25TH INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
7-8 SEPTEMBER 2023, ELISAVA UNIVERSITY SCHOOL OF DESIGN AND ENGINEERING, BARCELONA, SPAIN

ECOLOGICAL ETHICS AND DESIGN FOR SUSTAINABILITY: CO-HABITATION OR ROOMATES?

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ABSTRACT
Teaching strong sustainability and ecological ethics in technological higher education remains a challenging activity. This paper explores three pedagogical activities, carried out within and outside the university walls, addressing sustainability and ecological ethics within the practice of Design. Results show that ecological ethics and strong sustainability in design are both difficult to address but possible nevertheless, and that the role of facilitators in learning activities is crucial for students to gain maturity on these issues.

Keywords: Ecological ethics, pedagogy, design for sustainability

1 INTRODUCTION
Education for sustainability is a field of study that enables future designers to work for a sustainable transition of our sociotechnical systems [1]. Research shows that sustainability is in itself a wicked problem, i.e., it is complicated, multidimensional, and has no ideal answer(s). However, it is widely recognised that current global production and consumption patterns feeding a growth-oriented economic system leading to unsustainability. Therefore, design students are at the core of the solution, generating strategies for sustainable production and consumption, notably using the approach of Design for Sustainability (DfS). Learning sustainability becomes crucial for them to develop critical and systemic thinking, and to operate at the interface between multiple stakeholders with conflicting interests [2], challenging the, sometimes unsustainable, status quo at different scales.
There are multiple types of pedagogical methods focusing on developing competences in sustainability [2]. DfS is recognised as one that effectively promotes a transition towards strong sustainability; however, while implicitly integrating ethical concerns in some of its approaches, and reflecting on the ecological impact of its practice, it does not explicitly reflect on ecological ethics of its actions [3]. Ecological ethics aims to inform actions and behaviours of design students (among others) based on a self-reflection of their roles as designers, as humans, and as the intersectional beings they are, in relation with the wider ecological systems [3]; however, unlike environmental ethics [4], its practices are harder to translate from the theory. Petit et al. [5] stressed the distinction between environmental ethics and ecological ethics: while the first one focuses on the transition from an anthropocentric to a biocentric vision, the latter one focuses on building a vision where all living and non-living elements are seen as part of one functional ecosystem, an ecosophy. Using Petit et al.'s reflection, the aim of this article is to present an analytical grid that can help identify pedagogical activities that contribute to the development of DfS while carrying an ecological ethics approach.

2 STATES OF THE ART
Sustainability has become a top priority, nevertheless, there are not many academic research papers focused on the pedagogy of ethics for sustainability. An initial bibliometric analysis supports previous research results suggesting that ethical inquiry into sustainability-related issues requires a combination of methodologies from both formal and not-formal education learning, in and outside the classroom [6], [7], [8], [9]. This lines up with the conclusion of Petit et al. [5], which states that in order to learn and practice ecological (and environmental) ethics, formal education needs to get inspiration from the

popular education model, promoting learning outside the classroom**.** Popular education differs from normalised approaches to education in that it is rooted in the experiences, needs, and aspirations of community members and promotes collective action [10]. Teaching ecological ethics is a complex task in the sense that it becomes an extra layer of complexity to the already complex world of DfS. Therefore, to achieve a curriculum integrating ecological ethics, it may be necessary to use complementary methods coming from popular education's pedagogical approach. Our methodology, therefore, is based on 3 case studies, where 2 out of the 3 cases are inspired by popular education pedagogical approaches.

3 METHODS

Our methodology is structured in 5 steps. First, generating a state of the art of different pedagogical activities that are transversal to ecological ethics and strong sustainability, focusing on the 3 criteria given by Petit et al, [5]. Secondly, building an operational grid to evaluate the relevance of original pedagogical activities. Simultaneously to step 1 and 2, performing pedagogical activities inside and outside the university walls becomes step three. Step four consists of testing the grid on the pedagogical activities carried out by some of the authors. Lastly, as step five, we perform an analysis of the results.

