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Novel Biotechnological Solutions in Climate Change Mitigation

2024-1-EL01-KA220-HED-000251373

PILOT TRAINING REPORT

BIOSHIELD PILOT COURSES

1. General Information

Partner Institution	*Ionian University*
Department/Faculty	*Department of Food Science and Technology*
Country	*Greece*
Work Package	*WP4 — Pilot Course*
Date of Report Submission	*July 2026*
Pilot Training Dates	*May 2026- June 2026*
Responsible Person(s)	*Dr Nikolaos Kopsahelis, Dr Vasiliki Kachrimanidou, Dr Maria Alexadnri, Dr Aikaterini Papadaki, Aikaterini Natsia*
Associated Partner(s) Involved	*Not applicable*
Target Number of Participants	*20*
Actual Number of Participants	*18*

2. Overview of the Pilot Training

2.1 Organisation and Preparation

The current report refers to the pilot training on **Module 2 Sustainable Food systems: Biotechnology and Renewable Resources for Clean Label Products,** including two distinct problems, namely:

Problem 1: Food Sustainability: Emerging Approaches to Mitigate Protein Shortages and

*Problem 2: Waste to Treasure: Biorefinery and Upcycling Strategies in the Bioeconomy Era***.**

The academics participated were: Prof. Nikolaos Kopsahelias, Assistant Professors Dr Maria Alexandri, Dr Vasiliki Kachrimanidou and Dr Aikaterini Papadaki and Mrs Aikaterini Natsia (PjD student).

The pilot training was developed in compliance with the curriculum and the learning objectives, through the integration of the educational material produced during the project and particularly the educational videos and the handbook. Students were also provided with recent scientific publications from the open literature, including peer-reviewed articles published in high-impact international journals, enabling them to critically evaluate current research and emerging developments in sustainable food systems, alternative protein sources and biorefinery design. Students were also encouraged to use the online educational games created within the project to reinforce key concepts through interactive, self-directed learning.

Students were primarily recruited following the LTTA activity as previous part of the BIOSHIELD project and through announcements and an informative presentation of the project.

The course was scheduled as a semester-based module, with combined lectures and interactive activities along with each team's project work. Along the lectures, the students were allowed time to watch the educational videos, to reassure their engagement. The academics coordinated the delivery of the project and then each team was allocated to each lecturer for specific guidance, suggestions and progress monitoring of their projects.

2.2 Methodology and Learning Activities

The delivery of the course followed a blended/flipped learning approach as designated in the objectives of the BIOSHIELD project. The piloting phase combined theoretical teaching in the classroom with collaborative learning and project activities. The Design Thinking approach was applied to encourage students to develop innovative solutions to food sustainability challenges.

Firstly, the theoretical lectures were carried out to familiarize students with climate change crisis and the role of biotechnology, with special focus on sustainable food systems, the problem of protein shortage and the role of agro-industrial resources in biorefinery design. The concept of sustainable food systems within the framework of the United Nations Sustainable Development Goals (SDGs) was first introduced. Students explored the complexity of food systems through lectures and an interactive activity designed to highlight the interconnections between different stages, including food production, processing, packaging, transportation, consumption, and waste management. Specific attention was given to understanding the health, environmental, economic, and social dimensions of sustainability.

In the following weeks, students formed their teams and selected specific challenges to address, which served as the starting point for developing their projects. During in-class activities, students participated in role-play exercises designed to encourage broader perspectives and help them better understand the needs and viewpoints of different stakeholders, supporting the empathize stage of the Design Thinking process. In the define phase, they analysed current limitations of the conventional food systems and identified opportunities for sustainable interventions. For the ideation stage, the students worked in a collaborative manner to generate innovative concepts, either for alternative protein sources or for the valorization of specific food industry by-products. After consultation with the academics and critical assessment of the literature, the students proceeded in the prototype stage, where they further developed and improved their scientific proposals case studies. The test phase was concluded in the Biotech Fair – Conference (multiplier event) where the students presented their projects in academics, food industry stakeholders, NGO members and the general public, receiving positive feedback and suggestions for improvements and refining.

2.3 Participant Profile

The piloting phase involved undergraduate students, on the 3rd (77.8%) and 4th (22.2%) year of studies from the Department of Food Science and Technology. By that time of studying, students have already acquired a solid background in food science and technology, covering areas such as

food chemistry, microbiology, biotechnology, food processing and analysis, human nutrition and food engineering. This multidisciplinary foundation was strongly associated to the course content and enabled students to understand how to foster the resilience of food systems and explore innovative approaches for alternative protein sources and resource valorization for biorefinery design.

Students formed the working groups on their own and consisted of 4 or 5 students each. Some of them had already worked together during the LTTA activities or in other projects outside the piloting phase, hence facilitating collaboration. During the project development, each student undertook individual research tasks, which were further discussed through out-of-class activities and meetings with the instructors. During selected in-class activities, the lecturer intentionally reorganized the teams and assigned roles to encourage students to collaborate, strengthen their communication skills, their adaptability with different peers and the ability to work in diverse teams.

