RETEACH
ERASMUS+

Training Kit

on teacher education policies and practices in Europe

Funded by the European Union

Index

Glossary of Key Terms

A **clear glossary** is essential for ensuring consistency and understanding of key concepts, particularly when working across multiple countries and disciplines in the EU context.

Teacher education and policies

Elaborated by Daniela Popa

Term	Definition
Green Education	Teaching and learning focused on sustainability, climate change, and environmental responsibility.
Digital Pedagogy	The use of digital tools and technologies to enhance teaching, learning, and assessment.
Sustainability Competence	The ability to understand, evaluate, and act on environmental, social, and economic challenges related to sustainability.
Climate Literacy	The knowledge, skills, and attitudes needed to understand climate change and its implications for the environment and society.
Digital Citizenship	The responsible and ethical use of digital technology, including the understanding of issues like privacy, security, and digital rights.
Inquiry-Based Learning	A student-centered approach where learners investigate real-world problems through questioning, research, and collaborative solutions.
Digital Competence	A set of skills, knowledge, and attitudes related to using digital technology to solve problems, communicate, collaborate, and produce content.
GreenComp	The European sustainability competence framework that defines competences for addressing climate change and sustainability in various educational contexts.
DigCompEdu	The European Framework for Digital Competence of Educators, which outlines digital skills required for effective teaching and learning in the digital era.

EU and International framework

Terminology of European education and training policy, 3rd edition – CEDEFOP (2024); Biesa et al. (2021)[1]; UNESCO Institute for Statistics; User manual for the implementation of the new UIS Survey on Statistics of Information and Communication Technology (ICT) in Education.

Term	Definition
Quality assurance	In education and training, any activity implemented to ensure that education and training (content of programmes, curricula, assessment and validation of learning outcomes, etc.) meet the quality requirements expected by stakeholders.
Equity	In education and training, fair treatment of all learners through provision of resources and actions adapted to individual learner needs, to ensure equal opportunities.
Teacher education policy	Law-making procedure of defining the legal structure and provision of financial resources of how education functions
Pre-service teacher training	Recognised and organised, private and public educational programmes designed to train future teachers to formally enter the profession at a specified level of education. Graduates receive a government recognised teaching qualification. Pre-service training does not cover teachers who do not meet officially recognised training standards and are enrolled in a teacher training course to earn accreditation concurrent to their work as a teacher.
In-service [teacher] training	Training that is concurrent to official teaching responsibilities to improve teachers' qualifications and skills. In-service training can be compulsory relating to official professional development activities to maintain or upgrade professional qualifications or it can also be optional with the sole purpose to improve skills.
Training of teachers and trainers	Theoretical or practical training for teaching and training personnel, either practising as professional teachers or trainers or as professionals in a given field who accompany trainees in their work environment (occasional teachers or trainers).
Accreditation of an education or training programme	Process of quality assurance through which a programme of education or training is officially recognised and approved by the relevant legislative or professional authorities following assessment against predetermined standards. [Ed.: the same definition applies for accreditation of education or training providers, learning outcomes, etc.]
Skills management system / competence management system	Set of institutions and stakeholders, public policies, laws and provisions that work for the development and use of skills in the economy.

1 *adapted by G. Biesta et al. (2021).* Teacher education policy: part of the solution or part of the problem?. *Taylor & Francis*, https://doi.org/10.1080/1359866X.2021.1992926

Context of RETEACH Project

Beginning in 2005, with the approval of the national program “Environmental Education for All” by Resolution No. 255 of 1997, the Mongolian government has begun a long-term process of sustainable development policies to improve their national teacher education programmes, with a focus especially on green and digital education. Said strategy manifested in the adoption of several other policies in the following years, such as the “CONCEPT OF SUSTAINABLE DEVELOPMENT OF MONGOLIA-2030” in 2016, or the “Vision-2050”, approved in 2020. However, most Mongolian higher education institutions still fail to implement these changes in a significant manner, lacking specifical targeted courses, horizontal green and digital skills, or awareness in students.

To achieve an effective transformative process in Mongolian HEIs, the RETEACH project aims at using EU experience in the field as a model. Through this Training Kit, the European approach to teacher education is presented both in its top-down and bottom-up manifestations. By presenting the two approaches, it will be possible to confront the EU theoretical framework with some of its concretizations, thus generating a comprehensive depiction of how teacher education policies can be effectively conceptualized and, later, applied.

The present document is naturally complimentary to the *Fact Finding Analysis on the situation of the teacher education policy and programs in Mongolia* (D1.2), a comprehensive analysis of the current situation, policies, and issues of the Mongolian educational system. The Fact-Finding Analysis (FFA), developed within RETEACH project, also contains the result of an extensive survey conducted among Mongolian teachers in general secondary schools.

The FFA demonstrates several systematic issues that heavily affect the quality of Mongolian education system, such as weak integration of green and digital skills in educational programmes, overall low standards for education curricula, improvable accreditation systems, insufficient connection between pre- and in-service training for teachers. An extensive analysis of these issues is available in the FFA: due to the complementary nature of these two documents and to avoid repetition, this introductory section will not go into further detail on the Mongolian context, hence leaving space to a comprehensive observation of the European examples.

International and European framework

CESIE ETS

Introduction

The development of teacher education programmes to improve green and digital skills undeniably lies its roots into the larger pursuit of sustainable development by the international community. This process has characterized the mission of transnational and national policymakers for more than 30 years, with its emblematic beginning dating back to the signing of the Agenda 21 in 1992. This international act represents the first unified attempt to shape the future of nations in the name of sustainable development instead of mere economic growth. This change of global paradigm implies the incorporation of a set of values in every policy following 1992, with education being one of the core pillars of change, due to its responsibility in shaping new generations.

With years, despite the key principles of the Agenda revolving around sustainable development remained untouched in their significance, the necessity for an update became clear for two main reasons: the advancement of technology and the consequent reshape of society called for new, more specific guidelines; moreover, several practical goals of the Agenda remained unreachable for several countries across the globe, requiring adaptive measures by the International community.

For these reasons, a new cornerstone was developed, representing the most significant cornerstone of the global path towards sustainable development: the Sustainable Development Goals, published in 2015, within the context of the Agenda 2030. SDGs represent the renewed global strive for a better future, incorporating 17 different macro-categories of objectives that need to be prioritized by decision makers across the planet. Despite education is the focus of SDG 4 specifically, the structure of the Goals is by nature holistic: they intertwine as a system, simultaneously guiding policymakers in the objectives to pursue and showing the comprehensive approach that needs to be adopted.

These initiatives, far from being the only actions of the international community to support teacher education, represent the keystones of the global theoretical framework for the development of the education sector, both in terms of content and in structural terms, by demonstrating how holistic approaches can be the only effective way to tackle sustainable development. As such, these strategies have been pivotal in the definition of the European policy framework that has developed during the years. The focus of this Kit will be on programmes and initiatives that have been created in the timespan occurring between 2019 and 2025.

2019 is an emblematic year, since it marks the beginning of the European Green Deal, a manifesto of the European effort against climate change. Despite the Green Deal is primarily focused on sustainability and the environment, there are clearly stated implications for the education sector. Research and education are defined to be key fields in the green transition, being respectively responsible for the development of new approaches and tools to oppose climate change, and for the appropriation of the concept of sustainability by younger

generations. Researchers are required to abandon conventional approaches and to adopt new, holistic techniques. At school level, upskilling and reskilling should be at the centre of new curricula, and the green transition should affect school and university buildings as well.

Immediately after 2019, the COVID-19 pandemic marks a crucial moment in the policy development process. Despite the indisputable challenges to education caused by the health crisis, the pandemic proved to be an indirect tool to effectively identify which aspects of the educational system are pivotal for effective digital training and education, as well as demonstrating the digital skill deficiencies among educators, or the necessary digital equipment to guarantee high quality training and education.

The influence of these newly discovered gaps is clearly visible in several major European policy initiatives that have been launched between 2020 and 2021 in response to the issues arisen during the COVID-19 outbreak. In most cases, the issues highlighted during the pandemic combined with previously existing objectives: the initiatives launched during these years often refer explicitly to previous ones, with the explicit purpose of both reinforcing and expanding the instruments already available for the international community.

This ambivalent role of new initiatives as both a support for what already exists and as a resource for future innovation is another key element of the European policy framework. Every strategy is embedded in a larger canvas that reconnects to the principle of holistic reasoning, since new elements naturally strengthen pre-existing ones, while simultaneously open the way to new approaches. The framework resulting from this approach reflects also on national and supranational policies, since effective regulations need to be built on these principles of mutual connection and reinforcement.

Green and digital advancement in the education sector

The green and digital reform of the education sector plays different roles in these documents, being the core of the entire initiative, in some cases, and a piece of a larger picture, in others. One of the most significant initiatives that has education at its core is, without a doubt, the *Digital Education Action Plan 2021-2027*. This document marks the beginning of a 6-year effort to significantly boost digital upskilling and reskilling of both teachers and students, in response to the challenges shown by the global pandemic. The period we live in is defined as the "digital age", therefore it comes to no surprise that digital education is the key factor for the development of new generations, providing up-to-date soft and hard skills, equality, inclusivity, and digital literacy. The priorities of the plan are developing a high-performing digital education ecosystem and the enhancement of digital skills for everyone involved in educational processes, a parallel effort to improve technological equipment and human capacities.

The renewal of educational pathways is at the heart of another fundamental European strategy, namely the *European Skills Agenda*: a five-year plan entirely focused on reskilling and upskilling European citizens, both for professional reasons and life-long learning pathways. The reasoning behind the Agenda is not new, since it also lies its foundation on both previously existing international plans and the responses to the COVID-19 pandemic, despite focusing entirely on skills and the way educational pathways should help developing them.

Notably, the European Skills Agenda is strongly intertwined with another, almost simultaneously developed, large-scale initiative: the *European Pillar for Social Rights Action Plan*. As a matter of fact, the Action Plan has also the purpose of advocating for more widespread and effective soft and hard skills for people approaching the labour market, while simultaneously pushing for innovation, social protection, and inclusion. For the purpose of this research, the difference between the European Skills Agenda and the European Pillar for Social Rights mostly lays in

their approach to the transformation of the education system, since the Agenda is much closely related to the approach that should be taken by Higher Education Institutions (HEIs) and schools to improve skills, while the Pillar for Social Rights is more oriented to work skills, thus approaching education as a prerequisite and not as the objective.

One last education-centred initiative is worth mentioning, and it is the *European Education Area (EEA)*. This large-scale operation begun in 2020 with a 5-year objective to launch a wide network of cooperation among European states to improve quality education. This effort has invested teachers as well as students, including young and adult learners, with common objectives on inclusive green and digital educational pathways. Being 2025 the last foreseen year for the EEA, by 2026 it will be reasonably be possible to see the results of the initiative through its final report.

EEA is one of the actions to offer the highest number of practical tools for teachers across Europe. Specifically, the tools consist of:

- European Innovative Teaching Award, an award for the outstanding innovations and practices among teachers;
- Erasmus+ Teacher Academies, a network of European cooperation among educational institutions;
- Support to teaching professions, funds, initiatives, and events in support to professionals of the education sector.

All three of these categories are freely available on the EEA's website, making them an accessible informative tool for practical education-related initiatives at European level and a repository of previously developed practices and innovations.

Before analysing the initiatives that are not specifically centred on education, it is worth mentioning that there are two other public policy repositories available online, both related to the initiatives analysed so far. The first one is the *Standards on teaching and teacher education*, describing direct and indirect cooperation between the EU and national education systems; direct instruments include the aforementioned EEA's initiatives or annual monitoring actions carried out by the European Community, while indirect measures manifest through key documents to be adopted, such as the Eurydice report, on inclusive educational pathways.

The second repository tool worth of mention is simply called *Policies on educational issues*, and it is an instrument provided by the European Commission to collect significant initiatives, based on three macro-categories: policies addressing shared challenges, actions setting objectives and to measure progress, and, in more general terms, international cooperation actions.

This being said, it is clear that the overall approach to innovation in education does not differ significantly among various European initiatives developed between 2020 and 2021: all the aforementioned cases are based on interconnection and the pursuit of a future-oriented perspective. Educational institutions should create multifaceted learning frameworks that encompass students in a path of sustainable development, international cooperation, and creative experimentation. It should not surprise that the same leitmotiv characterizes other key European initiatives that do not revolve exclusively around education but include it among their focal points.

Arguably the most notable of these actions is the *Erasmus+ programme 2021-2027*. Erasmus+

is one of the most significant European funding programmes, including actions on a plethora of topics, addressing several different targets. Education is one of the most important fields of action of the programme, that dedicates two out of four horizontal priorities to digital transformation and environmental actions. The approach is once again holistic and oriented towards sustainable development.

Another significant action revolves around the intention to begin a European cultural shift through a transdisciplinary movement: the *New European Bauhaus*. This initiative was mentioned for the first time during the State of the Union Address by President von der Leyen at the European Parliament Plenary of September 16th, 2020. It aims at combining sustainability, culture, and innovation in the attempt to foster creative and inclusive practices that support the green transition. Obviously, educators play a major role in this effort, since they need to be the main catalysts for a mindset change in newer generation.

Lastly, it is fundamental to mention the European Digital Decade, an initiative that begun in 2020 and establishes key common objectives for digital advancement, to put workers and citizens at the heart of digital advancement. Educators are clearly included in the improvement process and need to hone their digital skills following the principles of the Digital Compass, which promotes inclusivity, participation, and sustainability, among other aspects.

Conclusions

All the actions mentioned so far are not to be considered as static documents that stand immutable since their creation, but as growing processes that keep adapting to the new challenges faced as societal level, encompassing new initiatives, manifestations, and strategies.

This potentially everchanging nature of the European initiatives, however, does not exclude the presence of recurring and fixed pillars, present both in the international and European strategy for development, on a wider scale, and for teacher education, on a more specific scale, remain the same. These key concepts, partly already mentioned in this chapter, should be kept in high regard in the definition of new large-scale reforms.

The first key concept is one that could be defined as “interdependence”. As it is easily understandable by a simple overview of the above-mentioned initiatives, most of them explicitly reference each other in their introduction or among the references for their development. Each initiative or action was created as a tool to expand and solidify its predecessors, updating their field of action or generating a ramification that focuses on a specific aspect. Moreover, each initiative is a gateway for future perspectives, laying the foundation for potential innovations or new approaches. Interdependent policies keep enforcing precedent initiatives and are naturally open for new perspectives, when the last developed initiative will inevitably present some degrees of obsolescence.

Another of the most important aspects is, without a doubt, the use of holistic approaches: a reform of the education system should be strictly interconnected with sustainable development approaches in the fields of green practices, employment, digitalization, infrastructure enforcement, just to mention some examples. Even considering only the educational sector itself, the conceptual background should be encompassing a multifaceted approach that would then be reflected in the shaping of teacher education curricula firstly, and then in educational programs created by teachers.

The last pillar worthy of mention is the long-term vision of EU educational initiatives. Despite usually limited in time – the programmes that were described in the chapter would vary between 5 and 10 years of duration – each action aims at changes that go beyond its

conclusions. Recurrent objectives include changing thinking paradigms in policy making or shaping minds of new generations according to the international principles of sustainable development; none of these objectives could be reached in a ten-years span. The purpose of EU initiatives, especially when focused on education, is to create deep, long-term changes in the mind of societies, particularly focusing on pupils and students through innovative educational approaches. Effective policies leave an impact that surpasses mere normative implementation.

The top-down approach of transnational institutions encourages the adoption of these values, promoting their permeation in educational institutions and, therefore, society. Similarly, national systemic reforms should be oriented on the same ideals to follow the EU model, by shaping vertically the structure of the education system and, consequently, the contents of curricula in schools.

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European Innovations in Digital and Green Education. A Systematic Literature Review

CESIE ETS

Introduction

As partner universities share their valuable experience to contribute to the reform of teacher education in Mongolia, other European initiatives in digital and green education may offer valuable guidance. This chapter shortly presents the main results of the Systematic Literature Review conducted by CESIE, offering a set of examples from across Europe, and occasionally outside Europe — ranging from immersive technology to nature-based learning — in the attempt to inspire teacher training and curriculum innovation. Focusing entirely on the illustration of concrete practices, this review aims to help Mongolian educators foster digital transformation and sustainability awareness in ways that are adaptable to local contexts.

Digital Innovation in Education

Across Europe, digital transformation in education is driven by immersive technologies, artificial intelligence (AI), and game-based learning. Here follow several examples of national approaches that systematically encompass some or all these strategies.

In Greece, at National Technical University of Athens, the MAGI platform employs large language models and digital avatars to simulate real-time conversations with students, enhancing engagement in remote and hybrid settings (Zhao et al., 2024). Concerning virtual reality (VR), the Spanish experience of the Polytechnic University of Catalonia's Faculty of Design and Visual Arts has been proven to be successful by equipping learners with Virtual Reality headsets, transforming design studios into three-dimensional playgrounds that accelerate task completion and deepen spatial understanding (Zhang, 2023).

On a similar note, in France, a national ecosystem for didactic games has emerged at the University of Lorraine, supported by a consortium of educators, developers, and public institutions. These games simulate complex, real-world scenarios such as urban planning, energy management, and democratic decision-making. Students take on professional roles and work collaboratively to design sustainable solutions, negotiate policy trade-offs, and allocate shared resources. This fosters deep content mastery, critical thinking, and civic awareness through experiential learning (Laforge et al., 2024).

Teacher training is evolving to meet these technological shifts. In University of Lisbon's Faculty of Education, pre-service teachers participate in hands-on workshops where they experiment with AI tools like ChatGPT to design quizzes, dialogue simulations, and personalized feedback. The training also includes ethical reflections on the use of generative AI in classrooms and pedagogical strategies to ensure meaningful integration (Tunjera & Chigona, 2023).

Efforts like the ones mentioned so far echo the broader evolution of pedagogical frameworks,

however there are other significant cases that further enforce this strategy. For instance, in the Education University of Hong Kong's School of Creative Media, the TPACK model—originally encompassing Technological, Pedagogical, and Content Knowledge—has been adapted to include AI literacy and ethics, enhancing teachers' readiness for digitally enriched environments. This strategy has been reported to be applied also in European teacher education programs, many of which are embracing similar revisions to support the Digital Education Action Plan (Kong, Yang, & Yeung, 2024). All these examples highlight the importance of structured, targeted training to ensure that digital tools are used effectively in classrooms.

Green Pedagogy and Sustainability Education

In parallel with these digital advances, European universities have championed sustainability in equally inventive ways. This systemic approach is demonstrated by several study programs and educational systems, as shown by some of the most notable best practices shown below.

For instance, Vasile Alecsandri University of Bacău's Faculty of Economic Sciences in Romania tied green procurement policies to interactive learning modules, thereby fostering resource-wise habits among both educators and learners (Bucea-Manea-Țoniș et al., 2024). Similarly, Denmark's Udeskole initiative—coordinated by the Ministry of Education—equips students with tablets and environmental sensors for biodiversity mapping, transforming outdoor spaces into living data laboratories that foster systems thinking (Bentsen et al., 2010). At once, Turkey's Eco-Schools program weaves digital monitoring into school-based sustainability projects, making environmental stewardship a hands-on, evidence-based initiative (Taşar, 2020).

It is also significant the case of West Hungary's Department of Service Design, where playgrounds have been transformed into "Living Laboratories." Students collaborate with teachers, families, and urban planners to co-create nature-based solutions that enhance local biodiversity, climate resilience, and social inclusion. The process involves digital mapping, prototyping, and public presentations, cultivating skills in sustainability, co-design, and active citizenship (Tapia & Reith, 2025).