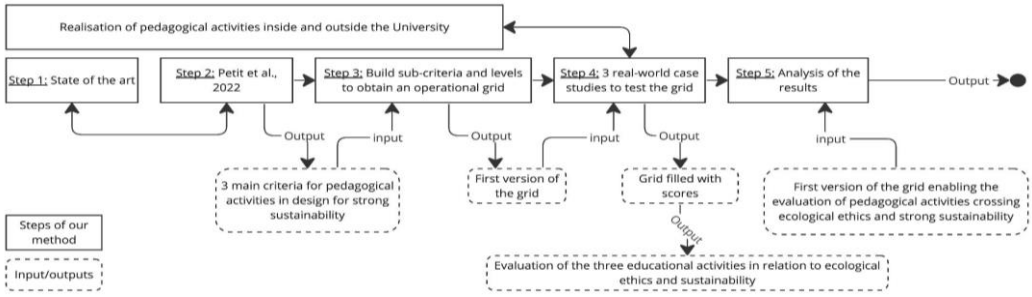

Figure 1. Diagram of steps and outputs of our research methodology

To illustrate how strong sustainability and ecological ethics can be integrated and assessed in pedagogical activities, we propose an assessment grid based on the 3 characteristics described by Petit et al. [5] of a pedagogy towards ecological ethics and sustainability:

- Breaking down the frontier between theory and practice
- Breaking down the frontier between the natural sciences and the humanities
- Breaking down the frontier around universities

The first characteristic is used to examine the gap between the theoretical objective of each activity and the observed practical results. The other two characteristics are detailed in Table 1, where they divide into several criteria, each defined by 3 or 4 levels of maturity (specific levels for each criterion).

Table 1. Assessment grid of pedagogical ethics for sustainability for design activities

Criteria / Levels	Level 0	Level 1	Level 2	Level 3
Characteristic 1: Breaking down the frontier between natural and human				
Criterion 1: Interactions between human systems and the biosphere	The biosphere is not mentioned	The biosphere is considered as a block outside of humans. Biosphere is referred to as the environment, without distinguishing between the elements that make it up.	The biosphere is seen as a set of complex interactions external to humans. Human activities understand the complexity of the biosphere while having a utilitarian relationship	The biosphere is seen as a set of complex interactions of which humans are a part. Humans are embedded in an environment
Criterion 2: Interactions	Human systems and	Humans build artefacts (action	Human is affected by	Human and artefact affect

between human and technical systems	artefacts are perceived as independent	only from the human systems to the artefacts)	artefacts (action only from the artefact to the human)	each other (two-way action)
Characteristic 2: Breaking down the frontier around universities				
Criterion 3: Involvement of local actors in a pedagogical module	No non-academic actors involved	Local actors involved in the pedagogical module (but not involved in the educational part)	Local actors involved s but a posteriori	Local actors and academics co-construct an educational activity
Criterion 4: Accessibility of knowledge for the territory	The module is proposed within the university, but it is difficult for the actors to take it up	The actors of the territory can take up what is done, but the access is not free	Territorial actors can take up what is being done elsewhere.	Local actors can take up the activity and are accompanied to do so
Criterion 5: Diversity of actors involved in the activity	Only 1 type of actor can participate (i.e., just companies)	2 types of actors can participate (i.e., 1 public and 1 private actor)	The activity can be addressed to different types of actors.	The activity is inter-generational and multicultural
Criterion 6: Level of commitment Participants: either it is free, either they paid Organisers: volunteer or in a commercial approach	Case where participants and organisers are in a commercial approach both pay or are paid to participate / organise)	Case where participants do not have the choice to participate (but do not pay for that) and there is a commercial approach on the part of the organisers (fixed price, service).	Case where the participants are volunteers. The organisers in a commercial approach - commercial: pay free price	Case where participants and organisers are volunteers to participate / organise the activity (can be free or can contribute via a donation).

The assessment grid was put to the test using the 3 real case studies described in the next section.

4 CASE STUDIES AND RESULTS

The assessment grid was tested using three pedagogical activities that already are or that can be integrated into formal educational programs. These activities have already been conducted by the authors on different typologies of students. These activities include an eco-design hackathon, which engages students in the design process from both engineering and artistic perspectives, a workshop on the concept of 'renunciation' or opting out, and a Climate Fresk, which prompts participants to better understand climate change.