2.4 Additional Organisational Information

The pilot training was delivered at the Department of Food Science and Technology, at the Ionian University, located in Argostoli, Kefalonia, Greece. During the pilot course, the facilities and the laboratory infrastructure were used to support face-to-face instruction to the students. Continuous mentoring, guidance and support were provided to the students throughout the project, with regular meetings face-to-face or online with the supervisors, to address challenges, refine their work and improve their understanding of the methodology, and development of the communication skills.

3. Pilot Training Indicators

The table below shows the quantitative results of the pilot training implemented at your institution. These indicators correspond to the quantitative (QN) indicators for WP4-O4 defined in the project application.

Indicator	Reported Value
Number of students participating in the pilot training	**18**
Number of students completing the satisfaction survey	**17**
Number of working groups formed	**4**
Number of research ideas and/or prototypes developed by the groups	**4**
Number of students successfully completing the pilot training	**18**
Number of students receiving certificates	**18**
Overall attendance rate	**100%**
Completion rate	**100%**

Number of academicians confirming effectiveness of course delivery methodology	**4**
Number of industry representatives confirming effectiveness of course delivery methodology	**0**
Number of student video testimonials collected	**4**

4. Satisfaction Survey Results

The table below reports the aggregated results of the post-training satisfaction survey administered to pilot participants, using a five-point Likert scale (1 = Strongly Disagree, 2= Disagree, 3= Neither Agree Nor Disagree, 4= Agree, 5 = Strongly Agree).

No	Survey Statement (5-point Likert Scale: 1 = Strongly Disagree, 5 = Strongly Agree)	1	2	3	4	5	4+5
1	I am highly satisfied with the overall quality and delivery of the BIOSHIELD training program.	%	%	%	47.1%	52.9%	100%
2	The program effectively improved my transversal skills, such as teamwork, communication, and creative problem-solving.	%	%	%	70.6%	29.4%	100%
3	I feel that my research skills in biotechnology (particularly related to climate change mitigation) have significantly improved.	%	%	11.8%	41.2%	47.1%	88.3%
4	I feel better prepared to enter the labour market as a result of this training.	%	%	17.6%	58.8%	23.5%	82.4%
5	The animated video tutorials effectively helped me understand the key concepts and prepare for hands-on activities.	%	%	11.8%	41.2%	47.1%	88.3%
6	The Design Thinking process enhanced my ability to generate innovative solutions to industrial challenges.	%	%	11.8%	52.9%	35.3	88.2%
7	The “Biotech Student’s Guide to Future Projections” handbook provided valuable guidance on biotechnology applications and entrepreneurship.	%	5.9%	%	52.9%	41.2%	94.1%
8	The use of digital tools and interactive technologies enhanced my learning experience.	%	%	11.8%	41.2%	47.1%	88.3%
9	Hands-on laboratory activities were essential for testing and refining our biotechnology research ideas.	%	%	%	41.2%	58.8%	100%
10	My team successfully developed a functional prototype or research project concept during the pilot training.	%	%	11.8%	35.3%	52.9%	88.2%
11	Interactions with industry representatives and academic experts helped me better understand real-world industrial challenges.	%	%	11.8%	47.1%	41.2%	88.3%
12	I intend to pursue a career in the biotechnology industry.	%	%	41.2%	41.2%	17.6%	58.8%
13	I have a strong intention to establish or join a biotechnology startup in the future.	%	11.8%	23.5%	47.1%	17.6%	64.7%

5. Analysis of Survey Results

This section interprets the survey findings reported in Section 4 and discuss the pilot training's contribution to the project's objectives. Please address the following points.

5.1 Overall Participant Satisfaction

In the pilot phase, eighteen (18) students were recruited and organized into four (4) groups of four (4) or (5) students, working on either Problem 1 or Problem 2. Of the 18 students, 17 completed the evaluation survey corresponding to 94.45% of engagement. Based on the responses of the 16 participants, a high overall level of satisfaction was achieved, with an average rating of 4.35 out of 5 across all the survey questions (13 in total). The students expressed a significantly strong satisfaction with the overall quality and delivery of the BIOSHIELD training program, the hands-on laboratory activities, the process of designing and developing novel research ideas and the integration of digital learning tools and activities in the educational experience. On the other side, a relatively lower average score -although still positive- was attained for the students' intention to pursue a professional career or launch startups in biotechnology. Nonetheless, the above findings indicate that the piloting successfully met the participants' expectations and provided a valuable learning experience that enhanced their transversal skills and theoretical knowledge.

