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Chapter 15. Education for Sustainability and Regeneration

15.1. COURSE SUMMARY

Table 15–1

Audience and level of studies	Students (Bachelor)	
Group size	20–30	
Course duration	14 weeks	
Credits	6 ECTS	
Workload	Presence: 48h (lectures) + 32h (exercises) Self-study: 70h (teamwork)	Total: 150h
Contents/primary topics	• State of the world: from globalization to SDGs, planetary boundaries and Anthropocene. • Sustainability indicators (water, ecological, carbon, social, etc.). • Global and individual transformations.	
Main course objectives	• Understanding the risks and opportunities related to sustainability and regeneration. • Increase the awareness and personal links to the topics. • Be able to design potential sustainable/regenerative solutions.	
Main teaching approaches	• Lecture-based learning. • Collaborative learning.	
Main teaching methods	• Case studies. • Flipped classroom. • Sustainability-regenerative related research project.	
Learning environment	Hybrid classroom (face-to-face and online learning).	

Link to Sustainable Development Goals (SDGs)	SDG 3 | Good Health and Well-being | Ensure healthy lives and promote well-being for all at all ages. SDG 5 | Gender Equality | Achieve gender equality and empower all women and girls. SDG 7 | Affordable and Clean Energy | Ensure access to affordable, reliable, sustainable, and clean energy for all. SDG 9 | Industry, Innovation, and Infrastructure | Build infrastructure, promote inclusive and sustainable industrialization and foster innovation. SDG 10 | Reduced Inequalities | Reduce inequality within and among countries. SDG 11 | Sustainable Cities and Communities | Make cities and human settlements inclusive, safe, resilient and sustainable. SDG 12 | Responsible Consumption and Production | Ensure sustainable consumption and production patterns. SDG 13 | Climate Action | Take urgent action to combat climate change and its impacts. SDG 14 | Life below Water | Conserve and sustainably use the oceans, seas and marine resources for sustainable development. SDG 15 | Life on Land | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. SDG 17 | Partnerships for the Goals | Strengthen the implementation and revitalize the global partnership for sustainable development.

Table 15–2

Impact assessment	(None) Low/ Medium/ High	Explanation
1. Degree of student participation / activeness	High	Conducting own research/ working on a personal/ individual project in single calculations such as carbon, water or ecological footprints related with its consumption.
2. Degree of student collaboration / group work	High	Most of the weekly assignments, activities and works are in the form of teaming and sharing in class, generating debates under a rich polyhedric approach being finally completed in the teacher's class.
3. Degree of student emotional involvement	High	Reading papers, news and personal approaches from their own countries' situations (flood, fires, migration, social inequalities, biocapacity, prosperity, footprints, etc.). These intense but straightforward exercises usually awaken consciousness and produce the beginning of change, from the personal to the global. The paralysing emotions by the results reach unsustainability to immediate action in the face of the urgency of solutions. The final goal is designing conceptual actions to be potentially implemented in the context selected.
4. Degree of inter-/transdisciplinarity	High	Lectures around disciplines to have a systemic perspective where everything is interconnected. Planetary boundaries, Anthropocene, SDGs, "the Great Acceleration", biodiversity index, sustainable finance (ESG), etc., can help to accomplish this issue. Again, the final objective is the application of the contents from the final project into a real context.

Impact assessment	(None) Low/ Medium/ High	Explanation
5. Degree of student (self-) reflection	High	Weekly assignments move the students "out of their comfort zones" to connect global issues with personal experiences or daily assumptions/decisions.
6. Degree of experience of real-life situations	Medium	The final project is based on an actual challenge/proposal on campus.
7. Degree of nature-related experiences	Medium	Nature-based solutions are only discussed in class; biomimicry related classes with analogies, gaming, etc., are used in any single class to evaluate how nature solves similar challenges from 3.8 billion years ago. However, when possible, outdoor activities take place.
8. Degree of stakeholder integration	Medium	Conducting interviews with representatives of one stakeholder group in a research study included in a final project (university students, staff, faculty, suppliers, etc.).
9. Degree of integration between theory and practice	High	A practical conceptual final project on an actual situation based on their observations and users' validation, requiring direct application of the theoretical classes, creativity, teaming.

