BRIGHTS

Bringing HEIs Towards Sustainability

INNOVATIVE TEACHING METHODOLOGIES FOR SUSTAINABILITY EDUCATION



Co-funded by the European Union

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ABOUT BRIGHTS

With climate change being perceived as the defining challenge of our time, BRIGHTS (Bringing Higher Education Institutions Towards Sustainability) is designed to fit in the current context the Green Deal paved the way to, recognizing the central role of universities for a successful Green transition. The project aims to contribute to boosting and valorizing the central role of HEIs in tackling the 2030 Agenda and the Green Deal objectives.



PROJECT GOALS

BRIGHTS aims at boosting the role of HEIs in the green transition, at all levels of the academic community:

- At the students' level, the project intends to respond to the need for awareness on the SDGs and Sustainability, and for skills development, necessary to ensure proper youth involvement in the transition, and as a tool of empowerment in the rising green jobs market.
- At the teaching staff level, BRIGHTS responds to the need for new methodologies to help teachers upskill and reskill their didactic modalities, and to deliver content in new stimulating ways, facing a context where education on sustainability is growing fast, and the contents and research on the matter are rapidly evolving.
- At a systemic and organizational level, BRIGHTS intends to meet the need highlighted by the Green Deal, to empower Universities in their capacity to address the green transition. It is fundamental that HEIs (Higher Education Institutions) do get the support in the establishment of a sustainability centre, working as a catalyst of green opportunities and boosting the institutes' capacity to be involved in sustainability.



PROJECT CONSORTIUM

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WHAT DOES OUR NAME STAND FOR?

Bringing Higher Education Institutions Towards Sustainability

OVERVIEW

- Funded under the Erasmus Plus Programme of the European Union.
- Call: Cooperation Partnership in the field of Higher Education. Year 2021.
- Budget: 320.231,00 euro.
- Project duration: 3 years

BRIGHTS

Bringing HEIs Towards Sustainability

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This publication is the outcome of the in-depth survey undertaken by the BRIGHTS consortium, and of the further research carried out through a dedicated 3-day workshop.

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ABSTRACT

This paper delves into the **critical importance of implementing innovative teaching methodologies across universities** in the European Union (EU). The following guidelines lay their bases on a collaborative research effort, realised by the project consortium, the study and data obtained from a comprehensive questionnaire distributed across EU member states, and a subsequent workshop convened at the University of Pavia. The combined research methods aimed to capture a holistic view of current teaching practices, assess the readiness for innovation, and identify the main challenges, obstacles, and opportunities within European higher education institutions.

The joint research effort, **merging quantitative insights from the questionnaire and qualitative, in-depth reflections from the workshop,** highlights the pressing need for universities to adopt innovative teaching methodologies. It explores how these methodologies can not only enhance the overall learning experience but also align with the broader goals of the European Higher Education Area.

The present handbook aims to highlight the importance of universities investing in innovation in teaching, fostering an environment where educators are empowered to employ diverse, student-centred approaches. Finally, and most importantly, it **provides recommendations and new approaches**, collected by the project consortium throughout the project activities.

By synthesising the outcomes of our joint research initiative, we contribute to the ongoing discourse on educational reform, advocating for a pedagogical shift that aligns with the dynamic needs of contemporary learners in the European Union.

1. GLOSSARY

- **HEI/HEIs**: Higher Educational Institutions.
- **Interdisciplinarity**: refers to an approach in education that integrates knowledge and methodologies from multiple academic disciplines to address complex issues. It encourages collaboration and the synthesis of diverse perspectives to provide a comprehensive understanding of a particular subject or problem.
- **Transdisciplinarity:** refers to the approach of going beyond interdisciplinary collaboration by transcending the boundaries of individual disciplines. It involves integrating insights from academic, professional, and community perspectives to address complex challenges. Transdisciplinary approaches aim for holistic understanding and collaborative problem-solving that extend beyond traditional disciplinary confines.
- **Sustainability Education:** it focuses on fostering knowledge, skills, and attitudes that empower individuals to contribute to creating a sustainable and equitable future. It encompasses environmental, social, and economic dimensions, aiming to instil an understanding of global challenges and promote responsible and ethical decision-making.
- **Open Badges[1]**: digital credentials that recognise and validate specific skills, achievements, or learning experiences. They are often used in online learning environments and provide a portable and verifiable way to showcase an individual's competencies, achievements, and qualifications.
- **Micro-credentials[2]**: they are concise, targeted learning programs designed to develop specific skills or knowledge in a short timeframe. They are smaller units of education compared to traditional degrees and are often focused on practical, industry-relevant competencies. Micro-credentials can be earned independently or stacked to form a more comprehensive qualification.
- **Hackathon:** A hackathon is an event where participants (e.g. programmers, designers, tech enthusiasts, etc.) come together to work, in groups, on a project within a limited timeframe, typically ranging from a day to a few days. The goal is usually to create a prototype, solve a specific problem, or explore new technologies.
- **Makeathon**: A makeathon is similar to a hackathon but with a focus on creating disruptive new solutions from scratch, as a response to a certain challenge. Makeathons usually attract a very diverse range of participants (e.g. engineers, designers, artists, economists, etc.)

More details:
University of Pavia, Open Badges (digital credentials) [1]

European Education Area, 2022, A European approach to micro-credentials [2]

2. METHODOLOGY & HOW TO READ THIS PAPER

This paper employs a multifaceted methodology to comprehensively investigate and present insights into innovative teaching methodologies in European universities. The approach is structured in two distinct phases, each of which contributes perspectives to the overarching analysis.

As a first element of the methodology applied, the consortium has employed a **Large-Scale international questionnaire.** To capture a broad overview of the current landscape of the employment of innovative methodologies for sustainability education, we initiated the research with a large-scale international questionnaire distributed across universities within the European Union. The questionnaire was designed to collect responses from a wide range of educators involved in the academic sphere of sustainability-related teaching. Questions focused on the prevalence of innovative teaching methodologies, perceived challenges, and the impact on the overall learning experience. The expansive nature of this survey allowed us to gather a remarkable amount of quantitative data, providing a solid framework for prevailing trends and patterns.





As a second step in the methodology, the consortium relied on **in-depth discussions**, investigations, and interviews. To complement the quantitative data garnered from the questionnaire, the second phase of our methodology involved a meticulous and in-depth investigation. A select group of individuals, including educators, experts in pedagogy, and students, were engaged in a structured series of discussions and interviews. These sessions allowed us to have a closer look at the needs and ratios behind the data. The targeted nature of these interviews allowed us to explore the complexity of innovative teaching from the perspective of those immersed in its application or willing to do so.