Scandinavian countries have localized the Sustainable Development Goals (SDGs) by embedding cultural values into curriculum design. This is the case of University of Helsinki's Department of Education and the University of Copenhagen's School of Education, in Norway and Finland, where sustainability is taught through narratives that connect ecological responsibility with indigenous philosophies and local lifestyles. This approach ensures that students don't just memorize environmental facts but develop meaningful connections between global challenges and personal identity, fostering long-term behavioural change (Borre Bragdo, Tuszyńska, & Żeber-Dzikowska, 2021).

Higher education institutions are also embracing sustainability pathways in more profound ways. Significantly, at the University of Granada's Department of Mathematics and Science Education, Spain, mathematics teacher training programs now include green chemistry modules that promote problem-based learning. Future educators learn to design interdisciplinary projects that combine equations, ecological data, and social impact analyses. This prepares them to teach mathematics not just as an abstract discipline, but as a tool for solving real-world environmental issues (Moreno-Pino et al., 2021).

Another experience that demonstrates this trend could be the case of University of Plymouth's School of Education, United Kingdom, where a Delphi study resulted in the production of strategic recommendations for climate change and sustainability education (Okada & Gray, 2023). Experts emphasized the need for flexible curricula that allow local adaptation, and for teacher training programs that build cross-disciplinary competencies — such as integrating

climate science into language, arts, and physical education. These findings have informed national guidelines and professional development initiatives.

In tandem, the University of Bucharest's Centre for Pedagogical Excellence and the University of São Paulo's Faculty of Education implemented the CARE–KNOW–DO coaching framework, through which structured mentoring elevated teachers' confidence and reframed them as ethical exemplars in sustainability education. The model encourages teachers to reflect on their roles not just as knowledge transmitters, but as ethical facilitators who model sustainable practices in daily school life (Gorghiu et al., 2024).

Humanistic studies have also a role in this shift towards systematic integration of sustainable principles in education. Language education is, indeed, another area where green pedagogy is gaining ground. Studies conducted at Humboldt-Universität zu Berlin's Institute for English and American Studies, show that integrating ecological content into English as a Second Language (ESL) lessons enhances student engagement and global awareness. For example, learners explore climate change vocabulary through debates, write essays on eco-friendly habits, and analyse media coverage of environmental issues. This makes language learning relevant to global citizenship and fosters ecological literacy (Mercer et al., 2023).

Obviously, this trend also applies to training and professional institutes. In Malaysia, expert consensus has led to the development of green skills modules for technical and vocational education and training (TVET). These modules cover topics such as resource efficiency, circular economy principles, and climate-resilient infrastructure. Students engage in project-based learning that links technical know-how to sustainable development goals, aligning workforce preparation with environmental responsibility (Alwi et al., 2020).

Merging Digital and Green Practices

The most impactful innovations occur when digital and green approaches are combined. In example, this is the case of University of West Hungary, in which digital tools like Miro and Teams have been used to facilitate co-design workshops for nature-based solutions, enabling students to visualize and refine their ideas collaboratively (Tapia & Reith, 2025). Another notable case would be the one of Denmark's Udeskole program, where outdoor learning is supported by digital dashboards that track biodiversity and environmental data, allowing students to analyse trends and propose interventions (Bentsen et al., 2010). Similarly, at the Technical University of Cluj-Napoca's Department of Computer Science and Green Engineering in Romania, interactive games explain energy efficiency, transforming abstract climate concepts into immersive, hands-on experiences (Banciu & Alexandru, 2010).

These blended approaches support systems thinking and active citizenship. Students learn to analyse complex environmental issues using digital simulations, then apply their knowledge in real-world projects. Teachers use online platforms to share best practices and co-create lesson plans that integrate sustainability across subjects. This synergy between technology and ecology prepares learners to navigate the challenges of the 21st Century with confidence and creativity.

Integrating DigCompEdu and GreenComp in National contexts

DigCompEdu and GreenComp are two significant tools developed at European level that have left a relevant trace in the innovation of teacher education curricula across European countries. Both documents present a similar structure, standardising digital and sustainable competencies in a common framework, similarly to the previously developed Common European Framework of

Reference for Languages (CEFR).

The adoption of these two frameworks in national study programmes is not only common, but relatively simple: educational institutions at all levels are required to standardise educators' skills through the frameworks, adapting previously existing curricula or simply introducing new tools to assess competencies and upskill teachers and professors. Significantly, this process can be conducted both through systemic approaches – e.g. at ministerial level – and individual approaches – with the adoption by the rectorate of a HEI.

To cite a relevant example for each case, DigCompEdu has been mentioned by the Italian Ministry of Education as a keystone in the design of two national strategies, the Integrated Digital Didactics Plan and the Digital Education Action Plan 2021-2027 (Linee guida per la Didattica digitale integrata 2020; European Commission 2020). On the other hand, as it is later mentioned in this document, Transilvania University of Brasov has included GreenComp Competency Framework as a fundamental requisite for the creation of environmental education programs, recreating a categorisation of sustainable competency levels for all students of environmental education programs.

Conclusion

The European and Asian examples presented in this review demonstrate that digital and green education are not separate domains but complementary forces that can drive meaningful change. By adopting and adapting these practices, Mongolian educators can develop curricula and training programs that are both innovative and culturally grounded. The best practices listed above may be a source of direct inspiration or could be used as tools to develop entirely new educational method that better fit national heritage or geo-cultural features.

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Shared Experience on Green and Digital Skills in Teacher Education Curricula

Transilvania University of Brasov

Digital Transformation in Teachers' Education

Introduction

The necessity to reconceptualize teacher education within digital frameworks emerges from the convergence of accelerating technological advancement, evolving pedagogical demands, and persistent educational inequities that characterize 21st-century society. As educational institutions grapple with the dual challenges of preparing educators for increasingly complex, technology-mediated learning environments while simultaneously addressing systemic disparities in access and achievement, the traditional models of teacher preparation prove insufficient to meet the multifaceted demands of contemporary educational practice.

The European Union's strategic vision for education, articulated through the Digital Education Action Plan 2021-2027 and the European Education Area initiative, explicitly calls for a fundamental transformation in educator preparation that prioritizes digital competency development, inclusive pedagogy, and cross-cultural collaboration. The EU framework emphasizes the cultivation of digitally literate educators who can navigate diverse learning environments, implement evidence-based digital pedagogies, and foster critical digital citizenship among students from varied socioeconomic and cultural backgrounds. This approach recognizes that preparing teachers for the digital age requires not merely technical skill acquisition, but the development of adaptive professional identities capable of leveraging technology to promote educational equity, democratic values, and sustainable development across member states.

At Transilvania University of Brașov (UNITBV), this transformation has been embraced as a strategic institutional priority, resulting in comprehensive programs, innovative partnerships, and concrete implementations that serve as models for digital teacher education across Europe and beyond. Consequently, the teacher education programs are designed to integrate digital innovation with social justice imperatives, preparing educators who can function as agents of both technological advancement and societal transformation within the broader context of European integration and global competitiveness.

This chapter examines UNITBV's specific contributions to digital transformation in teacher education, detailing the university's actual implementations, programs, and initiatives that have been developed and deployed over the past decade. While contextualizing these efforts within the broader European and Romanian digital education landscape, the primary focus is on sharing the concrete experiences, challenges, and successes that UNITBV has achieved in preparing digitally competent teachers for 21st-century educational environments.

European and Romanian Digital Education Context

Transposing European initiatives on digital and green skills into Romania's national policies and institutional practices

Following the European Action Plan for Digital Education (2021-2027) and the Council's subsequent recommendations on the provision of digital skills (adopted in November 2023), Romania has transformed its educational orientation through the Pre-university Education Law No. 198/2023 and the University Education Law No. 199/2023, adopted in July 2023. These laws give concrete form to Romania's commitment to address climate challenges through the National Strategy on Environmental Education and Climate Change 2023-2030, creating a direct link between European environmental priorities and national educational practices. The government has implemented these directives through the Strategic Initiative for the Digitalization of Education SMART-Edu 2021-2027, designed to reduce digital divides and promote social inclusion.

At Transilvania University of Brașov, we have adopted this vision through our participation in the European University Alliance UNITA, obtaining in November 2023 European funding of €14 million for academic mobility, collaborative research, and international partnerships. Through UNITA, we focus on innovative teaching approaches that embrace digitalization while promoting research in renewable energy, cultural heritage, and the circular economy. Our commitment extends to learning programs in advanced technologies through the EIT Deep Tech Talent initiative, which addresses the reality that only 27.7% of Romanians possess basic digital skills, turning this challenge into an opportunity to provide our students and communities with the means to develop.

Romanian Digital Education Infrastructure

Romania has emerged as a leader in digital education innovation through several groundbreaking initiatives. The EBSI4RO (European Blockchain Services Infrastructure for Romania) project, implemented between April 2021 and March 2023 by UEFISCDI and Politehnica University of Timișoara, created a sustainable ecosystem for blockchain technology adoption, implementing a system for issuing EBSI university diplomas integrated with the Single National Student Enrolment Registry (RMU) and micro-credentials.

The Romanian Educational Network (RoEduNet), administered by ARNIEC, operates the national research and education network providing transport services and internet connectivity to all Romanian universities and research institutions. EDULIB, a digital platform with open educational resources implemented through the Operational Programme Competitiveness 2014-2020, serves as a comprehensive repository of educational resources. The "Clasa Viitorului" (The Class of the Future) initiative promotes digital education transformation through Google applications for education, while EDU CRED creates open educational resources designed by teachers from across Romania.

Digital education at UNITBV

UNITBV has invested significantly in digital learning environments across its campus infrastructure, operating two student campuses – Colina and Memorandului – with state-of-the-art digital infrastructure. The campuses house 13 halls of residence with nearly 4,300 accommodation places, all equipped with high-speed internet. The university library provides

access to 573,204 volumes and extensive digital databases through the Anelis+ Mobile programme, including ISI Web of Science, Scopus, IEEE, ProQuest Central and ScienceDirect. UNITBV has set up specialised digital learning laboratories equipped with interactive whiteboards, virtual reality systems, augmented reality applications, tablet computing environments, collaborative learning platforms and multimedia production facilities.

UNITBV's digital transformation in teacher education is anchored by the Faculty of Psychology and Educational Sciences, established in 2004 (Transilvania University of Brașov, 2024a). This faculty serves as the university's primary centre for innovative teacher education, integrating digital competencies across all teacher preparation programs. The faculty offers comprehensive bachelor's programs in Education Sciences (3 years, 180 ECTS credits) in both full-time and distance learning formats, with curricula specifically redesigned to develop digital pedagogical skills (Transilvania University of Brașov, 2024a). The Teachers' Training Department of the faculty organises and implements psycho-pedagogical training programmes for the teaching profession, both for university students and higher education graduates. Level I (initial) graduates are eligible for teaching positions in pre-school, primary, lower secondary, vocational and lower secondary education, while Level II (advanced) graduates are certified to teach at all levels of the national pre-university education system. In 2024, the total number of people enrolled in DPPD programmes was 2,981, of which 2,624 were students in psycho-pedagogical training programmes (bachelor's and master's level) + 357 postgraduate students.

Research programmes

UNITBV faculty members are engaged in cutting-edge research that informs digital teacher training practices (Cazan, 2023). Key research includes the development of the Academic Adaptation Questionnaire (AAQ), conducted with over 500 first-year students, which provides information on the challenges of digital learning and informs support systems. The university has developed comprehensive digital competence assessment frameworks, including digital portfolio systems, online assessment platforms, virtual simulation environments and real-time feedback systems (Transilvania University of Brașov, 2024d).

The EnvEdu-OERs project (November 2020-October 2023), funded by the EEA Financial Mechanism, demonstrates the integration of environmental education with digital innovation (Transilvania University of Brașov, 2023). The project has developed an e-learning platform that incorporates IoT for real-time environmental monitoring, intelligent adaptive learning environments, AI/ML technologies and comprehensive analysis systems.

Teachers from several departments contributed their expertise in CAD, VR and AR to create innovative digital tools that enable students to design virtual environmental monitoring systems, create 3D models of the environment, develop AR applications for outdoor education and use advanced design software for sustainable classrooms.

Teacher development programmes

UNITBV implements a systematic teacher development programme, ensuring that all teacher trainers have advanced digital skills:

- Digital pedagogy certification programmes enable teachers who follow an extensive certification programme covering learning management systems, interactive content creation, online assessment design, virtual classroom management, educational technology integration and data analysis with comprehensive acquisitions in digital and

technology-assisted instruction.

- Annual digital innovation symposiums explore emerging technologies, including AI in educational assessment, blockchain for accreditation, VR/AR in teacher training, learning analytics, and IoT in classroom management.
- International teacher exchanges in digital education offer the opportunity for regular participation in international exchanges focused on innovation in digital education that brings best practices and establishes collaborative research relationships.

Programmes and implementations in digital education

Specialisation course in advanced digital teaching methods

UNITBV has developed a specialised curriculum that combines theoretical foundations with extensive practical experience. Students take courses in educational technology theory, digital learning design, VR/AR applications, AI in education, data analysis and digital citizenship. The course includes laboratory experiences with state-of-the-art technologies and internships at educational technology companies.

Laboratory experiences in educational technology integration

Comprehensive lab experiences provide hands-on experience with virtual reality educational simulations, augmented reality development platforms, collaborative robotics for STEM education, AI tutoring systems, and advanced video production facilities. Students complete structured rotations, develop original applications, and conduct effectiveness research.

Digital assessment skills development

The programmes train students in the use of digital assessment tools, advanced data analysis, learning analytics, digital portfolio management and online monitoring systems, using anonymised real student data for authentic learning experiences.

Blockchain technology and educational accreditation

Based on connections from the EBSI4RO initiative in Romania, UNITBV has developed innovative blockchain applications for teacher training (EBSI4RO Project, 2023):

- Comprehensive pilot programmes on digital certificate verification systems that enable secure and tamper-proof verification of teaching qualifications, supporting international mobility. A micro-certification platform that enables students to acquire and verify specific digital skills, with transparent professional development pathways.
- The integration of blockchain technology allows for the establishment of frameworks for the recognition of international certificates, facilitating student exchanges, international internships and the employment of graduates in several countries.

Advanced distance learning and blended models

UNITBV offers comprehensive distance learning programmes, maintaining academic rigour while offering flexibility through learning management systems, virtual classrooms, collaborative platforms and digital portfolio systems. Programmes include synchronous/asynchronous components, virtual office hours, access to remote laboratories and digital teaching simulations.

Innovative hybrid practical experiences

Innovative teaching approaches combine traditional observation with virtual reality teaching simulations, comprehensive video analysis, remote mentoring via digital platforms, and augmented reality applications that overlay instructional guidance on real classroom experiences.

Blended Intensive Programs

As an active participant through the UNITA (Universitas Montium) alliance, Transilvania University of Brasov is currently involved in a series of Blended Intensive Programs (BIP). The UNITA Erasmus BIPs aim at bringing together groups of students from at least three higher education institutions belonging to the UNITA - Universitas Montium alliance *UNITA Erasmus Blended Intensive Programme | University of Turin*. The university has implemented several BIPs, including “Forest management and biodiversity conservation,” “Project Management within the European Business Environment,” and “History, culture and traditions of mountain areas” *UNITA Erasmus Blended Intensive Programme | University of Turin*. These programs combine short-term physical mobility abroad with a compulsory virtual component *UNITA Erasmus Blended Intensive Programme | University of Turin*, typically offering 3 ECTS credits and conducted in English or multiple languages including French.

Career preparation and integration with national initiatives

UNITBV prepares graduates for enhanced traditional roles in teaching, with comprehensive digital integration skills, opportunities for specialisation in educational technology, including instructional design and consulting, as well as opportunities for international teaching through extensive partnership networks (Transilvania University of Brașov, 2024b).

The university strategically aligns itself with digital education initiatives in Romania, including EBSI4RO connections (EBSI4RO Project, 2023), integration of the EduApps/Clasa Viitorului platform (EduApps, 2024) and the use of the RoEduNet/ARNIEC infrastructure (National Agency for the Administration of the National IT Network for Education and Research, 2024). Alignment with the European Digital Education Action Plan ensures that institutional development is in line with continental priorities (European Commission, 2021). European partnerships through Erasmus+ projects, international research collaborations and student/teacher mobility programmes improve the quality of digital teacher training and its global relevance.

UNITBV’s comprehensive approach demonstrates the institutional commitment to preparing digitally competent educators who are ready for contemporary educational challenges, while contributing to the advancement of digital education at national and international level (National Agency for the Administration of the National Network for Education and Research, 2023; EDU CRED Project, 2024).

Teacher training programmes at UNITBV

The development of teacher training programmes at Transilvania University of Brașov (UNITBV) represents a comprehensive approach to preparing future educators within a structured framework that balances European standards with national requirements. Teacher training programmes at UNITBV are developed by the Department of Teacher Training (DPPD), which operates within the Faculty of Psychology and Education Sciences. These programmes aim to develop comprehensive digital teaching skills that enable teachers to develop in increasingly technology-rich learning environments. This competence encompasses much more than technical skills – it requires teachers to become skilled designers of digitally enhanced learning experiences, able to seamlessly integrate technology to support the achievement of meaningful educational outcomes.

Effective digital pedagogical skills also require skills in managing blended and fully online classrooms, where teachers face the unique challenges of maintaining student engagement, encouraging meaningful interactions and creating learning communities that provide support in different ways. In addition, teachers need to master the art of facilitating collaborative and interactive learning through digital platforms, understanding how to use technology to break down traditional barriers in the classroom and create dynamic, student-centred learning experiences. Assessment practices must also evolve, with teachers becoming experts in the use of digital formative and summative assessment tools that provide real-time feedback and support continuous improvement in learning. Equally important is developing a deep understanding of the ethical dimensions of digital education, including privacy protection, digital well-being and the responsible use of technology, ensuring that educational technology serves to enhance students' well-being, not compromise it.

The teachers' training programmes follow a systematic approach that integrates theoretical foundations with practical applications and are specifically designed for students who wish to pursue a teaching career at different levels of education. The subject they study within the psycho-pedagogical study programme, called *Computer-Assisted Instruction (CAI)*, illustrates this approach. It responds to the growing need to integrate technology into education. The programme is structured as a 2-credit course, with a duration of 28 hours per semester, equally divided between theoretical courses (14 hours) and practical seminars/laboratory work (14 hours).

The curriculum development process emphasises the creation of specialised teaching skills aligned with contemporary educational requirements. The programmes are designed to bridge the gap between traditional pedagogical approaches and modern technological requirements, ensuring that future teachers are equipped with both fundamental knowledge and innovative teaching methods.

The normative and ideological matrix that determines the structure of the curriculum

The structure of the curriculum underlying teacher training at UNITBV is determined by a multi-layered normative framework operating at European, national and institutional levels. This hierarchical approach ensures compliance with broader educational standards while maintaining institutional autonomy in programme delivery. The curriculum is unique throughout the country. All future teachers are required to take at least one subject involving the design and implementation of teaching activities using digital resources.

The integration of the European framework is explicitly visible in programmes' references to the European Union's educational policies and to the European Social Fund through the Sectoral Operational Programme for Human Resources Development 2007-2013.

The documentation shows direct funding and structural support from European initiatives, indicating alignment with EU educational standards and lifelong learning objectives. The emphasis on digital skills and open educational resources (OER) reflects European priorities in the field of educational innovation.