15.2. COURSE INTRODUCTION

Sustainability is imperative in any discipline, becoming more strategic day by day, regardless of the business sector. Nowadays, most professional activities handle materials, energy, water, people, and waste. In addition, designers and several industries place products and services in the market which must consider the repercussions of their design decisions. The scope of sustainability and its opportunities are not always well understood from the student's perspective. This course will cover the fundamental scientific principles that operate the functioning of the operating conditions of the Earth, where we live and compare them with the way humans do. We must understand and be aware that the current linear model of thinking and design must inexorably move to another, more circular approach, as dictated by nature, i.e., being sustainable and regenerative by design. Finally, it is well documented that emerging diseases, such as COVID-19, and biodiversity loss are interlinked (Tollefson, 2020), so it is relevant to check what we can do for nature.

The planet's current state will be analysed and its connection with the design field, consumption habits, business activities, etc., will be evaluated. In the end, sustainability is a global design problem and decision-making issue. Finally, one of the main objectives of this program is to change student mindsets. This subject also seeks to reach a higher degree of consciousness to design and combine doing good (1) and doing business (2) with Environment-

Social-Governance (ESG) impact as well as Corporate Social Responsibility (CSR) approaches in mind. Design and business not only have to be good but also do good. The subject also looks for an increase of awareness since the daily decisions sometimes are not easy to split and handle. Organic markets and other local eco alternatives will be actively revisited, opening the student's eyes to enhance their responsible consumption decisions. The importance of sustainable certifications is considered. Finally, through a final project, students in teams will design green campus proposals after analysing the space where they spend part of their lives in their stages as students.

15.3. LEARNING OBJECTIVES

Table 15–3

Learning objective dimension (UNESCO, 2017)	**Operationalization**	**Competency referred to (Rieckmann, 2018)**
Cognitive	Understanding how individual lifestyle choices influence social, economic and environmental development.	Self-awareness competency
	Understanding the production and consumption patterns and value chains and the interrelatedness of production and consumption (supply and demand, toxins, CO_2 emissions, water footprint, waste generation, health, working conditions, poverty, etc.).	Systems thinking competency
	Learning about different options and practices of sustainable design affecting the chosen production, usage and consumption strategies.	Strategic competency
	Calculating different footprints such as ecological, carbon, water or even social etc., and understanding the basic approach of Life Cycle Assessment (LCA).	Systems thinking competency
	Knowing the *status quo* of our planet, i.e., regarding its social and environmental dimensions connected with the business fields.	Systems thinking competency
	Ecosystem services understanding through small excursions nearby.	Integrated problem-solving competency
	A direct access to the new emergent economies such as bioeconomy, doughnut, regenerative, circular, etc.	Integrated problem-solving competency
Socio-emotional	Changing the personal perception and attitude being able to explain the impacts of climate change related to social and economic dimensions.	Self-awareness competency; Systems thinking competency
	Ability to encourage others to take action about different SDGs – looking for partnerships (SDG 17).	Collaboration competency
	Personal bonds directly affected by environmental or social footprints assist students in changing behaviours by recognising that joint action towards the implementation of SDGs is essential.	Collaboration competency; Systems thinking competency

Learning objective dimension (UNESCO, 2017)	Operationalization	Competency referred to (Rieckmann, 2018)
Behavioural	Ability to promote and support climate-friendly designed products and economic activities.	Self-awareness competency
	Basic understanding and research of their own country's dependence on natural resources and biodiversity.	Self-awareness competency
	To connect with local groups working towards biodiversity conservation and enhancement in their campus and nearby territory.	Collaboration competency