2. METHODOLOGY & HOW TO READ THIS PAPER

As a final step, the methodology applied led to the **integration of results.**

The paper synthesises the outcomes of both the large-scale questionnaire and the in-depth discussions, presenting a comprehensive view of the subject matter. The combination of extensive, 'superficial' analysis with focused, detailed investigations offers a holistic understanding of the challenges and opportunities in innovative teaching.

This methodological duality ensures that the findings encapsulate both the breadth and depth of the landscape, providing readers with a **holistic perspective** on the state of innovative teaching methodologies in higher education.

A three-phase apprroach to the development of this paper:

1) Large-scale questionnaire
2) In-depth discussions and intervies
3) Integration of the results



3. INTRODUCTION

Sustainability education has been gaining momentum within the European Higher Education Area (EHEA), reflecting a broader global trend toward integrating sustainability into various academic disciplines. However, it's important to note that the specific growth and status of sustainability education can vary across different countries and institutions within the EHEA.

Generally speaking, several factors are contributing to the growth of sustainability education in European higher education: international agreements and commitments (International agreements and commitments to sustainability and the UN SDGs have spurred interest in incorporating sustainability into education, including higher education curricula); institutional commitments of the Universities (integrating sustainability principles into their mission statements, strategic plans, and academic programs); student demand (there is a growing demand from students for education, to acquire knowledge and skills for conscious jobs); corporate influence (businesses increasingly recognize the importance of a skilled workforce with a strong understanding of sustainability issues, therefore supporting the inclusion of such topics into higher education); Grants from institutions and international donors: (many organisations, recognizing the urgency of addressing global sustainability challenges, have consequently allocated greater funding to support research initiatives in this field).



"There's a growing gap between the pace of change, the exponential nature of change, and the pace at which universities change: innovative teaching methodologies can help filling in that gap".

3.1 THE SPECIFIC CONTEXT OF INNOVATIVE TEACHING AND LEARNING

As the world moves forward and humans are rapidly evolving along with technology, there is something crucial that has remained stable for decades, the educational system and teaching methodologies. There is no wonder why people seem to struggle to learn, and educators are facing no student engagement in classrooms.

This is an issue that has been of great interest to both educators and the science community. Research has been done and proved that traditional methodologies teach students theoretical skills since they do not have any opportunity to participate in the learning process (Raja, 2018 [3]). This means that the transmitted knowledge does not stay with the students long after they leave the classroom; if it does, it is difficult to apply in real-life situations (Kalayani and Rajasekaran, 2018 [3]).

In this handbook, we provide a handful of innovative teaching methodologies and ways to apply them in the classroom, along with feedback from high educational institute educators and students.

More details:

D. Kalyani, K. Rajasekaran, 2018, Innovative Teaching and Learning.
[3]



4. INTRODUCTION TO INNOVATIVE TEACHING METHODOLOGIES AND CONTEXTS OF APPLICATION

Innovative teaching methodologies are new strategies and methods that differentiate from the traditional way of teaching (i.e., lecture-based); however, they share the goal of transmitting knowledge to students. An additional goal of innovative teaching methodologies is to promote equitable learning and improve academic outcomes. Educators should have a wide perspective on how to teach in their classrooms, taking into consideration that each student has their own way of learning to reach their full potential. This suggests that the educator should be able to understand which methodology works best for their students and apply a different approach when possible. Several innovative didactic methodologies can be found, as in detail below.

Innovative teaching methodologies make students Partners in the educational development, make their questions part of the teaching, and have their input also in the design of the curriculum.

4.1 SMALL-GROUP TEACHING:

Small-group teaching is when you instruct the students in small groups ranging from 2-12 students. It usually follows whole-group instruction. There are many benefits to small-group instruction. It is effective because instructors tailor their instruction to each student's needs to develop their academic abilities.

Student win: A setting where knowledge may be more easily absorbed and where concepts learned from lectures or textbooks can be more deeply analysed.

Educator's role: You need to provide the discussion with a good structure, give plenty of time to students to consider the implications of new ideas, and have a more responsive, listening role.

1. Start the discussion
2. Assist them in integrating the discussion with their prior knowledge and understanding, and when necessary, offer prompts to shift the discussion in a new direction.
3. Help students recognise what they've learned (and what to do next to continue learning) as you draw the lesson to a conclusion.

More details:
UCL Arena Centre, 2019, Small group teaching. [4].



4.2 FLIPPED CLASSROOM

The student studies before the lessons on the didactic material (videos, slides, podcasts, books, etc.) indicated by the teacher and the lesson is used to discuss the topics studied through group activities, debates, laboratories, etc. Student work outside of class is significant in a flipped classroom paradigm. If students do not understand how this task frees up class time to undertake activities that aid in their learning, they will resent the work.

Student win: Students become responsible for their learning as they learn at their own pace, not wasting time transferring information to students when it is available online or in books. Students and instructors are working closely and getting to know each other better, thus, instructors provide better assistance. Last but not least, students develop better collaboration skills and create a social experience in classrooms.

Educator's role: The importance of flipped classrooms is the time that students spend in the classrooms rather than the learning they do at home; thus, it is important to decide how you will use your class time and design those activities.

1.Step one is to identify the learning outcomes and the key concepts students need to learn to participate in your class.
2.They develop the resources, find or create, e.g., readings, audio files, websites, videos, animations, or podcasts. A great method to make sure that students will come to the class prepared is to ask them to complete simple and short assignments (e.g., practice quizzes, and short reflections)
3. Make sure that the in-class activities can be a space for students to apply concepts introduced in the homework.
The purpose of developing the homework content is to teach students how to use these materials at home.



More details:
University of Washington, Flipping the classroom [5]

Harvard University, The Derek Bok Center For Teaching and Learning [6]

4.3 CASE-BASED TEACHING

Strategies that explicitly refer to the case study where the activity requires identifying a solution through group discussion. This approach is learner-centred and features strong interaction between participants as they increase their knowledge and analyse the case as a group.

Student win: Students are provided with real-world context, and they are allowed to see the theory in practice. Students are required to analyse data to reach a conclusion and thus, develop analytic, communicative and collaborative skills.

Educator's role: The instructor serves as a facilitator while the students work together to analyse issues, come up with solutions, and answer open-ended questions.

1. Provide students with the case; the instructor can choose whether the case is finished and based on facts, an unfinished, open-ended case, or even a fictional case that the instructor has created.
2. Design activities for the students to work together on the case study. Here, the educator can structure the discussion by providing the group with case study questions and comparing group responses without interfering with the outcome.
3. Manage the discussion and shape an efficient debate by delaying the problem-solving part, helping with follow-up questions, and helping with shifting of contexts and different views.

More details:
Queen's University, 2023, Case-Based Learning: What is Case-Based Learning?
[7]



4.4 PROBLEM-BASED TEACHING

Where the definition of the solution to a problem not only required cooperative practice, discussion, and sharing of knowledge within groups but also further (bibliographic) research to develop a solution to a problem.