5.2 Strengths and Weaknesses

The BIOSHIELD piloting survey demonstrates a pronounced success in course satisfaction and learning experience, characterised by the strong participant satisfaction and meaningful practical skill development. At the same time a comparatively lower confidence for long-term entrepreneurial career in the biotechnology sector was observed. The principal strengths of the piloting phase centre on the high overall program satisfaction (100% rating 4+5) and the value of the hands-on laboratory engagement (4.6/5.0 with 100% positive ranking). Participants also reported on their substantial improvement in understanding biotechnology research for climate change mitigation, engagement with digital learning tools (e.g. video tutorials and interactive games) and the enhancement of transversal skills like teamwork and communication. Conversely, the survey identifies weaknesses areas for improvement and particular in fostering the entrepreneurial ambition and venture intentions like launching a biotech start-up. The perceived preparedness for the biotechnology industrial market, although still favourable in scores, ranked lower compared to the overall satisfaction. These findings indicate that the BIOSHIELD project, and particularly the piloting phase, was successful in delivering technical knowledge, mentoring and guidance however future programs should focus to strengthen components related to entrepreneurship, career planning and pathways to employment to enhance the students' confidence in applying the acquired skills in the professional workplace.

5.3 Learning Outcomes

The survey results exhibit strong evidence that the BIOSHIELD program and particularly the piloting phase enhanced the students transversal and research skills, whereas career and entrepreneurship demonstrated a greater variation within responses. All respondents agreed that the program improved in an effective manner their transversal skills such as the ability to work as a team, to communicate and creative problem-solving. Also, 88.3% reported a meaningful rise in their research skill insights within biotechnology for climate change mitigation. The perceived employability benefits were also high, as 82.4% of the participants reporting a greater sense of readiness to enter the labour market after the pilot course.

Career and entrepreneurship plans, while still positive overall, were more moderate compared to previous answers: 58.8% expresses their intend to pursue a career in the biotech industry over other sectors and 64.7% responded with an intention to launch or join a biotechnology start-up. Overall, the figures and the results confer that the piloting activities were highly effective in building the students' practical and transversal skills to compete with peers and feel confident for the labour market.

5.4 Achievement of Project Objectives

At the local level, the piloting process at the IU successfully trained 18 students (out of an initial target of 20 students) within the total target of 80 students across all partners, in leveraging biotechnology to generate innovative, impactful research ideas for climate change and disaster mitigation. Pilot satisfaction survey results confirmed the successful delivery of the training and the effective achievements of the intended learning outcomes. The curriculum and the supporting learning resources were efficiently utilized whereas the animated video tutorials were rated as an effective tool to prepare students for hands-on activities. Likewise, the interactive learning was highly rated as well as the hands-on laboratory activities, which were deemed crucial to test and refine the research ideas. Most importantly, in relation to the core objectives of the piloting, ~88% of the participants confirmed that their team successfully developed a functional prototype or research project directly evidencing the generation of creative and impactful biotech concepts targeted by WP4-O4. Overall, al resources provided to the students were highly rated and efficiently implemented both during the in-class and out-of class activities performed during the piloting phase. All students initially recruited, completed all weeks of training to receive the designated certificate of attendance.

5.5 Recommendations for Improvement

The overall satisfaction with the BIOSHIELD piloting was significantly high, still a few areas stand out for improvement based on the survey data points. Career and entrepreneurship intentions (responses 12 and 13) received the lowest mean scores, indicating the necessity for stronger and structured post-program support. Initiatives such as mentoring schemes, alumni

networks or links to incubators to help students translate their knowledge, skills and prototypes developed during the program into tangible career and business opportunities. Second, although most participants reported positive outcomes, a small proportion of the students expressed lower levels of confidence on labour-market readiness (response 4) and industry interaction (response 11), hence more opportunities for direct industry engagement could prove beneficial. Finally, a future objective would be to recruit a larger number of students to evaluate the results of the pilot phase in a larger and more representative sample.

