

Transferring Sustainability Competences through Green Pedagogies and Service-Learning in Higher Education

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ABSTRACT:

Sustainability competences are reflected in the ability to look ahead to change and shape the future of the societies in which they live through active participation in the sense of sustainable development. Through service-learning, students take responsibility for their actions. The complex nature of sustainability issues makes it useful to explore problems and their solutions holistically.

In the framework of the NEMOS project (A New Educational Model for Acquiring Sustainability Competences through Service-Learning), a collaborative process was initiated to pool the knowledge and experience of five Higher Education Institutions working together to implement new educational models for effectively acquiring sustainability competences through service-learning in food-related degrees. This EU-funded project was launched and aimed to advance the transition to sustainability education through practical and innovative educational approaches and interventions. Green pedagogy can support transformative learning through the exploration and clarification of learners' own values.

In the case of the Public University of Navarre (UPNA), which leads the NEMOS project, practical sessions on service-learning and green pedagogies were held to train university lecturers who teach in different degrees to integrate sustainability in higher education, recognising the relevance of the connection with the environment and the active participation of educators in this process.

Keywords: Experiential learning, know-how, sustainability education

1. Introduction

In a global context marked by the 2030 Agenda, sustainability will be one of society's core values and a key competence for students in the coming decades. In the future, students will need to address challenges such as climate change, food waste and food loss, as well as support producers seeking to meet global goals of economic, social and environmental sustainability. Education is crucial to achieving the Sustainable Development Goals (SDGs) (UN, 2015): creating a more sustainable world requires a collective effort by all individuals and societies. While public policies and initiatives can raise awareness and initiate sustainable actions, education is one of the most powerful vehicles for sustainable development.

However, the effective integration of sustainability across various educational contexts requires not only curriculum redesign, but also strategic efforts to overcome institutional barriers. Engaging stakeholders such as educators, administrators, and policymakers is crucial to ensure that sustainable education is adopted at all levels (Sharma, 2023). Strategies to foster collaboration, secure institutional support, and adapt teaching

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methods for diverse educational systems must be considered to maximize the impact of embedding sustainability into curricula (Filho et al., 2018).

In 2017 UNESCO published a guide to help develop sustainability competencies for all students (UNESCO, 2017). The guide identifies learning objectives and suggests learning topics and activities for each SDG. More recently, the European Commission's Joint Research Centre, through the Sustainable Competences publication, identified a set of sustainability competences for educational programmes to help learners develop knowledge, skills and attitudes that promote ways of thinking, planning and acting with empathy, responsibility and care for our planet and public health (Bianchi et al., 2022). The guide provides a framework for learning about environmental sustainability that can be applied in any learning context. While there have been substantial advances in sustainability education that have also generated new knowledge over the past two decades, they do not appear to have catalysed the change needed to address today's increasingly complex challenges (Wals & Corcoran, 2012; Wamsler et al., 2018).

At higher education level, the Erasmus+ project NEMOS (2022-2024) focused on service-learning (SL) as a means to increase sustainability competences of students in food degrees. The main objective of the NEMOS project was to provide an educational model, complete with a toolkit for teachers and educational practice standards, to integrate the acquisition of sustainability competences during curricular education in food-related degrees. The ultimate impact is on student learning and, consequently, in their attitudes, behaviours, and knowledge which will inform their decisions as globally responsible employees, entrepreneurs and future leaders in the Food Industry. However, a key limitation of the NEMOS project lies in its specific geographic and academic context, which may limit the universal applicability of its findings. Since the project focused on institutions and educational practices within a particular European framework, adaptation to other educational systems may require contextual adjustments. For instance, educational models, curricular structures, and pedagogical approaches in regions outside Europe might differ significantly, necessitating tailored strategies to ensure the relevance and effectiveness of the service-learning model in various cultural and institutional settings. Future research should explore how the NEMOS model can be adapted to diverse geographic and academic contexts, facilitating the broader application of its sustainability competences in different parts of the world.

The complex nature of sustainability questions means that it is useful to explore problems and their solutions in a holistic and non-linear way, in contrast to the reductionist approach increasingly seen in the scientific disciplines according to Wilhelm et al. (2015). This aspect of the pedagogy is not only relevant to discussing existing situations, but also relevant to the ability to conceive of different future scenarios as variables change. The teachers' role would be to help students (as potential change-makers in society) to visualize their possibilities with a sustainable approach.