The national regulatory framework comply with the regulations of the Romanian Ministry of Education, as evidenced by references to the curriculum frameworks (*https://rocnee.eu/index.php/dcee-oriz/curriculum*), school curricula and methodological guidelines. Institutional partnerships with pre-university education structures (ISJ, CCD, CJRAE) demonstrate compliance with national standards and requirements for teacher training.

The institutional framework of UNITBV emphasises competence-based education, aligned with the Romanian National Qualifications Framework. The programmes focus on the development of specific professional competences (CP1, CP2, CP3) and transversal competences (CT1, CT3) that ensure that graduates meet both the pedagogical and ethical standards required for a teaching career.

Communication of learning objectives and outcomes

Learning objectives and outcomes are systematically described to students through multiple channels and documentation formats. The course syllabus (Course Description) provides comprehensive information about competencies, learning objectives and expected outcomes.

Students are informed about the three basic professional competencies they will develop:

- CP1: Competence in designing instructional and educational processes for different age groups and levels of student preparation
- CP2: Competence in carrying out specific activities within the teaching and educational process in pre-university education
- CP3: Competence in assessing learning processes, results and student progress

The programme also develops transversal skills, including the application of professional ethics (CT1) and lifelong learning methodologies (CT3), ensuring that graduates are able to adapt to constantly evolving educational contexts.

Students receive detailed information about specific objectives, including the development of basic knowledge and skills for selecting and using modern IT tools in teaching activities, the formation of specialised skills for operating electronic devices and digital educational resources, and an understanding of online educational content and resources.

These objectives are communicated through multiple formats: comprehensive course programmes, practical activity guides, digital portfolios and interactive learning platforms that provide students with clear progress indicators and assessment criteria.

Comprehensive student assessment framework

All teacher training programmes are aligned with the European Framework for Digital Competences for Teachers, with students progressing through competence levels from beginner (A1) to pioneer (C2) in six competence areas (European Commission, Joint Research Centre, 2022). The system includes detailed assessment rubrics, targeted learning experiences and specialised support. Students develop extensive digital portfolios documenting progress through lesson plans demonstrating the integration of technology, reflective video documentation, multimedia projects, evidence of professional communication and documentation of community involvement. The system includes peer assessment, teacher assessment, self-assessment and external assessment components.

Students complete extensive practical applications, including implementing technology-enhanced lessons, creating digital resources, facilitating online learning, digital assessment with data analysis, and leadership in professional development for practising educators.

Teacher training programmes should provide continuous professional development opportunities for both prospective teachers and serving teachers who wish to improve their digital skills throughout their careers. This continuous professional development should promote an innovative, flexible and adaptable mindset, recognising that the digital landscape continues to evolve rapidly and that educators need to be prepared to adopt new technologies and methodologies as they emerge. The integration of artificial intelligence in education is a particularly important development that teacher training programmes need to address comprehensively. AI technologies offer unprecedented opportunities for personalised learning, automated assessment and adaptive feedback systems, which can dramatically improve the effectiveness of education. However, preparing teachers to work with AI requires more than technical training – educators need to understand both the potential and limitations of AI tools, use them ethically and responsibly, and develop the ability to teach students critical thinking skills regarding algorithms, bias and data use.

At the same time, the prevalence of blended learning models requires teachers to develop sophisticated instructional design skills that work effectively in both face-to-face and online environments, master learning management systems, and maintain high levels of student engagement regardless of the mode of delivery. Perhaps most importantly, modern teacher training must prioritise digital citizenship as a core competence, recognising that teachers play a crucial role in promoting responsible, safe and informed digital behaviour among their students.

This responsibility goes beyond basic online safety and includes comprehensive media literacy, strategies to prevent cyberbullying and a deep understanding of digital rights and data protection principles. Teachers must be equipped to guide students in navigating complex digital environments, while promoting students' expression and meaningful participation in digital spaces. By integrating these skills into teacher training programmes, we can ensure that the next generation of educators is equipped to harness the full potential of digital technologies, while protecting the well-being and rights of all students in an increasingly connected world.

Initiatives to support teacher training

UNITBV implements several parallel initiatives that go beyond formal classroom training to support comprehensive teacher training:

- The institution maintains an e-learning platform (https://elearning.unitbv.ro) specifically for the computer-assisted training course, providing students with continuous access to resources, interactive materials and collaboration tools. This platform exemplifies the institution's commitment to shaping the technologies that future teachers will use in their own classrooms.
- The curriculum emphasises connection with professional communities of teachers through online platforms, collaboration spaces and social networks. Students are familiarised with resources such as virtual meeting spaces with teachers, communities for sharing educational resources, access to educational resources focused on specific topics, etc.
- The programme includes extensive practical components in which students develop educational software projects, create digital portfolios and engage in real-world applications of technology in the educational environment. These activities link theoretical knowledge with practical implementation skills.

Assistance and guidance during and after the learning process

UNITBV offers comprehensive support systems that extend throughout the students' learning process and into their professional practice:

- Students receive support through multiple channels, including tutoring (2 hours allocated), individual guidance, additional documentary resources and practical mentoring for projects. The assessment system combines formative and summative approaches, ensuring continuous feedback and opportunities for improvement.
- The programme emphasises collaborative learning through group projects, peer assessment systems and the development of shared resources. Students work in teams to develop educational software, creating a learning community that supports collaborative professional practices.
- The digital portfolio system provides ongoing documentation of skills development, allowing students to track their progress and receive continuous feedback from instructors, in formative evaluation. This approach supports reflective practice and professional development.
- Students are permanently connected with teachers, educational institutions, and professional organizations through partnerships between UNITBV and pre-university educational structures. These connections provide mentoring opportunities and potential career paths.

Future Directions and Strategic Development

UNITBV is actively integrating cutting-edge technologies into teacher education through several key initiatives. The university is developing AI-powered systems that offer personalized tutoring support, provide instant feedback on student work, and use predictive analytics to identify students who need additional help or advanced challenges.

The institution is also expanding its use of virtual and augmented reality to create immersive classroom simulations where future teachers can practice in safe environments. These technologies enable virtual field experiences that give students access to educational settings they couldn't otherwise visit, while augmented reality overlays provide real-time instructional guidance during actual teaching experiences.

Additionally, the university is implementing Internet of Things (IoT) solutions to create smarter educational environments. These include systems for monitoring classroom conditions, optimizing learning spaces, and collecting comprehensive data that helps educators better understand how students learn and how effective different teaching approaches are.

Transilvania University of Brașov has demonstrated good leadership in digital transformation of teacher education through comprehensive program development, innovative research initiatives, and practical implementations that serve both local and international educational communities. The university's approach combines rigorous academic preparation with extensive hands-on technology integration, ensuring that graduates are thoroughly prepared for the demands of modern educational environments.

Another accomplishment in digital teacher education stems from its commitment to faculty development, student-centered learning, international collaboration, and continuous innovation. The university's programs have evolved beyond simple technology adoption to embrace fundamental pedagogical transformation that leverages digital tools to enhance learning, improve accessibility, and prepare teachers for lifelong professional growth in increasingly digital educational contexts.

The EnvEdu-OERs project exemplifies UNITBV's ability to integrate multiple institutional priorities - digital transformation, environmental education, and community engagement - into coherent, impactful programs that serve diverse stakeholder communities. This project demonstrates how universities can lead in addressing complex contemporary challenges while maintaining focus on their core educational mission and community service responsibilities.

The adopted approach to teacher training represents a comprehensive model that balances European standards with national requirements while addressing contemporary educational challenges. The institution's emphasis on technology integration, competency-based learning, and collaborative professional development creates a solid framework for preparing effective educators. Through systematic curriculum development, clear communication of learning objectives, parallel support initiatives and comprehensive student support systems, UNITBV demonstrates its commitment to training well-prepared teachers who are able to respond to the ever-changing demands of modern education. The integration of digital technologies, the emphasis on open educational resources and the focus on collaborative learning environments position our teacher training programmes as ambitious initiatives that prepare educators for the classrooms of the 21st century, while maintaining solid pedagogical foundations.

Green Skills in Teacher Education

Objectives

- Deliver an in-depth analysis of existing UNITBV approaches to environmental education for educators;
- Assist teacher trainers, policy stakeholders, and educational administrators in harmonizing national and institutional strategies with the European Green Deal framework (2021–2027);
- Provide participants with actionable resources, frameworks, and exemplars for embedding sustainability principles within educator preparation programs;
- Encourage reflective analysis of educators' contributions to developing environmentally conscious and inclusive communities;
- Facilitate international collaboration and shared learning through comparative studies and proven methodologies from across European contexts.

Introduction

Green pedagogies represent a transformative approach to teacher education that position environmental consciousness, sustainability principles, and climate action at the core of educational practice. At *Transilvania* University of Brașov (UNITBV), this transformation has been embraced through comprehensive program development, innovative research initiatives, and concrete implementations that demonstrate the university's leadership in environmental teacher education across Romania and Europe. This chapter provides a detailed examination of UNITBV's specific contributions to green pedagogies in teacher education, documenting the university's current programs, projects, faculty expertise, and institutional innovations that have been developed and implemented over the past decade.

While contextualizing these efforts within broader European and Romanian environmental education frameworks, the primary focus is on sharing the concrete experiences, methodologies, and outcomes that UNITBV has achieved in preparing environmentally conscious and sustainability-focused educators. UNITBV's approach to green pedagogies exemplifies how higher education institutions can effectively integrate environmental education into teacher preparation while addressing local community needs, engaging in international collaboration, and developing innovative pedagogical approaches that serve as models for other institutions.

Green Pedagogies in Teacher Education

The environmental challenges of the 21st century demand a fundamental transformation in how we prepare educators to address climate change, biodiversity loss, and sustainability within their professional practice. Green pedagogies in teacher education represent an innovative and comprehensive approach that integrates environmental consciousness, sustainability principles, and climate action into the very foundation of educational preparation.

This transformative framework goes beyond typical environmental education by embedding ecological thinking across all aspects of teacher training, from curriculum design and pedagogical methods to institutional culture and community engagement. As educational institutions worldwide recognize their critical role in preparing environmentally literate citizens and change agents, teacher education programs are increasingly adopting green pedagogies that combine rigorous academic preparation with practical environmental action, community partnership, and innovative technology integration.

This evolution reflects a growing understanding that effective environmental education requires educators who are not only knowledgeable about environmental science and sustainability concepts, but who are also skilled in facilitating transformative learning experiences that inspire students to become active environmental advocates for sustainable development in their communities and beyond.

Sustainability in Education

Sustainability in education represents a transformative approach that extends far beyond simply incorporating environmental content into curricula.

This comprehensive framework focuses on fundamentally shaping values, behaviours, and systems to create a more just, equitable, and liveable future for all. In the context of teacher training, sustainability education emphasizes the development of a whole-educational institution approach that permeates every aspect of educational practice, from classroom instruction to institutional operations. This approach requires embedding systems thinking throughout teacher preparation programs, enabling future educators to understand and communicate the interconnected nature of environmental, social, and economic challenges. Teacher training programs must also support the development of cross-curricular links, empowering educators to integrate sustainability themes across diverse subject areas rather than treating environmental education as a separate, isolated topic.

Eco-Pedagogy

Drawing inspiration from Paulo Freire's transformative critical pedagogy, eco-pedagogy represents a revolutionary approach to environmental education that fundamentally links social justice and environmental justice as interconnected struggles for human dignity and planetary health. This pedagogical framework encourages critical reflection on unsustainable practices, challenging both teachers and learners to examine the systemic roots of environmental degradation while recognizing how environmental challenges disproportionately affect marginalized communities.

Eco-pedagogy empowers teachers and learners to become active agents of change, moving beyond passive consumption of environmental information to engage in meaningful action that addresses both environmental and social inequities. This approach recognizes that environmental education cannot be separated from broader questions of power, privilege, and social transformation.

Climate Literacy

Climate literacy encompasses the essential ability to understand the scientific basis of climate change while recognizing its profound societal, economic, and ethical impacts on communities worldwide. This comprehensive understanding enables individuals to make informed decisions

and take climate-positive action in their personal and professional lives.

For teacher education, building climate literacy means developing both confidence and competence among future educators to teach about climate change in ways that are factually accurate, emotionally supportive, and ethically grounded. Teachers must be prepared to address the complex scientific concepts underlying climate change while also helping students to process the emotional challenges of confronting environmental crises and empowering them to envision and work toward positive solutions.

Integrating Sustainability into Teacher Training Curricula

The successful embedding of sustainability into teacher training curricula requires both structural and curricular shifts that transform how educators are prepared for their professional roles. Curriculum design must include mandatory modules or topics that comprehensively address environmental science, climate ethics, and the United Nations Sustainable Development Goals, ensuring that all teachers graduate with foundational knowledge in these critical areas.

Teacher training programs should offer interdisciplinary projects that meaningfully link science, geography, arts, and civic education, demonstrating how sustainability themes can be woven throughout diverse academic disciplines.

Pedagogical training must equip teachers with the skills and confidence to facilitate experiential, outdoor, and inquiry-based learning experiences that connect students directly with environmental concepts and challenges. This preparation should emphasize place-based education and real-world case studies that help students understand environmental issues within their local contexts while developing global perspectives. Critically, teacher training must address the growing phenomenon of eco-anxiety among learners, preparing educators to acknowledge environmental challenges honestly while providing hopeful narratives and empowering students to engage in meaningful environmental action.

The institutional culture of teacher training programs must also reflect sustainability principles through greening campus operations and teaching practices, creating living laboratories where future teachers can experience sustainability in action. This cultural transformation includes encouraging ongoing teacher reflection on their own consumption patterns and environmental impact, modelling the kind of critical self-examination that teachers will need to facilitate with their students throughout their careers.

European and Romanian Environmental Education Context

European Framework and Green Transition Priorities

The European competence framework on sustainability (GreenComp) provides a structured approach to developing green pedagogies, defining four key competence areas: embodying sustainability values, embracing complexity in sustainability, envisioning sustainable futures, and acting for sustainability. The European Green Deal recognizes education as a transformational force in the shift toward sustainability, emphasizing the development of green skills, climate literacy, and environmental awareness across all educational levels.

Romanian National Environmental Education Strategy

Romania made history in January 2023 by adopting the National Strategy on Education for the Environment and Climate Change 2023-2030, marking the first time that Romania has adopted a national strategy dedicated to education for the environment and climate change. This strategy establishes clear actions to increase environmental education and awareness among children and young people regarding sustainable development and environmental responsibility. The strategy emerges from the project of the Presidential Administration in Romania, *Educated Romania*, which aims to cultivate respect for the environment as part of the values promoted through education. Romania is establishing a network of green schools that combine green infrastructure with curricula and pedagogies based on learning for sustainability, with all schools and preschools organizing annual "*Green weeks*" on climate-related topics.

Various Romanian organizations contribute to environmental education: Teach for Romania's "*Green for Generation Alpha*" program reaches 109 schools and 17 kindergartens in vulnerable communities with 145 teachers working with 2,900 students; *Green initiative*, a Romanian environmental NGO, has worked with over 25 schools, more than 5,500 students, and 200 teachers in projects focusing on climate change, energy sustainability, and resource conservation.

UNITBV's Institutional Commitment to Environmental Education

Strategic Environmental Education Framework

Transilvania University of Brașov has established environmental education as a strategic institutional priority, reflected in its comprehensive approach to sustainability across all 18 faculties offering 43 study programmes. As the largest and most prestigious university in central Romania, UNITBV has leveraged its comprehensive structure to create an integrated environmental education ecosystem that spans multiple disciplines and serves diverse stakeholder communities. The university's mission explicitly includes enhancing interaction between the university and society through partnerships, positioning UNITBV as a bridge between academic environmental knowledge and community environmental action. This mission is operationalized through specific environmental education initiatives that engage rural communities, local government representatives, and educational professionals in comprehensive sustainability learning experiences.

Multi-Departmental Environmental Education Integration

UNITBV's approach to green pedagogies is characterized by systematic integration across multiple departments, creating interdisciplinary learning experiences that reflect the complex nature of environmental challenges:

- Department of Product Design, Mechatronics and Environment: This department serves as the primary hub for environmental science education, housing faculty with expertise in environmental monitoring, environmental analysis, environmental quality assessment, materials for solar energy conversion, photocatalysis, ecotoxicology, biomass waste recycling, biofuels, bio-fertilizers, and advanced materials for wastewater treatment.

- Department of Social Sciences and Communication: Contributing expertise in sociology of community development, environmental communication, social marketing for environmental causes, and community-based approaches to environmental education.
- Department of Law: Providing essential knowledge in environmental law, environmental management systems, waste management regulations, and environmental liability frameworks.
- Department of Mathematics and Computer Science: Contributing technological expertise in digital resource development, smart learning environments, and Internet of Things applications for environmental monitoring and education.
- This multi-departmental approach ensures that teacher education provides comprehensive preparation encompassing scientific, social, legal, and technological dimensions of environmental challenges.

The EnvEdu-OERs Project: UNITBV's Flagship Environmental Education Initiative

Environmental Education – OERs for Rural Citizens (EnvEdu-OERs) represents UNITBV's most significant contribution to environmental teacher education, implemented from November 1, 2020, to October 31, 2023, with financial support from The Education, Scholarships, Apprenticeships and Youth Entrepreneurship Programme (ESAYEP), one of the 12 financing programmes of the EEA Financial Mechanism, 2014-2021.

This project demonstrates UNITBV's innovative approach to environmental education that extends beyond traditional academic boundaries to engage rural communities directly in environmental learning. The project's scope includes environmental education through Open Educational Resources for rural local administration representatives and rural citizens, representing a unique model for community-engaged environmental teacher education. The EnvEdu-OERs project showcases UNITBV's interdisciplinary approach to environmental education, bringing together experts from multiple departments to create comprehensive learning experiences.

Environmental Science and Technology Leadership

Faculty staff from the Department of Product Design, Mechatronics and Environment provide scientific leadership for the project. The project coordinator brings extensive expertise in environmental monitoring, environmental analysis, and soil science, overseeing all aspects of project implementation including comprehensive project coordination and management, organization of transnational project meetings and multiplier events, leadership in intellectual outputs production, and coordination of research paper contributions and dissemination activities.

Some faculty members with expertise in materials for solar energy conversion, photocatalysis, and education for sustainable development contributed to development of Open Educational Resources (OERs) content that integrates cutting-edge environmental science with accessible community education approaches, leadership in teaching modules focused on sustainable rural community development, and development of policy recommendations based on research findings and community engagement experiences.

Other faculty members, specialized in ecotoxicology, biomass waste recycling, biofuels, and bio-fertilizers developed teaching modules addressing practical sustainability solutions that rural communities can implement, contributes to research papers advancing knowledge in environmental education and waste management, and organizes multiplier events that engage broader communities in environmental learning.

Faculty expertise in photocatalysis and thin films for solar energy conversion and wastewater treatment contributes to development of teaching modules addressing critical environmental health issues in rural areas, including wastewater management and sustainable practices for improving water cycles in local communities.

Legal and Policy Framework Integration

Faculty staff from the Department of Law provide essential expertise in environmental law, environmental management systems, waste management, and European law. Their contributions ensure that environmental education includes understanding of legal frameworks and regulatory requirements, development of teaching modules on legislation related to environmental quality, research paper contributions exploring the intersection of environmental law and environmental education, and development of policy recommendations that can inform regulatory frameworks for environmental education.

