deviation	1.6

Q12	How well do you know the rules of online etiquette when communicating online? The rules of friendly, respectful and responsible communication in digital environments, aware of cultural and generational differences. Rate on a scale from 1 (I don't know at all) to 8 (excellent).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I don't know at all))	0	0%	0%	0%
	2	1	3%	7%	7%
	3	1	3%	7%	13%
	4	1	3%	7%	20%
	5	1	3%	7%	27%
	6	3	10%	20%	47%
	7	3	10%	20%	67%
	8 (8 (excellent))	5	16%	33%	100%
Valid	Total	15	48%	100%	
		Average	6.2	Std . deviation	1.9

Q13	How often do you follow the rules of online etiquette when communicating online? Friendly, respectful, and responsible communication in digital environments and consideration of cultural and generational differences. Rate on a scale from 1 (never) to 8 (always).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%
	2	1	3%	7%	7%
	3	1	3%	7%	13%
	4	0	0%	0%	13%

	5	2	6%	13%	27%
	6	1	3%	7%	33%
	7	5	16%	33%	67%
	8 (8 (always))	5	16%	33%	100%
Valid	Total	15	48%	100%	
		Average	6.4	Std . deviation	1.9

Q14	How well do you manage your digital identity? Control over your digital identity, protection of personal data, care for your public image and reputation online. Rate on a scale from 1 (not interested) to 8 (excellent).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (not interested))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	1	3%	7%	7%
	5	2	6%	13%	20%
	6	5	16%	33%	53%
	7	5	16%	33%	87%
	8 (8 (excellent))	2	6%	13%	100%
Valid	Total	15	48%	100%	
		Average	6.3	Std . deviation	1.1

Q15	How often do you create digital content (e.g., writing blogs, making videos, taking photos)? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	4	13%	27%	27%
	2	6	19%	40%	67%
	3	2	6%	13%	80%
	4	0	0%	0%	80%
	5	2	6%	13%	93%

	6	0	0%	0%	93%
	7	1	3%	7%	100%
	8 (8 (very common))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	2.6	Std . deviation	1.8

Q16	How often do you adapt or recreate existing digital content? Editing and reworking photos, videos or texts. Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	3	10%	20%	20%
	2	3	10%	20%	40%
	3	2	6%	13%	53%
	4	3	10%	20%	73%
	5	2	6%	13%	87%
	6	1	3%	7%	93%
	7	1	3%	7%	100%
	8 (8 (very common))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	3.3	Std . deviation	1.9

Q17	How well do you know copyright and licensing when using digital content? Understanding copyright law, licensing of digital content (e.g. Creative Commons Attribution-ShareAlike License) Commons), including understanding how to use content without violating the rights of others. Rate on a scale from 1 (not at all familiar) to 8 (extremely familiar).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I don't know at all))	2	6%	13%	13%
	2	0	0%	0%	13%
	3	2	6%	13%	27%

	4	2	6%	13%	40%
	5	6	19%	40%	80%
	6	3	10%	20%	100%
	7	0	0%	0%	100%
	8 (8 (I know very well))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	4.3	Std . deviation	1.6

Q18	How often do you think about and consider copyright and licensing when using digital content? Copyright protection, licensing when using digital content without violating the rights of others (attribution when using images, texts, videos from the Internet). Rate on a scale from 1 (I don't care) to 8 (I always consider).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (not interested))	1	3%	7%	7%
	2	1	3%	7%	13%
	3	1	3%	7%	20%
	4	4	13%	27%	47%
	5	3	10%	20%	67%
	6	4	13%	27%	93%
	7	1	3%	7%	100%
	8 (8 (always consider))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	4.5	Std . deviation	1.6

Q19	How often do you use programming to create digital solutions? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	5	16%	33%	33%
	2	4	13%	27%	60%

	3	0	0%	0%	60%
	4	0	0%	0%	60%
	5	3	10%	20%	80%
	6	1	3%	7%	87%
	7	1	3%	7%	93%
	8 (8 (very common))	1	3%	7%	100%
Valid	Total	15	48%	100%	
		Average	3.3	Std . deviation	2.5

Q20	How do you keep your devices secure (e.g., software updates, antivirus protection)? Rate on a scale from 1 (very poor) to 8 (very good).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very bad))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	2	6%	13%	13%
	4	3	10%	20%	33%
	5	1	3%	7%	40%
	6	6	19%	40%	80%
	7	1	3%	7%	87%
	8 (8 (very good))	2	6%	13%	100%
Valid	Total	15	48%	100%	
		Average	5.5	Std . deviation	1.6

Q21	Do you pay attention to protecting your personal information and privacy online? Think about your habits for protecting your personal information and ensuring privacy in the online environment, including the use of strong passwords and encryption. Rate on a scale from 1 (never) to 8 (always).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	0	0%	0%	0%

	2	0	0%	0%	0%
	3	2	6%	13%	13%
	4	2	6%	13%	27%
	5	2	6%	13%	40%
	6	4	13%	27%	67%
	7	2	6%	13%	80%
	8 (8 (always))	3	10%	20%	100%
Valid	Total	15	48%	100%	
		Average	5.7	Std . deviation	1.7

Q22	How often do you consider health and well-being when using digital technologies? Frequency of breaks, adequate lighting, correct placement of devices, posture when using devices. Rate on a scale from 1 (never) to 8 (always).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	3%	7%	7%
	2	1	3%	7%	13%
	3	2	6%	13%	27%
	4	1	3%	7%	33%
	5	4	13%	27%	60%
	6	3	10%	20%	80%
	7	2	6%	13%	93%
	8 (8 (always))	1	3%	7%	100%
Valid	Total	15	48%	100%	
		Average	4.9	Std . deviation	2.0

Q23	How important do you think environmental protection is when using digital devices? Energy efficiency of devices, recyclability of devices and their components. Rate on a scale from 1 (not important) to 8 (very important).				
	Answers	Frequency	Percentage	Valid	Cumulative

	1 (1 (unimportant))	2	6%	13%	13%
	2	0	0%	0%	13%
	3	1	3%	7%	20%
	4	0	0%	0%	20%
	5	6	19%	40%	60%
	6	3	10%	20%	80%
	7	1	3%	7%	87%
	8 (8 (very important))	2	6%	13%	100%
Valid	Total	15	48%	100%	
		Average	5.1	Std . deviation	2.1

Q24	Do you face any technical difficulties when using digital devices? Rate on a scale from 1 (I have insurmountable difficulties) to 8 (I have no problems at all).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I have insurmountable problems))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	2	6%	13%	13%
	4	1	3%	7%	20%
	5	2	6%	13%	33%
	6	3	10%	20%	53%
	7	3	10%	20%	73%
	8 (8 (I have no problems))	4	13%	27%	100%
Valid	Total	15	48%	100%	
		Average	6.1	Std . deviation	1.8

Q25	Are you able to solve technical problems using digital devices yourself? Rate on a scale from 1 (I always need help) to 8 (I always solve problems myself).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (I always need help))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	0	0%	0%	0%
	4	2	6%	13%	13%
	5	3	10%	20%	33%
	6	1	3%	7%	40%
	7	6	19%	40%	80%
	8 (8 (I always solve problems myself))	3	10%	20%	100%
Valid	Total	15	48%	100%	
		Average	6.3	Std . deviation	1.4

Q26	How often do you analyze your technology needs and look for appropriate solutions? Thinking about your own needs when choosing software for work, upgrading hardware for better efficiency, or deciding to purchase a new device to meet your needs. Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	3%	7%	7%
	2	0	0%	0%	7%
	3	0	0%	0%	7%
	4	4	13%	27%	33%
	5	5	16%	33%	67%
	6	2	6%	13%	80%
	7	1	3%	7%	87%

	8 (8 (very common))	2	6%	13%	100%
Valid	Total	15	48%	100%	
		Average	5.1	Std . deviation	1.8

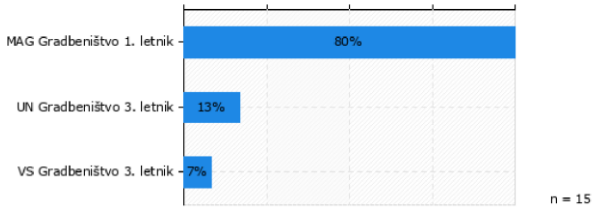
Q27	How often do you use digital technologies in creative ways? Rate on a scale from 1 (never) to 8 (very often).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (never))	1	3%	7%	7%
	2	1	3%	7%	13%
	3	3	10%	20%	33%
	4	1	3%	7%	40%
	5	1	3%	7%	47%
	6	6	19%	40%	87%
	7	2	6%	13%	100%
	8 (8 (very common))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	4.7	Std . deviation	1.9

Q28	How well do you identify gaps in your digital competences and try to improve them? Awareness of the lack of knowledge about online safety, knowledge about creating digital content, knowledge about protecting digital content and digital devices, knowledge about managing your online image, etc. Rate on a scale from 1 (very poor) to 8 (very good).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (very bad))	0	0%	0%	0%
	2	0	0%	0%	0%
	3	4	13%	27%	27%
	4	3	10%	20%	47%
	5	4	13%	27%	73%
	6	1	3%	7%	80%

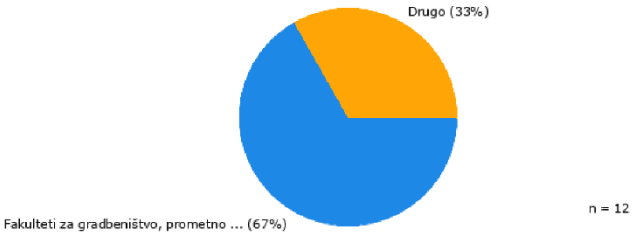
	7	3	10%	20%	100%
	8 (8 (very good))	0	0%	0%	100%
Valid	Total	15	48%	100%	
		Average	4.7	Std . deviation	1.5

ANALYSIS - Graphs

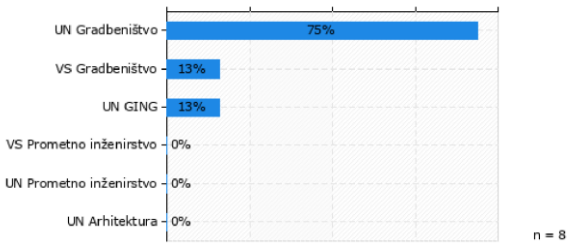
I am a student (n = 15)



I graduated from (n = 12) at the first level.



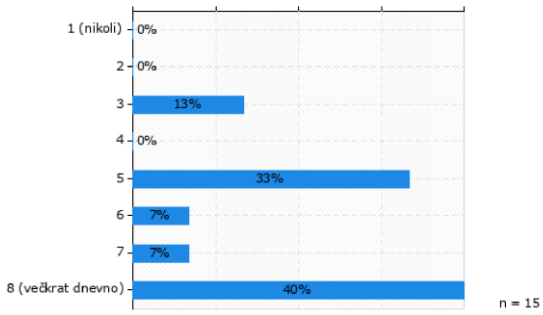
I have completed my studies (n = 8)



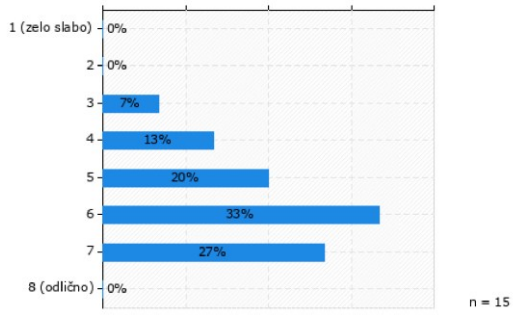
Please enter the program and institution where you completed your undergraduate studies:

Q4	Please enter the program and institution where you completed your undergraduate studies:				
	Answers	Frequency	Percentage	Valid	Cumulative
	gfzg , civil engineering , university	1	7%	25%	25%
	university north , construction	2	13%	50%	75%
	operational construction, FGPA UM	1	7%	25%	100%
Valid	Total	4	27%	100%	
Missing	-2 (Skip (if))	11	73%		
	Total	11	73%		
	TOTAL	15	100%		

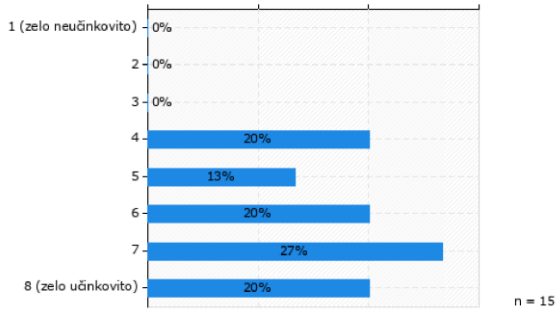
How often do you browse, search or filter data, information and digital content? Rate on a scale from 1 (never) to 8 (several times a day). (n = 15)