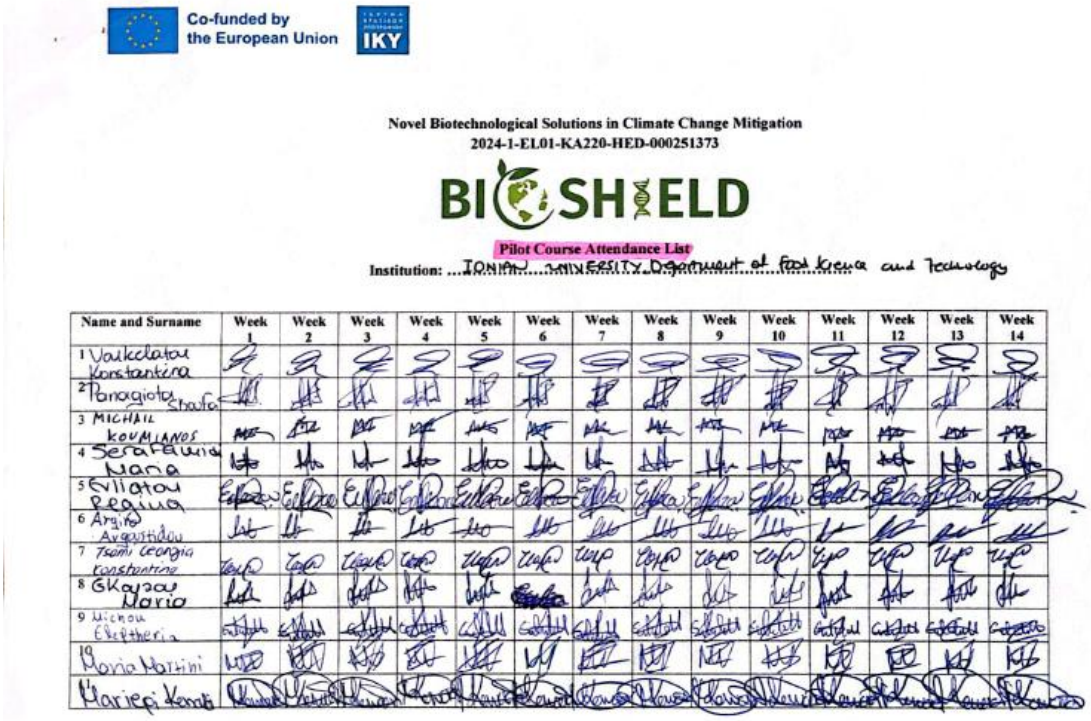
6. Annexes

Please list and attach any supporting documentation referenced in this report.

Annex	Description	Uploaded (Y/N)
Annex 1	List of participating students	Y
Annex 2	Certificates issued (sample)	Y
Annex 3	Raw satisfaction survey data (Google Forms/Excel Sheet)	Y
Annex 4	Photographic documentation / activity evidence	Y
Annex 5	Student video testimonials (.mp4 or video file reference)	Y
Annex 6	Description(s) of research ideas / prototypes developed (Student Presentations)	Y
Annex 7	Other supporting documents (if applicable)	Y

Annex 1 List of participating students

Signature lists: https://drive.google.com/drive/folders/1WCONosgApZq621WxWSCfG1OLeWsUSJq1?usp=sharing



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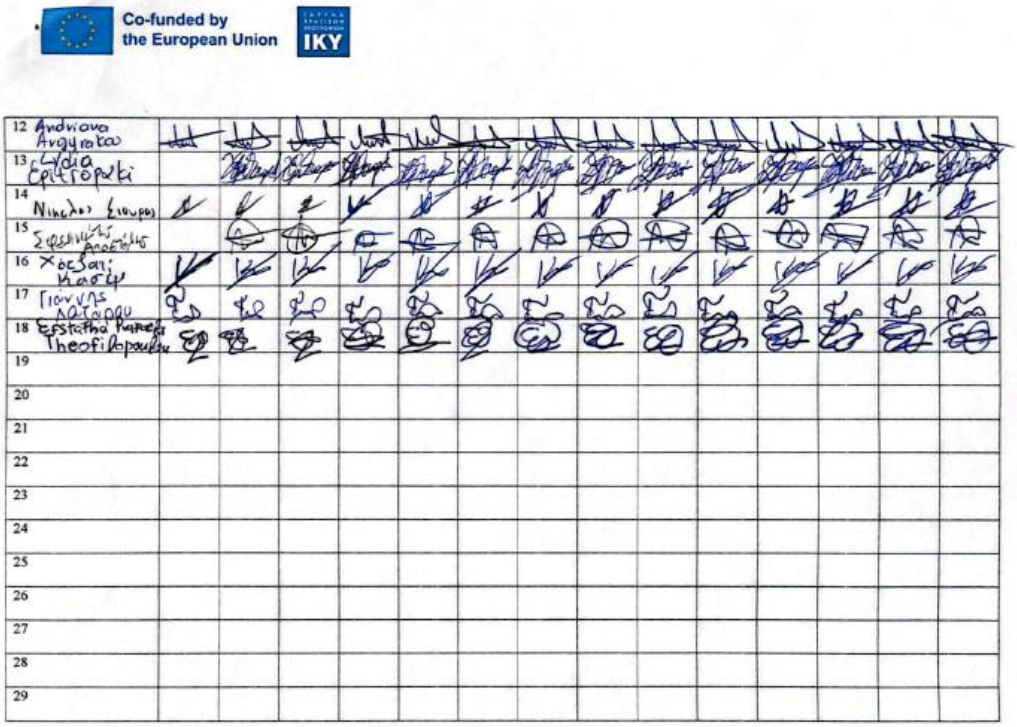
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BIOSHIELD

Pilot Course Attendance List

Institution: IONIAN UNIVERSITY Department of Food Science and Technology

Name and Surname	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
1 Vaikelatou Konstantina														
2 Panagiota Stavla														
3 MICHAIL KOUMIANOS														
4 Serafeimidi Nana														
5 Evliotou Regina														
6 Argiro Avgoustidou														
7 Tsami Georgia Constantina														
8 Gkaizas Nikos														
9 Lichnou Eleftheria														
10 Maria Martini														
11 Mariegi Kondi														