4.1 Case study 1 (CS1): Climate Fresk (adult version)

The Climate Fresk is an interactive activity designed to understand the causes and effects of climate change based on the latest IPCC reports. Divided into groups, participants use a set of cards containing relevant IPCC diagrams. The objective is to reflect on, discuss and arrange the cards in the correct order to describe the most important factors that contribute to climate change, and their consequences to the environment and society. Activities were also conducted by the organisers to encourage participants to share their emotions and discuss out loud.

4.2 Case study 2 (CS2): Workshop on ‘renunciation’ (opting out)

The objective of the 'renunciation' workshop is to co-envision which existing activities from today’s society should be discontinued, and in doing so, respecting the planetary boundaries. By examining individual activities from various perspectives, participants become aware of the complexity that a 'renunciation' process carries. Ultimately, participants work together to create a strategy for ‘renouncing’ the chosen activity or certain aspects of it. Participants become aware of existing unsustainable behaviours, their consequences and potential solutions.

4.3 Case study 3 (CS3): Ecodesign hackathon

The eco-design hackathon is a 24-hour hackathon in which Master students collaborate to eco-design products or services. Topics are suggested by local organisations, promoting direct engagement with relevant stakeholders. Teams are formed mixing students from engineering schools, design schools, and master's programs with different academic backgrounds to favour multidisciplinary work. The activity also serves as the final exam for an eco-design class for some of the participants.

4.4 Results[1]

Results are described for each criterion in a table and a descriptive text. The table shows the levels achieved by each workshop: X indicates the level(s) achieved. P indicates the levels partially achieved (in very specific cases or with only one actor).

Table 2. Results about Criterion 1

Criterion 1	Level 0	Level 1	Level 2	Level 3
Climate Fresk (CS1)				X
Workshop on ‘renunciation’ (CS2)	X	X	X	X
Ecodesign hackathon (CS3)		X		

For criterion 1, CS1 reaches level 3 as participants map the interactions between natural systems, human and technical ones. CS3 focusing more on proposing solutions, leaves little time devoted to mapping those interactions. Finally, the level addressed by the CS2 depends on several variables: the sensitivity of the facilitator to this criterion, the topic, and the facilitator's ability to make the link between the topic addressed and criterion 1.

Table 3. Results about Criterion 2

Criterion 2	Level 0	Level 1	Level 2	Level 3
Climate Fresk (CS1)				X
Workshop on ‘renunciation’ (CS2)				X
Ecodesign hackathon (CS3)		X	P	

For criterion 2, CS 1 and 2 address level 3 with ease. They both connect human and technical systems and identify interactions among them. For CS3, only level 1 and/or 2 are addressed as the identification of interactions among systems is shallower. Such interactions cannot be performed at CS3 due to more time being allocated to developing solutions. For CS3 it is not certain that participants have the tools to carry out the analysis of those interactions.

Table 4. Results about Criterion 3

Criterion 3	Level 0	Level 1	Level 2	Level 3
Climate Fresk (CS1)	X	X	X	P
Workshop on ‘renunciation’ (CS2)		X	P	
Ecodesign hackathon (CS3)		X	P	

For criterion 3, the participation of local actors in CS3 depends on the context. However, level 3 remains difficult to address for all the case studies, perhaps because co-construction depends on interpersonal

[1] All details of the chosen case studies, as well as all the results of each learning activity can be found on the following link: https://tinyurl.com/bdmzepk5

relationships (and is therefore very specific). Moreover, the proposed activities are already designed (support, logic, sequence), which does not support an environment of co-construction.

Table 5. Results about Criterion 4

Criterion 4	Level 0	Level 1	Level 2	Level 3
Climate Fresk (CS1)				X
Workshop on 'renunciation' (CS2)			X	
Ecodesign hackathon (CS3)		X		

For criterion 4, CS2 and CS3 can be carried out by any actor in the territory. The difference between local actors lies in the support available for this activity. CS1 can also be reproduced (under a different name), but its access to the territory's actors is subject to a cost (mostly financial).