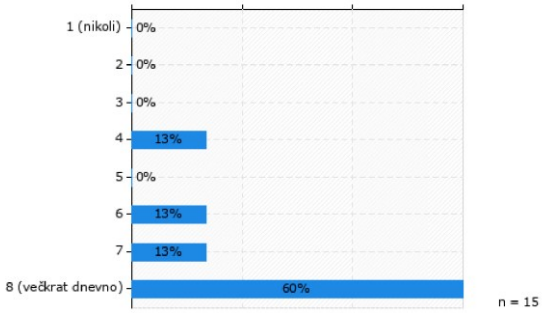
How would you rate your ability to evaluate the accuracy and reliability of information online? Think about your ability to analyze, compare, and critically evaluate the credibility and reliability of information sources and digital content. This includes identifying false or misleading information and checking the credibility of authors or sources. Rate on a scale from 1 (very poor) to 8 (excellent). (n = 15)



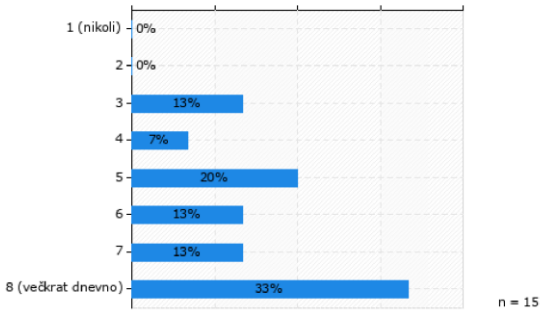
How effectively do you manage data, information and digital content? Storing, organizing, deleting and processing for future use in digital environments, along with structuring and categorizing information. Rate on a scale from 1 (very ineffective) to 8 (very effective). (n = 15)



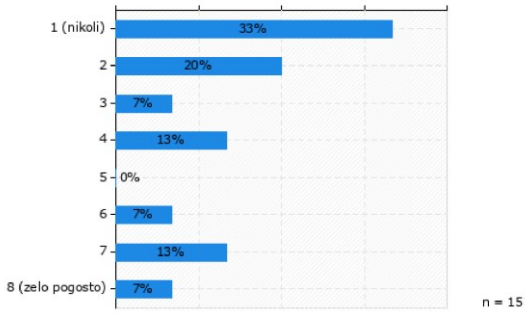
How often do you use digital technologies to communicate with others (e.g. email, social media)? Rate on a scale from 1 (never) to 8 (several times a day). (n = 15)



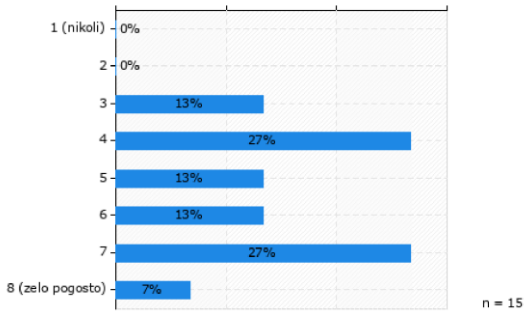
How often do you share content via digital technologies (e.g. images, documents)? Rate on a scale from 1 (never) to 8 (several times a day). (n = 15)



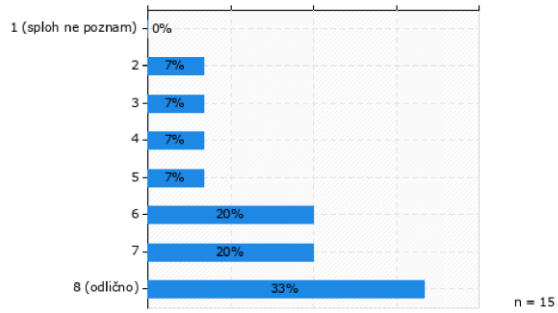
Do you engage in civic activities via digital platforms? Participating in online petitions, commenting on political topics, participating in political debates, signing petitions for referendums and similar activities that affect society. Rate on a scale from 1 (never) to 8 (very often). (n = 15)



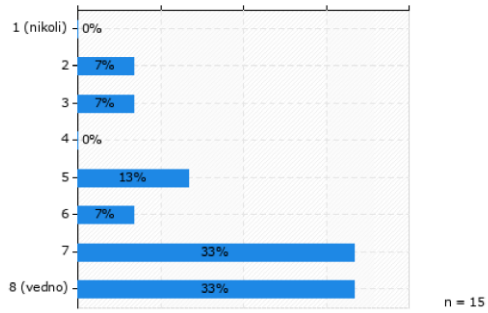
How often do you collaborate with others through digital technologies (e.g., teamwork, collaborative platforms)? Rate on a scale from 1 (never) to 8 (very often). (n = 15)



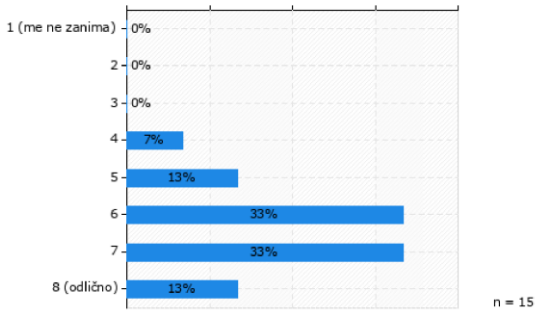
How well do you know the rules of online etiquette when communicating online? The rules of friendly, respectful and responsible communication in digital environments, being aware of cultural and generational differences. Rate on a scale from 1 (I don't know at all) to 8 (excellent). (n = 15)



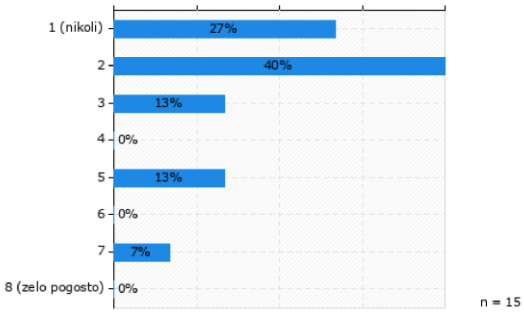
How often do you follow the rules of online etiquette when communicating online? Friendly, respectful, and responsible communication in digital environments and consideration of cultural and generational differences. Rate on a scale from 1 (never) to 8 (always). (n = 15)



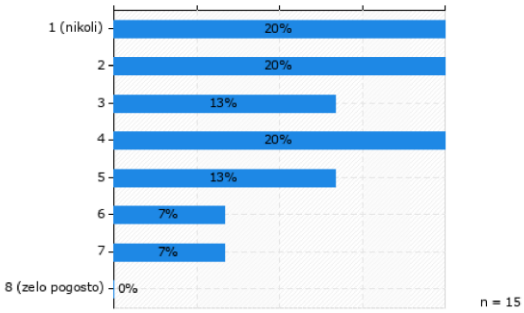
How well do you manage your digital identity? Control over your digital identity, protecting personal data, caring for your public image and reputation online. Rate on a scale from 1 (not interested) to 8 (excellent). (n = 15)



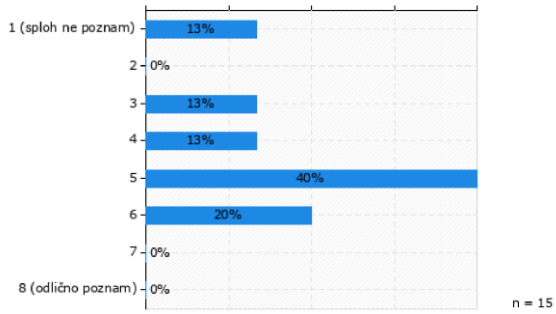
How often do you create digital content (e.g., writing blogs, making videos, taking photos)? Rate on a scale from 1 (never) to 8 (very often). (n = 15)



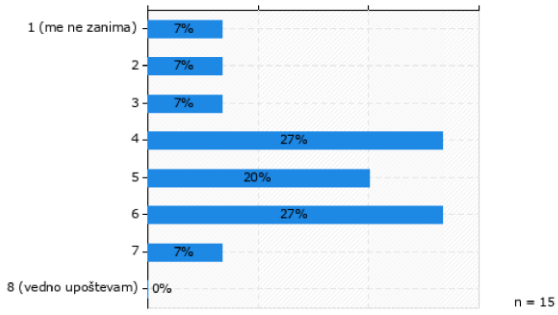
How often do you adapt or recreate existing digital content? Editing and reworking photos, videos or texts. Rate on a scale from 1 (never) to 8 (very often). (n = 15)



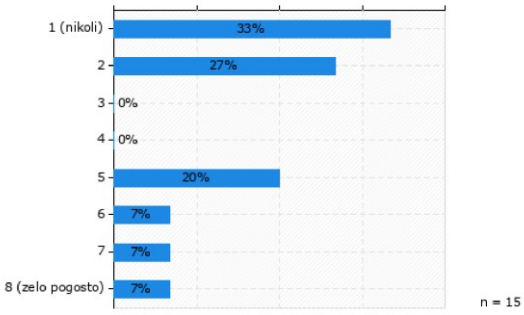
How well do you know copyright and licensing when using digital content? Understanding copyright law, digital content licensing (e.g. Creative Commons), including understanding how to use content without infringing the rights of others. Rate on a scale from 1 (not at all familiar) to 8 (extremely familiar). (n = 15)



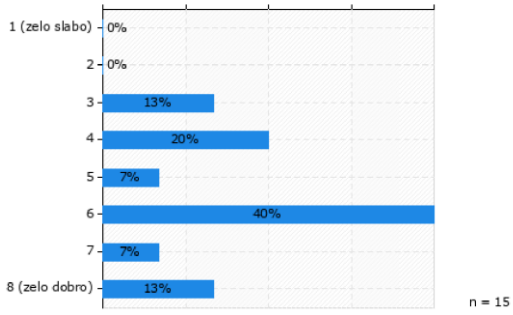
How often do you think about and consider copyright and licensing when using digital content? Copyright protection, licensing when using digital content without violating the rights of others (citing authors when using images, texts, videos from the Internet). Rate on a scale from 1 (I don't care) to 8 (I always consider). (n = 15)



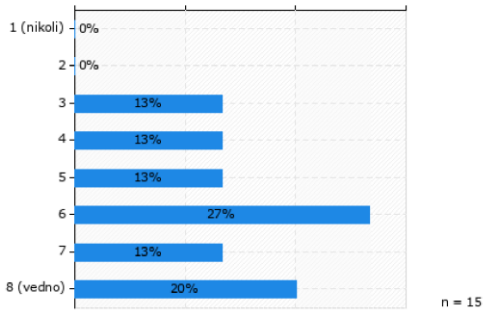
How often do you use programming to create digital solutions? Rate on a scale from 1 (never) to 8 (very often). (n = 15)



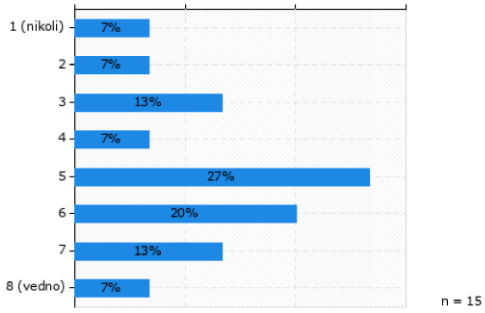
How do you keep your devices secure (e.g., software updates, antivirus protection)? Rate on a scale from 1 (very poor) to 8 (very good). (n = 15)



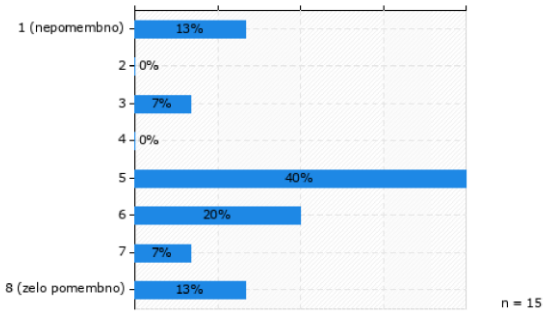
Do you pay attention to protecting personal information and privacy online? Think about your habits in protecting personal information and ensuring privacy in the online environment, including the use of strong passwords and encryption. Rate on a scale from 1 (never) to 8 (always). (n = 15)



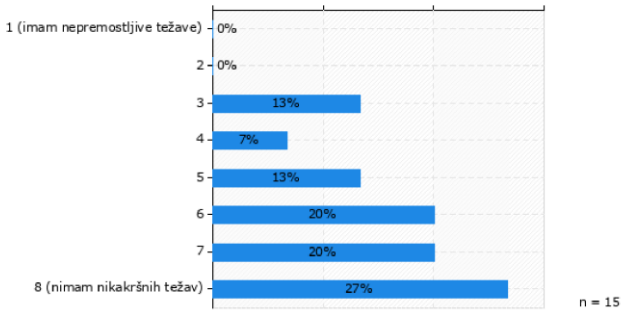
How often do you consider health and well-being when using digital technologies? Frequency of breaks, adequate lighting, correct placement of devices, posture when using devices. Rate on a scale from 1 (never) to 8 (always). (n = 15)



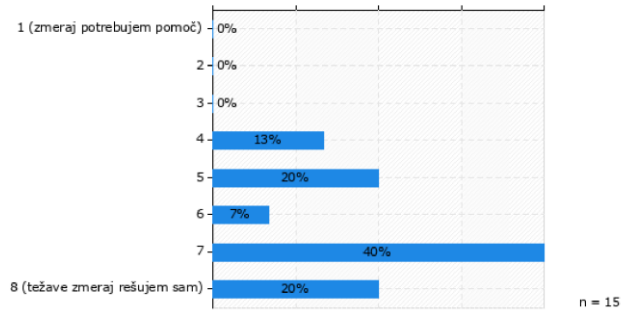
How important do you think environmental protection is when using digital devices? Energy efficiency of devices, recyclability of devices and their components. Rate on a scale from 1 (not important) to 8 (very important). (n = 15)