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12 Andriana Avgerinou														
13 Lydia Epitropaki														
14 Νικολάου Σταυρούλα														
15 Σφακιανάκη Αναστασία														
16 Χατζηγιάννη Μαρία														
17 Γιαννάκου Δήμητρα														
18 Eleftheria Theofilopoulou														
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Annex 2 Certificates issued (sample)

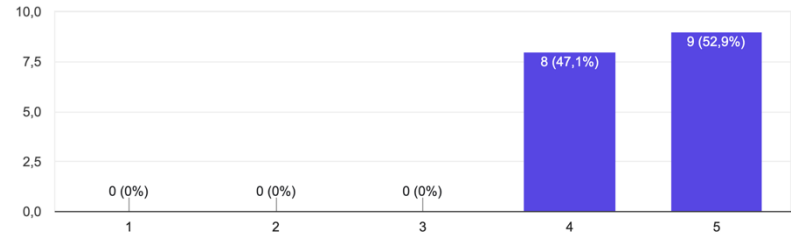
Indicative example of printed and signed Certificate for the participation in the Piloting phase.

All Certificates can be found: https://drive.google.com/drive/folders/1IgmJdkAaCu0LWxx--q-v2966_C2phzgu?usp=sharing

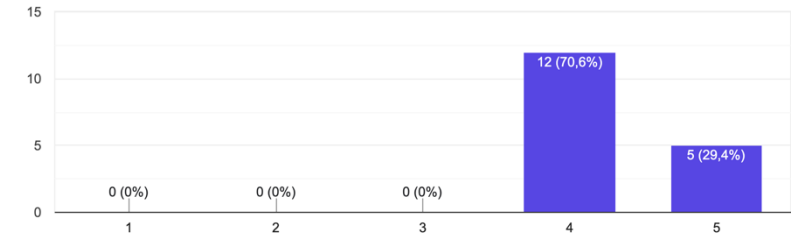


Annex 3 Raw satisfaction survey data (Google Forms/Excel Sheet)

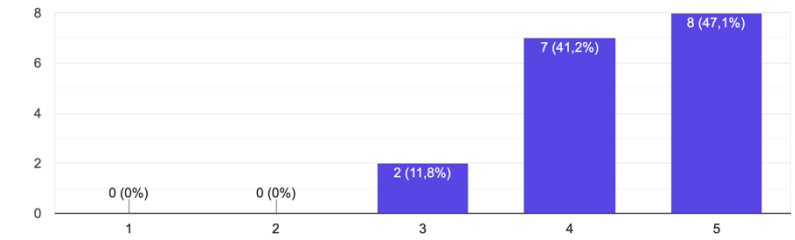
1- I am highly satisfied with the overall quality and delivery of the BIOSHIELD training program.
17 απαντήσεις



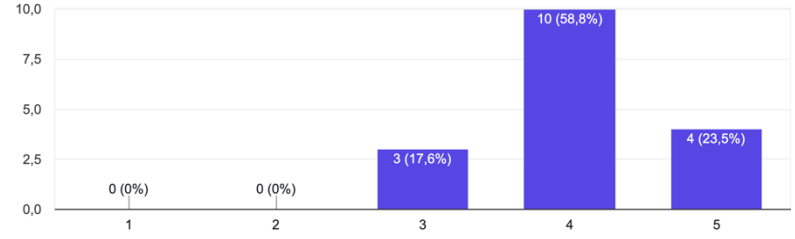
2- The program effectively improved my transversal skills, such as teamwork, communication, and creative problem-solving.
17 απαντήσεις



3- I feel that my insights into my research skills in the field of biotechnology (specifically for climate change mitigation) have significantly increased.
17 απαντήσεις

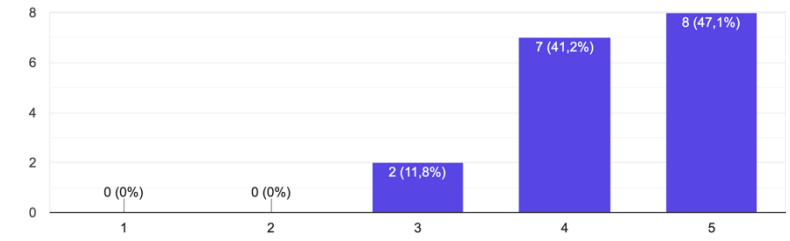


4- I feel better prepared to enter the labour market as a result of this training.
17 απαντήσεις



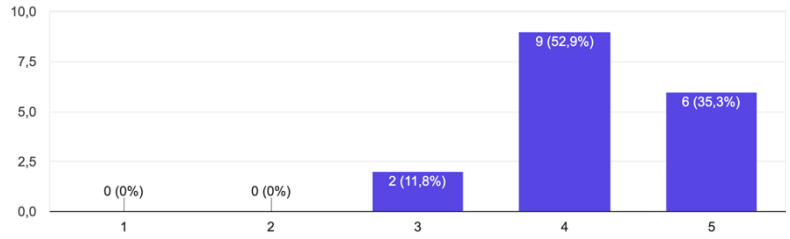
5- The animated video tutorials provided were effective in understanding the focal points and in preparing me for hands-on activities.