Table 6. Results about Criterion 5

Criterion 5	Level 0	Level 1	Level 2	Level 3
Climate Fresk (CS1)	X	X	P	P
Workshop on 'renunciation' (CS2)	X	X	P	
Ecodesign hackathon (CS3)			X	

For criterion 5, as the organisation of CS3 is based on the integration of different actors, the level is necessarily at least level 2. Regarding CS1 and CS2, it depends on the organisation and on the context.

Table 7. Results about Criterion 6

Criterion 6	Level 0	Level 1	Level 2	Level 3
Climate Fresk (CS1)	X	X	X	X
Workshop on 'renunciation' (CS2)				X
Ecodesign hackathon (CS3)	X			

For criterion 6, there is a strong difference between the case studies as they follow different participation models. The level reached by CS1 depends on the context. CS2 is positioned at level 3 because it is freely accessible and cannot be used for commercial purposes. CS3 is carried out as part of a paid training course (students) with stakeholders (companies) who pay to submit a topic, so we are at level 0 of the grid.

5 DISCUSSIONS

5.1 Breaking down the frontier between natural and human sciences (crit. 1 and 2)

In the CS1, the participants are guided, by the information displayed on the cards, to represent the interactions. In CS2, the facilitator guides the participants to highlight the interactions. For CS3, the students are mostly autonomous in the process. Reflection on the interactions between the natural, technical, and social systems are highly complex and require a system thinking approach [11]. This systemic approach may appear spontaneously to some students when they come in contact these pedagogical activities (even if this is not systematic). On the other hand, challenging an anthropocentric vision of design methods and questioning the role of the designer are weak if these issues are not explicitly raised by the facilitator. Therefore, if the activity doesn't include these elements, the link between strong sustainability and ecological ethics brought by the educational activity will be weak.

5.2 Breaking down the frontier around universities (criteria from 3 to 6)

In CS3, its activities are restricted to students of a module of a Masters-2 diploma, so while guaranteeing a diversity of actors, it does not remain accessible to external participants. Conversely, CS1 and CS2 are openly accessible but there was a lack of diversity in the participants. We noticed a segmentation of the actors taking place during the workshops (whereas it is not mandatory). This observation seems paradoxical because it shows a gap between the theoretical objectives of CS1 (open to all, mixing different types of actors) and its practice (lack of mixed interaction therefore few collective actions).

Another observation from CS3 is that students faced difficulties to feel engaged with their subject and with the company linked to the subject. Participants felt obliged to discuss a subject which was not necessarily aligned with strong sustainability or ecological ethics objectives. Thus, they felt themselves in an ethically difficult position. This issue might be due to a lack of preparation by the organisers for successfully integrating academic approaches (mostly idealistic and theoretical) from students to the more pragmatic professional world (existing within the current growth-based capitalist system). This shows that it is effectively not easy to break down the boundaries (from theory to practice) around universities on issues related to strong sustainability and ecological ethics. Such a result leads to some reflections on the preparation of students and their integration into the professional world. After participating in pedagogical experiences on strong sustainability and ecological ethics, are students more inclined to integrate the current growth-based capitalist system, or would they explore professional options that are different (i.e.: degrowth oriented)?

6 CONCLUSIONS

Thanks to this grid we can assert four elements: (1) The 3 criteria of the grid are relevant to assess DfS pedagogical activities; (2) both ecological ethics and strong sustainability are complex to address in pedagogical activities; (3) the role of the facilitator is crucial to address and link ecological ethics and strong sustainability in DfS pedagogical activities; (4) educating educators on the relationship of strong sustainability and ecological ethics is crucial for them to become successful facilitators and enable the environment for co-habitation for those concepts and practices.

The assessment grid proposed is a first draft to assess the integration of strong sustainability and ecological ethics principles in DfS activities. It is intended to be used to evaluate additional activities to better understand which pedagogical activities relate more, or less, to ecological ethics and strong sustainability. So far, the grid has allowed us to confirm that ecological ethics and strong sustainability can be assessed together (cohabitation) in DfS activities.

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