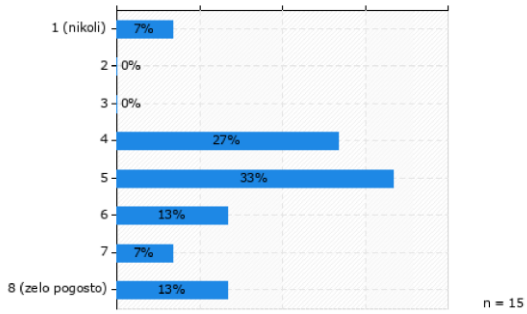
Do you face technical difficulties when using digital devices? Rate on a scale from 1 (I have insurmountable difficulties) to 8 (I have no problems at all). (n = 15)



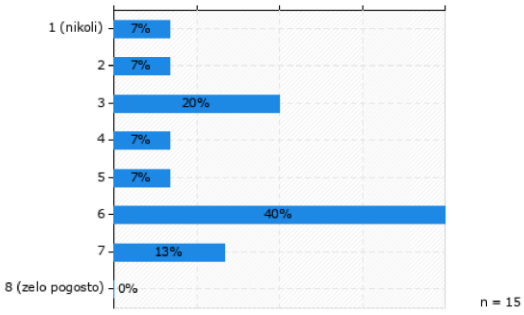
Are you able to solve technical problems when using digital devices yourself? Rate on a scale from 1 (I always need help) to 8 (I always solve problems myself). (n = 15)



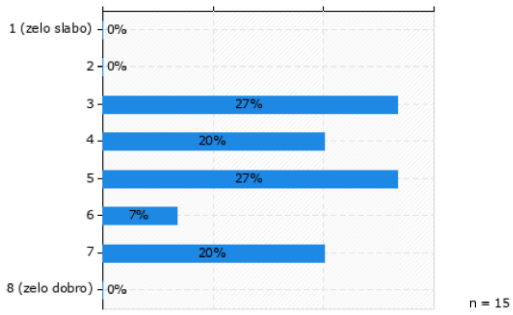
How often do you analyze your technology needs and look for appropriate solutions? Thinking about your own needs when choosing software for work, upgrading hardware for better efficiency, or deciding to purchase a new device to meet your needs. Rate on a scale from 1 (never) to 8 (very often). (n = 15)



How often do you use digital technologies in creative ways? Rate on a scale from 1 (never) to 8 (very often). (n = 15)



How well do you identify gaps in your digital competences and try to improve them? Awareness of the lack of knowledge about online safety, knowledge about creating digital content, knowledge about protecting digital content and digital devices, knowledge about managing your online image, etc. Rate on a scale from 1 (very poor) to 8 (very good). (n = 15)



APPENDIX 3: Summary and graphs of the survey on the competences of energy literacy, sustainability and green transition of students at the Faculty of Natural Sciences and Mathematics, University of Maribor

ANALYSIS - Summary

Q1	I am a student .				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (Physics, 2nd level, 1st year or 2nd year)	2	5%	29%	29%
	2 (Mathematics, 2nd level, 1st year or 2nd year)	1	2%	14%	43%
	3 (Physics, 1st level, 3rd year)	3	7%	43%	86%
	4 (Mathematics, 1st level, 3rd year)	0	0%	0%	86%
	5 (Subject teacher, 5th year)	1	2%	14%	100%
Valid	Total	7	17%	100%	

Average	2.6	Std . deviation	1.4

Q 2	Directions (choose two answers):							
	Sub-questions	Units					Quotes	
		Frequencies	Valid	% - Valid	Appropriate	% - Corresponding	Frequencies	%

Q2a	Educational physics	0	1	0%	41	0%	0	0%
Q2b	Educational mathematics	0	1	0%	41	0%	0	0%
Q2c	Educational technique	1	1	100%	41	2%	1	0%
Q2d	Educational biology	1	1	100%	41	2%	1	0%
Q2e	Educational computing	0	1	0%	41	0%	0	0%
Q2f	Educational chemistry	0	1	0%	41	0%	0	0%
	TOTAL		1		41		0	100%

Q3	I graduated from the first level at				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (FNM UM)	3	7%	100%	100%
	2 (Second)	0	0%	0%	100%
Valid	Total	3	7%	100%	

Average	1.0	Std . deviation	0.0

Q4	I have completed my studies.				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (Physics, 1st level)	2	5%	67%	67%
	2 (Mathematics, 1st level)	1	2%	33%	100%
	3 (Other)	0	0%	0%	100%
Valid	Total	3	7%	100%	

Average	1.3	Std . deviation	0.6

Q5	Please enter the program and institution where you completed your undergraduate studies:

Q6	I am aware of cause-and-effect relationships and energy flows in environmental systems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	14%	14%
	4	3	7%	43%	57%
	5 (5 (totally agree))	3	7%	43%	100%
Valid	Total	7	17%	100%	

Average	4.3	Std . deviation	0.8

Q7	I am capable of independently analyzing connections within environmental systems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	4	10%	67%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	4.0	Std . deviation	0.6

Q8	I am capable of an independent approach to solving environmental challenges, taking into account long-term sustainability . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%

	3 (3 (undecided))	3	7%	50%	50%
	4	3	7%	50%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

Average	3.5	Std . deviation	0.5

Q9	I know the basic physics concepts of energy and renewable energy sources. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	0	0%	0%	0%
	5 (5 (totally agree))	6	15%	100%	100%
Valid	Total	6	15%	100%	

Average	5.0	Std . deviation	0.0

Q10	I can explain energy conversions, the importance of different energy sources and the different ways of producing and storing electricity. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	1	2%	17%	17%
	5 (5 (totally agree))	5	12%	83%	100%
Valid	Total	6	15%	100%	

Average	4.8	Std . deviation	0.4

Q11	I can explain that different energy sources and different forms of energy conversion, transport and storage have their advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	2	5%	33%	33%
	5 (5 (totally agree))	4	10%	67%	100%
Valid	Total	6	15%	100%	

Average	4.7	Std . deviation	0.5

Q12	I know that energy flows are changing our planet, and I know the most important energy sources for processes on Earth. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	3	7%	50%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	4.2	Std . deviation	0.8

Q13	I can explain that the sun is a key source of energy and that a source of energy is needed for the flow of matter. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	1	2%	17%	17%
	5 (5 (totally agree))	5	12%	83%	100%
Valid	Total	6	15%	100%	

Average	4.8	Std . deviation	0.4

Q14	I can explain the impact of greenhouse gases on energy flows. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	2	5%	33%	33%
	4	2	5%	33%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	4.0	Std . deviation	0.9

Q15	I can explain that the Sun is the primary source of energy for organisms and ecosystems and that food is a biofuel for organisms. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	2	5%	33%	33%
	5 (5 (totally agree))	4	10%	67%	100%
Valid	Total	6	15%	100%	

Average	4.7	Std . deviation	0.5

Q16	I can explain that energy flows in food chains in a unidirectional manner from producers to consumers, and I know how ecosystems respond to the availability of energy and nutrients. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%

	2	0	0%	0%	0%
	3 (3 (undecided))	2	5%	33%	33%
	4	3	7%	50%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	3.8	Std . deviation	0.8

Q17	I understand the impact of humans on the energy flows of ecosystems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	2%	17%	17%
	3 (3 (undecided))	1	2%	17%	33%
	4	2	5%	33%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	3.8	Std . deviation	1.2

Q18	I know the basic concepts of biodiversity . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	2%	17%	17%
	2	0	0%	0%	17%
	3 (3 (undecided))	4	10%	67%	83%
	4	0	0%	0%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	3.0	Std . deviation	1.3

Q19	I am able to independently analyze factors that affect biodiversity and energy efficiency of systems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	2%	17%	17%
	2	2	5%	33%	50%
	3 (3 (undecided))	2	5%	33%	83%
	4	0	0%	0%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	2.7	Std . deviation	1.4

Q20	I am capable of independently designing strategies for biodiversity conservation . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	7%	50%	50%
	2	0	0%	0%	50%
	3 (3 (undecided))	2	5%	33%	83%
	4	1	2%	17%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

Average	2.2	Std . deviation	1.3

Q21	I know the basic principles of biodiversity management (for example, protected areas). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	7%	50%	50%
	2	1	2%	17%	67%
	3 (3 (undecided))	1	2%	17%	83%
	4	0	0%	0%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	2.2	Std . deviation	1.6

Q22	I am able to independently apply biodiversity management practices in different contexts (for example, species diversity in urban areas). Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	7%	50%	50%
	2	1	2%	17%	67%
	3 (3 (undecided))	1	2%	17%	83%
	4	1	2%	17%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

Average	2.0	Std . deviation	1.3

Q23	I am capable of independently planning biodiversity management programs . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	7%	50%	50%
	2	1	2%	17%	67%
	3 (3 (undecided))	2	5%	33%	100%
	4	0	0%	0%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

Average	1.8	Std . deviation	1.0

Q24	I understand the importance of conserving resources (water, energy...). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	0	0%	0%	0%
	5 (5 (totally agree))	6	15%	100%	100%

Valid	Total	6	15%	100%	

Average	5.0	Std . deviation	0.0

Q25	I recognize and apply measures for sustainable resource management (materials, water, energy, etc.). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	2%	17%	17%
	2	0	0%	0%	17%
	3 (3 (undecided))	1	2%	17%	33%
	4	2	5%	33%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	3.7	Std . deviation	1.5

Q26	I am capable of independently analyzing and optimizing measures for sustainable resource management. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	2%	17%	17%
	3 (3 (undecided))	2	5%	33%	50%
	4	2	5%	33%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	3.5	Std . deviation	1.0

Q27	I recognize everyday activities that use energy and the basics of saving energy consumption. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative

	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	1	2%	17%	33%
	5 (5 (totally agree))	4	10%	67%	100%
Valid	Total	6	15%	100%	

Average	4.5	Std . deviation	0.8

Q28	I know that social and technological innovations affect the amount of energy used by society and I recognize energy efficiency measures. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	2	5%	33%	50%
	5 (5 (totally agree))	3	7%	50%	100%
Valid	Total	6	15%	100%	

Average	4.3	Std . deviation	0.8

Q29	I am capable of independently planning and developing methods for efficient energy use and optimization of energy processes. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	2%	17%	17%
	3 (3 (undecided))	2	5%	33%	50%
	4	2	5%	33%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	3.5	Std . deviation	1.0

Q30	I know the basic operation of renewable energy technologies. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	1	2%	17%	33%
	5 (5 (totally agree))	4	10%	67%	100%
Valid	Total	6	15%	100%	

Average	4.5	Std . deviation	0.8

Q31	I understand how renewable energy technologies work and am able to analyze them. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	3	7%	50%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	4.2	Std . deviation	0.8

Q32	I am capable of planning and developing innovative solutions for the use of renewable energy sources. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	3	7%	50%	50%
	4	3	7%	50%	100%
	5 (5 (totally agree))	0	0%	0%	100%

Valid	Total	6	15%	100%	

Average	3.5	Std . deviation	0.5

Q33	I know basic green technologies (electric vehicles, etc.). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	2%	17%	17%
	2	0	0%	0%	17%
	3 (3 (undecided))	0	0%	0%	17%
	4	3	7%	50%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	3.8	Std . deviation	1.5

Q34	I understand basic green technologies and analyze their advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	2%	17%	17%
	4	2	5%	33%	50%
	5 (5 (totally agree))	3	7%	50%	100%
Valid	Total	6	15%	100%	

Average	4.3	Std . deviation	0.8

Q35	I am capable of independently planning, developing and optimizing green technologies. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	7%	50%	50%
	2	0	0%	0%	50%

	3 (3 (undecided))	2	5%	33%	83%
	4	1	2%	17%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

Average	2.2	Std . deviation	1.3

Q36	I am familiar with basic environmental policies and regulations and am aware that decisions about the choice and use of energy sources affect the quality of life of individuals and society. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	5%	33%	33%
	2	0	0%	0%	33%
	3 (3 (undecided))	1	2%	17%	50%
	4	1	2%	17%	67%
	5 (5 (totally agree))	2	5%	33%	100%
Valid	Total	6	15%	100%	

Average	3.2	Std . deviation	1.8

Q37	I can explain environmental policies that support the green transition and I am aware that decisions about the choice and use of energy sources are influenced by economic, political, environmental and social factors. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	5%	33%	33%
	2	0	0%	0%	33%
	3 (3 (undecided))	1	2%	17%	50%
	4	2	5%	33%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	3.0	Std . deviation	1.7

Q38	I am able to independently analyze and predict factors that influence decisions about the exploitation of energy resources, and to shape the development of environmental policies at the regional, national or international level. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	5%	33%	33%
	2	1	2%	17%	50%
	3 (3 (undecided))	0	0%	0%	50%
	4	2	5%	33%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	2.8	Std . deviation	1.7