17 απαντήσεις



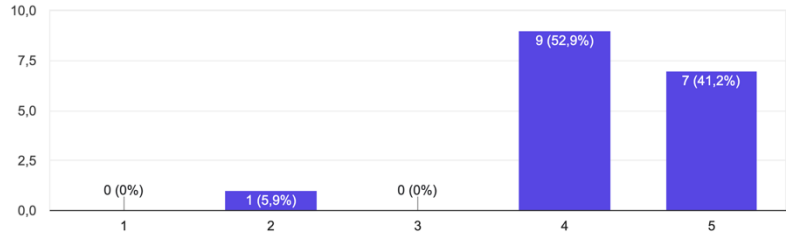
6- The Design Thinking process (Empathize, Define, Ideate, Prototype, Test) enhanced my ability to generate innovative solutions for industrial problems.

17 απαντήσεις



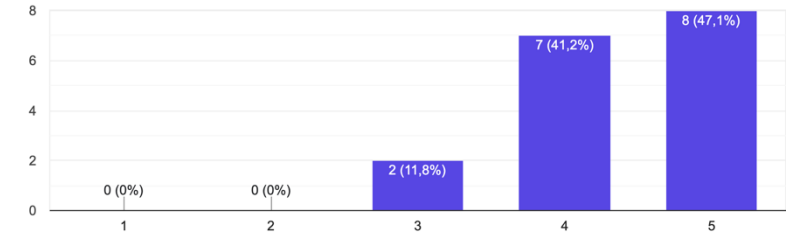
7- The "Biotech Student's Guide to Future Projections" handbook provided valuable guidance on biotechnological applications and entrepreneurship.

17 απαντήσεις



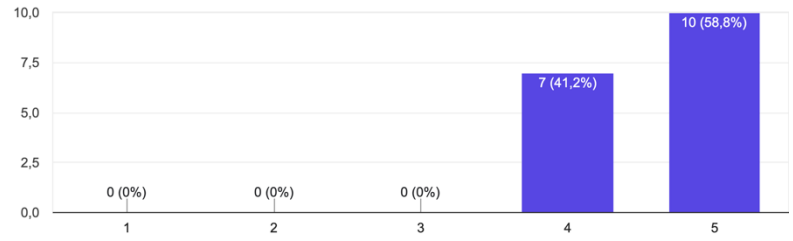
8- The use of digital tools and technologies facilitating interaction and engaging learning during the course enriched my active learning experience.

17 απαντήσεις



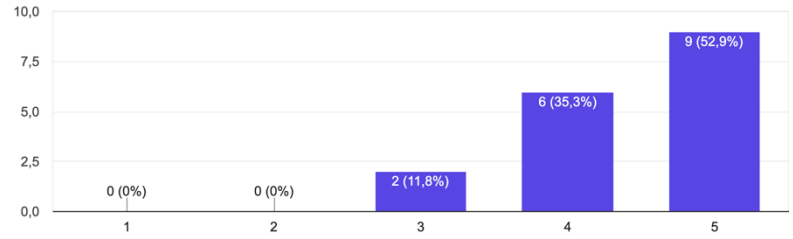
9- The hands-on laboratory work is essential for testing and refining our biotechnological research ideas.

17 απαντήσεις



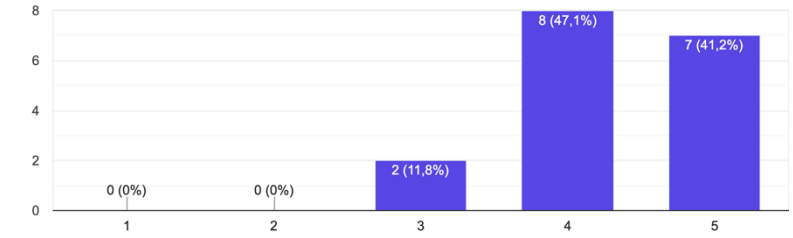
10- My team and I successfully developed a functional prototype or a research project idea with an outline during the piloting process.

17 απαντήσεις



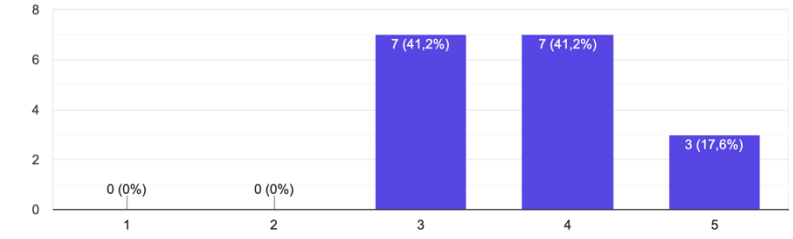
11- Interacting with industry representatives and academic experts provided me with a clear understanding of real-world industrial challenges.