15.4. COURSE OUTLINE

Table 15–4

Structure		Session focus	Homework
Week 1 (Unit 1)	Session 1 (3h)	Introduction to the subject, structure, grading, etc. Getting to know each other	Design a Miro template with a personal freestyle profile
Week 2 (Unit 2)	Session 2 (3h)	Introduction to Sustainability	Watching a video about Planetary Boundaries for a debate in class
Week 3–9 (Unit 3)	Session 3 (3h)	Water Footprint	Assignment around personal freshwater consumption
	Session 4 (3h)	Carbon Footprint	Personal carbon emissions using an online calculator
	Session 5 (3h)	Ecological Footprint	Personal calculation + debating around Overshoot and Biocapacity concepts
	Session 6 (3h)	Biodiversity	Express oral presentation after reading a World Wildlife Fund Report
	Session 7 (3h)	Social SDG domain	Work developed by teams of 3–4 students to apply the selected SDGs in real cases potentially applicable in the university itself, local companies or local NGOs.
	Session 8 (3h)	Organic Market Fair	Pair/Trio Assignments on particular bio-brands
Week 10 (Unit 4)	Session 9 (3h)	Evaluation test	
	Session 10 (3h)	Certification, ecolabelling and greenwashing	Express presentation and analysis of specific labels
Week 11–14 (Unit 5)	Sessions 4–6 (3h each one)	Application from the theory to concept proposal	Teaming Final Project Presentation and Prototyping

15.5. TEACHING APPROACHES AND METHODS

Different didactic approaches are used during the course. Some are based on theoretical classes to introduce learning processes to students; others are more practical, e.g., focus on a learning by doing methodology.

During the first two weeks of the course, making students open up and question their old habits or mindsets can be triggered by watching different videos related to the state of the world linked to the planetary boundaries approach (Rockström et al.,2009), the Anthropocene concept (Crutzen and Stoermer, 2000) or the six-mass extinctions (Barnosky, 2011; Ceballos, 2015) using different open-source videos available on the internet. These specific videos open the system thinking perception, facilitating the sustainability subject's complexity under a holistic approach. Most sustainability classes cover the social and economic issues leaving environmental aspects aside. Circularity, systemic vision, nature-based solutions, biomimicry, end of use perspective or eco-design are some approaches introduced to the student to open the design solutions.

Flipped classes (Herreid and Schiller, 2013; Tucker, 2012) are the basis during the first sessions, where students share a multifaceted approach for a weekly topic announced in advance. Through selected readings and online searches, students working individually or in pairs must prepare a quick digital presentation. After sharing these presentations, debates are naturally generated via lively and participative discussions in class. This method is interesting because the student feels that they are an active part of the learning process, generating a stimulus to enhance, week by week, their digital presentations. Open debates are generated, giving a chance to mitigate basic misunderstandings and perceptions based on their own culture, behaviour, country, etc. Finally, the teacher complements what has not been covered in their student work or what is considered relevant to cover. With these types of classes, week by week, students adopt a habit and culture of introducing the current reality of the unsustainable global situation and discuss possible existing solutions. The teacher conducts the classes to reaffirm the connection of apparently isolated dots due to the linear way of thinking and lack of comprehension of the holistic and interconnected sustainability culture.

On the other hand, some assignments are based on collaborative teamwork (Bravo et al., 2019; Riebe et al., 2016) with different activities where students must participate outside the classroom. Visits to fairs or exhibitions related to organic markets; social/environmental events in town; activities promoted by NGOs, the City Council, Institutions, Foundations, corporations, etc., focused on sustainability topics. These activities are essential and represent critical opportunities for the students to meet real people working in fundamental sus-

tainability topics, whatever the sector (food, fashion, arts, biodiversity, social, etc.).

Finally, in the last part of the subject, the student can propose solutions in a context that they choose. The facilities of their university, such as the campus itself, the classrooms, the Fab Lab (3D/additive printing facilities) or design studios (open spaces for students to implement their design products/services). Specific lectures or tutorials with NGO experts, city council consultants, and professionals outside the university were essential for this project. Weekly assignments of the evolution of the project are mandatory, giving the teams a basic structure to accomplish the proposal on time. The evolution of the process itself is also evaluated since sometimes these parts are an important site of the learning rather than the final "polished" proposal. Design thinking methodologies are widely used to have a systematic approach to problem-solving design, where IDEO did not invent the term but practise and apply it to problem solving (IDEO, n.d.). Additional nature-based methodology like biomimicry, from Biomimicry Institute in the U.S.A. or Delft University in Europe, is also used for final projects where living ecosystems and organisms work as mentors, models, and measures. This final part is orally and digitally presented to an invited jury with guests from the university (teachers, director of the program, staff from the sustainability department) and stakeholders from outside. This evaluation provides a broader view to the student thanks to new assessments from different professionals and sectors. This process enriches learning beyond the tutorials of the titular professor.