Q39	I understand the basics of green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	2%	17%	17%
	2	2	5%	33%	50%
	3 (3 (undecided))	0	0%	0%	50%
	4	2	5%	33%	83%
	5 (5 (totally agree))	1	2%	17%	100%
Valid	Total	6	15%	100%	

Average	3.0	Std . deviation	1.5

Q40	I am capable of independently analyzing examples of good practices in green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	4	10%	67%	67%
	2	1	2%	17%	83%
	3 (3 (undecided))	1	2%	17%	100%
	4	0	0%	0%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

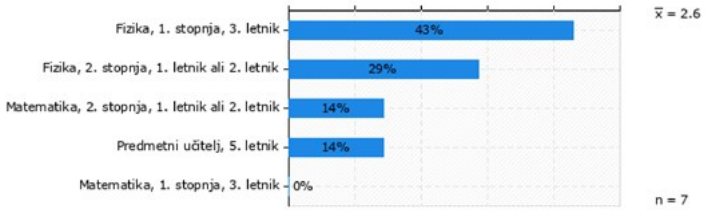
Average	1.5	Std . deviation	0.8

Q41	I am capable of independently planning and developing strategies for green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	4	10%	67%	67%
	2	1	2%	17%	83%
	3 (3 (undecided))	1	2%	17%	100%
	4	0	0%	0%	100%
	5 (5 (totally agree))	0	0%	0%	100%
Valid	Total	6	15%	100%	

Average	1.5	Std . deviation	0.8

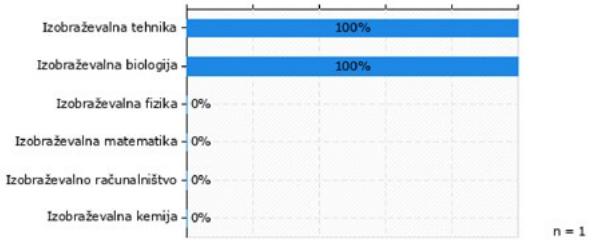
ANALYSIS - Graphs

a student (n = 7)



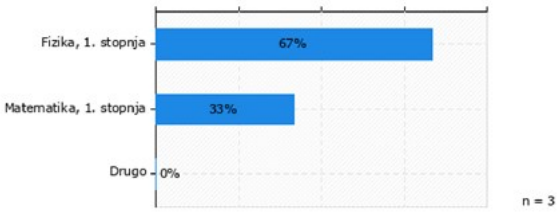
Orientations (choose two answers): (n = 1)

Multiple answers are possible.

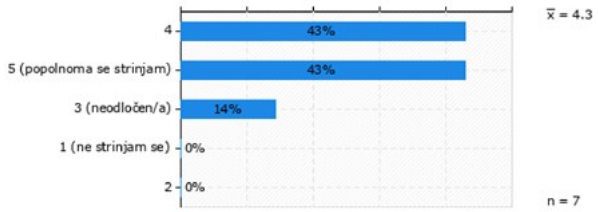


I graduated from (n = 3) at the first level.

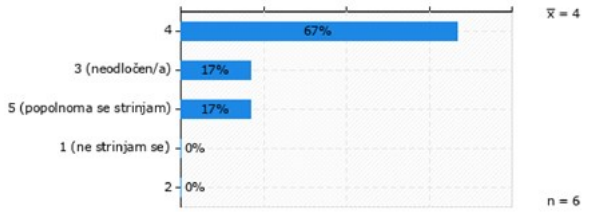
I have completed my studies (n = 3)



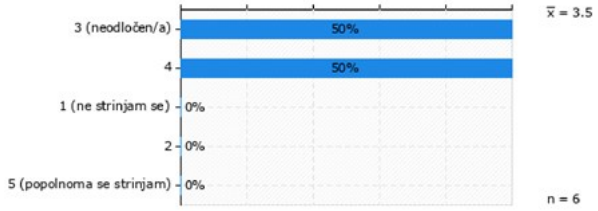
I am aware of cause-and-effect relationships and energy flows in environmental systems. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 7)



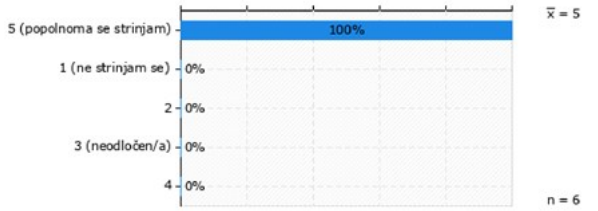
I am capable of independently analyzing connections within environmental systems. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



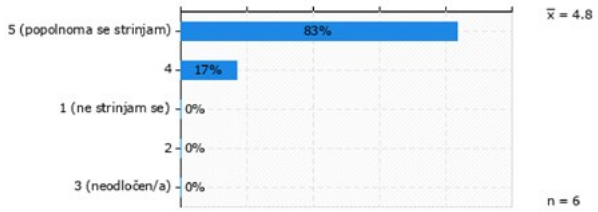
I am capable of an independent approach to solving environmental challenges, taking into account long-term sustainability . Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



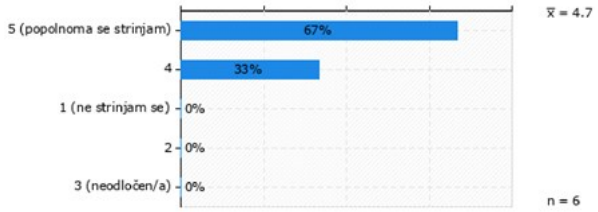
I know the basic physics concepts of energy and renewable energy sources. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



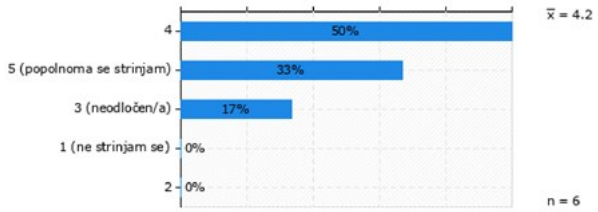
I can explain energy conversions, the importance of different energy sources and the different ways of producing and storing electricity. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



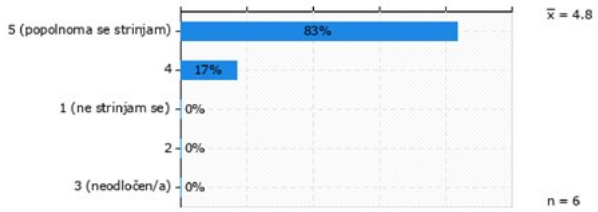
I can explain that different energy sources and different forms of energy conversion, transport and storage have their advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



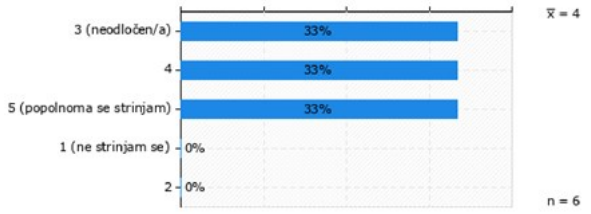
I know that energy flows are changing our planet, and I know the most important energy sources for processes on Earth. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



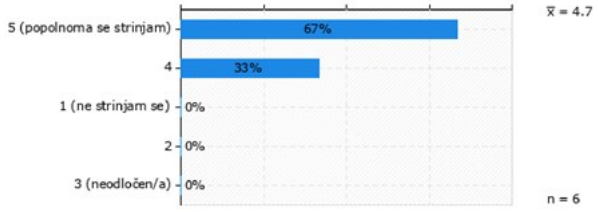
I can explain that the sun is a key source of energy and that a source of energy is needed for the flow of matter. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



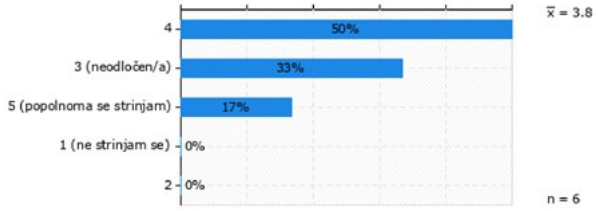
I can explain the impact of greenhouse gases on energy flows. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



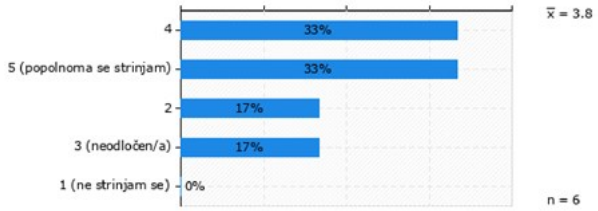
I can explain that the Sun is the primary source of energy for organisms and ecosystems and that food is a biofuel for organisms. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



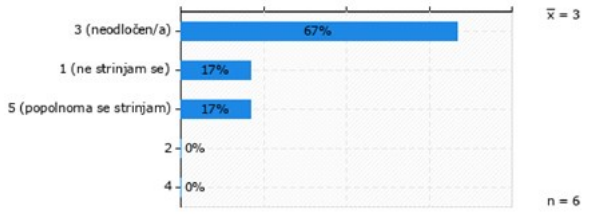
I can explain that energy flows in food chains in a unidirectional manner from producers to consumers, and I know how ecosystems respond to the availability of energy and nutrients. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



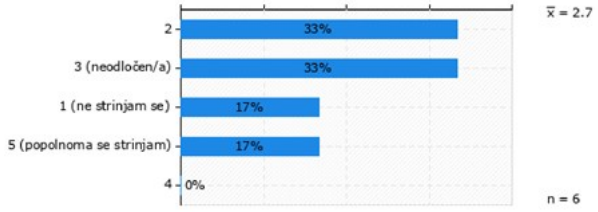
I understand the impact of humans on the energy flows of ecosystems. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



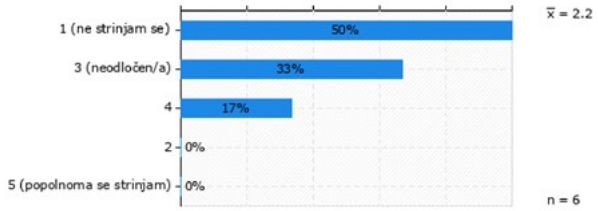
I know the basic concepts of biodiversity . Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



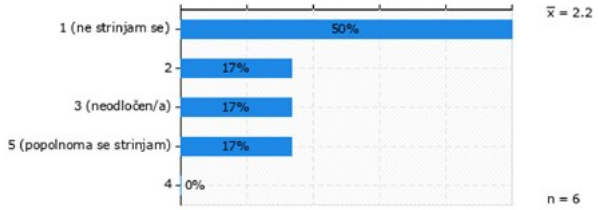
I am able to independently analyze the factors that affect biodiversity and energy efficiency of systems. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



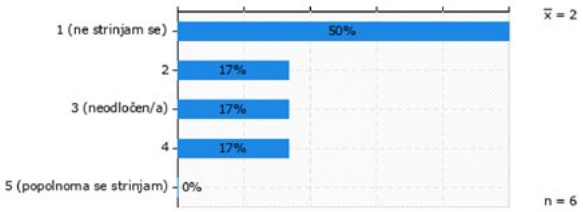
I am capable of independently designing strategies for biodiversity conservation . Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



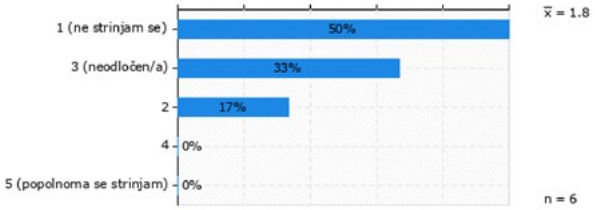
I know the basic principles of biodiversity management (e.g. protected areas). Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



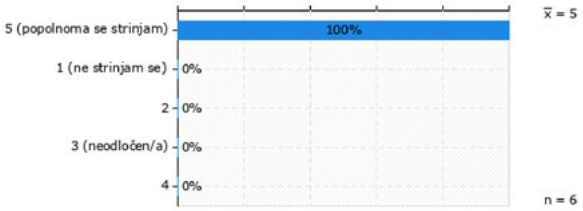
I am able to independently apply biodiversity management practices in different contexts (for example, species diversity in urban areas). Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



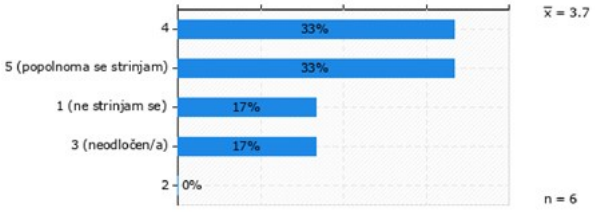
I am capable of independently planning biodiversity management programs . Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



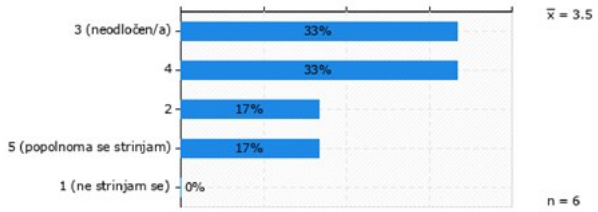
I understand the importance of conserving resources (water, energy ...) Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