We focused on the implementation of green methodologies, or pedagogies of reconnection, at university level in order to transfer sustainability competences through service-learning and green pedagogies to any university degree field, educational level and non-formal education.

2. Theoretical Background

Service learning (SL) is a pedagogical intervention that combines service to the community through the academic learning of students, based on a direct and meaningful relationship with reality, enabling the interaction with reality, facilitating the active participation of students and obtaining a deep reflection and awareness. In this way, a large number of authors agree with the last mentioned, stating that service learning helps to raise awareness and reflection of reality (García and Mendía, 2015; Puig and Bär, 2016; Contreras-Rodríguez *et al.*, 2021). Through SL, students assume responsibility in their actions (Batlle, 2020). The green pedagogy approach achieves sustainability competency through a controlled appeal to the emotions and the explicit uncovering of learners' own values to take on new ideas and new perspectives in a more sustainable direction (Cornell, 2018; Freire, 2024). In this way, sustainable practices based on green pedagogies and SL go beyond surface learning. Recently, there has been a development of rubrics for assessing sustainability competences at the theoretical level (UMASS LOWELL, 2024; Sousa and Doran, 2024). In the USA, UMSS LOWELL (2024) developed their own rubric to encourage sustainability among distinguished students at higher education. In Europe, Sousa and Doran (2024) proposed rubrics for assessing sustainability competences in line with the European GreenComp framework (Bianchi *et al.*, 2022). However, these authors do not provide the methodologies or tools that allow integrating these competences. Few are the studies that highlight the usefulness of service learning for fostering competences for sustainable development in higher education (Alvarez-Vanegas and Volante, 2024; Cantalejo *et al.*, 2023; Cebrian *et al.*, 2021; Molderez and Fonseca, 2018). None studies were found in the literature on the green pedagogies in sustainability competence studies. The aim of this paper is to provide ideas and methodologies to teachers for applying service-learning and green pedagogies for transferring in practice sustainability competencies to different Degrees and educational levels.

3. Methods

Starting point: The UPNA case within the NEMOS project

As a reference example of what was done in the consortium, we focused on the case of the Public University of Navarre (UPNA) in Northern Spain, as coordinator of the NEMOS project.

3.1. Determining the sustainability competences needed to define a Sustainability Profile for Students (PR1)

The first part of the NEMOS project consisted of two distinct parts:

A) Analysis of the embeddedness of sustainability dimensions in a Food-related degree at the UPNA university.

B) A community building methodology (both, quantitative and qualitative social research among the actors involved, students, professors and stakeholders) to determine what the sustainability profile of the students should be (PR1).

The Degree chosen was Bs Degree in Innovation on Food Processes and Products (IPPA) Credits: 240 ECTS. Duration: 4 terms (8 semesters) Maximum number

of students: 35 Center: School of Agricultural Engineering and Biosciences (UPNA). This Degree is aligned with Sustainable Development Goals of the UN 2030 Agenda.

Curricula review - Starting point for the PR1: The analysis of the embeddedness of sustainability dimensions within the Bs Degree in IPPA of the UPNA was carried out. A review of the competencies in general and of sustainability-related competences in particular in the mentioned degree curricula or courses was performed. Thirty meetings and interviews with the lecturers of the Bs Degree in IPPA were organised to find out their commitment and interest in effectively incorporating and implementing the sustainability competency in their subjects. Firstly, the analysis of the sustainability demand as a competence was performed in the chosen degree. Of the 39 competencies listed in this Degree, only 3 of them are related to sustainability: One was a general competency and 2 are specific ones. In the first 4 semesters, the level and the competencies related to sustainability were rather low: None of the sustainability-related competencies was either specific or focused on sustainability. In the 5th to 8th semesters, the modules in which sustainability was addressed represented 1/3 of the total number of modules, and the competency of sustainability accounted for 5-10% in the modules. Only one elective course in the 7th semester (“Sustainable food production”) was really focused on sustainability. Between 2016 and 2021, 66 Final Degree Projects were defended, 10 of which had a clear focus on sustainability, representing 15% of the total.

Therefore, there was an urgent need to work to increase the integration of sustainability. as a transversal competency in the Degree programme. As a summary of the starting situation in the IPPA Grade regarding the integration of the sustainability competence in the educational curriculum, the following table shows the percentages. Secondly, after having talked to 12 lecturers responsible for some of the topics taught in this Degree, the chosen core or compulsory subjects to work on sustainability skills were one for each semester 1 to 5 and semester 7 (6 modules in total) and 2 in semester 6 (48 ECTS in total which accounts for 20% of the total modules of the educational curriculum).