Community Development and Communication Expertise

Teachers from the Department of Social Sciences and Communication brought expertise in sociology of community development, social communication, and sociology of interethnic relations. Their contributions ensured that environmental education addresses social and cultural dimensions of environmental challenges through development of teaching modules on sustainable rural community development and communication skills for environmental education, research contributions exploring social dimensions of environmental education, and organization of multiplier events engaging diverse community stakeholders.

Faculty expertise in marketing, branding, destination marketing, community-based tourism, and project-based learning provides marketing and communication perspectives on environmental initiatives, focusing on effective communication strategies for environmental education, and utilizing professional marketing and communication strategies to share project outcomes.

Technology Integration and Digital Innovation

Faculty from the Department of Mathematics and Computer Science bring essential expertise in distributed systems, distance teaching and learning, and development of digital educational resources. Their contributions ensure that UNITBV's environmental education initiatives leverage cutting-edge digital technologies through leadership in intellectual outputs production creating innovative digital resources, coordination of teaching modules digital development, development and implementation of Open Educational Resources (OERs), and leadership in e-learning platform and project website development.

Faculty from the Department of Automotive and Transport Engineering contribute expertise in Computer Aided Design, Virtual Reality, Augmented Reality, and eLearning environments, providing organization of transnational project meetings utilizing advanced digital technologies, leadership in intellectual outputs production incorporating cutting-edge digital design and visualization technologies, and development of teaching modules integrating advanced digital

technologies with environmental education content.

Comprehensive Teaching Module Development and Implementation

UNITBV's EnvEdu-OERs project has developed a comprehensive suite of teaching modules that demonstrate innovative approaches to environmental teacher education.

TM1.1 Sustainable Rural Community Development

This foundational module integrates multiple perspectives on rural community development within environmental contexts. The module development team ensures interdisciplinary integration of environmental science, sociology, and communication perspectives. The module addresses environmental challenges specific to rural communities, social and economic factors influencing environmental decision-making in rural contexts, communication strategies for engaging rural communities in environmental initiatives, marketing and promotion approaches for environmental programs in rural areas, community development strategies integrating environmental sustainability, and case studies of successful rural environmental initiatives.

TM1.2 Development of Communication Skills

This module focuses on essential communication skills for environmental education, recognizing that effective environmental education requires sophisticated communication abilities that can engage diverse audiences and motivate behaviour change. The module covers communication theory and practice for environmental education, audience analysis and message adaptation for environmental topics, visual communication and multimedia production for environmental education, community engagement strategies for environmental initiatives, conflict resolution and negotiation skills for environmental challenges, and cross-cultural communication for international environmental collaboration.

TM2.1 Environmental Quality – Air, Water and Soil

This comprehensive environmental science module provides essential scientific foundations for environmental education while maintaining accessibility for non-specialist audiences. The module addresses scientific principles of air quality assessment and monitoring, water quality indicators, testing methods, and improvement strategies, soil science fundamentals and soil conservation practices, environmental monitoring technologies and methodologies, data collection, analysis, and interpretation for environmental assessment, and practical applications of environmental quality assessment in educational settings.

TM2.2 Legislation Related to Environmental Quality

This module ensures that environmental education includes understanding of legal and regulatory frameworks, addressing the complex relationship between environmental science, policy, and law. The module covers European Union environmental legislation and policy frameworks, Romanian national environmental laws and regulations, local and regional environmental governance structures, environmental impact assessment procedures and requirements, environmental liability and responsibility frameworks, and legal mechanisms for environmental protection and enforcement.

TM4.2 Biomass and Household Waste

This module addresses practical aspects of waste management and resource recovery particularly relevant to rural communities, demonstrating how environmental education can address immediate practical needs while building broader environmental awareness. The module includes biomass resource assessment and utilization strategies, household waste reduction, reuse, and recycling approaches, composting and organic waste management techniques, biofuel production from agricultural waste materials, bio-fertilizer development and application methods, and economic analysis of waste-to-resource conversion projects.

TM5.1 Water Resources and TM5.2 Water Waste Management

These modules address comprehensive water resource management in rural contexts, integrating scientific understanding with practical management strategies. The modules address water resource assessment and characterization methods, water conservation strategies for rural communities, watershed management principles and practices, water quality protection and improvement strategies, wastewater treatment technologies appropriate for rural contexts, and sustainable practices for improving water cycles in local communities.

TM5.3 Sustainable Practices for Improving the Water Cycle

This module focuses on practical interventions that communities can implement to improve local water cycles, including rainwater harvesting and management systems, wetland restoration and construction techniques, soil conservation practices that improve water retention, native vegetation restoration for watershed protection, and integrated water management approaches that combine multiple strategies.

Open Educational Resources Development and Innovation

UNITBV's EnvEdu-OERs project represents a significant innovation in making environmental education resources freely available to global audiences.

Comprehensive Digital Resource Development: The project has created extensive digital resources including interactive online modules that combine text, video, and interactive elements, multimedia presentations that make complex environmental concepts accessible, virtual laboratory experiences that simulate environmental monitoring and analysis, digital field guides for environmental assessment and species identification, and collaborative project templates that enable community-based environmental initiatives.

Community Engagement Platform Development: The project developed sophisticated platforms that enable teacher education students to engage effectively with rural communities, including mobile applications for environmental data collection that can be used by community members with varying technical expertise, online platforms for community environmental education providing accessible, multilingual content, digital storytelling tools for sharing environmental knowledge incorporating video, audio, and interactive elements, and virtual meeting spaces that enable collaboration between academic institutions and rural communities.

Multilingual and Accessible Resource Design: Recognizing Romania's linguistic diversity and international partnerships, UNITBV developed comprehensive multilingual resources including automated translation capabilities for key content, accessibility features for users with disabilities, cultural adaptation frameworks for different community contexts, and technical support systems for users with limited digital literacy.

UNITBV's Environmental Education Curriculum Integration

UNITBV has systematically integrated environmental education across its teacher education curriculum through several major implementations.

Environmental Education Specialization Track is a specialized curriculum track developed by the university that provides teacher education students with comprehensive preparation in environmental education pedagogy. This track includes courses in environmental science foundations for educators, environmental education theory and practice, outdoor and place-based education methodologies, community engagement strategies for environmental education, assessment and evaluation approaches for environmental learning, and integration of environmental themes across subject areas.

Students completing this track gain practical experience through partnerships with local schools, environmental organizations, and community groups, developing and implementing environmental education programs in authentic settings.

Interdisciplinary Environmental Project Requirements allow all teacher education students to complete interdisciplinary environmental projects that require collaboration across multiple departments and integration of diverse perspectives on environmental challenges. These projects involve partnership with community organizations or local government agencies, integration of scientific, social, and policy perspectives on environmental issues, development of educational materials and programs for specific target audiences, implementation and evaluation of environmental education interventions, documentation and dissemination of project outcomes.

Field-Based Environmental Education Experiences is mandatory. UNITBV requires all teacher education students to complete extensive field-based environmental education experiences that provide direct engagement with natural environments and environmental challenges. These experiences include guided field studies in local ecosystems and environmental sites, participation in environmental monitoring and data collection activities, collaboration with environmental scientists and conservation professionals, development of outdoor education skills and safety protocols, and creation of field-based educational materials and activities.

Environmental Education Research and Innovation Programs

UNITBV has established comprehensive research programs that engage teacher education students in cutting-edge environmental education research.

Student Research Participation Programs involve teacher education students in faculty research projects focusing on environmental education effectiveness, community engagement strategies for environmental education, technology integration in environmental education, and assessment approaches for environmental learning outcomes. Students gain experience in research design and methodology, data collection and analysis techniques, academic writing and presentation skills, and collaboration with research professionals.

Community-Based Research Initiatives are facilitated by UNITBV. Community-based research projects that address real environmental challenges while providing learning opportunities for teacher education students are organized in diverse partnerships. These initiatives involve partnership with local communities to identify environmental education needs, collaborative development of research questions and methodologies, implementation of research projects with community participation, analysis and interpretation of findings with community input, and development of recommendations and action plans based on research outcomes.

Innovation in Environmental Education Technology enhance UNITBV support to student innovation in developing technology applications for environmental education, including development of mobile applications for environmental monitoring and education, creation of virtual and augmented reality experiences for environmental learning, design of online platforms for environmental education and community engagement, and evaluation of technology effectiveness in environmental education contexts.

International Environmental Education Partnerships and Collaboration

UNITBV actively participates in European networks and initiatives focused on environmental education.

NATURE-DEMO Project Engagement allows UNITBV to provide teacher education students with exposure to cutting-edge research on climate adaptation and infrastructure resilience through connections with the NATURE-DEMO project focusing on Nature-Based Solutions for Climate-Resilient Infrastructure. Students gain understanding of how climate disruptions affect infrastructure systems, learn about nature-based solutions for climate adaptation, participate in research on climate-resilient infrastructure design, and develop educational materials on infrastructure and climate change.

WeNaTour Sustainable Tourism Education Collaboration, through UNITBV's participation in the WeNaTour Project, a European Alliance for Innovation and Sustainability Education in Welfare, Nature and Tourism, provides teacher education students with opportunities to explore connections between environmental education and sustainable tourism. Students learn about sustainable tourism destination management, participate in field-based training experiences in sustainable tourism contexts, develop educational materials for sustainable tourism education, and engage with international networks of sustainable tourism professionals.

Erasmus+ Environmental Education Project Participation is an opportunity for UNITBV to actively engage in Erasmus+ projects focused on environmental education, providing students and faculty with exposure to diverse international approaches and best practices. These projects involve collaborative curriculum development with European partner institutions, student and faculty exchange programs focused on environmental education, joint research projects on environmental education effectiveness, and development of shared resources and methodologies for environmental education.

International Research Collaboration and Knowledge Exchange

UNITBV maintains extensive international research collaborations that enhance environmental education programs.

Joint Research Projects with European Institutions allow faculty staff and students to participate in international research projects focusing on environmental education effectiveness across different cultural contexts, community engagement strategies for environmental education, technology integration in environmental education, and policy frameworks for environmental education development.

International Conference Participation and Presentation are scientific events in which UNITBV faculty staff and students regularly participate on environmental education topics, presenting research findings on innovative environmental education approaches, sharing best practices from UNITBV's environmental education programs, establishing collaborative relationships with international researchers and practitioners, and contributing to global knowledge networks in

environmental education.

Publication and Dissemination of Research Findings of UNITBV faculty staff, who actively publish research findings in international journals and conference proceedings, contribute to the global knowledge base on environmental education while gaining recognition for innovative approaches developed at the university.

Environmental Education Assessment and Evaluation Systems

UNITBV has developed systems for assessing student learning and competency development in environmental education.

GreenComp Competency Framework Integration is ensured. All environmental education programs are aligned with the European sustainability competence framework (GreenComp), with students progressing through clearly defined competency levels across four key areas: embodying sustainability values, embracing complexity in sustainability, envisioning sustainable futures, and acting for sustainability.

The university has developed detailed assessment rubrics for each competency area, has provided targeted learning experiences for competency development, has offered specialized support for students needing additional assistance, and tracks student progress across multiple competency dimensions.

Portfolio-Based Assessment Systems is largely used in the evaluation process. Students develop comprehensive portfolios documenting their environmental education learning and competency development, including detailed environmental education lesson plans demonstrating integration of scientific content with pedagogical practice, comprehensive reflections on environmental education experiences with documentation of learning outcomes, multimedia projects demonstrating environmental communication skills, evidence of community engagement through environmental education initiatives, and documentation of environmental action projects and their outcomes.

Performance-Based Assessment and Demonstration has transformed the evaluation process. All students complete extensive performance-based assessments that demonstrate readiness for environmental education practice, including design and implementation of environmental education programs in authentic community settings, benefit from the facilitation of environmental education experiences for diverse learner populations, conduct of environmental monitoring and assessment activities with educational components, leadership of environmental action projects with measurable outcomes, and professional presentation of environmental education research and practice.

Program Evaluation and Continuous Improvement

UNITBV has established systematic approaches to program evaluation and improvement in environmental education.

Regular Program Assessment and Review is provided through annual evaluations of environmental education programs include comprehensive assessment of student learning outcomes, faculty evaluation of program effectiveness and areas for improvement, community partner feedback on program relevance and impact, and comparison with international best practices in environmental education.

Stakeholder Engagement and Feedback Systems are the expression of the ongoing engagement with schools, environmental organizations, community groups, and government agencies ensures that UNITBV's environmental education programs remain relevant and responsive to evolving needs. This includes regular surveys and feedback sessions with program stakeholders, advisory committees including external environmental education professionals, and partnership evaluation processes that assess collaborative relationship effectiveness.

Innovation and Adaptation Processes are continuously addressed. The university maintains systematic processes for innovation and adaptation in environmental education, including regular review of emerging environmental challenges and their educational implications, evaluation of new technologies and methodologies for environmental education, assessment of changing community needs and priorities, and integration of new research findings into program design and implementation.

Community Engagement and Social Impact

UNITBV has established extensive partnerships with rural communities that provide authentic learning experiences for teacher education students while addressing real community environmental education needs.

Direct Community Collaboration is ensured through the EnvEdu-OERs project and other initiatives, UNITBV maintains ongoing partnerships with rural communities throughout central Romania, providing environmental education resources and support while offering teacher education students opportunities for community-based learning. These partnerships involve regular communication and collaboration with community leaders and residents, development of environmental education programs tailored to specific community needs and contexts, implementation of environmental monitoring and improvement projects with community participation, and long-term relationship building that supports sustained environmental education efforts.

Local Government Engagement enables UNITBV to work directly with local government agencies and officials to provide environmental education support and training, including development of environmental education materials for local government use, training programs for local officials on environmental education and community engagement, technical assistance for environmental assessment and monitoring initiatives, and policy development support for local environmental education initiatives.

Environmental Organization Partnerships allow the university to maintain collaborative relationships with environmental NGOs and organizations throughout Romania, providing opportunities for teacher education students to engage with professional environmental educators and activists, participate in environmental conservation and restoration projects, learn about diverse approaches to environmental education and advocacy, and develop professional networks in environmental education and conservation fields.

Measurable Community Impact Outcomes

UNITBV's environmental education initiatives have generated measurable impacts in partner communities.

Enhanced Environmental Awareness and Knowledge have been highlighted. Evaluation studies demonstrate increased environmental knowledge and awareness among community participants in UNITBV's environmental education programs, with participants showing

improved understanding of local environmental challenges and solutions, increased awareness of environmental regulations and policies, and enhanced ability to participate in environmental decision-making processes.

Behavioural Change and Action have been addressed through several actions. Community participants in UNITBV programs demonstrate measurable changes in environmental behaviours, including adoption of waste reduction and recycling practices, implementation of energy conservation measures, participation in environmental monitoring and restoration activities, and engagement in environmental advocacy and policy processes.

Capacity Building and Leadership Development have been demonstrated. UNITBV's programs have contributed to development of local environmental education capacity, including training of community members as environmental education leaders, establishment of ongoing environmental education programs in partner communities, development of local environmental monitoring and assessment capabilities, and creation of community networks focused on environmental education and action.

Postgraduate professional development courses at *Transilvania* University of Brașov

These four postgraduate professional development courses at *Transilvania* University of Brașov represent a comprehensive approach to advancing sustainable technology expertise among environmental professionals. Each course targets critical areas of environmental innovation and practical sustainability implementation.

The Photovoltaic Systems in Sustainable Communities course aims to develop expertise in community-scale renewable energy implementation. This program focuses on empowering professionals to design, implement, and maintain solar energy systems that serve entire communities rather than individual buildings. Participants learn to assess community energy needs, design appropriate photovoltaic installations, navigate grid integration challenges, and develop financing strategies for community solar projects. The course emphasizes the social and economic dimensions of renewable energy adoption, preparing professionals to work with local governments, community organizations, and residents to implement sustainable energy solutions that can serve as models for broader renewable energy transition.

Solar Thermal Systems Implemented in Built Environment targets the integration of solar thermal technology into existing and new construction projects. This course aims to bridge the gap between renewable energy technology and practical building applications, training professionals to optimize solar thermal systems for heating, cooling, and hot water production in various building contexts. Participants gain expertise in system design, performance optimization, installation protocols, and maintenance strategies, with particular emphasis on retrofitting existing buildings and integrating solar thermal solutions into new construction projects. The course addresses both technical and regulatory aspects of solar thermal implementation, preparing professionals to navigate building codes, permitting processes, and performance standards.

The Development of Composite Materials Based on Waste Materials course aims to advance circular economy principles through innovative materials science. This program targets the critical challenge of waste management by teaching professionals to transform waste streams into valuable composite materials with superior performance characteristics. Participants learn waste characterization techniques, composite design principles, manufacturing processes, and quality assessment methods. The course emphasizes life cycle thinking and environmental

impact assessment, preparing professionals to develop commercially viable products that simultaneously address waste management challenges and create economic value. This approach directly supports sustainability goals by reducing waste disposal needs while creating new material resources.

Water Purification for Reuse course addresses the growing global challenge of water scarcity through advanced treatment and reuse technologies. This course aims to develop expertise in transforming wastewater and contaminated water sources into high-quality water suitable for various reuse applications. Participants learn advanced treatment technologies, system design principles, water quality assessment methods, and regulatory compliance requirements. The course emphasizes practical implementation strategies for industrial, municipal, and community-scale water reuse projects, preparing professionals to develop sustainable water management solutions that reduce freshwater consumption while meeting growing water demands.

Collectively, these courses aim to create a team of highly skilled professionals capable of implementing practical sustainability solutions in their communities and organizations. By combining cutting-edge technical training with practical implementation strategies, these programs prepare participants to become leaders in the transition toward sustainable communities, contributing to environmental education through their professional practice and community engagement.

Emerging Trends in Environmental Education

UNITBV continues to adapt its environmental education programs to address emerging trends and challenges. Climate Change Education Enhancement is a main objective. The university is expanding programs specifically focused on climate change education, including development of climate science literacy programs for teacher education students, integration of climate adaptation and mitigation strategies into environmental education curricula, collaboration with climate scientists and policy experts to provide current and accurate climate information, and development of climate action projects that engage students and communities in climate response efforts.

Regenerative and Nature-Positive Approaches are parts of the development strategy. Building on emerging trends in environmental education, UNITBV is developing programs that emphasize regenerative approaches to environmental education, including focus on restoration and enhancement of environmental systems rather than simply conservation and protection, integration of indigenous and traditional ecological knowledge into environmental education programs, development of nature-positive educational experiences that actively contribute to environmental improvement, and promotion of biophilic design and nature connection in educational settings.

Digital Innovation in Environmental Education emerge in the current context. The university continues to develop innovative digital approaches to environmental education, including virtual and augmented reality applications for environmental learning experiences, Internet of Things (IoT) systems for environmental monitoring and education, artificial intelligence applications for personalized environmental education, and online platforms for global environmental education collaboration and knowledge sharing.

Institutional Sustainability and Green Campus Initiatives

UNITBV is implementing comprehensive campus sustainability initiatives that serve as living laboratories for environmental education.

Campus Sustainability as Curriculum represents a sustainable initiative. The university's campus sustainability initiatives provide authentic learning experiences for teacher education students, including participation in campus environmental assessment and monitoring, development of sustainability education programs for campus community, leadership of campus environmental improvement projects, and research on campus sustainability practices and their educational applications.

Green Building and Infrastructure are current concerns. UNITBV is implementing green building and infrastructure projects that demonstrate sustainable design principles and provide educational opportunities, including energy-efficient building design and renewable energy systems, sustainable water management and conservation systems, native landscaping and biodiversity enhancement projects, and waste reduction and recycling program expansion.