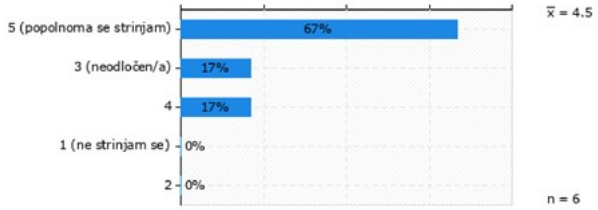
I recognize and apply measures for sustainable resource management (materials, water, energy ...). Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



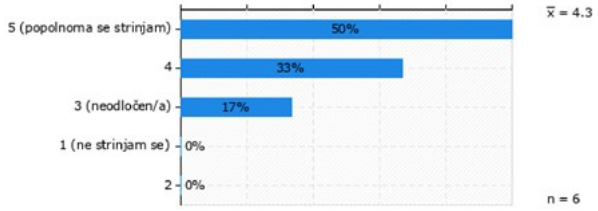
I am capable of independently analyzing and optimizing measures for sustainable resource management. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



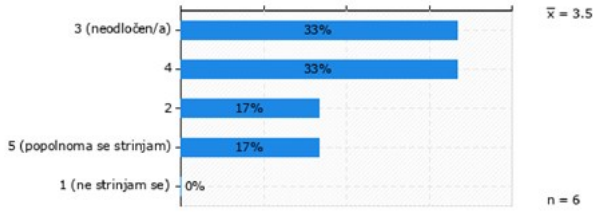
I recognize everyday activities that use energy and the basics of saving energy consumption. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



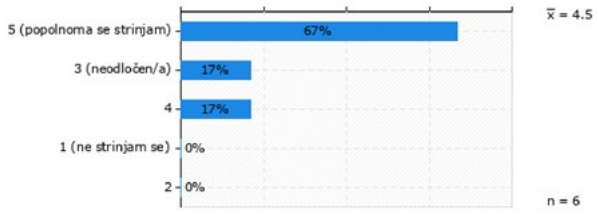
I know that social and technological innovations affect the amount of energy used by society and I recognize energy efficiency measures. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



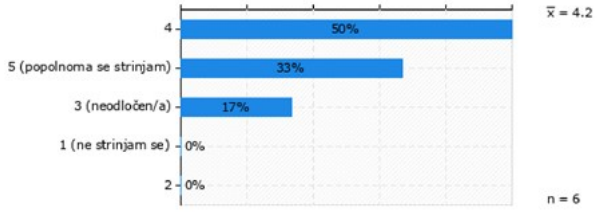
I am capable of independently planning and developing methods for efficient energy use and optimization of energy processes. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



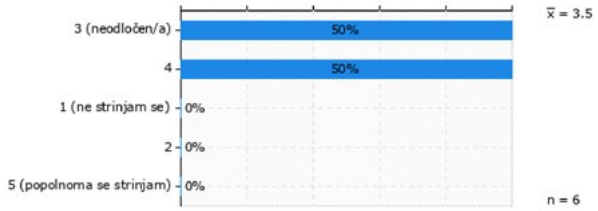
I know the basic operation of renewable energy technologies. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



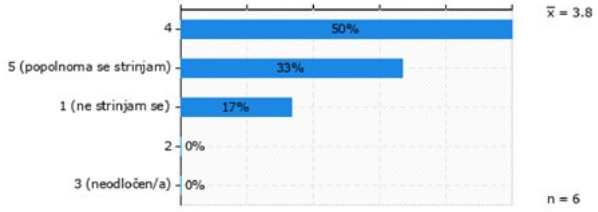
I understand how renewable energy technologies work and am able to analyze them. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



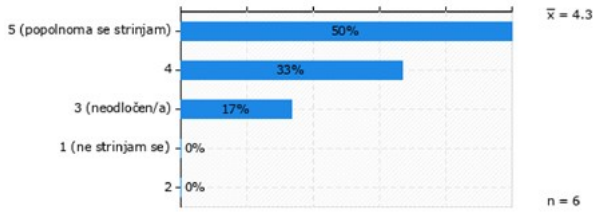
I am capable of planning and developing innovative solutions for the use of renewable energy sources. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



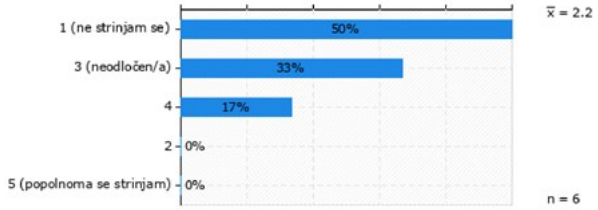
I know basic green technologies (electric vehicles, etc.). Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



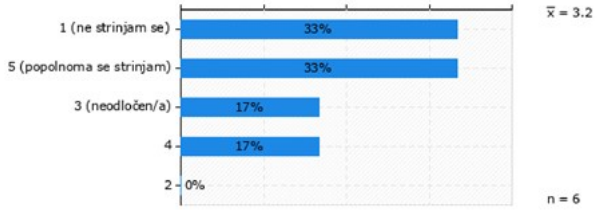
I understand basic green technologies and analyze their advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



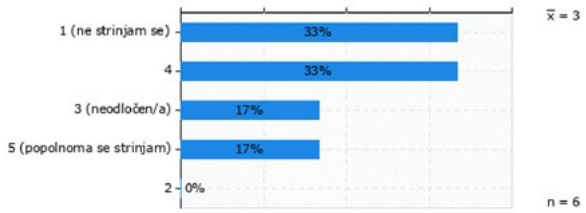
I am capable of independently planning, developing and optimizing green technologies. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



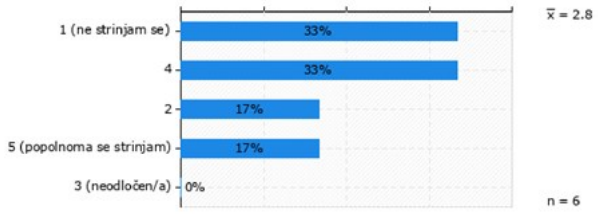
I am familiar with basic environmental policies and regulations and am aware that decisions about the choice and use of energy sources affect the quality of life of individuals and society. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



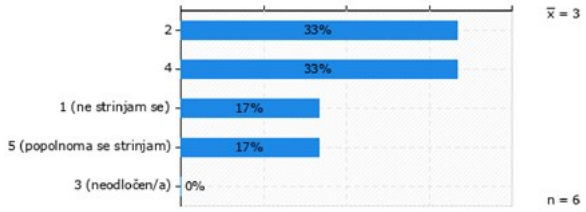
I can explain environmental policies that support the green transition and I am aware that decisions about the choice and use of energy sources are influenced by economic, political, environmental and social factors. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



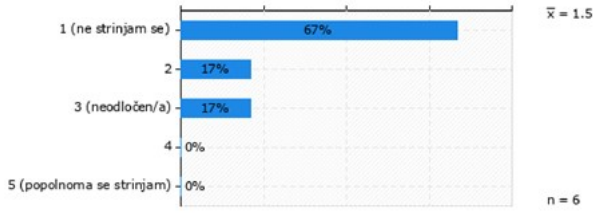
I am able to independently analyze and predict factors that influence decisions on the exploitation of energy resources, and to shape the development of environmental policies at the regional, national or international level. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



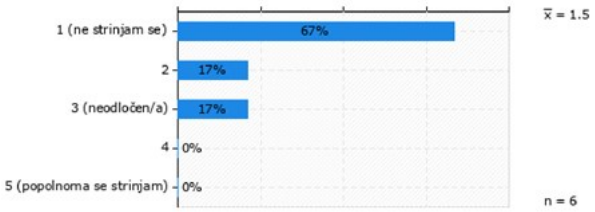
I understand the basics of green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



I am capable of independently analyzing examples of good practices in green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 6)



I am capable of independently planning and developing strategies for green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 6)



APPENDIX 4: Summary and graphs of the survey on the competences of energy literacy, sustainability and green transition of students at FGPA UM

ANALYSIS - Summary

Q1	I am				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (student of UN Civil Engineering (1st level))	1	6%	6%	6%
	2 (student Civil Engineering (1st level))	1	6%	6%	13%
	3 (student Civil Engineering MAG (2nd level))	13	81%	81%	94%
	4 (graduate of Civil Engineering MAG (2nd level))	1	6%	6%	100%
Valid	Total	16	100%	100%	
		Average	2.9	Std . deviation	0.6

Q2	I finished my studies at the first level.				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (UN Construction at FGPA)	4	25%	29%	29%
	2 (Civil Engineering VS at FGPA)	3	19%	21%	50%
	3 (Other)	7	44%	50%	100%
Valid	Total	14	88%	100%	
		Average	2.2	Std . deviation	0.9

Q3	Please enter the program and institution where you completed your undergraduate studies:
	gfzg
	fgpa construction
	university north , construction
	ging
	university north , construction
	fgg vs.

Q4	I am aware of cause-and-effect relationships and energy flows in environmental systems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	6%	6%
	3 (3 (undecided))	4	25%	25%	31%
	4	9	56%	56%	88%
	5 (5 (totally agree))	2	13%	13%	100%
Valid	Total	16	100%	100%	
		Average	3.8	Std . deviation	0.8

Q5	I am capable of independently analyzing connections within environmental systems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	3	19%	21%	21%
	3 (3 (undecided))	4	25%	29%	50%
	4	6	38%	43%	93%

	5 (5 (totally agree))	1	6%	7%	100%
Valid	Total	14	88%	100%	
		Average	3.4	Std . deviation	0.9

Q6	_ I am capable of an independent approach to solving environmental challenges, taking into account long-term sustainability . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	8	50%	62%	62%
	4	3	19%	23%	85%
	5 (5 (totally agree))	2	13%	15%	100%
Valid	Total	13	81%	100%	
		Average	3.5	Std . deviation	0.8

Q7	I know the basic physics concepts of energy and renewable energy sources . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	0	0%	0%	0%
	4	9	56%	69%	69%
	5 (5 (totally agree))	4	25%	31%	100%
Valid	Total	13	81%	100%	
		Average	4.3	Std . deviation	0.5

Q8	I can explain energy conversions, the importance of different energy sources and the different ways of producing and storing electricity. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	2	13%	15%	15%
	3 (3 (undecided))	1	6%	8%	23%
	4	8	50%	62%	85%
	5 (5 (totally agree))	2	13%	15%	100%
Valid	Total	13	81%	100%	
		Average	3.8	Std . deviation	0.9

Q9	_ I can explain that different energy sources and different forms of energy conversion, transport and storage have their own advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	2	13%	15%	15%
	4	8	50%	62%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	4.1	Std . deviation	0.6

Q10	I know that energy flows are changing our planet, and I know the most important energy sources for processes on Earth. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%

	3 (3 (undecided))	0	0%	0%	0%
	4	7	44%	54%	54%
	5 (5 (totally agree))	6	38%	46%	100%
Valid	Total	13	81%	100%	
		Average	4.5	Std . deviation	0.5

Q11	I can explain that the sun is a key source of energy and that a source of energy is needed for the flow of matter. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	0	0%	0%	8%
	3 (3 (undecided))	0	0%	0%	8%
	4	5	31%	38%	46%
	5 (5 (totally agree))	7	44%	54%	100%
Valid	Total	13	81%	100%	
		Average	4.3	Std . deviation	1.1

Q12	I can explain the impact of greenhouse gases on energy flows. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	4	25%	31%	31%
	4	5	31%	38%	69%
	5 (5 (totally agree))	4	25%	31%	100%
Valid	Total	13	81%	100%	

Average	4.0	Std . deviation	0.8

Q13	I can explain that the Sun is the primary source of energy for organisms and ecosystems and that food is a biofuel for organisms. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	6%	8%	8%
	4	4	25%	31%	38%
	5 (5 (totally agree))	8	50%	62%	100%
Valid	Total	13	81%	100%	
		Average	4.5	Std . deviation	0.7

Q14	I can explain that energy in food chains flows in one direction from producers to consumers, and I know how ecosystems respond to the availability of energy and nutrients . Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	8%	8%
	3 (3 (undecided))	2	13%	15%	23%
	4	7	44%	54%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	3.9	Std . deviation	0.9

Q15	I understand the impact of humans on the energy flows of ecosystems. Rate on a scale from 1 (disagree) to 5 (completely agree).