Table 1. Level of embeddedness of the sustainability competence in the IPPA Grade

Academic Year	(1) Not focused	(2) Related	(3) Focused
1 st Year	80%	20%	0%
2 nd Year	50%	50%	0%
3 rd Year	30%	70%	0%
4 th Year	65.2%	30.5%	4.3%
Global	56.3%	42.6%	1.1%

The social research methods and techniques carried out represented an open and flexible process with qualitative methodology and, later on, with quantitative methodology. In the qualitative part, we carried out two group dynamics with the *teaching staff* in the form of a discussion group. A first session was held with teachers who actively work with

Sustainability as a competence included in their teaching guides and a second one with those who did not integrate it in their teaching. We also organized 4 discussion groups with representatives of public and private entities (Regional and local administrations, Associated partners, NGO's, Food companies, ...) that helped us to define the sustainability profile of students. We planned to set up two more focus groups: one with students from IPPA Grade and the other one from different degree programmes (Social Work Degree, Sociology Degree, Teaching Degree and others).

Starting point was the Sustainability as a social concept: Sustainability in education in general and at the UPNA in particular. Also, the strengths and weaknesses for its presence at the University; the personal position as lecturers (experiences, if they incorporated it in their teaching, if they did not incorporate it, why not). In addition, we considered the training needs of lecturers and students, and what attitudes towards the subject they saw among teaching staff, students, the School of Agricultural Engineering and the University itself. It was also important to consider what sustainability values should be transmitted to students, as well as the sustainability profile to be built for students as “a professional branding”, and the competences they highlighted in themselves with respect to their teaching in the Degree programme. The UPNA team carried out 7 discussion groups. The one we could not perform was that with students of other Degrees. They also did the surveys for lectures and for students. In case of students, 103 out of 130 from the different academic years (4 in total) completed the survey. The completed surveys for students accounted for almost 80% (specifically 79,23%). In the case of lecturers, 17 out of 26 completed the survey. The completed surveys for lecturers accounted for 65,4%.

The main objective of the research work was focused on finding out the sustainability competences needed to define the Sustainability Profile of students at University in studies related to the specific field of food. The more specific objectives of the study were as follows:

- To analyse the opinions and attitudes of staff in different areas (public administrations, NGOs, associations related to food and sustainability, etc.) towards the implementation of a new transversal training profile in sustainability. Detect the strengths and weaknesses associated with the proposed change.
- In the specific group that made up this discussion group, we wanted to know their attitudes towards training undergraduate students from the chosen Degree and incorporating the aforementioned profile in a transversal manner.
- We also wanted to measure the interest among employers in the food sector in the implementation of a sustainability profile among students and with a view to hiring professionals trained at University in the future.

3.2. Specific food sustainability topics/competencies for the agri-food sector (PR2)

We organised three seminars on sustainability (key competences for sustainability, UNESCO, 2017) and SL for lecturers to apply in their subjects. The idea was to integrate ESD-SL in teacher education and to extend it to sustainability service internships and Bachelor's final projects. We were supported by organisations such as:

Food Bank of Navarre, solidarity canteen (Paris 365), NGOs (SETEM), agrifood organizations, organic product consumer associations (Landare and Ekoalde), and others.

The UPNA team designed and is currently implementing a model of activities for the acquisition of sustainability competences through SL within its IPPA of the School of Agricultural Engineering and Biosciences. For this purpose, 8 core and compulsory subject areas (48 ECTS) of the IPPA Degree were selected as representative for incorporating sustainability approaches and activities. One of the primary challenges was the lack of knowledge and familiarity among lecturers regarding service-learning methodologies. To address this, the UPNA team organized a working group with the academic staff responsible for these subject areas and UPNA experts on sustainability and service-learning to collaborate in the design and implementation of these pilot activities. Two workshops were carried out to train the teachers in service-learning and sustainability approaches and several meetings were held to program and plan the activities. Regular meetings were also held with teaching staff and experts to plan and implement the pilot activities in each subject.