Student win: Development of communication and collaboration skills, critical and analytical thinking, self-directed learning, and working independently. The students will also develop skills in problem-solving across disciplines and applying course content to real-world examples.

Educator's role: The instructor in this paradigm should be a facilitator.

1. Identify the learning outcomes
2. Develop the problem or scenario.
3. Setting ground rules for the teams so the students achieve efficiency in their work.
4. If necessary select different roles for the student

More details:
Cornell University, 2023, Center for Teaching Innovation. [8]

Health Professions Education, 2016, Problem-Based Learning: An Overview of its Process and Impact on Learning [9]



4.5 GAMIFICATION OR GAME-BASED LEARNING

Using playful situations to motivate student action and promote learning by offering objectives, interaction, feedback, problem-solving, competition, stories, and enjoyable learning settings.

Gamification: turning the learning process into a game.
Game-Based Learning: Using a game as part of the learning process.

Student win: Increased student engagement, optimising learning, and socialising. Development of problem-solving skills and having sustained motivation for learning.

Educator's role: Technical administrator and game administrator

1. Designing the game-based curriculum
2. Create infrastructure needed to support the gaming sessions
3. Administrating during and around gaming sessions.



More details

J. A. P. M. Coelho, L. B. Marques, S. J. Rigo, R. Smiderle, P.A. Jaques, 2020, The impact of gamification on students' learning, engagement and behavior based on their personality traits.
[10]

Centre for Teaching Excellence, University of Waterloo, Gamification and Game-Based Learning.
[11]

M. Ma, A. Oikonomou, 2017, Serious Games and Edutainment Applications.
[12]

D. N. Karagiorgas, S. Niemann, Journal of Educational Technology Systems, 2017, Gamification and Game-Based Learning
[13]

4.6 TEACHING BY PROJECTS

Practices that require, in addition to group activity and knowledge sharing, a design and delivery of a finished product. Students gain knowledge in a subject by devoting a significant amount of time to researching and solving a challenging question, challenge, or issue.

Student win: Acquire deeper knowledge through active exploration of real-world challenges and problems and preparation for life after graduation.

Educator's role: Promotes discussion, cross-questioning, and arguments so that students can come up with their own driving questions.

It is not recommended to give out driving quizzes since it isolates students from the process. The figure below outlines various attitude adjustments instructors should take to perform their responsibilities properly.

1. Questioning
2. Listening
3. Feedback
4. Affirmation

More details:
Worcester Polytechnic Institute, 2022, PBL in Higher Education.
[14]
Boston University, **Center for Teaching & Learning**, Project-Based Learning.
[15]

Evelyn Learning, 2022, Teachers' Role in Project-based Learning.
[16]



4.7 CONVERSATIONAL DIDACTICS

Practices that take place thanks to a debate around a stimulus offered (e.g., dispute, mock trial), where everyone intervenes, making use of transversal knowledge, integrating, expanding, and, arguing what has already been said by others or their point of view.

Student win: is to facilitate effective communication, critical thinking, and knowledge transfer in a conversational context.

The educator's role: is to help the students engage in meaningful conversations and create a supportive and intellectually stimulating environment.

1. Use of questions to stimulate critical thinking or ask open-ended questions to encourage deeper exploration of ideas.
2. Being active listeners and providing constructive feedback.
3. Being a role model for the students. It is very important in cases of debate to show respect to both parties and actively think critically, so the students can understand that they are engaging in a dialogue and not a fight.



5. RESULTS OF THE BRIGHTS SURVEY.

INNOVATIVE METHODOLOGIES IN THE CONTEXT OF SUSTAINABILITY EDUCATION.

BACKGROUND: THE QUESTIONNAIRE

From April to July 2023, the BRIGHTS Project consortium created and distributed a questionnaire aimed at investigating the state of implementation, diffusion, and utilisation of Innovative Teaching Methodologies, with specific reference to the use of such methodologies for the delivery of sustainability-related content.

The final purpose of such investigation is the development of new student-centred approaches, characterised by:
-Increased teacher-learner interaction
-Increased teaching effectiveness
-Upskilled teachers' didactic methodologies to deliver new and constantly evolving topics, such as those of sustainability

This questionnaire was targeted to professors and researchers holding a course or teaching in a course related to the sustainability-subject area with a transversal and multi-disciplinary approach. Each professor/researcher could fill in the responses for up to three courses.

To comply with privacy, no personal information is included in the following report: the responses are used only as aggregate data. The full copy of the survey is available as an attachment, at the bottom of the present document.

5.1 RESULTS

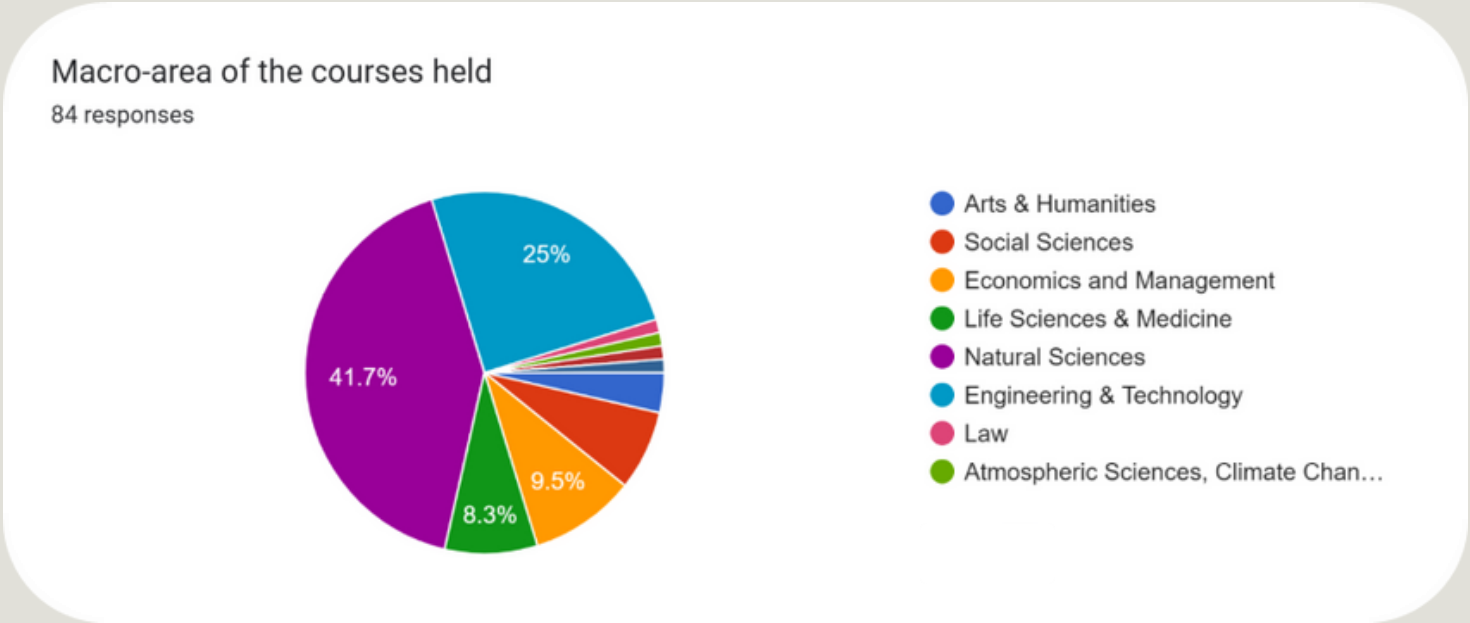
The questionnaire has received a feedback from **84 respondents** in the EU, even beyond the project consortium, each of them could provide data as for up to 3 courses he/she is currently providing, with 111 responses being finally collected, distributed as follows:

Course n° 1 → 84 responses
Course n° 2 → 25 responses
Course n° 3 → 2 responses

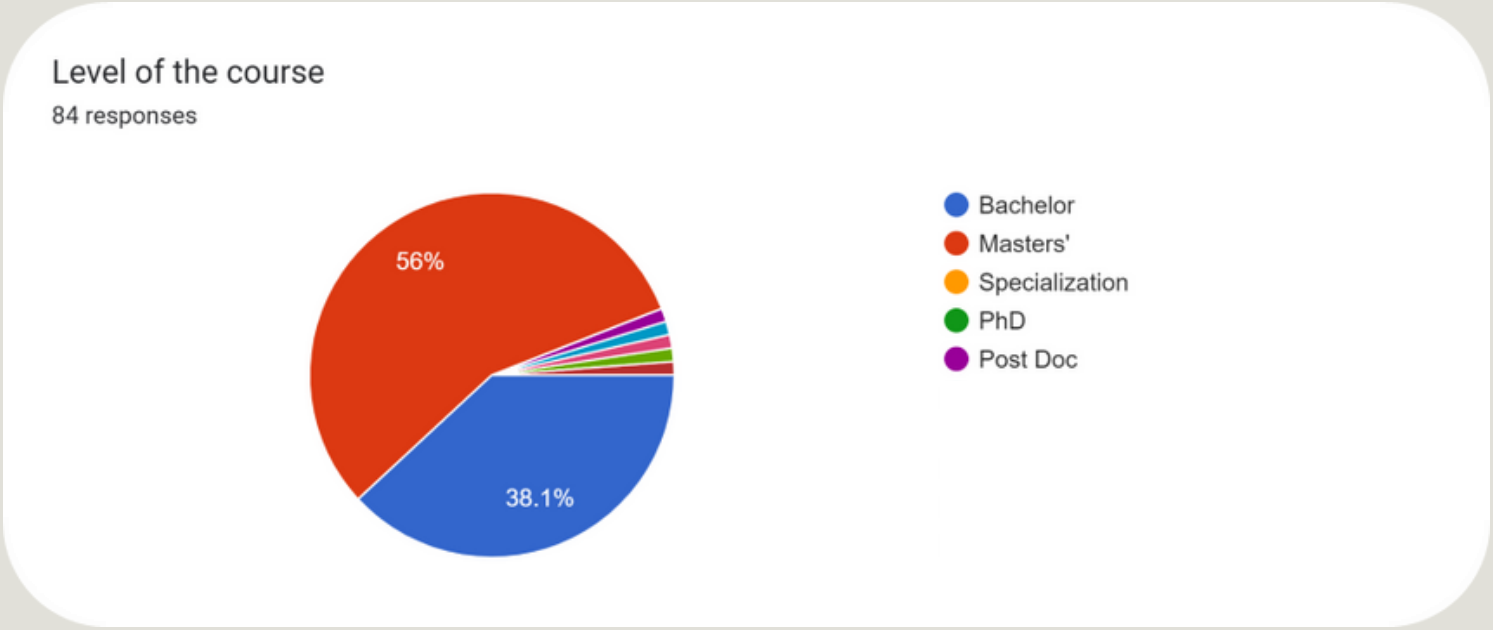
The transversal and multidisciplinary approach carried out by the survey is testified by the departments and macro-areas involved, which represented a high heterogeneity in the respondents' profile, still presenting a predominant trend towards disciplines such as Natural Sciences and Engineering.

As a matter of fact, 17 departments have responded to the questionnaire, specifically:
- Department of Anthropology
- Department of Biology
- Department of Biotechnology
- Department of Chemistry
- Department of Civil Engineering and Architecture
- Department of Civil and Environmental Engineering
- Department of Computer Science
- Department of Economics
- Department of Engineering
- Department of German as a Foreign Language
- Department of Industrial and Information Engineering
- Department of International Relations
- Department of Law
- Department of Multimedia Graphics
- Department of Musicology and Cultural Heritage
- Department of Natural Sciences
- Department of Physics
- Department of Political Sciences
- Department of Public Health, Experimental and Forensic Medicine

5.1 RESULTS



The vast majority of responses (56%) concern Masters' courses, while the 38% concern Bachelor courses. The remaining 6% of responses provide data for Specialization, PhD, and Post-doc courses.



5.2 METHODOLOGIES APPLIED AND TOOLS USED

The survey has investigated the application of the most diffused methodologies. The data below show, in percentage, the most applied innovative methodologies by the respondents (they could tick as many options as necessary):

- 56% Teaching by project
- 52% Case-based Teaching
- 44% Small group teaching
- 36% Conversational Teaching
- 36% Problem-Based Teaching
- 24% Gamification
- 20% Smartboard
- 16% Flipped Classroom

5.3 REPORTED TEACHERS' EXPECTATIONS IN APPLYING INNOVATIVE TEACHING METHODOLOGIES



5.3 REPORTED TEACHERS' EXPECTATIONS IN APPLYING INNOVATIVE TEACHING METHODOLOGIES

Some of the main strengths that university professors expect to achieve by applying innovative teaching methodologies to their courses, improving the way the course is given, are:

- **Stimulate students to be more open, interactive, and to have conscious participation**: teachers expect to foster an environment where students feel encouraged to express their opinions, ask questions, and actively participate in discussions, promoting a dynamic learning experience. With specific reference to hands-on activities, discussions, and real-world exercises, professors aim to foster a more organic approach among the students with the course material, which they expect to produce a more conscious understanding of the subject.

- **Improved performance/Higher success in passing exams:** Professors expect that innovative teaching approaches will contribute to improved academic performance and success in examinations. Teachers report they expect to enhance students' understanding of the material, in turn leading to better outcomes in exams and assessments.

- **Flexible learning for students:** Teachers expect to better deal with students' needs in terms of flexibility, i.e., creating a learning environment where students can study the material at their own pace, accessing resources and materials in various formats.