	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	3	19%	23%	23%
	4	7	44%	54%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	4.0	Std . deviation	0.7

Q16	I know the basic concepts of biodiversity . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	2	13%	15%	23%
	3 (3 (undecided))	4	25%	31%	54%
	4	2	13%	15%	69%
	5 (5 (totally agree))	4	25%	31%	100%
Valid	Total	13	81%	100%	
		Average	3.5	Std . deviation	1.3

Q17	I am able to independently analyze factors that affect biodiversity and energy efficiency of systems. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	1	6%	8%	15%
	3 (3 (undecided))	6	38%	46%	62%
	4	3	19%	23%	85%

	5 (5 (totally agree))	2	13%	15%	100%
Valid	Total	13	81%	100%	
		Average	3.3	Std . deviation	1.1

Q18	_ I am capable of independently designing strategies for biodiversity conservation . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	2	13%	15%	23%
	3 (3 (undecided))	5	31%	38%	62%
	4	2	13%	15%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	3.3	Std . deviation	1.3

Q19	I know the basic principles of biodiversity management (for example, protected areas). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	3	19%	23%	31%
	3 (3 (undecided))	1	6%	8%	38%
	4	5	31%	38%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	3.5	Std . deviation	1.3

Q20	I am able to independently apply biodiversity management practices in different contexts (for example, species diversity in urban areas). Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	2	13%	15%	23%
	3 (3 (undecided))	3	19%	23%	46%
	4	4	25%	31%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	3.5	Std . deviation	1.3

Q21	I am capable of independently planning biodiversity management programs . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	4	25%	31%	38%
	3 (3 (undecided))	2	13%	15%	54%
	4	3	19%	23%	77%
	5 (5 (totally agree))	3	19%	23%	100%
Valid	Total	13	81%	100%	
		Average	3.2	Std . deviation	1.4

Q22	I understand the importance of conserving resources (water, energy...). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%

	3 (3 (undecided))	0	0%	0%	0%
	4	3	19%	23%	23%
	5 (5 (totally agree))	10	63%	77%	100%
Valid	Total	13	81%	100%	
		Average	4.8	Std . deviation	0.4

Q23	I recognize and apply measures for sustainable resource management (materials, water, energy, etc.). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	6%	8%	8%
	4	6	38%	46%	54%
	5 (5 (totally agree))	6	38%	46%	100%
Valid	Total	13	81%	100%	
		Average	4.4	Std . deviation	0.7

Q24	_ I am capable of independently analyzing and optimizing measures for sustainable resource management. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	8%	8%
	3 (3 (undecided))	3	19%	25%	33%
	4	5	31%	42%	75%
	5 (5 (totally agree))	3	19%	25%	100%
Valid	Total	12	75%	100%	

Average	3.8	Std . deviation	0.9

Q25	I recognize everyday activities that use energy and the basics of saving energy consumption . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	2	13%	17%	17%
	4	6	38%	50%	67%
	5 (5 (totally agree))	4	25%	33%	100%
Valid	Total	12	75%	100%	
		Average	4.2	Std . deviation	0.7

Q26	I know that social and technological innovations affect the amount of energy used by society, and I recognize energy efficiency measures . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	8%	8%
	3 (3 (undecided))	2	13%	17%	25%
	4	5	31%	42%	67%
	5 (5 (totally agree))	4	25%	33%	100%
Valid	Total	12	75%	100%	
		Average	4.0	Std . deviation	1.0

Q27	I am capable of independently planning and developing methods for efficient energy use and optimization of energy processes. Rate on a scale from 1 (disagree) to 5 (completely agree).

	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	2	13%	17%	17%
	3 (3 (undecided))	2	13%	17%	33%
	4	6	38%	50%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.7	Std . deviation	1.0

Q28	I know basic methods of sustainable water use and measures to reduce water consumption (e.g. rainwater harvesting). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	1	6%	8%	8%
	4	5	31%	42%	50%
	5 (5 (totally agree))	6	38%	50%	100%
Valid	Total	12	75%	100%	
		Average	4.4	Std . deviation	0.7

Q29	I am capable of independently designing water management systems, including reducing wastewater in small projects. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	4	25%	33%	33%

	4	6	38%	50%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.8	Std . deviation	0.7

Q30	I am capable of independently designing complex water and wastewater management systems in larger projects. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	2	13%	17%	17%
	3 (3 (undecided))	3	19%	25%	42%
	4	5	31%	42%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.6	Std . deviation	1.0

Q31	_ I know the basic operation of renewable energy technologies. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	0	0%	0%	0%
	3 (3 (undecided))	3	19%	25%	25%
	4	5	31%	42%	67%
	5 (5 (totally agree))	4	25%	33%	100%
Valid	Total	12	75%	100%	
		Average	4.1	Std . deviation	0.8

Q32	I understand how renewable energy technologies work and am able to analyze them. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	8%	8%
	3 (3 (undecided))	2	13%	17%	25%
	4	7	44%	58%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.8	Std . deviation	0.8

Q33	I am capable of planning and developing innovative solutions for the use of renewable energy sources. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	13%	17%	17%
	2	1	6%	8%	25%
	3 (3 (undecided))	3	19%	25%	50%
	4	4	25%	33%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.3	Std . deviation	1.4

Q34	I know basic green technologies (electric vehicles, etc.). Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	8%	8%

	3 (3 (undecided))	0	0%	0%	8%
	4	7	44%	58%	67%
	5 (5 (totally agree))	4	25%	33%	100%
Valid	Total	12	75%	100%	
		Average	4.2	Std . deviation	0.8

Q35	_ I understand basic green technologies and analyze their advantages and disadvantages . Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	2	13%	17%	25%
	3 (3 (undecided))	2	13%	17%	42%
	4	5	31%	42%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.4	Std . deviation	1.2

Q36	I am capable of independently planning, developing and optimizing green technologies. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	19%	25%	25%
	2	1	6%	8%	33%
	3 (3 (undecided))	3	19%	25%	58%
	4	2	13%	17%	75%
	5 (5 (totally agree))	3	19%	25%	100%
Valid	Total	12	75%	100%	
		Average	3.1	Std . deviation	1.6

Q37	I know the basic characteristics of sustainable building materials (e.g. recycled concrete, wood, local materials) and their impact on the environment. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	0	0%	0%	8%
	3 (3 (undecided))	2	13%	17%	25%
	4	6	38%	50%	75%
	5 (5 (totally agree))	3	19%	25%	100%
Valid	Total	12	75%	100%	
		Average	3.8	Std . deviation	1.1

Q38	I understand the advantages and disadvantages of different sustainable materials in construction projects and can analyze them. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	8%	8%
	2	0	0%	0%	8%
	3 (3 (undecided))	3	19%	25%	33%
	4	5	31%	42%	75%
	5 (5 (totally agree))	3	19%	25%	100%
Valid	Total	12	75%	100%	
		Average	3.8	Std . deviation	1.1

Q39	I am able to conduct a life cycle analysis of materials and compare carbon footprints. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	19%	25%	25%

	2	0	0%	0%	25%
	3 (3 (undecided))	3	19%	25%	50%
	4	3	19%	25%	75%
	5 (5 (totally agree))	3	19%	25%	100%
Valid	Total	12	75%	100%	
		Average	3.3	Std . deviation	1.5

Q40	I understand basic energy efficiency standards (e.g. TSG-1-004) and measures for energy efficient construction. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	3	19%	25%	25%
	2	1	6%	8%	33%
	3 (3 (undecided))	3	19%	25%	58%
	4	3	19%	25%	83%
	5 (5 (totally agree))	2	13%	17%	100%
Valid	Total	12	75%	100%	
		Average	3.0	Std . deviation	1.5

Q41	I can design basic energy solutions for buildings and use software tools for basic simulations. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	13%	18%	18%
	2	0	0%	0%	18%
	3 (3 (undecided))	2	13%	18%	36%
	4	4	25%	36%	73%
	5 (5 (totally agree))	3	19%	27%	100%

Valid	Total	11	69%	100%	
		Average	3.5	Std . deviation	1.4

Q42	I am able to use advanced techniques (e.g. thermal simulations, BIM) to design energy-efficient buildings. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	9%	9%
	2	1	6%	9%	18%
	3 (3 (undecided))	5	31%	45%	64%
	4	2	13%	18%	82%
	5 (5 (totally agree))	2	13%	18%	100%
Valid	Total	11	69%	100%	
		Average	3.3	Std . deviation	1.2

Q43	I understand the basic measures for adapting building structures to extreme weather conditions. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	13%	18%	18%
	2	1	6%	9%	27%
	3 (3 (undecided))	2	13%	18%	45%
	4	3	19%	27%	73%
	5 (5 (totally agree))	3	19%	27%	100%
Valid	Total	11	69%	100%	
		Average	3.4	Std . deviation	1.5

Q44	I can use basic methods for risk assessment and adaptation of infrastructure to climate risks. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	2	13%	18%	18%
	2	2	13%	18%	36%
	3 (3 (undecided))	2	13%	18%	55%
	4	3	19%	27%	82%
	5 (5 (totally agree))	2	13%	18%	100%
Valid	Total	11	69%	100%	
		Average	3.1	Std . deviation	1.4

Q51	I am able to conduct studies to adapt existing infrastructure and plan improvements from a climate change perspective. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	4	25%	36%	36%
	2	0	0%	0%	36%
	3 (3 (undecided))	3	19%	27%	64%
	4	2	13%	18%	82%
	5 (5 (totally agree))	2	13%	18%	100%
Valid	Total	11	69%	100%	
		Average	2.8	Std . deviation	1.6

Q52	I understand the basics of digital tools (e.g. BIM) for planning and visualizing projects. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	9%	9%

	3 (3 (undecided))	4	25%	36%	45%
	4	3	19%	27%	73%
	5 (5 (totally agree))	3	19%	27%	100%
Valid	Total	11	69%	100%	
		Average	3.7	Std . deviation	1.0

Q53	_ I can use BIM to analyze projects and simulate basic construction parameters. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	9%	9%
	2	0	0%	0%	9%
	3 (3 (undecided))	6	38%	55%	64%
	4	2	13%	18%	82%
	5 (5 (totally agree))	2	13%	18%	100%
Valid	Total	11	69%	100%	
		Average	3.4	Std . deviation	1.1

Q54	I am able to develop complex BIM models for building lifecycle optimization and energy efficiency. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	9%	9%
	2	3	19%	27%	36%
	3 (3 (undecided))	3	19%	27%	64%
	4	3	19%	27%	91%
	5 (5 (totally agree))	1	6%	9%	100%
Valid	Total	11	69%	100%	

Average	3.0	Std . deviation	1.2

Q45	I am familiar with basic environmental policies and regulations and am aware that decisions about the choice and use of energy sources affect the quality of life of individuals and society. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	9%	9%
	2	0	0%	0%	9%
	3 (3 (undecided))	5	31%	45%	55%
	4	4	25%	36%	91%
	5 (5 (totally agree))	1	6%	9%	100%
Valid	Total	11	69%	100%	
		Average	3.4	Std . deviation	1.0

Q46	I can explain environmental policies that support the green transition and I am aware that decisions about the choice and use of energy sources are influenced by economic, political, environmental and social factors. Rate on a scale from 1 (disagree) to 5 (strongly agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	2	13%	18%	18%
	3 (3 (undecided))	3	19%	27%	45%
	4	3	19%	27%	73%
	5 (5 (totally agree))	3	19%	27%	100%
Valid	Total	11	69%	100%	
		Average	3.6	Std . deviation	1.1

Q47	I am able to independently analyze and predict factors that influence decisions about the exploitation of energy resources, and to shape the

	development of environmental policies at the regional, national or international level. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	11%	11%
	3 (3 (undecided))	2	13%	22%	33%
	4	4	25%	44%	78%
	5 (5 (totally agree))	2	13%	22%	100%
Valid	Total	9	56%	100%	
		Average	3.8	Std . deviation	1.0

Q48	I understand the basics of green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	10%	10%
	3 (3 (undecided))	1	6%	10%	20%
	4	5	31%	50%	70%
	5 (5 (totally agree))	3	19%	30%	100%
Valid	Total	10	63%	100%	
		Average	4.0	Std . deviation	0.9

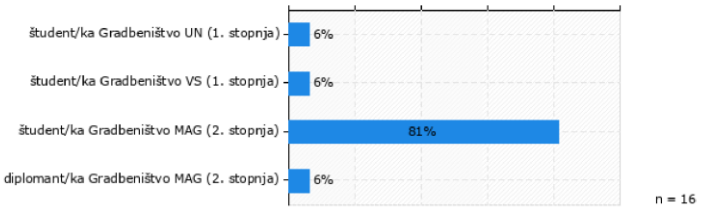
Q49	I am capable of independently analyzing examples of good practices in green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	0	0%	0%	0%
	2	1	6%	10%	10%

	3 (3 (undecided))	1	6%	10%	20%
	4	6	38%	60%	80%
	5 (5 (totally agree))	2	13%	20%	100%
Valid	Total	10	63%	100%	
		Average	3.9	Std . deviation	0.9

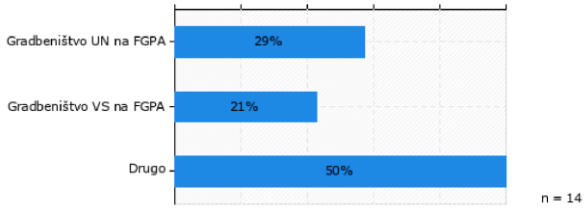
Q50	I am capable of independently planning and developing strategies for green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree).				
	Answers	Frequency	Percentage	Valid	Cumulative
	1 (1 (disagree))	1	6%	10%	10%
	2	1	6%	10%	20%
	3 (3 (undecided))	2	13%	20%	40%
	4	3	19%	30%	70%
	5 (5 (totally agree))	3	19%	30%	100%
Valid	Total	10	63%	100%	
		Average	3.6	Std . deviation	1.3

ANALYSIS - Graphs

I am (n = 16)



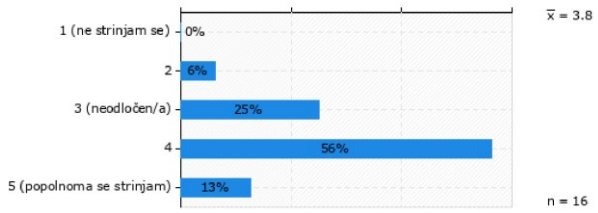
I completed my studies at the first level (n = 14)