3.3. Assessment tools for Food Sustainability Profile and Methodological Guides by co-creation practices in service- learning (PR3)

The UPNA team adopted, and adapted to the sustainability-related competences, the rubric for self-assessment and enhancement of service-learning projects of the University of Barcelona (Puig et al., 2023). Norris and Weiss (2017) highlighted the changing nature of criteria used to assess the impact of community engagement work by universities; from student outcome focused to ‘increasingly taking a more comprehensive approach to capturing an array of activities and assessing how they relate to a variety of outcomes’. The learnings from this process were embedded within the NEMOS “Methodological handbook (MH) in food sustainability through service learning”, which aims to serve to train both teachers and students in sustainability through service learning at any educational level (Cantalejo et al., 2024).

3.4 A new educational model for acquiring sustainability competences through Green pedagogy and Service Learning: Guidelines and toolbox for a Pedagogical strategy in Higher Education (PR4)

In the context of the NEMOS project, and in order to showcase the structure and content of the teachers training in service-learning and green pedagogies for transferring in practice sustainability competencies to different degrees and educational levels, first of all a multidisciplinary group was created with lecturers from different degrees. Those lecturers came from the Faculties and Schools represented at UPNA: Education, Physiotherapy, Heritage and History, Physical Education, Industrial Engineering, Food Innovation and Law. One of the lecturers was a Secondary education teacher of Philosophy. The basis for the discussions of the group was the Methodological Handbook for food-related lecturers helping them to provide students with the skills necessary for addressing the sustainability within the curricula (Cantalejo et al., 2024). Different theoretical and practical sessions were held with the multidisciplinary lecturer team (Table 2).

Table 2. Summary of sessions with the multidisciplinary teaching team.

Dates	Time (hours)	Number of participants	Aim of the session
27 Sept 2023	2	10	Presentation of the NEMOS Project and the work to be carried out in the working sessions.
11 Oct 2023	2	9	Presentation of the Student Sustainability Profile elaborated in the NEMOS Project (PR1) and discussion on the concept of Sustainability.
25 Oct 2023	2	8	Presentation of Service-learning case studies in Food Innovation subjects at UPNA (PR2)
08 Nov 2023	2	8	Review of Evaluation Tools (PR3)
22 Nov 2023	2	7	Reflections of lecturers and students, attitudes and difficulties in transmitting sustainability in University Degrees
13 Dec 2023	2	8	Final evaluation of the participation process
15 Jan 2024	8	13	Green Methodologies in an 8 hour-Practical Session

Duration of sessions: in total, 20 hours.

The multidisciplinary group reviewed the definition of sustainability, as well as the Sustainability Profile for Students and assessment tools. Likewise, the difficulties and obstacles in applying it to other degrees were discussed. The methodology used in the first 6 sessions was the free inquiry technique (Okesola et al., 2019) The objective of the Methodological Handbook (Cantalejo et al., 2024) was to facilitate decision-making for teachers and higher-level educational institutions that want to start integrating or continue to integrate and promote sustainability competences in the curricula and classroom daily practice. The lecturers, as external evaluators of the MH, had to fill in a survey, which was aimed to gather feedback on several dimensions to assess the effectiveness and usefulness of this tool, in terms of: accuracy, clarity, relevance, completeness, structure, and above all, how practical the MH was, i.e. whether the handbook provided sufficient practical solutions and applicable advice and included relevant examples and case studies that could be transferred to other degrees and educational contexts.

The last 8-hour practical session was to connect with nature, to restore the links to nature through emotion and the senses, and to provide a transformative and sustainable experience, with an ecological outlook, using different methodologies for each person to connect with the group and the natural environment, enjoying the experience. In this case, some IPPA Degree's teachers, who participated in the sustainability and SL training mentioned above, joined the group. The practical sessions in nature were as follows:

A) Super-sense activity: The relational function in living beings is essential, comprising perception and response. The five human senses, working together, can give rise to the so-called sixth sense or intuition. Each person has a more developed super-sense that influences their perception and actions. The activity consisted of participants introducing themselves, the modules they teach and the most developed sense, along with vision. Then, they shared the most pleasant and the least pleasant perception of their super-sense. It was expected that the activity would create a relaxed atmosphere and that the sharing of perceptions would arouse surprise and sympathy among the participants.

B) Landscape icebreaker activity: This was aimed to break the ice, facilitate shared laughter and surprise through the observation and choice of landscapes of Navarre (Northern Spain). Aerial photographs were placed in a circle, and participants chose four landscapes to answer questions. Afterwards, they had to share their choices and discuss aspects of sustainability.