- **Improve teacher/student communication**: A common perception, that emerged from teachers, is the feeling that innovative teaching methodologies can improve communication between professors and students, to facilitate a more dynamic exchange of ideas, clarification of concepts, etc.

- **A greater propensity to work in a group:** professors expect that, through simulations, group-works, gamification of exercises, presentations, etc. they will be able to cultivate a greater propensity among students to work collaboratively. By fostering teamwork, professors aim to enhance students' interpersonal skills, promote diverse perspectives, and prepare them for collaborative work environments in their future careers.

5.4 FINDINGS AND MAIN OBSERVATIONS BY WHO HAS APPLIED THEM

5.4.1 ADVANTAGES

The main strengths that university professors have noticed and achieved by applying innovative teaching methodologies are:

- **Increased students' participation:** Professors have reported a notable increase in student participation through the application of innovative teaching methodologies. These methods, such as interactive discussions, group activities, and technology-enhanced engagement, create an inclusive learning environment where students feel encouraged to contribute actively to class discussions and activities: students are more willing to express their thoughts, ask questions, and engage in discussions. This increased participation not only enhances the overall learning experience but also contributes to a more engaging and interactive atmosphere.

- **Greater involvement:** Innovative teaching methodologies have led to greater student involvement in the learning process. By incorporating hands-on activities, collaborative projects, and real-world applications of concepts, professors have observed a greater sense of engagement and commitment from students. This, in turn, enables a greater understanding and assimilation of the subject.

- **Higher rate of classroom presence:** The implementation of innovative teaching methodologies has resulted in professors witnessing a higher rate of classroom presence. These methods, which may include multimedia presentations, interactive technologies, and varied teaching strategies, contribute to a more dynamic and impactful teaching style, capturing students' attention and fostering positive classroom attendance. In comparison to traditional classroom management, professors have reported an increased number of students attending classes in their presence.

5.4 FINDINGS AND MAIN OBSERVATIONS BY WHO HAS APPLIED THEM

- **Successful passing of exams:** Professors have observed a positive correlation between the application of innovative teaching methodologies and students' success in exams. Teachers report students are better equipped to tackle exams and assessments due to a deeper understanding of the subject matter. The emphasis on critical thinking, practical applications, and active engagement contributes to improved exam outcomes and academic success.

- **Increased level of attention:** Innovative teaching methodologies have contributed to a higher level of attention from students. The use of varied instructional techniques, multimedia resources, real-world examples, and interactive activities helps capture and maintain students' focus, leading to a more attentive and receptive learning environment. This heightened level of attention enhances information retention, facilitates a deeper understanding of complex concepts, and contributes to a more rewarding educational experience. This is true not only for students but also for teachers as well, who end up being more satisfied.

> "A greater participation, an increased interest in the subject if it is internalised throughout the teaching and not only given the exam, an increase in curiosity that can lead to a personal deepening, a greater sharing with the classmates, and a solid and mature comparison with the teaching".

5.4 FINDINGS AND MAIN OBSERVATIONS BY WHO HAS APPLIED THEM

5.4.2 CRITICALITIES

Despite the positive aspects cited above, professors often report remarkable challenges when trying to incorporate innovative teaching methodologies into their educational approaches. These difficulties have to do with several elements, mainly related to the **extra burden, time consumption, and resource/tool availability.**

The planning, development, and implementation of new strategies demand **extra time and effort.** This adds an extra burden on teachers' workload, which is already full of tasks and responsibilities (including research, administrative duties, student supervision, etc.). Professors need to invest time in learning and becoming proficient with these tools to effectively integrate them into their teaching methods, requiring significant commitment from educators. Innovative teaching often involves time-consuming activities, such as designing interactive lessons, creating multimedia content, and providing personalised feedback. These tasks may not always be appropriate for the professors' busy schedules; therefore, administrative or specialised support to help them with the task is very much perceived as a priority from teachers.

Similarly, shifting from traditional teaching modalities to innovative approaches requires a **period of adjustment:** professors may need to re-evaluate and modify their instructional techniques, classroom dynamics, and assessment methods to align with the principles of innovative teaching.

Furthermore, a **commonly perceived obstacle is related to the lack of appropriate tools and training:** the availability and access to suitable tools represent a challenge for many professors. Some may face constraints in acquiring necessary resources, such as institutional subscriptions to advanced educational platforms or software. The lack of access to essential tools, and not receiving constant training, can harm the effective implementation of innovative teaching methodologies.

5.4 FINDINGS AND MAIN OBSERVATIONS BY WHO HAS APPLIED THEM

5.4.2 CRITICALITIES

Finally, an extra challenge comes from the resistance to change, both from educators and students. Some professors may be hesitant to move on from the traditional teaching methods that they are used to, and students might resist adapting to novel learning approaches. Overcoming this resistance and fostering a positive attitude towards innovation is crucial for the success of new teaching methodologies.

In summary, **even though teachers are prone to introducing innovation in their teaching methods, and are aware of the many positive implications they can have, they still fear a number of difficulties.** Ensuring proper training and support for teachers is fundamental to give them the opportunity to embed such methodologies in an efficient way. Addressing these challenges requires a comprehensive approach that includes institutional support, professional development opportunities, and a collaborative effort to create a conducive environment for innovation in higher education.

Teachers fear a number of difficulties in applying innovative methodologies. Addressing these challenges requires a comprehensive approach that includes **institutional support, professional development opportunities, and a collaborative effort.**

5.5 CONCLUSIONS

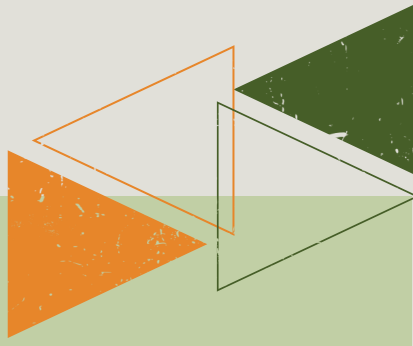
Summing up the main findings gathered from the analysis of the questionnaire, a crucial concept emerged is that of balancing, on the one hand, the promotion and boost to the adoption of new methodologies for improved learning experiences and, on the other hand, supporting teachers' needs.

Below are some suggestions gathered from the questionnaire, to foster the adoption of new teaching methodologies, at a general, university level:

- **Cultivating a culture of innovation**: Universities can promote workshops, seminars, and forums that highlight the benefits of innovative teaching methodologies, fostering a mindset that values continuous improvement in the learning experience.

- **Showcasing successful implementations**: Highlighting successful case studies and best practices in the adoption of innovative teaching methodologies can inspire and motivate faculty members. Sharing success stories within the academic community can serve as a powerful tool for encouraging wider adoption and demonstrating the positive impact of the learning experience.