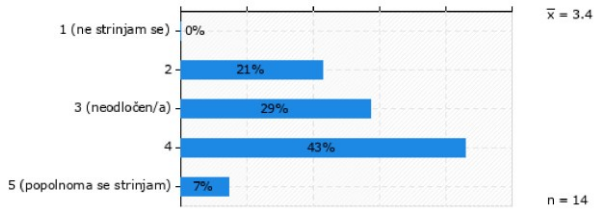
Please enter the program and institution where you completed your undergraduate studies:

Q3	Please enter the program and institution where you completed your undergraduate studies:				
	Answers	Frequency	Percentage	Valid	Cumulative
	gfzg	2	13%	29%	29%
	fgpa construction	1	6%	14%	43%
	university north , construction	1	6%	14%	57%
	ging	1	6%	14%	71%
	university north , construction	1	6%	14%	86%
	fgg vs.	1	6%	14%	100%
Valid	Total	7	44%	100%	
Missing	-2 (Skip (if))	9	56%		
	Total	9	56%		
	TOTAL	16	100%		

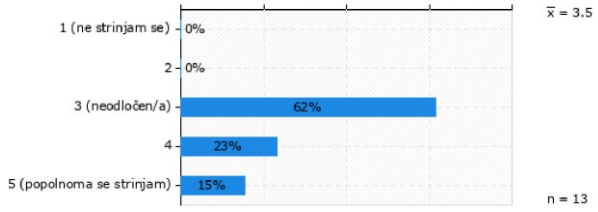
I am aware of cause-and-effect relationships and energy flows in environmental systems. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 16)



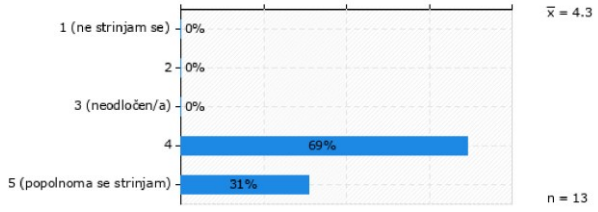
I am capable of independently analyzing connections within environmental systems. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 14)



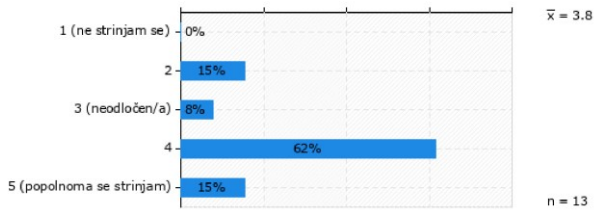
I am capable of an independent approach to solving environmental challenges, taking into account long-term sustainability. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



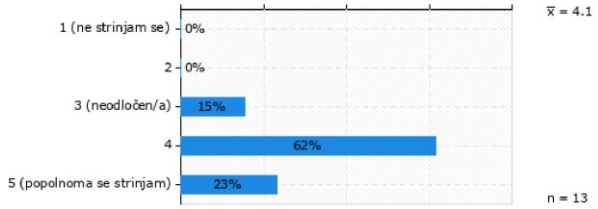
I know the basic physical concepts of energy and renewable energy sources. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



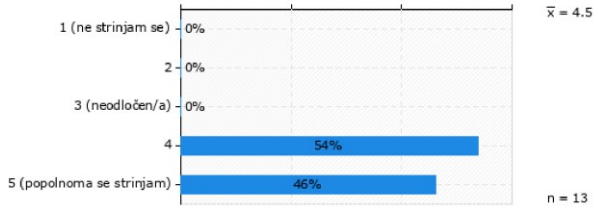
I can explain energy conversions, the importance of different energy sources and the different ways of producing and storing electricity. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



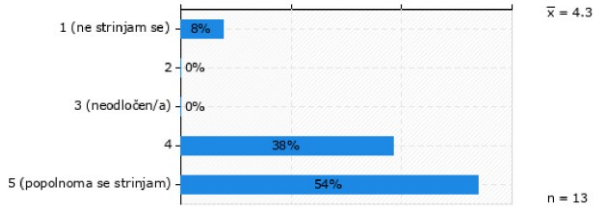
I can explain that different energy sources and different forms of energy conversion, transport and storage have their advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



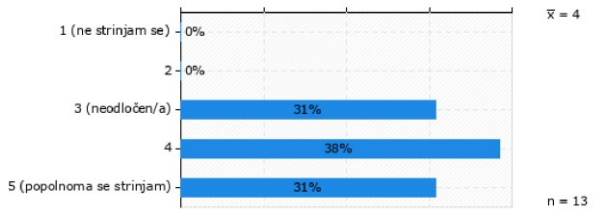
I know that energy flows change our planet, and I know the most important energy sources for processes on Earth. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 13)



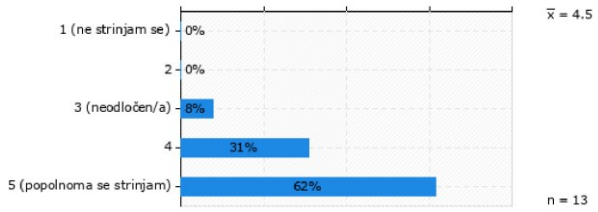
I can explain that the sun is a key source of energy and that the flow of matter requires an energy source. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 13)



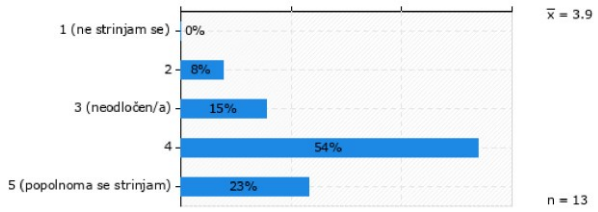
I can explain the impact of greenhouse gases on energy flows. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



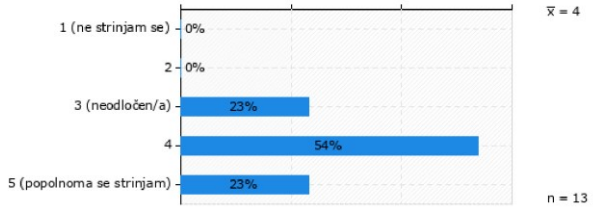
I can explain that the Sun is the primary source of energy for organisms and ecosystems and that food is a biofuel for organisms. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 13)



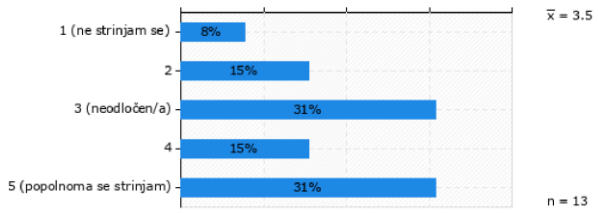
I can explain that energy in food chains flows in one direction from producers to consumers, and I know the response of ecosystems to the availability of energy and nutrients. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 13)



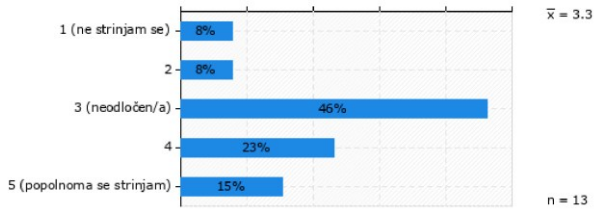
I understand the impact of humans on the energy flows of ecosystems. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



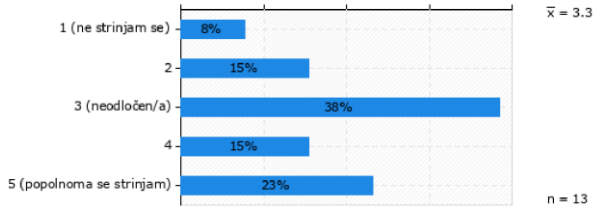
I know the basic concepts of biodiversity. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



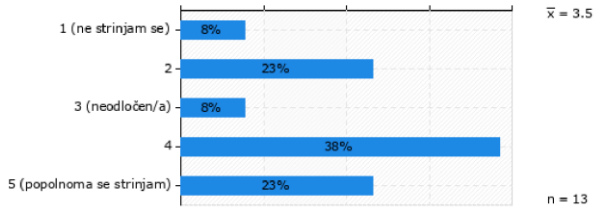
I am able to independently analyze the factors that affect biodiversity and energy efficiency of systems. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



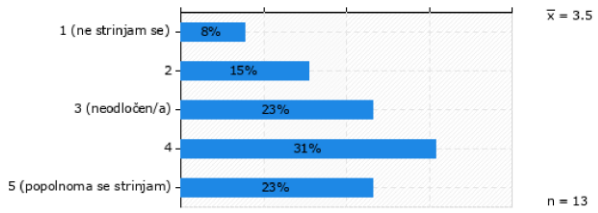
I am capable of independently designing strategies for biodiversity conservation. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



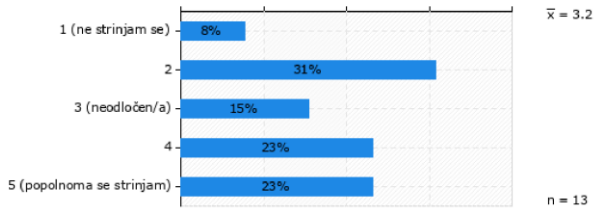
I know the basic principles of biodiversity management (e.g. protected areas). Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 13)



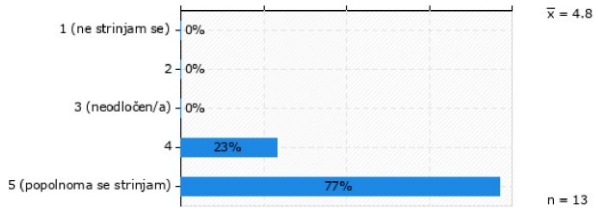
I am able to independently apply biodiversity management practices in different contexts (for example, species diversity in urban areas). Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 13)



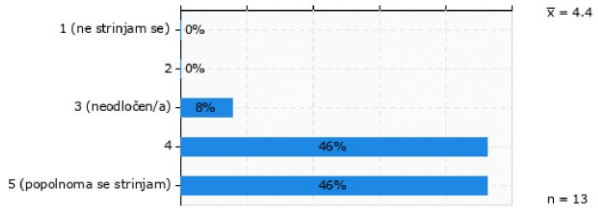
I am capable of independently planning biodiversity management programs. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



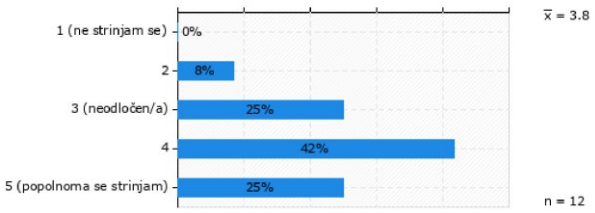
I understand the importance of conserving resources (water, energy ...) Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



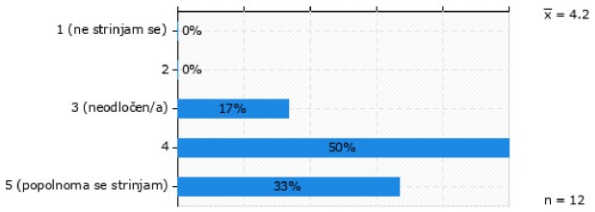
I recognize and use measures for sustainable resource management (materials, water, energy ...). Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 13)



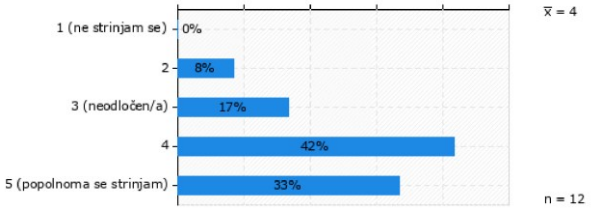
I am capable of independently analyzing and optimizing measures for sustainable resource management. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



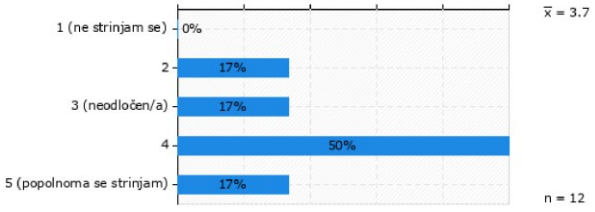
I recognize everyday activities that use energy and the basics of saving energy consumption. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



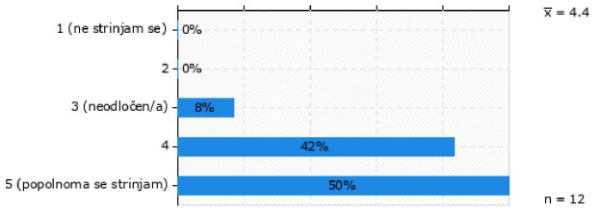
I know that social and technological innovations affect the amount of energy used by society and I recognize energy efficiency measures. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