Sustainable Transportation and Mobility is a main focus. The university is developing sustainable transportation initiatives that reduce environmental impact while providing educational opportunities, including promotion of active transportation options such as walking and cycling, development of public transportation partnerships and incentives, implementation of electric vehicle charging infrastructure, and creation of educational programs on sustainable transportation options.

Conclusions

Transilvania University of Brașov has positioned itself as a leader in green pedagogies and environmental teacher education through comprehensive program development, innovative research initiatives, and extensive community engagement that serves both local and international environmental education communities. The approach university demonstrates how higher education institutions can effectively integrate environmental education across multiple disciplines while maintaining academic rigor and addressing real-world environmental challenges

The success of UNITBV in environmental teacher education stems from its commitment to interdisciplinary collaboration, community partnership, international cooperation, and continuous innovation. The university's programs have evolved beyond traditional environmental science education to embrace comprehensive approaches that integrate scientific, social, legal, and technological perspectives on environmental challenges, preparing teachers who can address complex environmental issues through education.

The EnvEdu-OERs project exemplifies UNITBV's ability to combine multiple institutional priorities - environmental education, community engagement, international collaboration, and digital innovation - into coherent, impactful programs that serve diverse stakeholder communities while advancing knowledge and practice in environmental education.

As UNITBV continues to develop and enhance its environmental education programs, the university's experience provides valuable models and insights for other institutions seeking to implement similar initiatives. The combination of rigorous academic preparation, extensive community engagement, international collaboration, and innovative technology integration that characterizes UNITBV's approach offers a replicable framework for environmental teacher education that can be adapted to various institutional and cultural contexts.

UNITBV's commitment to addressing contemporary environmental challenges through education positions the university as a continuing leader in green pedagogies, contributing to the development of environmentally conscious educators who are prepared to address complex environmental challenges while inspiring and empowering future generations to become environmental stewards and advocates for sustainable development.

Integrated Practices: Green and Digital Skills

Objectives

- Demonstrate understanding the fundamental relationship between digital and environmental approaches;
- Design project-based learning experiences that integrate digital tools with environmental themes to create authentic, future-focused learning experiences for students;
- Facilitate cross-disciplinary collaboration between environmental science, technology, and education, preparing educators to unite diverse knowledge domains in meaningful educational practice;
- Reflect on personal ecological and digital footprints as educators while developing the capacity to prepare digitally skilled and eco-conscious citizens for sustainable futures.

Transilvania University of Brașov (UNITBV) has strategically positioned itself at the forefront of integrating sustainability and digital innovation through its €7 million "Digital Transformation for Innovation and Competitiveness" project, funded through Romania's National Recovery and Resilience Plan (PNRR). The university's comprehensive approach demonstrates clear synergies between environmental consciousness and technological advancement, particularly through:

- Digital labs for environmental science provide virtual reality systems, 3D scanners, and integrated sensors for environmental monitoring applications in medicine, environment, and agriculture
- Project-based learning combining technology and green issues are cross-disciplinary programs that unite environmental research with digital innovation
- Cross-cutting Erasmus+ programs are appropriate opportunities. The EnvEdu-OERs project exemplifying environmental education through Open Educational Resources for rural communities is just one example.

Digital transformation and environmental sustainability are often treated as separate domains—but they can mutually reinforce each other. Teacher education at UNITBV helps future educators see and design for these synergies, empowering learners to become both eco-conscious and digitally skilled citizens.

Synergies between Sustainability and Digital Innovation

The integration of green and digital approaches at UNITBV creates powerful opportunities for transformative education. Key examples include:

- **Digital labs for environmental science**
  - Advanced virtual reality systems for simulating climate scenarios and biodiversity research
  - Data modelling capabilities for environmental impact assessments and waste management solutions
  - Integrated sensor networks for real-time air and water quality monitoring
- **Citizen science platforms**
  - Students contribute to environmental research through digital applications tracking local ecological data
  - Community-based projects connecting rural citizens with environmental education resources
  - Building skills in data literacy, collaboration, and environmental responsibility
- **Sustainable use of technology**
  - Promoting environmentally friendly practices in all university activities
  - Teaching about energy-efficient devices, e-waste management, and ethical technology consumption
  - Encouraging adoption of green IT policies across campus infrastructure
- **Digital storytelling for climate action**
  - Using multimedia tools to raise awareness about local environmental challenges
  - Developing communication strategies for environmental advocacy in rural communities
  - Integrating creativity, research, and environmental activism

Project-Based Learning Combining Tech and Green Issues

Project-based learning (PBL) serves as UNITBV's cornerstone pedagogical approach for cross-cutting green and digital themes. Teacher education programs prepare educators to design and facilitate innovative projects such as:

- **"Smart Environmental Monitoring" Projects**
  - Students utilize IoT sensors and 3D scanning technology to monitor environmental conditions
  - Integrating biology, engineering, and sustainable development principles

- **Digital Eco-Audits**
  - Students assess campus energy usage and carbon footprints using advanced data processing systems
  - Results shared digitally with stakeholders to drive real environmental action
- **Sustainable Innovation with AR/VR**
  - Virtual reality applications for reimagining greener urban spaces and sustainable design
  - Merging environmental science, geography, and digital innovation
- **Environmental Communication Campaigns**
  - Creating digital content promoting sustainable practices in rural and urban communities
  - Encouraging authentic communication, digital citizenship, and environmental advocacy
- UNITBV's teacher educators and institutional leaders actively:
  - Model and assess cross-disciplinary thinking uniting technology and sustainability
  - Organize training courses for effective digital technology use and implementation of digital education principles
  - Prepare teachers to create authentic, future-focused learning experiences
  - Help trainees reflect on their own ecological and digital footprints
  - Encourage co-design with learners to solve real-world environmental problems using digital tools

Through these integrated approaches, UNITBV demonstrates how higher education institutions can effectively bridge the digital-environmental divide, preparing educators who understand that technological innovation and environmental stewardship are not competing priorities, but complementary pathways to sustainable futures.

Methodologies & Pedagogical Approaches

Contemporary teacher education must embrace transformative pedagogical approaches that prepare educators for the complexities of 21st-century classrooms. As European educational systems face unprecedented challenges—from climate change and digital transformation to increasing cultural diversity and social inequality—teacher preparation programs require methodologies that are both innovative and responsive to these evolving realities. The integration of inquiry-based learning, place-based and experiential education, interdisciplinary collaboration, and culturally responsive teaching represents a fundamental shift toward learner-centered approaches that empower both teachers and students.

This paradigmatic evolution emphasizes innovative, learner-centered teaching methods that empower teachers to respond effectively to complex societal challenges such as climate change, digitalization, and inclusion while promoting active engagement and critical thinking. These methodologies prepare students for intercultural and sustainable citizenship, fostering

educational environments where diversity is celebrated as a strength and where learning transcends traditional disciplinary boundaries.

Inquiry-Based Learning (IBL)

Inquiry-based learning stands as a cornerstone of progressive teacher education, representing a student-centered approach that fundamentally transforms the traditional teacher-student dynamic. This methodology encourages learners to ask meaningful questions, investigate real-world problems systematically, collect and analyze evidence rigorously, and draw conclusions that lead to informed action. Rather than passive recipients of information, students become active researchers and critical thinkers who construct their own understanding through guided discovery.

The significance of IBL in teacher education cannot be overstated. It fosters critical thinking and scientific literacy by requiring learners to evaluate sources, analyze data, and synthesize information from multiple perspectives. This approach develops teachers' capacity to facilitate open-ended learning experiences where outcomes are not predetermined, requiring educators to become skilled facilitators rather than mere content deliverers. Furthermore, IBL prepares future educators to design cross-curricular projects rooted in authentic investigation, breaking down artificial barriers between subjects.

Consider a practical example where a teacher training module guides participants to design a comprehensive unit around the question: "How does our school impact the local environment?" This inquiry-driven project would engage learners in collecting environmental data through various methods, consulting diverse stakeholders including administrators, custodial staff, local environmental experts, and community members. Students would utilize digital tools such as online surveys, GIS mapping software, and data visualization platforms to analyze their findings. The culminating experience involves proposing evidence-based solutions that address identified environmental challenges, potentially leading to real policy changes within the school community.

This approach transforms teacher trainees from passive learners into active researchers who understand how to guide their future students through similar investigative processes. The experience of conducting authentic research provides teachers with firsthand knowledge of the challenges and rewards of inquiry-based learning, making them more effective facilitators of student-driven discovery.

Place-Based and Experiential Education

Place-based education represents a powerful pedagogical approach that connects learning directly to local environments, communities, and cultures, while experiential learning emphasizes hands-on, reflective engagement with real-life situations. This methodology recognizes that meaningful learning occurs when students can connect abstract concepts to their immediate surroundings and lived experiences.

The effectiveness of place-based and experiential education stems from its ability to strengthen learners' sense of agency, relevance, and belonging. When students engage with their local environment, they develop deeper understanding of how global issues manifest in their immediate context. This approach encourages environmental stewardship and civic engagement by making abstract concepts tangible and personally meaningful. Students begin to see themselves as active participants in their communities rather than passive observers of distant phenomena.

In teacher education contexts, place-based approaches might include field-based practicums where teacher trainees engage in activities such as mapping urban biodiversity, collaborating with local NGOs on community projects, or conducting oral history interviews with community elders. These experiences provide teachers with models for integrating local history, ecology, and cultures into their future lesson planning while developing their skills in community partnership and authentic assessment.

An exemplary application involves a group of student teachers co-designing a walking tour for pupils that explores their town's water use history. This project naturally integrates multiple disciplines—science concepts related to water cycles and conservation, historical research into municipal development, and geographical analysis of watershed management. Students learn to see their community through multiple academic lenses while developing practical skills in project management, public speaking, and collaborative planning.

Interdisciplinary and Collaborative Learning

Interdisciplinary and collaborative learning approaches recognize that the most pressing challenges facing contemporary society cannot be understood or addressed through single-subject perspectives. This methodology involves bridging disciplinary boundaries to explore complex problems from multiple viewpoints while emphasizing peer-to-peer interaction and co-construction of knowledge.

The essential nature of this approach becomes evident when considering real-world challenges that defy subject-bound solutions—climate change requires understanding of science, economics, politics, and social justice; artificial intelligence ethics demands knowledge of technology, philosophy, psychology, and law. These interdisciplinary approaches encourage teamwork, empathy, and essential 21st-century soft skills including communication, collaboration, creativity, and critical thinking. Moreover, they promote teacher collaboration across departments and subjects, breaking down institutional silos that often limit educational innovation.

In teacher training contexts, interdisciplinary collaboration might involve Design Thinking projects addressing challenges such as "rethinking school food systems." Such projects require teams to consider nutritional science, agricultural practices, economic sustainability, cultural food traditions, and environmental impact. Teaching teams learn to co-plan integrated units, such as combining mathematics and geography for eco-footprint calculations, creating authentic learning experiences that mirror real-world complexity.

Peer-led workshops represent another powerful application, where future teachers coach each other on lesson design and reflection. These collaborative experiences model the type of professional learning communities that effective schools require while developing teachers' capacity for constructive feedback and continuous improvement.

Erasmus+ Teacher Academies exemplify this approach by bringing together teacher educators from various disciplines to create joint curricula that address shared challenges while respecting disciplinary expertise. These international collaborations demonstrate how cultural and disciplinary diversity enhances educational innovation.

Culturally Responsive Teaching (CRT)

Culturally Responsive Teaching represents an urgent pedagogical imperative in contemporary European education contexts. This approach acknowledges and values learners' cultural

identities and experiences, utilizing diverse perspectives as assets in the learning process while promoting equity, inclusion, and critical consciousness.

The urgency of CRT in European contexts reflects increasing cultural and linguistic diversity across EU classrooms, ongoing migration and displacement including Ukrainian refugees and asylum seekers, and the pressing need for intercultural dialogue and inclusive education practices. Traditional educational approaches that assume cultural homogeneity are inadequate for contemporary diverse classrooms.

Effective teacher education in CRT involves training future teachers to recognize their own cultural biases and assumptions while developing skills in culturally relevant content selection and inclusive pedagogical strategies. These strategies might include multilingual scaffolding that validates students' home languages, identity texts that encourage students to share their cultural experiences, and cooperative learning structures that facilitate cross-cultural interaction and understanding.

Narratives, storytelling, and dialogue serve as powerful tools for building bridges between communities and creating inclusive learning environments where all students feel valued and empowered to contribute their unique perspectives.

Consider a practical example where a teacher trainee designs a unit around "Stories of Migration" utilizing interviews, family narratives, and digital storytelling tools. Students map migration journeys, explore historical and contemporary patterns of human movement, and reflect deeply on questions of identity, belonging, and cultural preservation. This approach validates diverse student experiences while building empathy and understanding across cultural boundaries.

Integrating All Four in Practice

The most powerful teacher education experiences integrate all four methodological approaches within coherent, authentic learning experiences. Consider "Our Sustainable School" project as a comprehensive example that demonstrates this integration.

The inquiry-based component begins with the essential question: "What is our school's biggest sustainability challenge?" This question drives student investigation and research. The place-based element involves students conducting comprehensive audits of their local school building and surrounding area, connecting abstract sustainability concepts to immediate, tangible environments.

Collaborative learning manifests as teachers and learners work together in interdisciplinary teams, combining expertise from science, social studies, mathematics, and arts to address complex sustainability challenges. The culturally responsive dimension ensures that activities include diverse voices—such as incorporating migrant perspectives on climate impact—utilize multiple languages as resources and employ inclusive decision-making processes that value all community members' contributions.

This integrated approach prepares teachers who understand that effective education transcends methodological boundaries, creating learning experiences that are simultaneously rigorous, relevant, and responsive to student needs and community contexts. Through such comprehensive preparation, teacher education programs can develop educators capable of meeting the complex demands of contemporary educational environments while fostering student success across diverse populations and contexts.

Romanian Teacher Education Policies - Key Aspects for TEC and BTEM Development

Romania's teacher education system operates under a dual-pathway framework that exemplifies flexibility in initial training models, offering both concurrent and consecutive approaches that could provide valuable insights for TEC and BTEM development. The initial training for all teaching positions in Romania is based on both a concurrent model – meaning that education and training in specialization are combined with professional training for the teaching career within the same educational sequence – and a consecutive model, where education and training for the teaching career are realized after education and training in the specialty.

Since 2020-2021, the initial training of teachers can be done through two routes: concurrent model through the psycho-pedagogical module realized in parallel with specialized studies, or consecutive model through a 2-year didactic master's degree after bachelor's degree studies (pilot stage). The legal framework was anchored in National Education Law No. 1/2011 with subsequent amendments, which requires initial training theoretical in specialty achieved in universities within accredited programs, teaching (didactic) master lasting two years or training within psycho-pedagogical education programs of level I and II, and practical training lasting one school year performed under mentor teacher supervision. The new laws of education applicable from 2023 (The Law of pre-university education no. 198; The Law of higher education no.199) keep the models of certification for the teaching career: concurrent in the case of undergraduate students and consecutive in the case of postgraduate students. As a transitional measure, until the didactic master programme will be fully implemented, postgraduate training is still accepted for the graduates who have not completed the certification career path during university studies.

The evaluation and monitoring system operates through specialized Departments for Teacher Training (DTT) within universities, where acquiring pedagogical competences is carried out in modules through theoretical and practical training throughout academic study years, with student assessment done through periodic summative exams organized for each curriculum subject. Following on-the-job confirmation, further professional development is a 2-stage process accomplished through specific evaluations leading to certification of higher professional degrees: didactic level II and didactic level I, which ensure higher stability in the profession, higher salaries and entitle holders to compete for management positions.

Current challenges and reforms include implementing the new pre-university education laws (198/2023 and 199/2023) which introduced the obligation for new teachers to follow a Master's programme in pedagogics, a revised system of continuous professional development, and a new teacher competence framework to guide teacher education, career development and certification, while addressing ongoing issues such as Romania being one of the few countries in the OECD and EU that does not have national teaching standards and the need to strengthen pedagogical practices through performance-based career structures. These Romanian experiences in balancing flexible training pathways, regulatory frameworks, and continuous professional development systems could offer particularly relevant insights for Mongolia's teacher education curriculum development, especially in designing programs that accommodate diverse entry points while maintaining rigorous quality standards and supporting career-long professional growth.

Additional Context for Appendix Development

Sample Teacher Education Curriculum Framework (Based on Romanian DPPD Model):

Concurrent Model Structure

- Year 1-3/4: Subject specialization + parallel pedagogical modules
- Core Pedagogical Modules: Educational psychology, didactic methodology, curriculum development, assessment strategies
- Practical Components: Observation periods, microteaching, supervised practice
- Assessment: Portfolio-based evaluation + practical training grades

Consecutive Model Structure

- Post-Bachelor: 2-year specialized didactic master's program
- Intensive Pedagogical Training: Accelerated psycho-pedagogical competence development
- Mentorship Integration: One-year supervised school-based practice
- Certification: Dual certification (master's degree + teaching qualification)

Monitoring and Quality Assurance

- Institutional Level: DPPD departmental oversight within universities
- National Level: Ministry of Education accreditation and evaluation
- Professional Development: Structured career progression (Level II → Level I) with performance-based advancement
- Continuous Assessment: Regular competency evaluations tied to salary progression and leadership opportunities

This framework could be adapted for Mongolian contexts by incorporating local cultural elements, language requirements, and specific educational priorities while maintaining the structural flexibility and quality assurance mechanisms that characterize the Romanian system.

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Shared Experience on Green and Digital Skills in Teacher Education Curricula

University of Palermo

Introduction

Elaborated by Elena Mignosi

The contribution of UNIPA consists not only in presenting University initiatives in the field of technologies and sustainability, but also in proposing a theoretical and methodological framework regarding students training (curricula for educational professions) in these areas.

For this reason, the text is divided into two macro chapters with a similar internal structure: the first, presenting **digital technologies in higher education**, conducts a theoretical dissertation on students training and at the same time shows its applications and tools within the University of Palermo through some examples. Two practical case studies follow, presenting what is available to the studentsat a structural level, that is, a master's degree course and a predominantly online Master's degree.

The second, regarding **green transition**, presents the Centre for Sustainibility and Ecological Transition of the University of Palermo, an opportunity to observe concrete applications and good practices. The Greenwork project at UNIPA Campus is then presented, to present the work in progress carried out by the research team.

Similarly related to the theme of green transition, two more projects follow, as notable examples: the Photovoice project, that contributed to a redevelopment of a part of the campus based on the proposals of the students themselves, and the Place-Based Literary Education project, focused on outdoor learning experiences.

Each paragraph of this chapter has been developed by different authors of UNIPA's team, according to their expertise in a specific field or in their experience in the management of a project. For this reason, each author will be mentioned at the beginning of their chapter.

EU Legislation on Sustainability and Digital Transition in Italian Universities: Legal Frameworks and Educational Practices

Elaborated by Marina Galioto

The European Union has increasingly consolidated its role as a driver of policies aimed at promoting sustainability and advancing digital transformation across its Member States. Within this framework, higher education institutions are called upon to act as key implementers of such directives, fostering a culture of environmental responsibility and technological innovation. In Italy, universities are responding to this call by progressively aligning their strategies, academic offerings, and campus operations with the priorities outlined in flagship

EU initiatives such as the European Green Deal, the Digital Education Action Plan, and the Next Generation EU programme.