- **Aligning with educational objectives**: It is crucial to align innovative teaching methodologies with overarching educational objectives and learning outcomes. Ensuring that these methodologies contribute directly to academic goals helps legitimise their adoption and emphasises their role in enhancing the overall quality of education.



Need for “Balancing the fostering of new methodologies adoption for improved learning experiences and supporting Teachers' needs, first of all through an appropriate training of trainers”

5.5 CONCLUSIONS

On the other hand, the crucial points that have been highlighted to support teachers' needs, enabling and preparing them for correct implementation of such new methodologies, are:

- **Providing access to resources:** Universities need to invest in providing teachers with access to a diverse range of resources, including educational technologies, multimedia tools, etc. Specifically, professors have highlighted their need to receive premium accounts access to such tools (e.g. Mentimeter) to be enabled to access all the tools' functionalities.

- **Professional development opportunities:** Continuous professional development is essential for teachers to stay updated on emerging tools and methodologies. Offering workshops, training sessions, and mentorship programs can help educators become more confident in adopting new technologies and methodologies, ensuring they have the necessary skills to navigate the evolving educational landscape.

- **Technical support and guidance**: as a concrete tool to support teachers, professors highlight that universities should establish dedicated support teams or help desks to assist teachers with the challenges they may face in implementing new tools or methodologies.

- **Collaborative learning communities:** creating communities of practice (working groups or roundtables) where teachers can collaborate, share experiences, and offer guidance to each other is valuable.

> Therefore, a critical point in efficiently tackling the implementation of innovative teaching methodologies is providing appropriate support to teachers' needs in terms of tool availability and guidance. Ensuring that teachers get empowered to apply the new methodologies implies, in turn, a more performing and rewarding application of the methodologies themselves: this will contribute to a thriving educational environment that embraces innovation while meeting the needs of educators.

6. OUTCOMES OF THE BRIGHTS WORKSHOP. PERSPECTIVES FROM STUDENTS AND TEACHERS.

BACKGROUND: THE "INTERNATIONAL WORKSHOP: SUSTAINABILITY & INNOVATIVE TEACHING METHODOLOGIES"

From September 18th-20th 2023, the BRIGHTS Project held a three-day intensive workshop where students and teachers, from the partner universities and others had the chance to meet and discuss possible improvements of the teaching methods, to guarantee a more efficient learning experience when it comes to sustainability-related courses.

During the first day of workshop activities, participants went through different speakers' sessions, receiving insights and best practices on innovative teaching methodologies, contexts of application, practical examples, as well as updates on the innovation in the recognition of educational pathways and skills (e.g., open badges, micro-credentials, etc.). On the second day, students and teachers had the opportunity to be divided into groups to discuss the teaching methods that were implemented in their universities, analysing their positive and negative aspects.

The goal was not only to understand how a traditional class can be limiting for students and how innovative methodologies can help to improve the learning experience but also - and especially - to identify the needs of students and teachers to be considered in the implementation of innovative didactics.

In the following pages are the main findings from the group work and discussions as to the implementation of innovative didactics.









Participants in the workshop, group pictures & working groups, September 2023, Pavia.

6.1 COMMUNICATION & INTERACTION

From the discussion, it emerged that generally, students have traditional lectures in which they passively listen to the professors, with some exceptions in master's courses, where the environment is more dynamic due to smaller class groups.

Traditional lectures can be very theoretical, with very little interaction between the professor and the students and among the students. The interaction becomes more critical in the case of international students who do not have sufficient proficiency in the language in which the course is given or in the presence of students with disabilities. Indeed, it was noted that professors should have more opportunities to be trained in accessibility, diversity, and communication.

6.1.1 TOOLS AND APPLICATIONS TO FOSTER INTERACTION AND SUPPORT STUDENTS' ENGAGEMENT IN THE CLASSROOM

Students also noted that the implementation of didactic tools during classes, such as Mentimeter, Padlet, Miro, etc., are very useful to revise notions learned in previous lectures, but also to keep the attention high; another suggestion that emerged was to organise little ice-breaking activities at the beginning of courses to create a good group dynamic.

Communication between students and teachers is fundamental to establishing a fruitful and productive environment; in this regard, the existence of joint committees formed by both students and teachers is important to create a dialogue between them to understand each other's problems and needs. Another point that has been raised is the importance of feedback surveys about professors that students can fill out at the end of the course, underlining what didn't work and proposing some suggestions to make the course better.

Some tools that were appreciated by students after the pandemic were recorded lessons. This is a controversial tool because, from the teachers' point of view, it is just a way for students to avoid going to lectures, but for students, it is a useful way to revise previous lessons or to catch some pieces of information that they have missed. A possible compromise could be having highlight videos of the classes in which there are all the main contents, also thanks to the support of the technical staff within the universities.

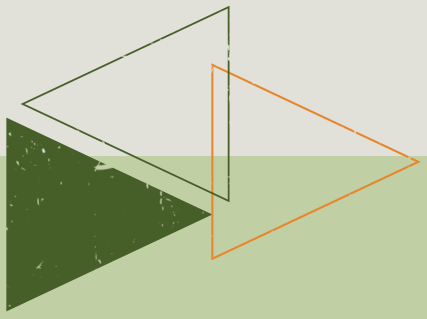
6.1 COMMUNICATION & INTERACTION

Finally, students reported that **study groups** could be very useful at the beginning of the study path to push students to know each other and interact, therefore, assigning more group work could be strategic to enhance collaborative skills among them.

Furthermore, there is not enough time for discussion or exercises to put into practice what students have learned.

Students report they do feel more engaged if they are given tasks to tackle during the course, e.g., analysing some case studies or working on projects to present in class; these tasks should be aimed at developing soft skills such as communication, team-working or problem solving, and to make the lecture more practical and engaging.

Students reported that it would be very useful if courses could **host, on a more frequent basis, seminars by professionals and fieldworkers that could present their experience:** that would be helpful for students to identify a connection between the university and their academic studies, and the labour market. Receiving practical examples of fields of application of theoretical knowledge is highlighted as crucial by the students, in order to receive guidance and inspiration.



> Students report “we feel more engaged if they are given little tasks to tackle during the course, e.g. analysing some case studies or work to some projects to present in class; these tasks should be aimed to developed soft skills, such as communication, team-working or problem-solving, and to make the lecture more practical and engaging.”

6.2 TEACHING METHODOLOGIES

During the brainstorming, the groups were also given a list of teaching methods, and they were asked to discuss them.

- **Small-group teachings** have been experienced by students on few occasions due to the large number of people attending the courses; it has been reported that this type of teaching is mainly used during masters' lectures, seminars or language lessons and it proved to be an excellent strategy to boost communication and the share of ideas among students and receiving feedback from the professors.

- **Flipped classrooms** have shown that this type of method is quite controversial: some students gave good feedback towards it; however, many of them, and the teachers too, explained that this type of lesson is quite redundant, and they have good results only if students are interested in the topic they need to prepare. Moreover, students with learning difficulties struggled to work in this way, preventing them from actually participating in the lessons.