17 απαντήσεις



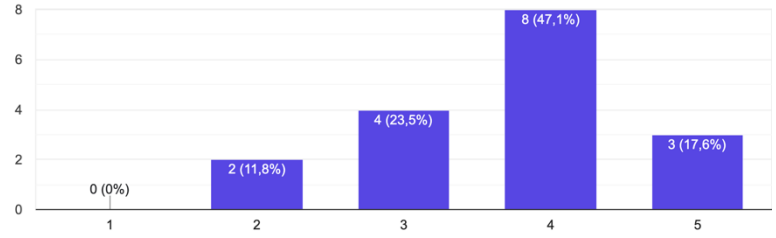
12- I intend to pursue a career in the biotechnology industry rather than other employment sectors.

17 απαντήσεις



13- I have a strong intention to launch a startup or be a part of it as a partner in the biotechnology field in the future.

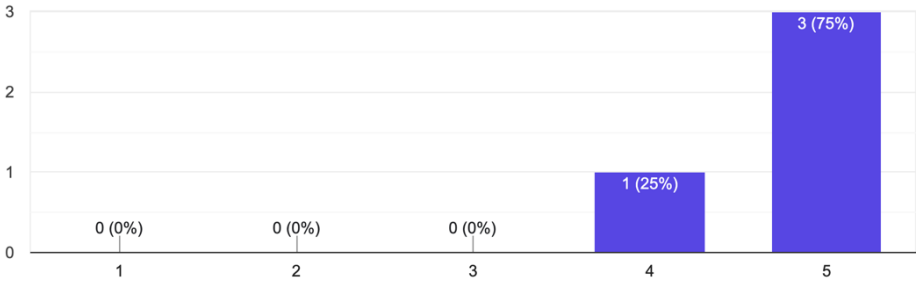
17 απαντήσεις



Number of academicians confirming the effectiveness of the course delivery

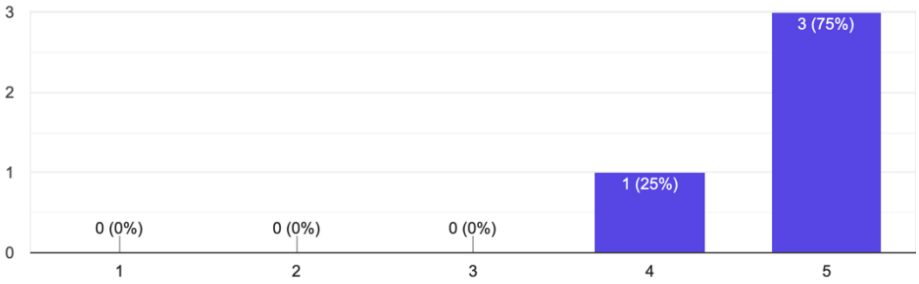
1- I confirm the effectiveness of the course delivery methodology including blended learning approach.

4 απαντήσεις



2 - I confirm the effectiveness of the course delivery methodology including design thinking.

4 απαντήσεις



Annex 4 Photographic documentation / activity evidence



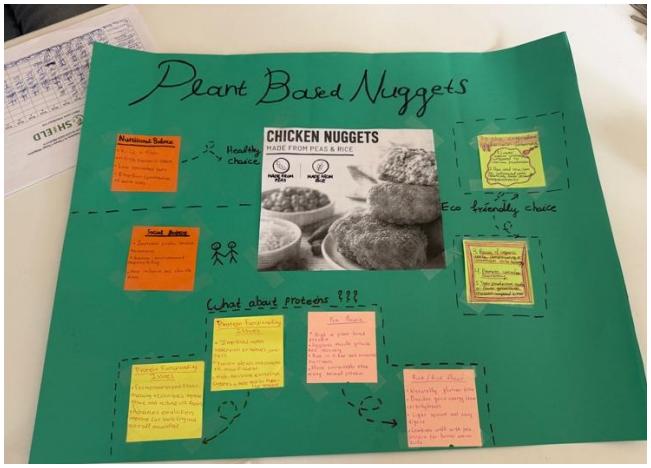











Plant Based Nuggets
CHICKEN NUGGETS
MADE FROM PEAS & RICE
Healthy choice
Eco friendly choice
What about proteins ???


MYCOPROTEINS


Plant Based Nuggets
CHICKEN NUGGETS





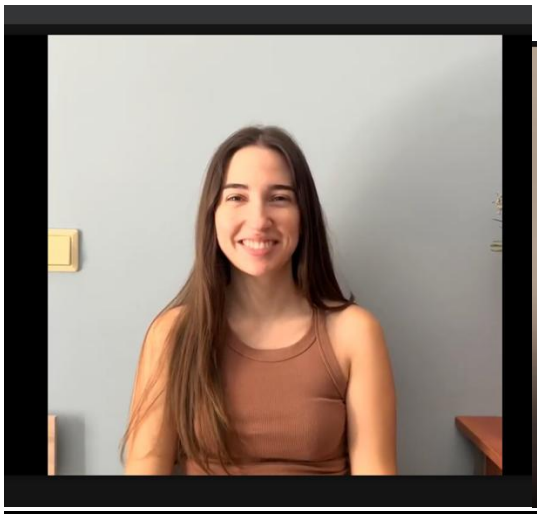


Annex 5 Student video testimonials (.mp4 or video file reference)