After these proposals, we continued with 5 games of Joseph Cornell's Fluid Learning phases (Cornell, 2028). After each game, each participant collected on a small piece of paper what the game had given him/her and this part was reflected in the results collected.

a) Touch your nose: The game aimed to awaken interest in biodiversity, encourage curiosity and connect with nature. The dynamic consisted of the facilitator reading out clues about a living thing and the participants touching their noses when they thought they knew which living thing it was. If a clue did not fit, they stopped touching their noses. The clues went from the general to the concrete.

b) Sound map: The activity is based on the importance of the sense of hearing for communication, the perception of the environment and the detection of dangers. The calm and connection with nature that active listening provides seeks to intensify appreciation for the surrounding life and the need to regain connection with the natural environment. The activity took place outside, where each person, individually and in silence, chose a place that appealed to them. With their eyes closed, they concentrated on listening to the sounds of nature. Then, each person reflected on paper the sounds perceived, sharing them later as a group.

c) Discovering textures: The activity is based on the importance of the sense of touch, the most primitive sense in humans and animals. This sense allows interaction with the environment, stimulates the production of hormones related to well-being and is vital for cognitive and emotional development. Therefore, opaque bags were prepared with natural elements from the immediate environment of different textures. Participants, organised in small groups, had 30 seconds to touch and remember the textures of the items inside the bags without looking. Then, they searched the environment for items with similar textures.

d) "I count and you paint": The activity seeks to increase the capacity of perception by bringing the senses into a state of maximum attention. By focusing on the oral description of the landscape, memories are stimulated and multisensory experiences are generated. Sharing reveals prior learning, key words and elements that have captured attention. In our case, the group was divided into pairs, providing each pair with a stand, a sheet of paper and a paint/pencil. Both people stood back to back in a natural space and, by mutual agreement, one described the landscape while the other reflected it on paper. Then, they

exchanged roles, and at the end, they compared what they had drawn with the real landscape, reflecting on the elements that stood out.

e) Postcard for the future: The proposal seeks to bring out shared and individual memories, strengthening the appreciation of nature and the connections between people. Blank postcards reflecting natural elements were distributed. The group had time to reflect and freely reflected on their experiences and feelings related to the nature session on the postcard. They could decide whether to include their postcard data. Afterwards, the facilitator team will send the postcards after weeks, months or years.

By repeating this sequence over several days, sublime moments of connection with nature could be experienced.

4. Results and Discussion

4.1. Integrating sustainability in the curricula

For the analysis of the embeddedness of sustainability dimensions within the curricula, the following steps were proposed:

- *Choose of the Degree*: Goals, Structure of the syllabus
- *Review of the competencies* in general and of sustainability-related competences in particular in the existing degree curricula or courses. Check the competencies described in each module and topic and which of them have any link (Focused, related, not-related) with sustainability and have an interview with some of the lecturers who teach courses focused, related and/or not-related with sustainability to check the level of embeddedness of sustainability in his/her topic/module.
- *Analysis of the sustainability demand* as a competence in the chosen Degree (Based on the percentage that sustainability represents in the chosen Degree), i.e. if most of the courses are focused on sustainability, the percentage will be very high.
- *Choose of core/compulsory courses* more appropriate to work on sustainability skills in a progressive way during all the degree's academic years through SL: At least one topic per semester or per academic year.

Definition of sustainability: It was articulated in the discourses as a broad and constantly evolving concept that mainly encompasses three axes: environmental, social and economic. This was in line with the dialogue kept among educators, policymakers, and stakeholders to create a unified framework that supported effective sustainability education, aligned with global sustainability goals (Cantalejo *et al.*, 2024).

Barriers to achieving sustainability: There were positive attitudes of students towards sustainability in their private lives, with price and convenience being the main obstacles. There was a need for effective communication and promotion of sustainability in the general university environment. The actions on sustainability best valued by the students were: Workshops, Curricular internships, Work placements in companies and Work placements abroad.

Sustainability key concepts and challenges for the agri-food sector: There was an awareness that in reality no useful actions were being taken to meet the objectives of the 2030 Agenda. There is a need to improve consumer information on product labelling to foster a better

culture of sustainability. There is a demand for specific training for local producers on sustainability in the production and management of their products and businesses, with greater support from institutions.

With respect to the SWOT analysis, current strengths in providing food sustainability learning were as follows: Companies and stakeholders support collaboration with educational institutions. There was a willingness and interest in sustainability training among all parties involved. Current weaknesses were the lack of training and information for lecturers. The opportunities were an issue supported by the European Union through the SDGs. Companies in all sectors are demanding sustainability experts. Current threats were the lack of participation of university institutions. Lack of coordination between the actors involved.