- **Case-based\problem-based teaching and teaching by projects** are profoundly appreciated because they enhance analysis skills and give the chance to go further memorization and prefer critical thinking; additionally, they provide an interesting way to link the theory to practise. A case-based approach is not really implemented in most universities, such as the University of Pavia, therefore, it should be proposed.

- **Gamification** is a methodology largely employed in Cyprus and Germany, and it is reported to keep students' attention high. Indeed, the use of tools such as Kahoot, Mentimeter or Padlet should be considered by professors.

- **Debating and conversational didactics** are highlighted as important and appreciated by students even though they are possible mostly when classes are not very big; indeed, students reported that they are discouraged from asking questions or interacting when there are lots of people.

7. RECOMMENDATIONS AND PROPOSALS FOR NEW APPROACHES

BASED ON THE INTEGRATION OF SURVEY & WORKSHOP FINDINGS

In the following pages, you will find the list of recommendations to universities and hints for new approaches, developed by the combination of the dual approach carried out: the inputs from the extensive questionnaire, and the in-depth analysis during the Workshop.



Photo credits: sangkuriank280



ENHANCING LEARNING WITH CLIPS OF EXPLANATORY HIGHLIGHTS

This specific approach aims at providing, after the lecture time, clips featuring explanatory highlights from professors. These short video segments encapsulate fundamental and key moments of a professor's explanation, serving as valuable resources for students to revisit and reinforce their understanding of crucial concepts. These clips serve as targeted supplements to course materials, textbooks, and lecture notes, enabling a more efficient and effective study routine.

7.1 NEW APPROACHES TO TEACHING AND LEARNING

The fundamental benefits that we envisage in this methodology are:

- **Reinforcing key concepts**: Clips of explanatory highlights act as concise and focused resources, allowing students to revisit essential concepts.

- **Facilitating self-paced learning:** The availability of explanatory clips empowers students to engage in self-paced learning. Students can revisit specific segments as needed, tailoring their review to individual learning preferences and timelines.

- **Supporting accessibility and inclusivity:** Explanatory clips can be a valuable resource for students with diverse learning needs. They enhance accessibility by providing additional support to students who may benefit from reviewing content in different formats, contributing to a more inclusive learning environment.





INTEGRATED THESIS: FOSTERING INTERDISCIPLINARY COLLABORATION FOR SUSTAINABLE SOLUTIONS

In response to the growing need for holistic and multidisciplinary approaches to global challenges, we propose the implementation of an innovative "integrated thesis" initiative within multi-disciplinary universities. This initiative aims to gather the diverse expertise of students from various disciplines and promote collaborative problem-solving through a shared project plan.

7.1 NEW APPROACHES TO TEACHING AND LEARNING

Our proposal is to bring **students from different disciplines** together, defining a **multidisciplinary challenge or topic they would like to address as a final thesis.** The selection of an overarching sustainability challenge, implies the final thesis to be addressed from different perspectives.

A limited number of students, at the same level of studeies (e.g. Bachelor's/ Master), and their respective supervisors, shall work together on the macro-topic, and independently to develop the specific research related to each student's discipline.

During the graduation session, each student will present his/her specific work within the project. Following individual presentations, a dedicated event to present the final product shall be organized, providing the entire interdisciplinary group with an opportunity to collectively present the final product. This event serves as a showcase for the integrated thesis, demonstrating how the collaboration of diverse disciplines has contributed to a holistic and impactful solution addressing the chosen SDG.

As an incentive, a special certificate/ Open Badge will be awarded to each participant, acknowledging their involvement in this experimental trial, to certify, to future employers, the student's commitment to collaborative, interdisciplinary work.

The integrated thesis initiative is specifically designed for **multi-disciplinary universities.**

By encouraging collaborative **problem-solving** and **interdisciplinary exploration,** this initiative seeks to provide skills and mindset needed to tackle complex, **real-world challenges**.





AUGMENTED REALITY VIEWERS IN SUSTAINABILITY EDUCATION

The proposal, to include augmented reality viewers in the educational experience, aims at making field visits more accessible, especially in departments such as those of Natural Sciences, Sustainable Agronomy, Agri-Food Sustainability, Engineering, etc.

7.1 NEW APPROACHES TO TEACHING AND LEARNING

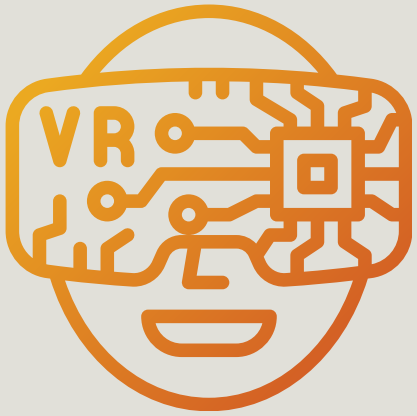
Technological advancements have opened new avenues for enhancing education with augmented reality (AR). The use of AR in university courses has been highlighted both by the questionnaire and by the outcomes of the workshop.

The main expectation and application of AR are **virtual field trips,** allowing students to explore ecologically significant locations without leaving the classroom. This can be beneficial for both students and university departments. The former can benefit from more experiences (rather than real field trips), decreasing their costs, and making these experiences more accessible to all students, even those with disabilities or other limitations. The former, can as well benefit from a cost reduction.

Another envisaged application is related to the creation of **interactive learning modules,** fostering a deeper understanding of environmental issues and sustainable practices, observing and understanding the impacts of human activities on ecosystems and natural resources.

Challenges:

- **Technological infrastructure** of the university: the successful integration of AR viewers requires a robust technological infrastructure within universities),
- **Accessibility and inclusivity:** even though they can be beneficial to expand the chance for students to join “virtual field trips," special attention must be given to ensure that AR applications are accessible to all students, even those with visual impairments, etc.
- **Faculty training:** teachers may require training to effectively utilise AR viewers in their teaching. Workshops and professional development opportunities can empower educators to integrate these technologies confidently.





INTRODUCING THE USE OF MOBILE PHONE APPLICATIONS

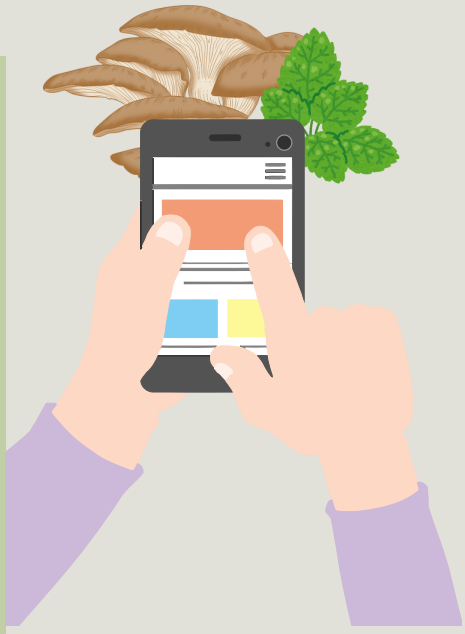
Incorporating mobile phone applications into teaching, especially in the field of Natural Sciences, to assist in recognizing various species of fungi, plants, and other natural elements, can boost the learning experience, and make it more effective.