15.6. EXERCISES

Calculating Footprints

Weekly quick basic individual/pair exercises around sustainability footprints with the aim to calculate personal data and countries' figures. With the results obtained from the footprints, students designed a synthesised digital image with the results complemented with their partners. This exercise is shared in class through express (two to three minutes) oral communication. After this digital presentation, the group in class starts a discussion using different perspectives, approaches, and realities.

Visit Your Local Fair/Bio Market

In groups of two to three students visit a local/national organic market fair, attend different activities and interview owners of product/services stands. The following briefing is provided:

1. Before going to the fair, you might explore the digital schedule of activities, select and attend one to two you might like. Teams must attend one activity per student to have a broader perception.
2. Once reached the fair, take a short walking tour around the stands to get a general overview. Have a look at the certifications you already know and also new ones you see.
3. You might talk with the producers/stands to know more about why they are organic markets and other relevant info interesting for you.
4. Don't forget to attend the activities previously selected at home.

After the visit, a short (one to two minutes) engaging video must be produced to promote responsible consumption. The video will show interesting approaches to promote these particular daily options. Upload to YouTube/Vimeo and share the link via the campus online system. In addition, two short (one to two slides) PowerPoint presentations must be prepared to be shared with the class. One showing two to three certifications and their characteristics. The other showcasing one ingredient from a particular product and comparing industrial and organic by taking into account people's health or the environment.

Campus Mapping

In groups of four to five students, the final project is designed around a "hot spot" (problematic spaces on campus related to some SDGs selected by the teams) mapping the university campus. Following a design thinking methodology with a biomimetic approach, teams will empathise, ideate, validate, and design a conceptual proposal. Students must deliver a digital presentation and, in addition, be ready for a short Q&A session, answering in front of an external academic jury. A series of deliverables are requested, such as a digital report including the economic approach (university reputation, added value, marketing), prototyping, samples, models, etc. and one minute video.

15.7. ASSESSMENT

Evaluation consists of four different ways to show a global understanding and integration of the subject: 1) constant effort, 2) individual comprehension, 3) working in a team in a particular challenge, and 4) active participation. These

four criteria will provide a balanced and fair sense of the subject's primary culture, awareness, and decision-making.

Individual presentations (30 %). During the first period, week by week, every student must complete a series of seven assignments, building their mindset about sustainability through personal research and application, readings, and everything included in the syllabus. The main objectives to cover are personal transformation, enhancing awareness, systemic thinking, access to relevant and reliable data, working in groups, etc. This part will be essential to develop critical thinking about the actual global situation and solutions.

Intermediate test (20 %). A non-memory evaluation where systemic connections and consumption patterns will be tested according to the topics described in the content outline of this publication.

Final project (30 %). During the last part of the course, the student teams will scan the actual state of sustainability of the university campus and other facilities to design alternatives to enhance the situation as a final project.

Active class participation (20 %). Active and motivating participation in class, debating and showing a positive attitude.

15.8. PREREQUISITES

Required prior knowledge from students:

- No prior knowledge required

Required instructors and their core competencies:

- Teacher (core competences: sustainability indicators)

Required tools:

- Online communication platforms (e.g., Zoom)
- Online learning platform (e.g., CampusOnline)