In the case of knowledge and skills, the teaching staff require to provide sustainability education, including in SL. It is pointed out that increased teacher training in promotion of sustainable values and attitudes is required as well as service-learning projects and a real approach to experts and companies that work in sustainability.

The training of the teaching staff should be carried out through methodologies that are better adapted to their agendas and workloads (online). It would also be desirable to bring the business network closer to the University through a roadmap of visits to companies in the sector, as well as greater commitment to the inclusion of sustainability in the curricular modules. Furthermore, greater contact with the business and social network working in sustainability should be encouraged, in order to carry out internships in this field and to promote training in self-employment at university level as professional opportunities, in addition to working in large companies. The students are very supportive of this type of work tool. The teaching staff see a need for training in this type of methodology, in order to adapt it to their programmes. The university should offer more service-learning projects in all areas.

To sum up, from the analysis of the discourse of the discussion groups, the diagnosis of the situation in our IPPA grade at UPNA was as follows: Sustainability was not present in the academic curriculum in a cross-cutting manner and the same concepts and content were repeated in the different subjects. Furthermore, there was a lack of coordination between departments and lecturers and the application of innovative methodologies. These new methodological tools (service-learning and green pedagogies) would favour the acquisition of sustainable competences and the involvement and awareness of this issue. The lack of training of the teaching staff in sustainability resulted in less presence of the issue in the subjects. However, there was a positive attitude on the part of lecturers to training in sustainability, as long as this training would be adapted to their work and personal situation. Students also believe that the training they receive in sustainability should be extended. In general, lecturers are more informed about sustainability issues than students thanks to their participation in sustainability projects, but both groups share the same type of sustainable actions in their daily lives: recycling, responsible consumption and clean mobility.

The service-learning methodology was quite unknown, both among students and lecturers. However, there is a very positive attitude on the part of both groups towards the development of this type of learning and related projects. Service-learning in the university context would contribute to the opening up of the university to social and business life

and would improve students' training and competences. It would also enrich the training skills of lecturers and broaden the ethical, responsible and social sense of the knowledge acquired in the Bachelor's and Master's degrees.

The University should be more open to the business network and stakeholders working in sustainability and should articulate a transversal axis between all the parties involved which, together with institutional support, would mark the lines of action on this issue.

4.2. Results from the multidisciplinary lecturer discussions

Reflecting proved to be a practical and effective tool for the evaluation of the Methodological Handbook (Cantalejo *et al.*, 2024) that involved lecturers in reflecting via focus group discussions at the end of the NEMOS Project. In this phase, the feedback of the teachers who were predominantly involved as reviewers reported the user-friendliness and practicality of the MH. Based on several studies reported on interviewing their teachers at the end of the project, in which in some cases, those interviews were compared to interviews conducted at the start of the project (Bron *et al.*, 2018; Guadalupe & Curtner-Smith, 2020; Wahl-Alexander *et al.*, 2016), we replicated it. The evaluators were able to verify that the NEMOS project outputs had been achieved and that significant positive outcomes had resulted from the project's engagement with students and the wider community. The evaluators reflected on the levels of involvement achieved which far exceeded the outlined targets, as well as the strong collaborative working which had been established. Not only had the goals set out for the project all been met, but the true meaningfulness of the student engagement had been proven. The impact of this project will continue to have positive effects on the individual students who had been involved, the working relationship between both lecturers from IPPA Degree and from other Grades and the wider community (e.g. Regional government, local government, NGOs, Associations).

These are, in summary, some of the findings that have created the greatest consensus among the participants in the first 6 working sessions: Sustainability should be more than a competence; it should be a social value that should be present at all levels of education. It would be a matter of changing the focus; provoking a change of outlook. Before, the individual was at the centre, now it is the planet. If sustainability is equated with sustainable relationship, it can be seen as something simpler and is not such an unclear concept and it may be easier to approach it. Practical methodological experiences such as SL or Project Based Learning can be applied in optional multidisciplinary, core or compulsory subjects.

Students need a conceptual framework in which to place themselves in order to be able to apply it in temporal and spatial situations and to have a working methodology to be able to use in these situations, in terms of sustainability. The key is that students need to experience the concepts and theories, so that they can be transformative. In relation to the sustainable profile of the university student, the student gives a different response to any problem and that this response comes from a learning process that has been carried out on sustainability issues throughout the Degree courses.