The Italian legislative system has gradually transposed European directives into national policies, thereby shaping the obligations and opportunities for universities. Notably, the Decreto-Legge n. 77/2021, also known as the "Decreto Governance PNRR," laid the foundation for the implementation of the National Recovery and Resilience Plan (PNRR). This plan dedicates significant investment to both ecological transition and digital transformation, with specific attention to education and research under Mission 4. Through this initiative, substantial resources have been allocated to enhance digital infrastructures, support the acquisition of digital skills, and foster the creation of more sustainable and energy-efficient academic environments.

Ministerial guidelines issued by the Ministry of Universities and Research (MUR) further emphasize the importance of integrating sustainability and digital competencies into university curricula. These directives, while not always mandatory, establish a framework of strong encouragement and expectation. Universities are thus increasingly introducing interdisciplinary courses that explore climate change, energy transition, environmental ethics, and sustainable development goals (SDGs). Simultaneously, they are deploying digital tools and hybrid learning platforms that aim to render higher education more inclusive, resilient, and future-oriented.

Alongside curricular transformation, Italian universities are also undertaking infrastructural and organizational reforms. Many have adopted policies of Green Public Procurement (GPP), in compliance with national and EU regulations, to ensure that procurement choices reflect environmental considerations. Campuses are gradually being reimagined as sustainable ecosystems: from the use of renewable energy sources such as solar panels to the construction of buildings certified by green standards (e.g., LEED), sustainability is increasingly embedded in the daily operation of academic institutions.

Several universities stand out for their proactive approach in this regard. The University of Bologna, for instance, has integrated the SDGs into a wide range of its study programs. The Politecnico di Milano has launched cross-disciplinary training pathways aimed at equipping students with the knowledge and skills needed to address complex environmental and digital challenges. The University of Padua has established a Sustainability Office and implemented a Living Lab model that fosters innovation through the collaboration of students, researchers, and local stakeholders.

The University of Palermo has a specific Centre of Sustainability and Ecological transition dedicated to these themes that integrates the "green" in programs, institutional activities and research paths. Digital transition, accelerated by the COVID-19 pandemic, has similarly become a cornerstone of academic transformation. Universities have significantly invested in the development of e-learning platforms, cloud services, and artificial intelligence applications designed to enhance educational delivery and student engagement. Faculty training in digital pedagogy has become a strategic priority, ensuring that teaching methods evolve in tandem with technological advancements as the Edunext courses developed at University of Palermo.

Student engagement has also proven to be a crucial element in this process. Many institutions support student-led sustainability initiatives, including start-ups, research projects, and public awareness campaigns such as PhotoVoice project at University of Palermo. These efforts are often facilitated by university incubators and receive academic mentoring, contributing to a participatory model of governance that places students at the heart of institutional change.

The integration of sustainability and digitalization is not only programmatic but is also subject to institutional monitoring and evaluation. The Italian National Agency for the Evaluation of

Universities and Research Institutes (ANVUR) has begun including sustainability and digital indicators in its quality assurance processes, thus reinforcing alignment between university governance and the strategic objectives of the European Union.

In conclusion, Italian universities are increasingly aligning themselves with EU legislation on sustainability and digital transition. This alignment is not merely a matter of compliance but represents a deeper transformation of the academic mission, structure, and pedagogical practices. While disparities in implementation persist among institutions, the framework provided by the PNRR and broader EU policy context offers a clear and structured pathway. Continued investment in faculty development, infrastructure, interdisciplinary research, and international cooperation will be essential to sustaining this momentum and ensuring that Italian higher education remains a vanguard in Europe's green and digital future.

Integration of Digital Practices in Teacher Education Curricula

Digital Technologies in Higher Education

Elaborated by Eleonora Spada

Introduction

In recent years, the landscape of higher education has undergone a profound transformation thanks to the introduction and evolution of digital technologies. The transition to flexible and hybrid learning models has led to the emergence of more inclusive, customizable, and participatory teaching methodologies. In this context, blended learning has established itself as an effective paradigm that integrates face-to-face lessons with online activities, making the most of educational technologies to enhance the quality of teaching and learning.

Blended curricula are not limited to a mere alternation between online and in-person learning; rather, it they are based on careful pedagogical planning that enhances the strengths of both environments. E-learning platforms such as Moodle, Teams, and Blackboard – all adopted by the University of Palermo – enable flexible management of teaching activities, offering tools for interaction, collaboration, monitoring, and ongoing assessment. These tools allow instructors to personalize the educational experience according to students' needs and give students access to content according to their own pace, timing, and cognitive styles.

The Advantages of Digital Tools in Higher Education

The systematic introduction of digital tools has made teaching more open and accessible. Online platforms, in fact, allow the overcoming of spatial and temporal limits associated with traditional lectures, making learning continuous, distributed, and accessible at any time. In this way, they promote the inclusion of working students, students with disabilities, those living far from university campuses, and those with specific time management needs or different learning styles.

Another significant advantage of using new technologies is the ability to create collaborative learning communities. Digital tools such as forums, chats, wikis, videoconferencing, and shared environments promote wider peer-to-peer and student-teacher interaction, encouraging critical discussion, metacognitive reflection, and co-construction of knowledge.

Moreover, technologies support active learning approaches: methodologies such as Problem-Based Learning (PBL), flipped classrooms, and project-based learning can be more easily integrated into digital environments. Thus, learning becomes more participative, as it is centred on student experience and active participation.

The conscious use of technology can also serve as an important tool for inclusion. Platforms guarantee more accessible content, personalization of activities, and mediation through multiple communication channels (text, audio, video, images). This gives universities the opportunity to better respond to students' needs and promote equity in learning opportunities.

In this regard, the adoption of accessibility standards and Universal Design for Learning (UDL) are essential in creating truly inclusive digital learning environments.

The Universal Design for Learning (UDL) is a systemic pedagogical approach that seeks to effectively respond to the increasing heterogeneity of students in contemporary educational contexts, particularly within higher education. Developed in the 1990s by the Center for Applied Special Technology (CAST), the UDL model is based on the premise that learning difficulties are not rooted in the students themselves, but rather in traditional teaching methods and environmental barriers (Rose & Meyer, 2002; CAST, 2018).

In university settings, the implementation of UDL principles allows for the design of flexible and accessible educational pathways that recognize and value individual differences while promoting equity. This approach results in learning environments that adapt to varying cognitive styles, levels of preparedness, cultural backgrounds, and physical or psychological conditions.

The UDL framework is structured around three core principles:

- Multiple means of representation: Presenting content through diverse channels (e.g., written texts, audiovisual materials, graphics, interactive simulations) to ensure comprehension for all students, regardless of their preferred or most effective learning modality (CAST, 2018).
- Multiple means of action and expression: Allowing students to demonstrate what they have learned through a variety of assessment formats (e.g., essays, presentations, digital projects, creative work), thereby accommodating different learning profiles and strengths.
- Multiple means of engagement: Fostering motivation and active participation through differentiated, meaningful strategies. These may include offering choices in assignments, supporting self-regulation, and providing formative feedback (Rose & Meyer, 2002).

In higher education, the integration of UDL is facilitated by the widespread availability of digital technologies, which serve as crucial tools for personalizing instruction and removing learning barriers. Furthermore, UDL aligns with data-informed teaching practices and learning analytics, enabling more targeted and inclusive pedagogical responses (D'Alonzo, 2012).

It is essential to emphasize that UDL is not exclusively intended for students with disabilities or special educational needs. Rather, it is conceived as a universal model aimed at enhancing the learning experience for all students. As such, UDL constitutes a fundamental strategy for advancing social justice and the right to education within university institutions.

Digital Platforms at the University of Palermo

The University of Palermo has made significant investments in strengthening the technological infrastructure supporting both teaching and learning. Among the digital platforms adopted, Microsoft Teams plays a central role alongside Moodle. While Moodle primarily supports asynchronous learning through the organization of educational content, assessments, and forums, Teams is widely used for synchronous teaching, virtual classroom management, and real-time collaboration between students and instructors.

Microsoft Teams enables the delivery of live lectures, virtual office hours, and interactive seminars, offering tools such as breakout rooms, integrated chat, file sharing, and calendar management. Its integration with other Microsoft 365 tools (such as OneNote, Forms, and SharePoint) enriches the learning experience and facilitates cooperative work on shared documents and projects.

In addition, Moodle and Teams can be used in a complementary way, creating a seamless learning ecosystem: Moodle for structured content delivery and ongoing assessment, and Teams for dynamic, face-to-face interaction in digital spaces.

Beyond these two platforms, the University has also introduced various digital tools for multimedia content creation, virtual classroom management, automated testing, and student performance tracking, thereby enriching the teaching offer and aligning it with the evolving needs of the academic community.

These resources have made it possible to develop more flexible and modular learning paths, ensure teaching continuity during emergencies (such as the COVID-19 pandemic), and bring the academic environment closer to the expectations of a digital and interconnected society.

At the University of Palermo, Microsoft Teams has become a fundamental tool in the initial training of future teachers, particularly within the specialization courses for support teaching and the qualification pathways for teaching in primary and secondary schools.

Another important advantage is the ability to record lessons and make them available for later viewing, thus promoting flexible and inclusive learning. This functionality is essential for working students or those who need personalized study times.

In summary, Teams has supported a more interactive, accessible, and well-organized training process, responding to the specific needs of a professional path that requires strong relational and reflective components, such as teaching and support education.

New Technologies in University Teaching: The Educational Experiences at the University of Palermo

Edited By Eleonora Spada

Introduction

E-learning platforms have taken on an increasingly central role in higher education, offering new opportunities to enrich students' learning experiences. Among these, Moodle stands out for its flexibility, its wide range of tools and educational resources, and its foundation in social constructivist pedagogy. This report explores the usefulness of the Moodle platform through the analysis of two teaching experiences conducted at the University of Palermo, highlighting how this digital environment can effectively support both blended learning and active methodologies such as Problem-Based Learning (PBL).

The adoption of online learning environments like Moodle in universities represents a significant transformation in how teaching and learning are conceived and delivered. As a matter of fact, Moodle is not merely a tool for content delivery, but a dynamic environment that facilitates interaction, collaboration, and active knowledge construction. Its importance lies in its ability to adapt to various educational needs, supporting both traditional models and innovative pedagogical approaches.

In this context, the integration of Moodle into university teaching opens new frontiers for student engagement, personalized learning, and the development of transversal skills. The platform allows instructors to create flexible and modular learning paths, to continuously monitor student progress, and to provide timely and personalized feedback. At the same time, it offers students a space to actively interact with content, with peers, and with professors, promoting more significant and participatory learning.

The use of technology in university classrooms through Moodle goes far beyond the simple digitization of educational activities. It enables a genuine rethinking of the times, spaces, and dynamics of learning.

The teaching experiences conducted at the University of Palermo concretely demonstrate how Moodle can be used effectively to enhance teaching and learning in university contexts. Through the analysis of two specific cases, this document will highlight the platform's potential in supporting both blended learning and active methodologies such as Problem-Based Learning, emphasizing its key role in educational innovation in higher education.

Case study 1: Community Pedagogy and Adult Training Models

The first experience analysed took place within the Master's Degree Program in Educational Sciences, specifically in the course on Community Pedagogy. The introduction of blended learning methodology arose from the need to integrate in-class activities with an online environment, in order to foster reflection, collaboration, and meaningful learning.

In this context, Moodle was used both as a learning environment for accessing educational materials and as a space for interaction and co-construction of knowledge. The course was structured into "topics," each of which included resources (study materials) and activities (forums, quizzes, assignments). A central element of the experience was the use of discussion forums, where students were invited to reflect and share their impressions and ideas following in-class activities.

Interaction was further encouraged through the creation of work groups within the platform, which allowed students to actively collaborate and experience the benefits of peer learning. The results of this experience showed improved student participation and a positive perception of the learning environment, in which all participants saw themselves both as students and as potential educators.

The implementation of Moodle in the Community Pedagogy course represented a significant innovation in how the course was delivered and experienced by students. The platform provided a flexible and accessible space where students could deepen their understanding of course content, interact with peers and the instructor, and develop reflective and collaborative skills. The use of discussion forums, in particular, promoted continuous and constructive dialogue among students, enabling them to compare ideas, build new knowledge, and develop a sense of learning community.

Furthermore, the ability to work in groups within Moodle facilitated collaboration among students, allowing them to share resources, compare perspectives, and tackle complex tasks cooperatively. This approach not only improved the quality of learning but also contributed to the development of important social and relational skills for their future professional roles.

Case study 2: Physics for Primary and Early Childhood Education

The second experience involved students from the course “Physics for Primary and Early Childhood Education” within the Primary Education Science degree program. Here too, the main objective was to integrate face-to-face teaching with the potential offered by Moodle, promoting an active and collaborative approach.

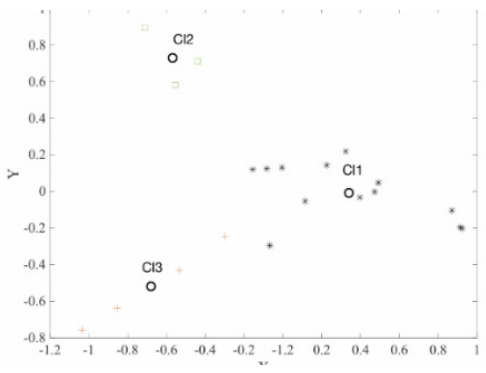
In this context, the online application of Problem-Based Learning (PBL) was tested. PBL is a teaching methodology that presents students with real-life problems, encouraging them to actively search for solutions through a structured process. Moodle provided the ideal environment for implementing this methodology, facilitating communication, collaboration, and the sharing of results.

Students, divided into groups on the platform, analysed problems related to the effects of physical forces, followed the steps of the PBL cycle, and produced reports on their findings. At the end of the course, a survey was administered to collect students’ perceptions of both the use of Moodle and the online PBL experience.

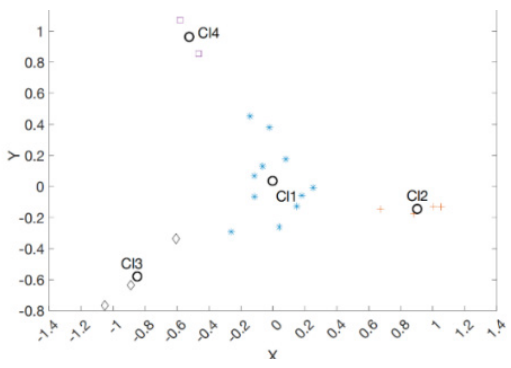
Specifically, at the end of the survey, two binary matrices were created from student responses to two distinct sections. These matrices were used as input for a clustering algorithm, and the results were visualized in a two-dimensional Cartesian space, where each point represents a student. Clusters and their centroids highlight homogeneous response patterns among students.

Figures 1 and 2 illustrate the results of the two cluster analyses performed on the two different sections presented to students:

(1)



(2)



Results of the cluster analysis on students' perceptions of the use of the Moodle platform (1) and students' perceptions of the online PBL approach (2).

Overall, the analysis uncovers diverse student profiles and attitudes, ranging from enthusiastic and engaged to indifferent and uncertain, offering insight into areas where instructional strategies could be refined.

The adoption of online PBL supported by Moodle in the Physics course for primary education represented a significant shift from traditional teaching approaches. Students were actively involved in solving authentic and meaningful problems, developing critical thinking, problem-solving, and collaboration skills. Moodle provided a structured and flexible space where students could work in groups, share resources, communicate their ideas, and present the results of their work.

Using Moodle also made it possible to overcome the spatial and temporal limits of traditional teaching, allowing students to work autonomously and flexibly, access course resources at any time, and interact with peers and the instructor outside of scheduled class times. This fostered more personalized, student-centred learning, where each participant could proceed at their own pace and explore topics of particular interest.

Conclusion

The two experiences described highlight the versatility and effectiveness of Moodle as a tool for supporting innovation in university teaching.

The platform enhances blended learning by combining online and in-person activities and supports active methodologies like PBL, which rely on student interaction and collaboration. Moodle goes beyond being a simple content repository; it functions as a dynamic learning environment that promotes interaction, knowledge building, and the development of transversal skills. Rooted in social constructivism and connectivism, its design encourages active, collaborative, and student-centred learning.

However, it is essential to emphasize that Moodle's effectiveness depends on instructional design and the instructors' ability to use its features strategically and consciously. The integration of online and in-person activities must be designed coherently and synergistically in order to maximize the benefits of both environments and promote meaningful, lasting learning.

Moreover, the analysed experiences underscore the importance of the instructor's role as facilitator and guide in the learning process. The instructor is no longer just a transmitter of knowledge, but an expert who supports students along their path of discovery and knowledge construction, providing guidance, feedback, and encouragement. Moodle offers instructors the tools and resources to effectively play this role, fostering richer and more meaningful interactions with students.

Finally, the two experiences demonstrate how the use of Moodle can contribute to creating a learning community in which students and instructors feel part of a shared project, where collaboration, exchange of ideas, and mutual support are fundamental values. This aspect is particularly important in university contexts, where learning is not only an individual process but also a social and collective experience.

Other notable initiatives

University of Palermo: Master's Degree Programme in Adult Education and Lifelong Learning Sciences (LM-57)

Elaborated by Francesca Pedone and Cristina Moscato

The master's degree Programme in Adult Education and Lifelong Learning Sciences, class LM-57, represents an innovative and highly specialised educational offering, designed to address contemporary society's evolving educational and professional needs. The programme is structured to provide advanced theoretical, methodological, and operational preparation in the fields of adult pedagogy, lifelong learning, and education within extracurricular contexts.

This course of study is distinguished by its adherence to the EDUNEXT model. Which is an initiative promoted by the Ministry of University and Research within the framework of Italy's National Recovery and Resilience Plan (*Piano Nazionale di Ripresa e Resilienza*, PNRR), aimed at innovating higher education through the integration of digital technologies and flexible didactic approaches. The EDUNEXT model features a blended learning delivery, where up to two-thirds of activities can take place remotely.

Objectives of the LM-57 Programme

The primary objective of the LM-57 programme is to cultivate highly qualified professionals capable of designing, managing, and evaluating educational interventions for young adults, adults, the elderly, vulnerable groups, and professionals undergoing updating or retraining. Specifically, the programme aims to:

- Develop core skills in the design and management of continuous and lifelong learning pathways;
- Train experts in analysing training needs and constructing personalised interventions;
- Provide tools for operating in multicultural, corporate, social, educational, and penitentiary contexts;
- Foster social inclusion, community activation, lifelong learning, and active citizenship;
- Offer an accessible and flexible training opportunity for working students or those residing in remote/rural areas.

The programme aligns with international directives on education (Agenda 2030, EQF, ESCO) and recent Italian regulations, such as Law 55/2024, which established the professional register for pedagogists.

Structure and Didactic Organisation

The study curriculum spans two years, totalling 120 University Training Credits -CFU (According to an agreement stipulated at the Bologna Congress in 2002, throughout Europe 1 CFU

corresponds to 25 hours of work: at least 5 of these must correspond to lessons given in person or online by the teacher/professor and the others can be homeworking.).

These credits are distributed among core subjects, elective activities, foreign language studies, internships, and the final thesis. The didactic structure is organised into Educational Clusters (EC), which are interdisciplinary courses integrating 12-15 CFU, each subdivided into modules of 3 CFU.