15.9. RECOMMENDED RESOURCES

Table 15–5

Topic	Readings	Videos & Web sources
Units 1&2	• Bakker, C., Hollander M., Hinte, E. & Zljlstra, Y. (2014). *Products that last. Product Design for Circular business models.* TU Delft Library. • Leonard, A. (2010). *The story of stuff.* London, England: Constable.	• Johan Rockström (2010, July). Let the environment guide our development [Video]. TED Conferences. https://www.ted.com/talks/johan_rockstrom_let_the_environment_guide_our_development/transcript?language=en • elvladyman (2019, May). Before the Flood Full Movie National Geographic [Video]. YouTube. https://www.youtube.com/watch?v=zbEnOYtsXHA • Laurent, M. & Dion, C. (2017) Tomorrow (Demain) The Film [Film]. Move Movie; Mars Films; Mely Productions. • Devas, F. (2016). Cities (6/6) [TV series episode]. In Gunton, M. (executive producer) BBC Planet Earth II. BBC Natural History Unit; BBC America; ZDF, Tencent; France Télévisions. • The Toaster Challenge (2015, June). Olympic Cyclist Vs. Toaster: Can He Power It? [Video]. YouTube. www.youtube.com/watch?v=S4O5voOCqAQ • Sustainable Human (2014, December). How Whales Change Climate [Video]. YouTube. https://www.youtube.com/watch?v=M18HxXve3CM • Eames Office (2010, August). Powers of Ten™ (1977) [Video]. YouTube. https://www.youtube.com/watch?v=0fKBhvDjuy0
Unit 3	• Benyus, J. M. (1997). Biomimicry: Innovation inspired by nature. New York: Morrow. • Allen, R. (Ed). (2010). Bulletproof Feathers. How science uses nature's secrets to design cutting-edge technology. University of Chicago Press. • McDonough, W., & Braungart, M. (2010). Cradle to cradle: Remaking the way we make things. North Point Press. • McDonough, W., & Braungart, M. (2003). Towards a sustaining architecture for the 21st century: the promise of cradle-to-cradle design. Industry and Environment, 26(2), 13–16.	• Story of stuff. Story of Bottled Water [Video]. https://storyofstuff.org/movies/story-of-bottled-water/ • Scientific American. Fresh Water crisis [Video] https://www.scientificamerican.com/article/is-there-really-a-freshwater-crisis/?redirect=1 • Conservation International. Nature is Speaking [Video]. https://www.conservation.org/nature-isspeaking/Pages/default.aspx • Kiss the Ground. Media [Videos]. https://kisstheground.com/videos/ • Project DrawDown Project. Climate Solutions 101 [Video]. https://drawdown.org/climate-solutions-101 • Water footprint network (n.d.) Water footprint. https://www.waterfootprint.org/en/

Topic	Readings	Videos & Web sources
Unit 3	• Pilloton, E. (2009). Design revolution: 100 products that empower people. Metropolis Books. • Berners-Lee, M. (2011). How bad are bananas? The carbon footprint of everything. Grey Stone Books Publ. • Yarrow, J. (2008). How to reduce your carbon footprint. Duncan Baird Publ.	• Carbon footprint (n.d.) Carbon footprint. https://www.carbonfootprint.com/ • Global Footprint Network (n.d.) Footprint calculator. https://www.footprintnetwork.org/resources/footprint-calculator/ • World Wildlife Foundation (n.d.) Living Planet Index. https://livingplanet.panda.org
Unit 4	• Health Plan Magazine (2014). *Food E Numbers Explained*. https://www.healthplanspain.com/blog/health-tips/266-food-e-numbers-explained.html • Reggs Design Studio (2017). *Seven facts you didn't know about E-numbers*. Medium. https://medium.com/@reggs/seven-facts-you-didnt-know-about-e-numbers-9700e2343f53	• Ecolabel Index (2021) http://www.ecolabelindex.com

15.10. GENERAL TIPS FOR TEACHERS

Based on the author's own experiences on the evolution of students' attitudes year by year, the author considers that one of the most relevant aspects appreciated by the students is to share the opportunity for them to be an active part of the subject. There are numerous ways to develop positive group involvement that will depend on each topic. Based on the author's experience regarding the aspects of culture, self-confidence, determination, commitment to global challenges, and knowledge, the teacher must build "building blocks" around fostering a sustainability culture/mindset. The scope and perspective of connecting isolated dots needs to be combined with showing the students enthusiasm that pollinates the group and encourages them to participate. The evaluation required by the university, is a minor element that the student must also appreciate. In "real life", no company or institution is going to ask for their grades, but for the solutions, they can contribute to the challenges of the 21st century.

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