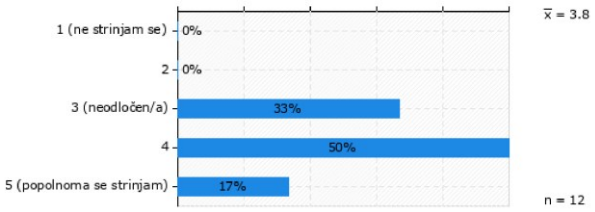
I am capable of independently planning and developing methods for efficient energy use and optimization of energy processes. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



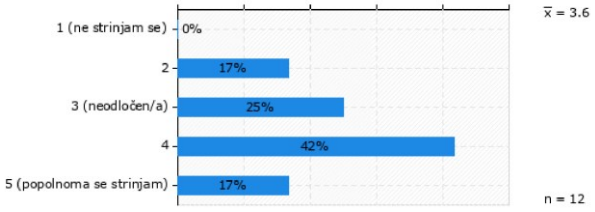
I know basic methods of sustainable water use and measures to reduce water consumption (e.g. rainwater harvesting). Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



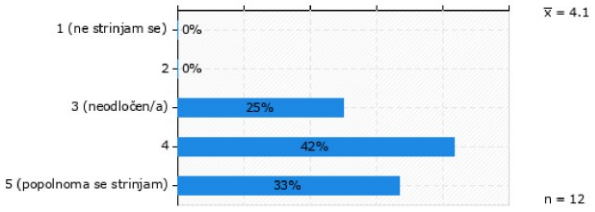
I am capable of independently designing water management systems, including reducing wastewater in small projects. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 12)



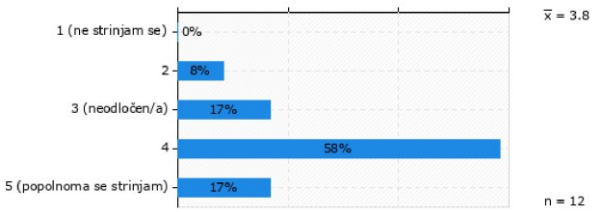
I am capable of independently designing complex water and wastewater management systems in larger projects. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 12)



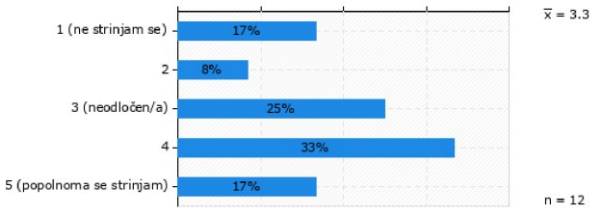
I know the basic operation of renewable energy technologies. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



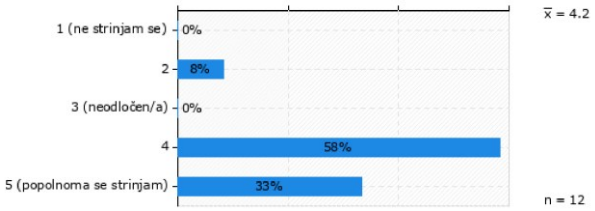
I understand how renewable energy technologies work and am able to analyze them. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 12)



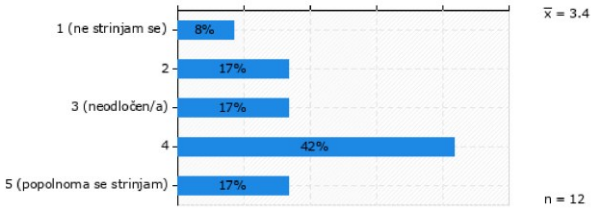
I am capable of planning and developing innovative solutions for the use of renewable energy sources. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



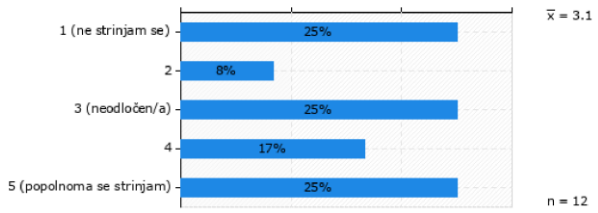
I know basic green technologies (electric vehicles, etc.). Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



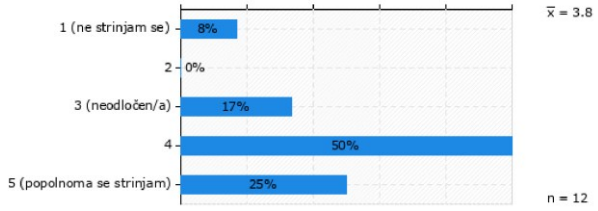
I understand basic green technologies and analyze their advantages and disadvantages. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



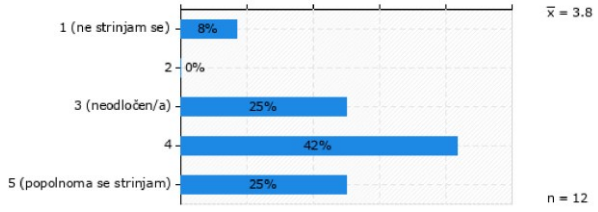
I am capable of independently planning, developing and optimizing green technologies. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



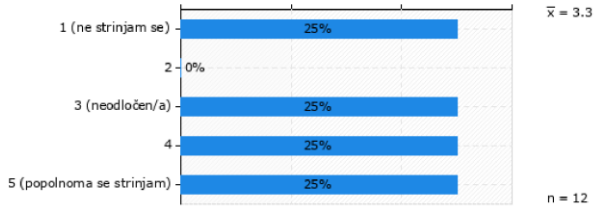
I know the basic characteristics of sustainable building materials (e.g. recycled concrete, wood, local materials) and their impact on the environment. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 12)



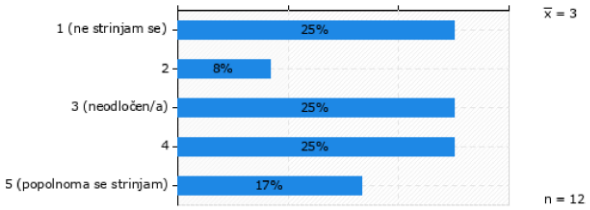
I understand the advantages and disadvantages of different sustainable materials in construction projects and can analyze them. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 12)



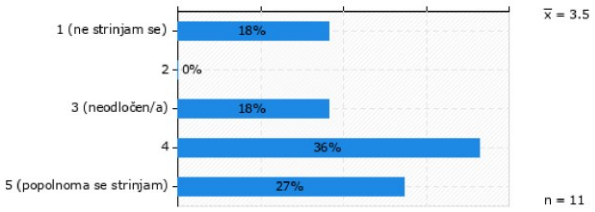
I am able to conduct a life cycle analysis of materials and compare carbon footprints. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 12)



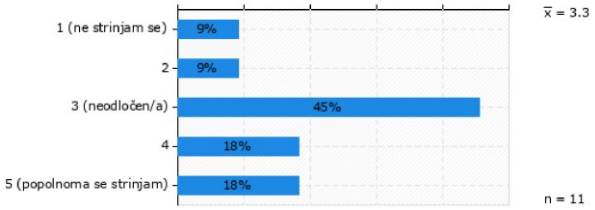
I understand basic energy efficiency standards (e.g. TSG-1-004) and measures for energy efficient construction. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 12)



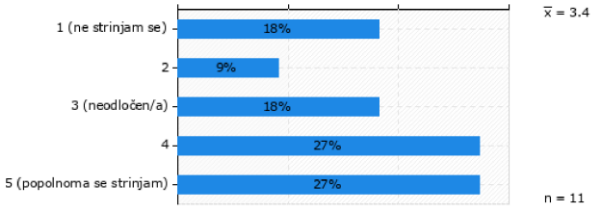
I can plan basic energy solutions for buildings and use software tools for basic simulations. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 11)



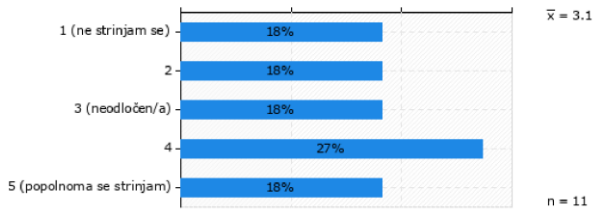
I am able to use advanced techniques (e.g. thermal simulations, BIM) to design energy-efficient buildings. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 11)



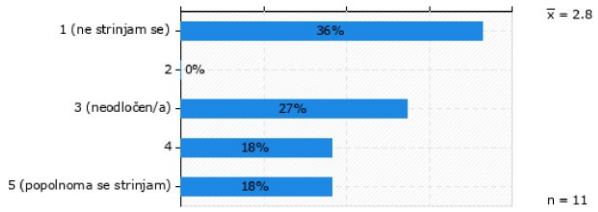
I understand the basic measures for adapting building structures to extreme weather conditions. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 11)



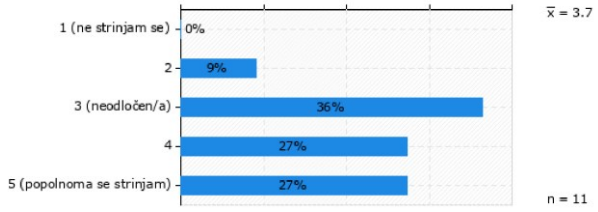
I can use basic methods for risk assessment and adaptation of infrastructure to climate risks. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 11)



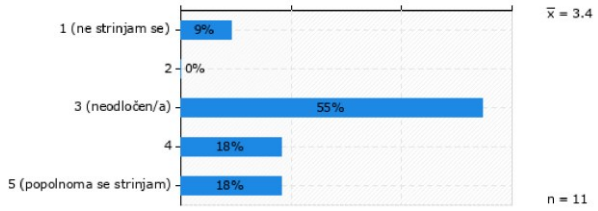
I am able to conduct studies to adapt existing infrastructure and plan improvements from a climate change perspective. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 11)



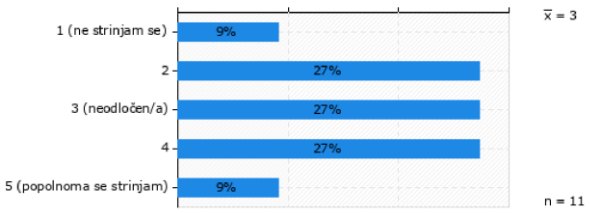
I understand the basics of digital tools (e.g. BIM) for planning and visualizing projects. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 11)



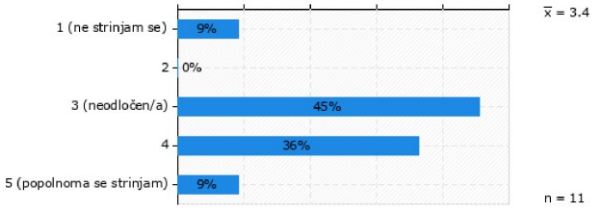
I can use BIM to analyze projects and simulate basic construction parameters. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 11)



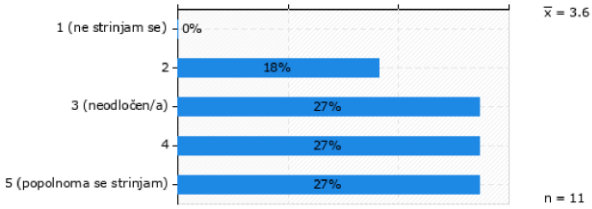
I am able to develop complex BIM models for building lifecycle optimization and energy efficiency. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 11)



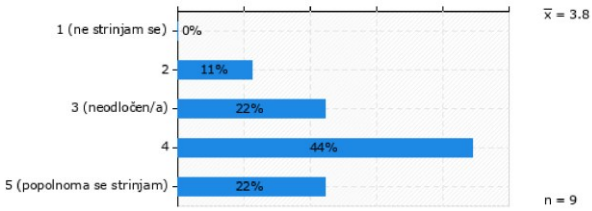
I am familiar with basic environmental policies and regulations and am aware that decisions about the choice and use of energy sources affect the quality of life of individuals and society. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 11)



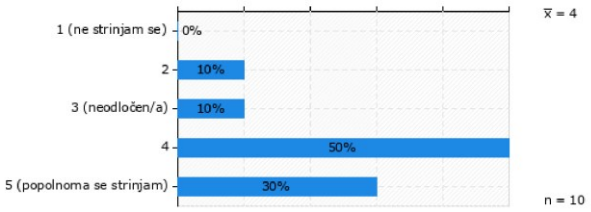
I can explain environmental policies that support the green transition and I am aware that decisions about the choice and use of energy sources are influenced by economic, political, environmental and social factors. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 11)



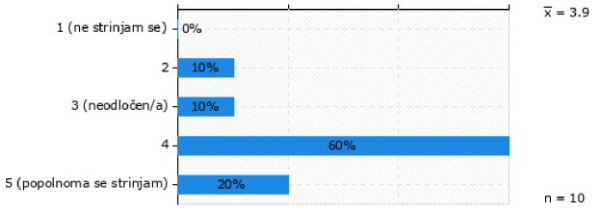
I am able to independently analyze and predict factors that influence decisions on the exploitation of energy resources, and to shape the development of environmental policies at the regional, national or international level. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 9)



I understand the basics of green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (strongly agree). (n = 10)



I am capable of independently analyzing examples of good practices in green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 10)



I am capable of independently planning and developing strategies for green business and sustainable entrepreneurship. Rate on a scale from 1 (disagree) to 5 (completely agree). (n = 10)