Student testimonials are uploaded:
https://drive.google.com/drive/folders/1ZcDuMc9rfWWwrUW7buoOs7NPOJSshwVu?usp=sharing

INDICATIVE SCREENSHOTS





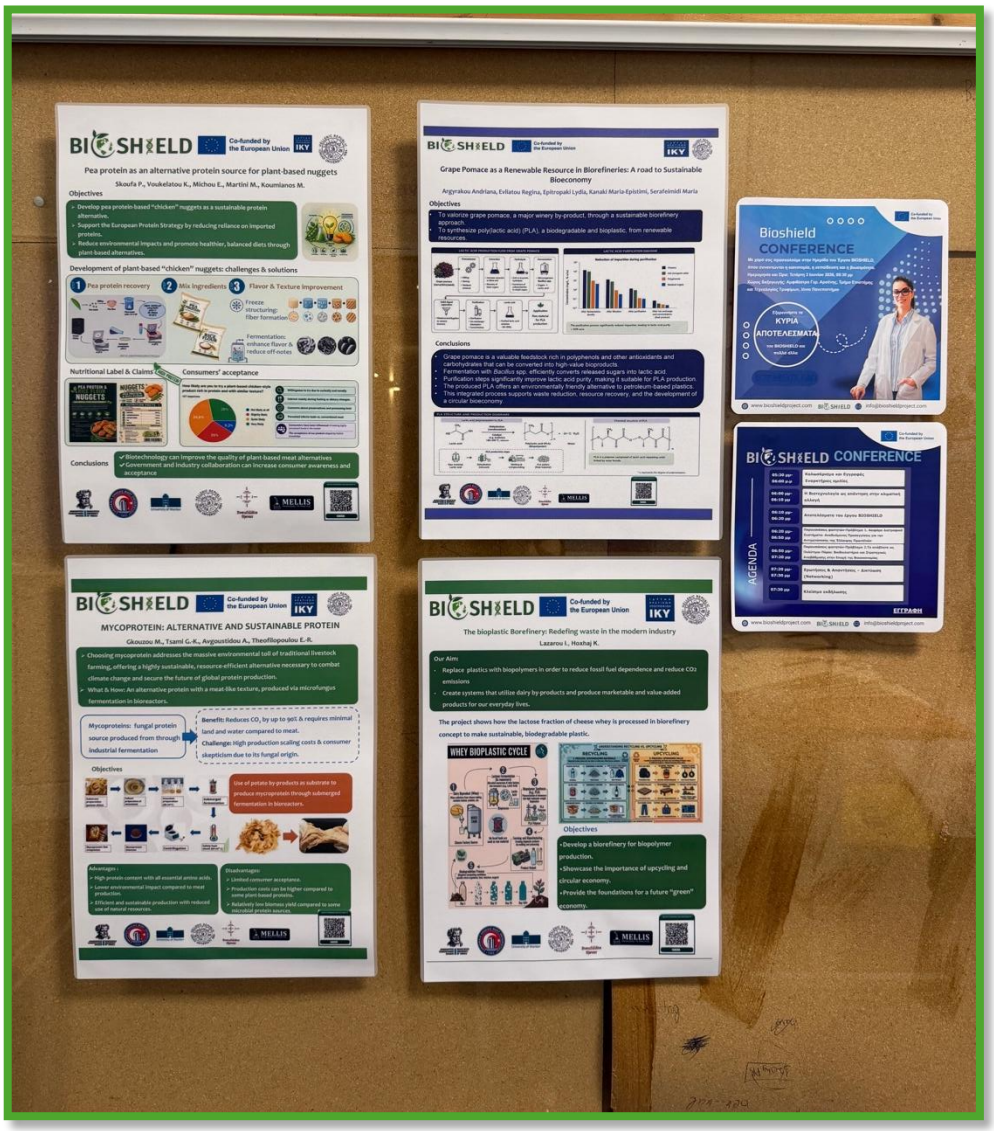


Annex 6 Description(s) of research ideas / prototypes developed (Student Presentations)

Student presentations uploaded at:
https://drive.google.com/drive/folders/1mvgFzFXD9XdZEl9Y-Rn0nH1Lb0C9iHT9?usp=sharing

Student posters uploaded at:
https://drive.google.com/drive/folders/1lnq3XPLYmUZmK4s35X5qJlDCZZPId8zy?usp=sharing

Posters displayed during the Biotech Fair- conference at Ionian University



Annex 7 Other supporting documents (if applicable)

Extra teaching material provided to the students can be found:
https://drive.google.com/drive/folders/1eIUm8sZBSUDCZnp_CxARGPJQb6EvylYI?usp=sharing

Indicative screenshots of the online platform used (open eclass, opencourse.ionio.gr) to upload learning material, notify and communicate with the students.