The educational proposal is based on the ECOBI model (Educational Cluster, Open Badge, Blended Intensive Programme), derived from the EDUNEXT guidelines. This model facilitates a coherent progression in competence acquisition, ensuring visibility and traceability of the learning path. Upon completing each module and cluster, students receive Open Badges and Milestone Badges, digital tools that certify acquired competencies.

Each EC is designed to ensure the acquisition of specific and transversal competencies. Therefore, the degree programme aims to achieve the following learning objectives:

- Deepening of pedagogical and methodological-didactic disciplines, particularly to adult and elder learning. Emphasis is placed on continuous and lifelong learning, understood as a fundamental lever for personal and professional development;
- Acquisition of competencies in the management and innovation of educational services, to identify emerging training needs and propose effective and creative project solutions. This includes the use of digital tools and the application of updated organisational models, in coherence with policies and normative frameworks dedicated to adult education;
- Acquisition of skills in analysing adult training needs, to thoroughly understand the training requirements of adult individuals, evaluating updating and retraining pathways;
- Promotion of lifelong education and cultural development, aimed at designing and promoting training pathways throughout the lifespan, fostering inclusion and active citizen participation;
- Deepening knowledge of regulations and policies for adult education, at European, national, and local levels, with particular attention to funding policies, service planning, and quality certification;
- Design and evaluation of complex training interventions aimed at various contexts, such as companies, public organisations, and local communities, also in an interdisciplinary and interprofessional key;
- Career guidance and professional skills development, to support job placement and re-entry through orientation and training pathways with particular attention to more vulnerable individuals, such as those excluded from the labour market, promoting personalised professional growth pathways;
- Development of lifelong education pathways aimed at counteracting phenomena of social marginalisation with educational programmes for the elderly, people with disabilities, in conflict with the law, with migrant background, and other groups facing exclusion, contributing to bridging educational gaps and promoting inclusion through the design and implementation of innovative training interventions and training of trainers activities, aimed at bridging the deficit of specific and transversal knowledge and skills necessary to address continuous innovation processes;

- Management of pedagogical and ethical issues related to adult education, operating responsibly, ethically correct, and in compliance with current regulations in the educational and training sector;
- Integration of multidisciplinary knowledge that combines psychological, sociological, philosophical, and motor insights. This vision enables a coordinated response to the educational needs of individuals and groups, while also promoting the ability to collaborate in multidisciplinary professional teams;
- Analysis and management of adult learning processes, including cognitive, emotional, motivational, and physical aspects for the design of personalised training pathways, centred on the experience and uniqueness of individual learners.

Blended and Innovative Didactic Modality

The blended learning modality is one of the most significant characteristics of the programme: 67% of didactic activities are delivered online, enabling flexibility and accessibility also for students with work or family commitments. This approach distinguishes between expository teaching (TEL-DE) and interactive teaching (TEL-DI), in line with the EDUNEXT model. Blended learning guarantees flexibility, accessibility, and quality, and is designed according to a competency-based paradigm, covering from the expected final competencies to the structure of the content.

Expository teaching (TEL-DE) consists of recorded video lessons of approximately 15 minutes, designed to ensure a sustainable cognitive load and maintain high student attention. Each video lesson is monothematic, conceived as an autonomous training unit aimed at achieving a single micro-didactic objective. Materials can be integrated with audio-video resources from other EDUNEXT network universities.

Interactive teaching (TEL-DI), complementary to TEL-DE, involves interactive and collaborative activities among students, instructors, and disciplinary tutors. It includes:

- Structured e-tivities, which are online exercises designed by instructors and conducted in co-teaching with tutors;
- Formative assessments, such as quizzes, tests, and simulations;
- Web-conference sessions, forums, blogs, and wikis for in-depth study and discussion;
- Collaborative student projects, with feedback from the instructor or tutor. Activities can be synchronous or asynchronous, based on the instructor's didactic choices and learning needs.

The predominant didactic modality promotes active student participation through collaborative digital environments prepared by EDUNEXT, which facilitates group work, problem-solving, and the acquisition of transversal competencies. In-person activities are organised in an intensive and laboratory format, while the remote component includes short video lessons, interactive e-tivities, group work, and webinars.

Internship and Career Opportunities

The study plan includes a compulsory 9-CFU internship, to be carried out at affiliated entities operating in the field of adult education. This activity is fundamental for gaining practical experience of acquired competencies and fosters the connection between theory and practice.

Graduates of the master's degree Programme in Adult Education and Lifelong Learning can pursue careers in various professional contexts:

- Adult educational and training services;
- Employment centres, training institutions, public and private companies;
- Correctional facilities, therapeutic communities, associations, and NGOs;
- Schools, CPIA (Provincial Centres for Adult Education), and other educational and extracurricular institutions;
- Sectors of welfare, guidance, and active labour policies;
- University research and doctoral programmes, such as "Technologies and Methods for University Education".

The programme also prepares graduates for registration in the professional register of Pedagogists, as stipulated by current legislation.

International Opportunities

Internationally, the programme benefits from participation in the FORTHEM programme, funded by the European Union, which promotes student exchanges and cooperation projects among European universities. Furthermore, Erasmus+ agreements are foreseen for internships and mobility.

Online post-graduate in "Psychology and Pedagogy for School Inclusion"

Elaborated by Antonella D'Amico

Presentation of the course

The annual II level Post-graduate in "Psychology and Scholastic Pedagogy of Inclusion" aims to train school psychologists, pedagogists and future teachers with the aim to develop knowledges and competencies in the following areas:

- Knowledge of the school institution and the family as educational agencies (parenting skills, school organization)
- Work-related stress risk assessment for the prevention of teacher burn-out
- In-depth knowledge of teaching and learning processes and use of new teaching methodologies

- Knowledge of the tools used for the early recognition of pupils with neurodevelopmental disorders and development of empowerment strategies
- Knowledge of methodologies aimed at the inclusion of students with Special Educational Needs
- Knowledge on behavioral psychopathology and intervention strategies for psychological, emotional and relational disorders by referring to the networks present in the area for any specialist referrals
- Acquisition of skills related to group dynamics
- Knowledge of theories and methodologies for school guidance, encouraging the development of awareness of one's own resources
- Instructional technologies for inclusion
- Strategies for inclusion

The skills acquired will allow specialists to operate on four levels:

- Pupils: promotion of development and inclusion strategies
- School system: enhancement of human resources and promotion of organizational well-being
- Family: improvement of the school-family educational alliance
- Community: network interventions with local services

The main professional field of application are schools, but the specialists trained will be able to use the knowledge and skills learned in all the others psychoeducational contexts.

The course is aimed at bachelor's degree graduates or graduates with the old Italian system – precedent to the Bologna process – in any discipline, and aims to specialize participants in the topics of psychology, school pedagogy and inclusion. At the end of the course, which develops over a year for a total of 60 credits, the students will acquire practical skills that will allow them to operate effectively on four levels of the school system: pupils, school system, family and community.

The lessons are recorded and then made available for the students at any preferred time, within a time frame of about two months for each teaching module. An automatic tracking function will certify class attendance.

Trainees are able to make use of the support of tutors with regard to the management of agreements with schools, contact with teachers and other needs that may arise during the course.

Course structure

There are 5 teaching modules distributed over five consecutive bimesters and organized in such a way as to dedicate the last period of the course exclusively to the final project work.

Teaching modules:

- School, organization and community;
- Strategies to stimulate cognitive and metacognitive development at school;
- Strategies to stimulate emotional development and life skills at school;
- Strategies for the inclusion of SEN students;
- Educational technologies and AI for learning and inclusion.

All professors publish an online office hours calendar with the students in proportion to the teaching hours held in the Master, during which they are available for questions and/or insights. The slides are available for the students, and the automatically generated transcription of the lessons is also available. At the end of each module there are online evaluation tests with multiple-choice questions prepared by the course teachers

Trainees can carry out the mandatory internship at schools in the area of their interest. The school identified by the students, when available to host them, files an agreement with the faculty, through which the School Principal certifies the activities carried out by the student.

During the internship, students have to carry out a project work, according to guidelines established by the Course Scientific Committee. The project work is eventually presented in the form of a final paper of about 20-30 pages.

At the end of the course, a final exam takes place in synchronous online mode; during the exam, students present their project work. For foreign students, linguistic intermediation is included.

The Master will start approximately in May 2025 and will end by March 2026.

Green Transition in the University of Palermo

Presentation of the Centre for Sustainability and Ecological Transition of the University of Palermo

Elaborated by Marina Galioto

The first Center for Sustainability and Ecological Transition inside the University of Palermo is directed by Prof. Maurizio Cellura and constituted by a Scientific Council composed of faculty members from the University have begun at the University of Palermo. The Scientific Council is composed by experts in the fields of the 17 Sustainable Development Goals (SGDs) set out in the United Nations' Agenda 2030, which put the concept of sustainability under a completely new light, based on an interdisciplinary and cross-cutting approach, capable of crossing themes such as equal opportunities, access to education, and the establishment of democratic institutions.

"I firmly believe that the future of the new generations depends on the Sustainable Development Goals, and with this awareness they will be able to make a difference for a better future. Our youth must be adequately trained to obtain the necessary skills, knowledge, values and become agents of change,"

Comments the Rector of the University of Palermo, Prof. Massimo Midiri.

"With the activities of the first Center for Sustainability, our university, one of the main players in the Sicilian territory, further strengthens its position as a point of reference, particularly in the Mediterranean context. The development of living labs, from which methodological working indications and new best practices in the field of sustainability will be disseminated, will lead to offering the territory concrete solutions with sustainable and economically feasible technologies and systems that can generate employment by acting as multipliers of development. UniPa thus contributes directly to the theme of sustainability, not only through training and research, but also with sustainable energy, mobility and supply choices, capable of decreasing the environmental, social and economic impacts of activities related to institutional roles and with eco-oriented design and management choices aimed at implementing a decarbonization path consistent with the European Union's New Green Deal."

The objectives of the Centre are:

- Implementing participatory and shared solutions and strategies aimed at environmental, economic, and social sustainability;
- Activating ecological transition pathways;
- Identifying actions that contribute to the achievement of the Sustainable Development Goals outlined in the 2030 Agenda;
- Creating an integrated, equitable, and sustainable approach to teaching, research, and the third mission;
- Limiting negative spill-overs related to the organization (e.g., through GPP and sustainable production and consumption practices).

The Center's responsibilities include:

- Promoting and incentivizing, through a flexible and multidisciplinary structure, the University's research activities in the field of sustainability and ecological transition, and fostering the strengthening and development of educational pathways capable of responding to new needs (e.g., climate change, the carbon market, etc.);

- Interacting with the University's Departments and individual scholars engaged in research and innovation activities in the fields of sustainability and ecological transition to implement effective solutions applicable to the management of the University's facilities and the local territory (e.g., mapping "green" PhDs and "green" fixed-term researchers);
- Horizontally integrating the principles of sustainability and ecological transition pathways into the University's educational, informational, and third mission activities;
- Activating a structured dialogue between the various technical and administrative bodies of the University aimed at adopting a culture of environmental sustainability;
- Engaging in dialogue and collaborating with the Rector's advisory board;
- Supporting local initiatives aimed at the concrete achievement of the "New Green Deal."
- Contributing to the creation of a Regional Forum on Sustainability and Ecological Transition to strengthen dialogue between the University and stakeholders operating in various capacities in the field of sustainability (e.g., collaborative platform);
- Promoting and strengthening the University's participation in sustainability networks at the local, regional, national, and international levels (RUS, SDSN, ASVIS, environmental associations, etc.);
- Promoting educational outreach activities regarding knowledge of sustainability, also aimed at schools of all levels (e.g., RUS "lesson zero");
- Participating in the various cultural and scientific initiatives undertaken by the University concerning sustainability and ecological transition;
- Supporting research activities related to the themes of the SDGs;
- Promoting and overseeing the production of both scientific and popular publications (e.g., UNIPA statement on SDGs).

Relevant initiatives

Among the activities carried out by the Centre is the creation of a Regional Forum on Sustainability and Ecological Transition to strengthen the dialogue between the University and stakeholders working in various capacities in the field of sustainability.

The Center, also through the support of professional organizations, will also involve small and medium-sized enterprises in the Forum to guide them in defining eco-innovative and sustainable production solutions, assessing and reducing the energy-environmental impacts related to their production processes, and implementing eco-design practices, including the transfer of good practices already in place.

The Sustainability Centre has initiated a process of cooperation with the RUS - Network of Sustainable Universities, of which UNIPA is a founding member, through participation in thematic working groups, from sustainable food to climate change, evaluating actions immediately applicable to the University.

The concept of sustainability and ecological transition will be integrated into the educational tracks, also to meet the new needs in terms of key professional figures for ecological transition. A table will be established with the University's departments and individual scholars engaged

in research and innovation in the fields of sustainability and ecological transition in order to implement effective solutions applicable in the management of the University's facilities and the relevant territory.

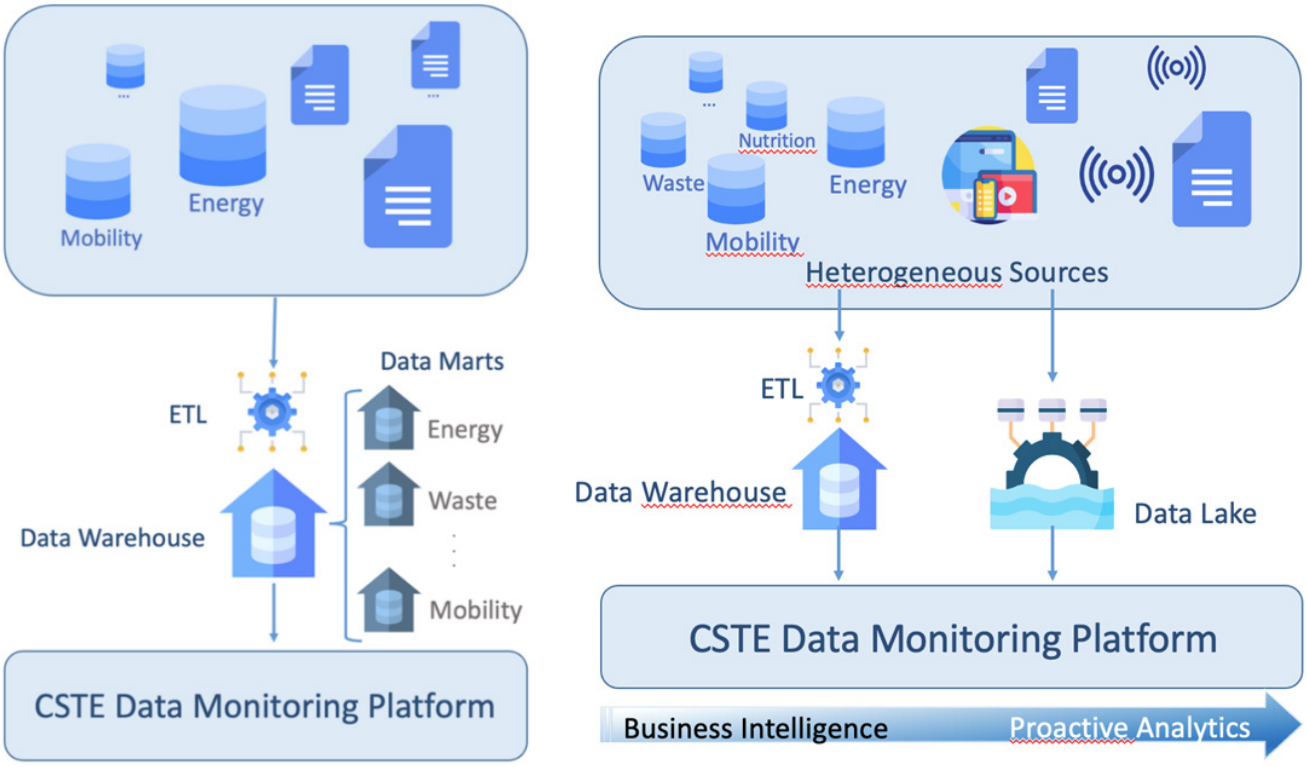
A structured dialogue will be activated among the various technical and administrative bodies of the University aimed at the transposition of "Green Public Procurement" practices.

Support will be provided at the local scale of initiatives aimed at the concrete achievement of the European Union's "New Green Deal."

Consumption survey and Energy Atlas

A survey of the University's energy consumption and mobility practices, in collaboration with the Technical Office, Energy Manager and Mobility Manager, has been initiated to estimate the carbon footprint. The Energy Atlas of the University's building stock is also being compiled.

The center has a Data Observatory where data and technologies for monitoring indicators related to all 17 SDGs converge. A key aim is to follow a systematic, flexible and reproducible approach to organizing data and analyzing them, through business intelligence platforms and big data analytics technologies.
From the CSTE's Data Observatory, the design and implementation of a platform based on data warehousing and data lake, for decision support aimed at university managers and SDG leaders, has started.
This platform will interface with other university databases and also with external databases. The aim, in fact, is to extend the approach for analyzing a wide variety of spatial data, to enable more responsible choices and predict what actions may be best to help achieve the goals defined by the United Nations.



Greening strategies for Natural capital, ecosystem services and human well-being – The Greenwork project at UNIPA Campus

Elaborated by Antonella D'Amico

Here follows the list of technicians that are part of the Research Team operating in the project, with each respective faculty:

- Simona Colajanni (Icar/10-Technical Architecture)
- Carmelina Anna Catania (Icar/13-Design)
- Antonella D'Amico (Psic-02/A)
- Francesco Marra (Agr/03 – Agricultural, Food and Forestal Sciences)
- Maria Antonietta Ragusa (Bio/11 – Biological, Chemical and Pharmaceutical Sciences and Technologies)
- Mariantonietta Ruggieri (Secs-S/01 – Economics, Business and Statistics)
- Rossella Corrao (Icar/10- Technical Architecture)
- Tiziana Campisi (Icar/10- Technical Architecture)
- Manfredi Saeli (Icar/10- Technical Architecture)
- Calogero Vinci (Icar/10- Technical Architecture)
- Elisa Di Stefano (M-Fil/04 – Human Studies)

Many European university campuses have recently launched greening initiatives to reduce environmental impact and promote sustainable development models. These actions are part of a global context of increasing awareness regarding environmental challenges and the crucial role of educational institutions in the transition towards sustainability. Universities, as centers of education and research, are uniquely positioned to positively influence society through the adoption of sustainable practices. The European Union recognizes the importance of environmental education, emphasizing that students must develop the knowledge and skills needed to live more sustainably, modify consumption patterns, and contribute to a greener future. Education and training play a fundamental role in helping individuals move from awareness to both individual and collective action.

Following these directions, the Greenwork project may be a key example of the transformation of the University of Palermo campus to improve livability and well-being of teachers and students. Greenwork project focuses on health, climate resilience, innovation, and sustainability. It aims to create an integrated framework for regenerating large public buildings using vegetation-based solutions, particularly in Mediterranean urban contexts. The project involves a multidisciplinary team and uses case studies to assess the impact of Nature-Based Solutions (NBSs) to address climate change, improve environmental quality, and promote socio-economic development. These include green roofs, permeable surfaces, and urban green spaces, which help reduce heat, air pollution, and stormwater runoff while enhancing biodiversity and mental health.