4.3. Green pedagogies for sustainability

The green pedagogy work carried out during the 8-hour practical session was reported as follows:

During the Super-sense activity, a relaxed atmosphere was generated, sharing personal information with low emotional charge and exploring the importance of the senses in connecting with the environment. A relaxed atmosphere was created and the exchange of perceptions aroused surprise and sympathy among the participants.

In the case of the landscape icebreaker activity (Fig. 1), based on the idea that human beings, being primarily visual, can use landscape as a thread in educational processes, the visual perception of the landscape revealed elements that are culturally valued (biophilia) and others that are considered threats to survival (biophobia). The results showed emotional connections with landscapes related to childhood or memories, as well as feelings of fear or comfort in certain spaces. They also felt attraction to water and vegetation, and a desire to choose more than one landscape. They recognised the diversity of perspectives and felt the influence of the brain and accumulated experience on visual perception. The activity was very useful to promote coherent and sustainable attitudes towards the natural environment.



Figure 1. Landscape icebreaker activity

In the case of the games of Joseph Cornell's Fluid Learning phases (Cornell, 2018), the results collected after each game were the following:

a) During the 'Touch your nose' activity, expressions of ignorance and curiosity about nature emerged, as well as anticipation and interest in learning more about the biodiversity of the surroundings. Participants expressed their reconnection with nature and acknowledged a lack of appreciation for the diversity of life forms and their originality. They also reflected on how little observation we devote to animals and became aware of previously unconsidered inhabitants of the environment. This emotional connection with familiar animals helped to stimulate their curiosity and awareness of the connection with nature.

b) The ‘Sound Map’ activity provoked feelings of peace, calm and relaxation in the participants, as well as awareness of the importance of stopping to wake up and appreciate the connection with the natural environment. The ability to concentrate and internalise emotions and the connection with both themselves and the environment contributed to a sense of peace when listening to natural sounds, serenity and tranquility centred on the surrounding environment, albeit disturbed by anthropogenic noise. They focused their perception and were able to abstract themselves from the rest.

c) The activity of discovering textures served to awaken awareness of the small treasures of the environment, to recognise the importance of all the senses, to rediscover touch through the organic and inorganic, to feel isolated from the outside to connect with the senses and nature, to stimulate curiosity and the senses, to experiment and develop knowledge through touch, to evoke memories and strengthen knowledge of nature and to discover new textures in the natural environment and connect with it.

d) After the ‘I count and you paint’ activity, the challenge arose to explain the landscape in detail and to recognise the difficulty of expressing everything visualised, i.e. how to explain everything observed. The participants felt absorbed, concentrated and empathetic during the activity, but also with mixed feelings, e.g. of discomfort in drawing and satisfaction in listening. They also enjoyed combining oral description and visual representation.

e) Postcard for the future: It was not shared, as this point is intimate and personal.

After experiencing the four phases of fluid learning, two further activities were proposed and carried out:

f) Barometer sheet: The activity (Fig. 2) sought to develop less confrontational and more flexible discussions, encouraging flexibility in dialogue. It was refined with various statements to explore different aspects and make the group feel comfortable expressing opinions. It was a useful tool for deliberating in small groups. It was conducted in an open space, without tables or chairs. An imaginary centre line was drawn on the floor marking positions according to agreement or disagreement with a statement. Participants moved around and presented their arguments. The round was closed and repeated with different statements. We were able to contrast ideas in a less confrontational way, understanding that changing positions requires effort, exemplified in the movement. It was also possible to open up and develop discussions on a less formalised basis, because if we look at the same information from different perspectives, we move away from absolute truths, and thus allow ourselves to reflect on the information and contrast it with personal judgement, using communication to build collective knowledge.

g) Theoretical Brushstrokes Space: This innovative and dynamic proposal aimed to present the theoretical framework. A ‘stall’ was set up with theoretical information. Time was given to explore it and then the group met to comment, expand and contrast the information. The idea was to offer the theoretical framework in an innovative way, to awaken interest in the theoretical part that underpins the practical proposals.