7.1 NEW APPROACHES TO TEACHING AND LEARNING

One of the new approaches proposed lays on the idea of incorporating mobile phone applications into teaching to transform traditional learning environments into interactive, engaging spaces.

Mobile phone applications have been highlighted by both students and teachers as a tool that can significantly enrich the learning process. This has been specifically underlined **in the context of Natural Sciences** where, for instance, apps that assist in recognizing various species of fungi, plants, and other natural elements, can boost the learning experience, and make it more effective. Such tools not only provide immediate access to a wealth of information but also encourage active participation and observation, essential skills in the scientific method and inquiry-based learning.

However, attention should be paid to issues such as **digital equity** and ensuring the **quality of educational content**: educators need to critically evaluate apps for accuracy, relevance, and pedagogical value, as well as develop strategies to integrate them effectively into their teaching practices: for these reasons, the proposal from the BRIGHTS Project is to integrate these specific applications only in the context of Natural Sciences.





INCLUDING MAKATHONS AND HACKATHONS AS A LEARNING TOOL IN THE COURSE PATH

Including Makathons & Hackathons in the learning path: to get students working on a "hands-on approach", fostering a deeper understanding and the development of interdisciplinary collaboration

7.1 NEW APPROACHES TO TEACHING AND LEARNING

Introducing **Makathons and Hackathons as a learning tool** in university courses can offer numerous benefits for students, enhancing their academic experience and preparing them for real-world challenges in their respective fields.

As a matter of facts, Makathons and Hackathons provide students with opportunities to apply theoretical knowledge gained in the classroom to **real-world problems**. The "hands-on approach" they foster brings students to apply concepts learned in lectures and textbooks, fostering a deeper understanding and the development of **interdisciplinary collaboration.** These events, indeed, often require participants from diverse backgrounds to work together in teams: this turns out to be particularly beneficial when students from different fields are brought to work together, with unique perspectives and expertise to the table. However, also when applied in the same field, this kind of collaboration can be beneficial to mirror real-world work environments with interdisciplinary teams and joint approaches. This is extremely relevant to support students in gaining **interpersonal skills and capacity to work in teams, which are fundamental abilities for the real job market.**

Furthermore, Makathons and Hackathons can encourage participants to **think creatively and innovatively** to solve complex problems within limited time frames, cultivating critical thinking skills and basic project management skills, as they require teams to manage their time effectively, **set goals, allocate resources, and communicate efficiently.**



Incorporating Makathons and Hackathons into university courses could not only enrich students' learning experiences but also equip them with the skills and mindset needed to thrive in today's dynamic world.

7.2 SUGGESTIONS & RECOMMENDATIONS TO UNIVERSITIES

Moving from the typical model of teaching toward different means and modes of delivery, where sharing and encouraging learning, requires appropriate support to the faculty members. Below, are the identified recommendations and suggestions for universities, that we deem most urgent and effective.



Photo credits: Alexas_Fotos

7.2 SUGGESTIONS & RECOMMENDATIONS TO UNIVERSITIES



AD-HOC REGULAR TRAINING SESSIONS FOR TEACHERS

For teachers to remain updated and be able to implement the methodologies.

To ensure professors can efficiently implement innovative teaching methodologies, it is necessary to guarantee them a constant possibility of training. Due to their busy agendas and schedules, the identified approach in this sense is composed of ad-hoc workshops training from ½ day to an entire day, to be arranged in presence and regularly, in the periods before and after the class activities.

The training shall be arranged by pedagogical centres within the university if equipped with one, or in collaboration with external trainers.

7.2 SUGGESTIONS & RECOMMENDATIONS TO UNIVERSITIES



BOOSTING TRANSVERSAL AND INTERDISCIPLINARY MODULES AND COURSES

Supporting transversal and interdisciplinary approaches, e.g. micro-credentials and courses that stretch beyond the single discipline

This recommendation fits in the wider scope of rethinking the curriculum structure: it is particularly relevant for education for sustainability to **unbundle contents in a more transversal and interdisciplinary way**. Transversal courses are a solution to **make sure all the students, across the disciplines, are tackled and enriched by the contents.**

The rationale at the basis of the proposal is to **give students the chance to address transversal contents in their educational career,** providing a solid access to these topics, despite their specific educational curriculum and path.

The suggestions, arisen from the research, propose to boost sustainability education as a **Micro-credential**, with the awarding of innovative certifications systems such as open badges, to make such educational experiences more skills-recognizing for the job market.
An important note, in this perspective, is to enshrine the Open Badges into European-recognized frameworks (e.g. the **GreenComp Framework**) [17]

More details:

European Commission, GreenComp: the European sustainability competence framework. [17]

7.2 SUGGESTIONS & RECOMMENDATIONS TO UNIVERSITIES



REVISE THE REWARDS AND INCENTIVE SYSTEMS

To reward those who implement new methodologies in their classes, to legitimise and boost these virtuous approaches,

Revise the rewards and incentive systems to legitimise and boost these virtuous approaches, for instance:

- revising the criteria for promotion,
- removing barriers actively supporting the teachers' attempts for cross and multi-interdisciplinary and transdisciplinary work, which is very relevant to delivering programs related to sustainability or sustainable development, as their contents don't fit neatly in boxes.

7.2 SUGGESTIONS & RECOMMENDATIONS TO UNIVERSITIES



SUPPORTING AND LEGITIMISING THE WIDER SCOPE OF THE UNIVERSITY

Including sustainability and climate education in the scope of the university, to better legitimise initiatives in this perspective.

Supporting and legitimising the wider scope of the university: instead of mandating climate education, which could get resistance or push back, through the legitimisation of the broader educational mission, it is possible to work on a mindset change.

To obtain a real willingness to work on sustainability from the students, it is reported that it is necessary to train imagination and creativity first, i.e., the ability to see the system and the whole framework. At the same time, it takes imagination and vision from the university itself to try new things.



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For any further inquiry or necessity, the BRIGHTS Project team remains available at the email: brights@unipv.it

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"In the end we will conserve only what we love; we will love only what we understand and we will understand only what we are taught"

Babe Dioum



ANNEX 1

QUESTIONNAIRE TEMPLATE "INNOVATIVE DIDACTICS METHODOLOGIES. MAPPING THEIR USE AND DISTRIBUTION"

The full questionnaire is available here.

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