The impact of greening on mental health

Environmental psychology highlights the positive effects of nature on mental health, including reduced stress, improved mood, and enhanced cognitive function. Individuals with a stronger connection to nature benefit more from these effects. Research shows that even virtual nature exposure can boost well-being and attention. Theories like Stress Recovery Theory (SRT) and Attention Restoration Theory (ART) explain how green spaces support emotional and cognitive recovery. In education, natural environments act as "the third teacher," stimulating children's creativity, social interaction, and learning. Studies in Italy show that outdoor play improves children's attention and perceived restoration. The benefits of green spaces are also relevant for university students, who face high mental and academic stress. The COVID-19 pandemic further worsened students' psychological health. University campuses are ideal for implementing green areas to support mental health. Greener universities can enhance well-being, motivation, and learning outcomes for both students and faculty.

Soil Biodiversity and Native Plants for a Holistic Approach to Health

Biodiversity-friendly green spaces benefit human health by purifying air, enhancing soil quality, and supporting ecosystems. When combined with restorative practices, these spaces help reverse environmental degradation and promote sustainability. Rich, biodiverse soils expose people to a wider range of environmental microbes, boosting immune function through "microbial rewilding." Contact with natural environments—especially during early life—can increase skin and respiratory microbial diversity, reducing risks of inflammation, allergies, and autoimmune diseases. This supports the "biodiversity hypothesis," which links modern diseases to reduced microbial exposure due to urbanization. Studies show that biodiverse environments improve immune regulation in both children and adults. Urban green spaces should prioritize native species and resilient wild herbs that thrive naturally. Such strategies enhance the health benefits of nature while improving ecological resilience. Integrating biodiversity into city planning is essential for healthier, more sustainable urban living.

Greening and aesthetics for fostering sense of belonging and care

Philosophical approaches, like the aesthetics of atmospheres, stress the need for meaningful interactions between nature, space, and people. Co-design methods involving users can improve outcomes and foster a sense of belonging and care. "Aesthetic engagement" links beauty, well-being, and community responsibility. Beautiful, well-maintained spaces encourage social interaction and long-term use, while neglected ones lead to disengagement. In dry climates like Palermo, sustainable solutions include endemic plants and low-water designs. Ultimately, successful green strategies must blend ecological function with emotional and aesthetic value, promoting shared stewardship.

The first results of the Greenwork project

The ability to select the buildings that suite the most to undergo greening interventions becomes a useful support tool for decision-makers in defining the most effective interventions. The public buildings that are potentially considered in this analysis, have been mapped, filed, ranked, and assessed based on their typological, constructive, urban, and environmental features to identify their proneness to both undergo greening interventions and define the most effective strategies in terms of increasing permeable surfaces, improving microclimate, botanic,

and hydraulic behaviour and the most convenient in durability, economic, and investment terms.

Moreover, the realization of a statistical survey entitled “Greening strategies for the redevelopment of buildings, areas and spaces of the University of Palermo (UNIPA), was aimed to identify campus areas that also for students and teacher were suitable for greening strategies to improve environmental and psychophysical well-being. An online survey collected responses from 1,437 participants, including students, faculty, and staff, over two months starting in March 2024. The questionnaire gathered demographic data, knowledge of campus spaces, familiarity with greening strategies, and opinions on green area uses and expected benefits. The analysis, conducted with R^2 and visualized using ggplot2, explored links between users’ characteristics and their views on greening impacts. Respondents assessed aspects such as air, light, and thermal comfort, the need for green spaces, and potential locations for interventions. Psychophysical benefits included emotional well-being, focus, productivity, and sense of belonging. Environmental improvements were linked to air quality and comfort. Preferences for new green areas included study, relaxation, and social zones. The research highlights the importance of co-design and user engagement in creating greener, more attractive, and functional university spaces.

The survey highlighted a strong demand for green infrastructure among campus users, with Building 16 identified as a priority for redevelopment. Statistical analyses reveal that perceptions of environmental and psychophysical benefits from greening are shared across roles, genders, and fields of study. Using both qualitative and quantitative methods—including choropleth maps and experiential walks—the research demonstrates that greenery fosters emotional well-being, social cohesion, and cognitive performance.

The next steps of the Greenwork project

A user-friendly platform will be developed for the application of the implemented tools. In addition, greening interventions, included in broader urban regeneration strategies, would allow the conversion of interior open spaces into public green areas. Using a strategy at the building scale on rooftops and especially on free outdoor areas, a “network of green public pathways” would be created where such spaces are lacking, thus also acting from a human and urban health perspective.

Conclusion

In conclusion, the GREENWORK project has created a basis for a promising development in terms of promoting green spaces as identity-forming elements that enhance daily campus life. Endemic plant species are recommended for sustainable, low-maintenance design and Nature-Based Solutions (NBS) and Ecosystem Services frameworks support the planning approach. Moreover, the creation of an interdisciplinary team integrating architecture, psychology, urban planning, and aesthetics seems the best way to gain the expected results and to address complex University challenges. In this perspective, GREENWORK project could be a replicable model for sustainable and inclusive campus transformation.

2 R is a programming language for statistical computing and data visualization

Other notable initiatives

Photovoice Project for the redevelopment of the University campus

Elaborated by Cinzia Novara

Photovoice is a methodology used in the field of community psychology to represent aspects of daily life that could be elusive or stigmatized by common sense. The photos are the tool in order to raise awareness in the community and make proposals to politicians and governance. The image constitutes the synthesis of concepts that can, in some cases, be difficult to express through traditional channels of communication such as words and writing. The picture is able to synthesize stories, emotions and ideas and uses an easily understandable language. This methodology lends itself to being used as an educational method, and therefore of empowerment, as it is capable of activating the subjects in the search for solutions to their problems. The first to use this methodology was Caroline Wang in 1998.

This methodology aims to achieve three objectives:

- Enabling people to reflect on strengths and concerns regarding their community (self-awareness);
- Fostering critical dialogue and awareness of important issues through group discussion among the participants, about topics emerging from the photos;
- Promoting social change through the involvement of politicians.

We report summary panels of the experience that has led, thanks to the photovoice project developed together with university students, to a redevelopment of some green areas of the campus. The title of the project is a pun and is called “Più Chiosco per tutti” (*More Kiosk for everyone*). The images presented below demonstrate the key elements of this project.

1

THE TEACHING EXPERIENCE: PHOTOVOICE

As part of the teaching of Community Psychology, students from the Bachelor of Science in Education program participated in the Photovoice experience, entitled. **"PIÙ CHIOSCO PER TUTTI"**, which allowed them to reflect on aspects of a place that they inhabit and experience on a daily basis and make proposals for its improvement: the kiosk and the surrounding park, located in front of Campus Building 14.

After a **training meeting** on the Photovoice, students were invited to capture, through 10 **photographs**, aken on different days and at different times, their own their own view of the kiosk.

Each student then associated a title and a short caption to each image. The generation of these narratives was guided by 4 reflective questions:

- **What does the photograph portray?**
- **What did you want to portray?**
- **Why did you take this photograph?**
- **How is it connected to your daily life on the Campus?**

Through subsequent **group meetings**, guided by the images, participants analyzed what they could do to improve the conditions of the kiosk and how to make proposals for **change**.

THEMES EMERGED FROM THE NARRATIVES

ETHIC OF RESPONSIBILITY AND USABILITY OF PLACE
ATTACHMENT TO DISTANT PLACES AND MEMORIES
INDIFFERENCE AND PEDAGOGY OF INTENTIONS
ENVIRONMENTAL AND EMOTIONAL ASPECTS
PLACE OF AGGREGATION

PROPOSALS

FOR THE CAMPUS

- Allocate resources to raise new areas of socialization and informal learning
- Produce a virtual and interactive map of the campus to identify other areas to be enhance with interventions participatory
- Launch an ideas competition on eco-systemic sustainability among different Courses of study

FOR THE KIOSK

- Ensure the decorum and respect of the area pertaining to the kiosk
- Sharing responsibilities for the care of the place between concessionaires and users of the kiosk
- Activate a program of Community Education to raise awareness of the issue among the academic community

WHAT WE HAVE ACHIEVED

- Create constructive discussion with Governance to present and share proposals
- Ensure routine cleaning and waste disposal services

PARTICIPATING STUDENTS
Calvaruso Miriam, Causa Martina, Città Arianna, Di Maio Davide, Fasone Martina, Guidera Francesca, Marretta Maria Teresa, Migliore Alessandra, Milazzo Teresa, Palmiero Sabrina, Pizzo Valentina, Salario Giusi, Sidoti Martina, Spagnolo Valer, Tronca Nadia, Turco Antonella.

TRANSLATION
The students of History of the English Language A.A. 2023/2024, Educaional Sciences (cv Education of Community), teacher Massimiliano Schirinzi

TEACHER COORDINATOR OF THE INITIATIVE
Prof.ssa Cinzia Novara

PROCESS FACILITATORS
Gaetano Di Napoli, Iva Marino, Martina Farace

2

FROM SNAPSHOT TO ACTION

"Più chiosco per tutti"

Before the action of Photovoice...

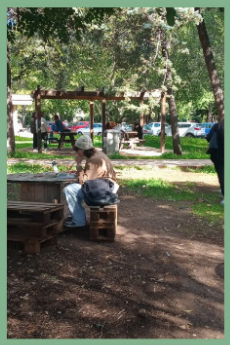





... after!








Did you like the initiative?
Let us know by leaving a like

If you would like to contribute to the initiative and be part in the action group, contact us
photovoicechiosco2022@gmail.com

3
THE PHOTOVOICE METHOD

Photovoice is a **participatory action-research** methodology developed in the 1990s by Caroline Wang. Influenced by the values of Freire's pedagogy of the oppressed and the feminist movement, this methodology aims to engage people otherwise excluded from traditional decision-making processes.
Through a combination of **photography and group discussions**, Photovoice allows people to identify different points of view, develop personal and community empowerment, foster greater awareness about the socio-political environment, connect people, activate subjects in expressing and **seeking of solutions** to their own problems and those of the local community. By developing a critical view regarding a specific issue, a process of **social change** is initiated.

1 TRAINING MEETING

Aims

- Support and stimulate the **motivation** of the participants
- show the **potential of images** as a tool for promoting social change
- raise participants' awareness of compliance with laws on **privacy** in the use of photography
- **circumscribe the theme** that will be the subject of attention and taken up by the photographic shots

2 PHOTOGRAPHIC EXPLORATION

Each participant is invited to take some photographs and to choose, from them, the shots most representative of their point of view.
Through the **SHOWED** method, the description of the images and the reflective thinking of the participants.
Each image is given a **title** and a **short caption** to define its meaning and enrich the communicative power of the picture

what is **S**hown here?
what is really **H**appening?
how does this relate to **O**ur lives?
Why are things this way?
how could this image **E**ducate people?
what should be **D**one about this?

3 PARTICIPATORY ANALYSIS

The group comes together to share the images and **activate a discussion** from the narratives constructed.

The purpose is to trigger a process of conscientization and **shared analysis of reality** that leads to a greater awareness of the determinants of personal and common.

The following are then selected by the group the photographs with greater power evocative power and visual impact.

4 SOCIAL ACTION PLANNING

Participants come to critically define the problem in order to develop ideas and implement **change programs**.

The process facilitator is responsible for providing information useful about the technical, territorial, organizational, social and educational **resources**, involved in the concretization of the proposals.

At this stage, it involves making **contact with the stakeholders** (politicians, administrators) and the whole community, to inform, sensitize and involve them in the process of change. Usually, social actors are invited to a **community event** concluding the transformative process of Photovoice and preliminary to that of change community.

FOR MORE:

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- Wang, C.C., Yi, W.K., Tao, Z.W., & Carovano, K. (1998). Photovoice as a participatory health promotion strategy. *Health Promot Int, 13* (1): 75-86.
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An Introduction to Place-Based Literary Education

Elaborated by Salvatore Laneri

Place-based literary education responds to the challenge of declining the teaching and learning of literature in out-of-the-classroom approaches, with the intention of rooting this subject area to the real lives of students and readers.

Indeed, this field of research and area of teaching values educational experiences that ground the acquisition of literary skills in the educational transactions established between three essential elements: the text, the student, and the reading place. Such proposals of outdoor reading education (Laneri, 2022) or outdoor literary education (Laneri, 2024) can currently rely on a specific educational model of place-based reading (Eggersen, 2023) and represent concrete opportunities for the development of learners' literary skills and also of their cultural, socio-historical and ecological awareness regarding the environments they inhabit or traverse.

The theoretical framework supporting this approach to literature and place encompasses a wide range of suggestions from different disciplinary fields, including place-based education (Smith, 2002; Sobel, 2004; Beames et al., 2012), literature didactics (Langlade, 2005; Brilliant Rannou et al., 2020; Giusti, 2023), embodied narratology (Gallese & Wojciehowski, 2011), and geohumanistic and phenomenological perceptions of place (Tuan, 1977; Greve, 2000).

These contributions are evidently complemented by theoretical reflections and empirical research more specifically devoted to the relationship between places and reading (Wason-Ellam, 2010; Lundhal, 2011; Novack, 2014; Pjedsted, 2020) and writing activities (Esposito, 2012; Case, 2017; Montgomery & Montgomery, 2024; Reato, 2024).

The relationships established between reading and writing activities and the places in which they take place not only deeply enhance the aesthetic and embodied experience of literature, but also solicit new gazes and interpretive hypotheses about the environmental, cultural, and social circumstances of the communities in which students' real lives take place.

The Recruitment of Secondary-School Teachers in Italy

In recent years, Italy has profoundly reformed the system governing the training, qualification, and recruitment of secondary-school teachers. The principal regulatory framework is defined by Legislative Decree No. 59 of 13 April 2017, which reorganised access to permanent posts, and was subsequently amended by Decree-Law No. 36 of 30 April 2022. The Prime Ministerial Decree of 4 August 2023, published in the Official Gazette on 25 September 2023, finally set out the initial teacher-education pathways and the concluding profile of the qualified teacher.

Qualification Pathway of 60 University Credits (CFU/CFA)

The first essential requirement to become a permanent teacher is the attainment of the teaching qualification through a university or higher-education pathway worth 60 University Credits, (CFU)4.

Access to the 60-CFU pathway is reserved for holders of a master's degree or a single-cycle degree (or an equivalent/recognised qualification) consistent with the intended teaching field. It is also open to students enrolled in a master's or single-cycle degree who have already earned at least 180 CFU. In all cases, the qualifying final examination may be taken only after obtaining the relevant degree. The pathways are designed and delivered by Universities and "AFAM" institutions (Higher Education in Art and Music) accredited by the Ministry of Universities and Research. The qualification pathway includes courses in Pedagogy, Education & General Teaching, and psycho-pedagogy; a school-based apprenticeship (direct and indirect), as well as digital competences applied to teaching and to the inclusive management of the classroom. Successful completion of the final examination leads to the award of the teaching qualification (Prime Ministerial Decree of 4 August 2023, Annex A).

Public Competitive Examination for Teaching Posts

The public competitive examination is the sole channel for access to permanent teaching posts. It is organised at regional level and is primarily reserved for those who have obtained the teaching qualification through the 60 CFU pathway. During certain transitional phases, specific categories—such as teachers with three years service—may also take part. The examination assesses both disciplinary knowledge and didactic-methodological competences (Legislative Decree 59/2017; amendments introduced by Decree-Law 36/2022).

Teaching Induction Year and Initial Training

Candidates who pass the competitive examination are hired on a fixed-term contract to complete an induction year in service. During this year, in addition to teaching activities, teachers participate in initial training initiatives and are supported by tutors or experienced colleagues. The induction year concludes with a final assessment; if positive, it results in appointment to a permanent post (Prime Ministerial Decree of 4 August 20233).

The Profile of the Qualified Teacher

The profile of the upper-secondary teacher is not contained in a single document but emerges from several sources: among these, the National Collective Labour Agreement (CCNL) for the Education and Research sector and, above all, Annex A to the Prime Ministerial Decree of 4 August 2023, which defines the final profile of the qualified teacher (Tecnica della Scuola, 27/09/2023). Foundational premises of the professional profile are:

- professional motivation, understood as a genuine commitment to the educational guidance of students;
- reflective and dialogic awareness, meant as the capacity to continually improve one's competences in real contexts through reflection and collaboration with more experienced colleagues;
- a vocation for guidance and inclusion, expressed in supporting each student in discovering and developing personal talents and potential.

The Teaching Process

The training process of the qualified teacher is articulated in several phases that must be coherently integrated. They are set out as follows:

- observation;
- design;
- planning;
- documentation;
- assessment;
- adjustment (regulation).

Required Professional Competences

The profile of the qualified teacher encompasses a broad spectrum of competences that go beyond mastery of the subject:

- cultural, disciplinary, educational, pedagogical, psycho-pedagogical, teaching, methodological, relational, reflective, and self-evaluation competences;
- capacity for didactic and educational planning;
- skills in classroom management and in creating favourable learning environments, grounded in positive relationships with students and attentive to inclusion;
- digital competences: a conscious and critical use of technologies to support teaching, communication, and organisational tasks.

Minimum Professional Standards

Within the framework defined by Annex A to the Prime Ministerial Decree of 4 August 2023, the profile of the qualified teacher does not rest on disciplinary competence alone. The regulation requires that teachers command the full spectrum of their professionalism: from the substance of content to the most current methodological orientations, including the dialogue between bodies of knowledge. For this reason, the decree states that the teacher “must demonstrate command” of a number of fundamental axes that give solidity and depth to teaching practice:

- “the basic nuclei of disciplinary knowledge and of disciplinary didactics” pertaining to the relevant disciplinary field;
- “the contemporary epistemology and methodology of the teaching disciplines”;
- “the disciplinary epistemologies” which, historically and up to the contemporary period, have underpinned the organised production of knowledge;
- “the principal interdisciplinary connections” between the reference disciplines and others.

Assessment and Evaluation Criteria

The criteria specified for evaluating competent teachers are:

- "knowledge of national guidelines/indications" and their correlation with disciplinary knowledge and with the objectives/results provided for by current regulations;
- "the capacity to construct inclusive learning environments" and to engage all students actively;
- "planning based on significant disciplinary nuclei", together with the capacity for co-planning with colleagues.

Conclusions

The Italian system for recruiting secondary-school teachers is characterised by several fundamental elements: the centrality of the 60 CFU/CFA qualification pathway; access to posts through public competitive examinations; the induction year as a moment of verification and professional consolidation; a broad professional profile that brings together disciplinary, pedagogical, methodological, relational, and digital competences; and consistent attention to inclusion and continuing professional development. In this way, Italy aims to ensure teachers who are not only competent in disciplinary terms but also capable of responding to contemporary educational challenges, supporting students in their personal, cultural and social growth.

Regulatory references

Legislative Decree No. 59 of 13 April 2017 — Reorganisation of access to permanent teaching posts.

Decree-Law No. 36 of 30 April 2022 — Amendments to the recruitment and training framework.

Prime Ministerial Decree of 4 August 2023 (Annex A) — Initial teacher-education pathways and minimum professional standards.

Ministerial Decree No. 509 of 3 November 1999 and Ministerial Decree No. 270 of 22 October 2004 — CFU framework (1 CFU = 25 hours; annual load 60 CFU).

Ministerial Decree No. 931 of 4 July 2024 — Recognition of university credits from prior or external learning activities.

Ministerial Decree of 3 November 1999, No. 509 – Regulations concerning university autonomy in teaching. Available at: https://www.fnopi.it/archivio_news/leggi/276/DM031199n509.pdf

Ministerial Decree of 22 October 2004, No. 270 – Amendments to the regulations on university teaching autonomy. Available on Normattiva: https://www.normattiva.it/uri-res/N2Ls?urn:nir:ministero.istruzione.universita.e.ricerca:decreto:2004-10-22;270!vig=

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