Figure 2. Barometer activity

Within the framework of the NEMOS project, the diversity of contexts among the teachers participating in the session has been remarkable, in terms of group size, length of subjects and content. After the practical session, the question arose as to how to transfer the proposals for reconnecting with nature to their subjects. At this point, it was recognised that these proposals are a good starting point to address sustainability in a broader and more concrete way. The group experienced a greater cohesion and connection with the natural environment, transforming the initial dynamic of nervousness into a spirit of innocence and fun. However, questions arose about how to integrate these experiences into everyday subjects. Some of the group participants' proposals included active breaks to refresh and reconnect with the body, games in the subject of nutrition to bust myths, and projects in the natural environment to explore sustainability. The use of landscapes to understand sustainable uses, games to address regulations and legislation, and sensory analysis in food assessment were also considered. The facilitating team proposed concrete strategies, such as using rural landscapes to explore the adaptation of passive houses and role-plays to understand regulations and legislation.

5. Discussion

This article sought to provide ideas and methodologies to teachers for applying service-learning and green pedagogies for transferring in practice sustainability competencies to different Degrees and educational levels. In order to transmit sustainability (as teachers), it would be necessary to live and have an attitude created as an individual. Only through experience can unsustainable toxic dynamics be broken and this is applicable to any discipline. It is essential to look for tools and spaces to experiment, think and integrate. The more automated the assessment tool is, the more it saves the teacher work and the more it encourages them to introduce sustainability in their subject. The tools should be easy to apply and easy to correct because teachers already have a heavy

teaching and administrative load. Assessment should be two-fold: a) how you have experienced it; b) how you have applied it.

Another idea is that it can be done with a control group and another group that is not trained in sustainability and do the same work and compare. Another way to evaluate the results could be to measure the competence in graduates with the sustainability training they have acquired and in new trainees. The general idea of the majority is that sustainability should be in compulsory subjects, not optional. In secondary education, project assignments are possible in several subjects. A figure or department at the University should be present with expertise in sustainability to provide advice to all undergraduate degrees. It should have a broad vision of the concept and create a base and subjects to begin to work on and to be in charge of training and accompanying teachers and advising on guides, subjects, etc. It would be interesting to create an "Accreditation" in sustainability, coordinated between different Degrees and subjects. A kind of certification in sustainability that would also be useful for companies. It would be necessary to see where this accreditation appears and who provides it.

As well as green pedagogies, emotional intelligence (EI) training could be useful to transform attitudes towards sustainability and the holistic development as shown by previous studies (Nogueira *et al.*, 2023; Warriier *et al.*, 2021). Just as green pedagogy encourages experiential learning and personal reflection to promote sustainable attitudes, EI provides students with the emotional tools to navigate uncertainty and develop resilience (Warriier *et al.*, 2021). Studies have shown that incorporating EI in educational practices enhances the holistic development of scholars by equipping them with essential competencies for adapting to unforeseen challenges. EI strategies, particularly those focusing on self-awareness, self-control, adaptability, and general mood, align with the goals of green pedagogies by encouraging reflection, emotional resilience, and thoughtful decision-making (Warriier *et al.*, 2021). EI is also known to allow individuals to build strong relationships with others, to be more flexible, and open-minded in their approach to sustainability, and to be more proactive in their efforts to address sustainability challenges (Nogueira *et al.*, 2023). Together, these approaches could offer a robust framework for preparing students to address the complexities of sustainability.

6. Implications and further research

Through providing examples on training the teachers on sustainability competences through service-learning and green pedagogies, this research contributes to the advancement in incorporating sustainability in education. The examples provided work for the Iberian Peninsula. Their transferability to other contexts and cultures with a more technocratic or engineering-focused approaches of sustainability could be limited.

Emotional connection is essential to induce changes in the production and use of human space since without this connection, changing attitudes becomes difficult. Sustainability requires not only intellectual and technological judgement, but also emotional engagement, promoting cooperative and conscious actions. A holistic approach to reconnecting with sustainability must be rooted in an active, emotional connection with the natural environment. To cultivate such emotional connections in students, educators must focus on experiential learning and emotional intelligence. Experiential learning,

through methods like service-learning and green pedagogies, immerses students in real-world sustainability challenges, allowing them to engage meaningfully and develop a personal commitment to sustainability. Emotional intelligence, on the other hand, enhances students' ability to understand and manage emotions in a way that fosters empathy and responsibility toward environmental issues fostering a deep, personal commitment to sustainable practices. By integrating these approaches, educators can foster a deep emotional commitment in students, awakening their curiosity and interest in sustainability as an essential step in this transformative process.

Future research could delve deeper into how these nature-based learning experiences can be systematically integrated into curricula and explore their long-term impact on students' attitudes and behaviors toward sustainability, thereby providing empirical evidence to support their inclusion in educational programs.

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