Pilar Acosta

Chapter 10. Solving Sustainability-Related Problems Using Self-Directed Learning

10.1. COURSE SUMMARY

Table 10–1

Audience and level of studies	Students (Bachelor)	
Group size	26–50	
Course duration	16 weeks	
Credits	3 ECTS	
Workload	Presence: 48h Self-study: 72h	Total: 120h
Contents/primary topics	• Sustainable development • Organisational strategies for sustainability	
Main course objectives	• Explain the concept of sustainable development and sustainable development goals (SDGs) • Analyse organisational strategies for achieving SDGs • Create a proposal for overcoming sustainability problems facing a specific organisation	
Main teaching approaches	• Experiential learning • Self-directed learning • Active learning	
Main teaching methods	• Sustainability-related consulting project • Lecture • Field trip	
Learning environment	Classroom (face-to-face learning) Beyond classroom (organisational visits)	
Link to Sustainable Development Goals	SDG 9 | Industry, Innovation and Infrastructure | Build infrastructure, promote inclusive and sustainable industrialization and foster innovation SDG 12 | Responsible Consumption and Production | Ensure sustainable consumption and production patterns	

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Table 10–2

Impact assessment:	(None) Low/Medium/High	Explanation
1. Degree of student participation / activeness	High	Students are working on their own sustainability-related consulting project. They are responsible for directing their individual knowledge acquisition process. The teacher offers guidance by providing the necessary resources, but students should demonstrate initiative and curiosity when developing the projects.
2. Degree of student collaboration / group work	High	Students work in groups throughout the entire course.
3. Degree of student emotional involvement	Medium	Students reflect on their learning process in a self-assessment assignment. However, emotions are not explicitly explored.
4. Degree of inter-/transdisciplinarity	High	Students work in groups organised by the teacher to combine different disciplines to encourage critical thinking.
5. Degree of student (self-) reflection	Medium	Students reflect on their individual learning processes through a self-assessment exercise.
6. Degree of experience of real-life situations	High	Students provide solutions to real-life problems faced by a specific organisation. They also conduct a field trip to the organisation.
7. Degree of nature-related experiences	(None)	
8. Degree of stakeholder integration	Low	Students learn through lectures and readings about how to map stakeholders and understand materiality as defined and used in the Global Reporting Initiative (GRI).
9. Degree of integration between theory and practice	High	Students work in groups using problem-based learning (PBL). This self-directed learning approach involves an integration of theory and practice.

10.2. COURSE INTRODUCTION

This course offers students the opportunity to create organisational strategies for achieving SDGs by using active learning pedagogies. The SDGs have been conceived recognizing the importance that multiple actors, including for-profit organisations, have in achieving them. In this course we seek to contribute to

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the participation of organisations of different nature to reach the goals of this global agenda.

Throughout the semester, students work on a project using problem-based learning (PBL). In this experiential learning approach (Kolb, 1984), students tackle real-world problems in small interdisciplinary groups. PBL is based on the principle that students are responsible for their own learning process, and it can be considered a self-directed learning approach (de Graaf & Kolmos, 2003).

Using PBL, students develop a proposal for solving a sustainability-related problem faced by a given organisation. Students must first define the problems at hand and then devise corresponding solutions. The teacher identifies organisations facing environmental and social issues in the context of local debates about sustainability (e.g. water access, biodiversity loss, poverty, lack of environmental education). For instance, in one semester, students dealt with problems faced by a social business in the industry of sustainable tourism; in another semester, students dealt with a distribution company's problem of how to reduce the impact of transportation. The course also includes a field trip that allows students to assess the sustainability situation of the target organisation.

At the end of the course, students present their proposed course of action to the organisation. They conduct a self-reflection exercise to assess their learning processes and the work they performed in groups.

10.3. LEARNING OBJECTIVES

The learning outcomes and competencies of this course are aligned with the competencies described in the educational institutional plan of Universidad Icesi (Universidad Icesi, n.d.). As required by the university, each course must contribute to the core abilities and competencies of the university. The course also contributes to the specific competencies of the business school which offers this course. It is also worth mentioning that this course seeks to develop higher-order competencies, i.e. analysis, synthesis, and evaluation (Bloom, 1956; St. Edward´s University, n.d.).

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Table 10–3

Learning objective dimension (UNESCO, 2017)	Learning objective	Competency referred to framework of Universidad Icesi (n.d.)
Cognitive	Ability to explain the concept of sustainable development and the SDGs	Multiperspectivism
	Understand the historical evolution of sustainable development and related concepts	Local–global thinking
	Understand the principles of systems thinking	Multiperspectivism
	Ability to analyse organisational strategies for achieving SDGs	Strategic thinking
	Ability to understand different tools for the design, implementation and monitoring of strategies in terms of sustainable development	Innovation
Socio-emotional	Ability to critically reflect on the impacts of the sustainability practices of different organisations, particularly companies	Critical thinking
	Ability to critically reflect on the citizens' role in achieving the SDGs	Critical thinking
	Ability to associate everyday actions with the SDGs	Critical thinking
Behavioural	Ability to apply the socio-ecological system's framework	Multiperspectivism
	Ability to create a proposal to solve the sustainability problems identified in an organisation	Strategic thinking
	Ability to communicate the developed proposal to various audiences	Expression
	Ability to link organisational practices to the SDGs	Strategic thinking

10.4. COURSE OUTLINE

Table 10–4

Structure		Session focus	Homework
Week 1	Introduction (3 hours)	• Climate Fresk	• Read an excerpt from "The Limits to Growth" (Meadows et al., 1972) • Watch videos developed by the professor on the concept of sustainable development, as well as the course description and methodology of the course (PBL)
Week 2	The concept of sustainable development (3 hours)	• Lecture on the concept of sustainable development • Group exercise on sustainability in the food industry (see subchapter "Exercises")	• Read an excerpt from "Collapse" (Diamond, 2005) • Form groups for the semester

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Structure		Session focus	Homework
Week 3	The concept of sustainable development (3 hours)	• Video and discussion on "Collapse" (TED, 2003) • Guest: biodiversity and conservation	• Read website about SDGs (UN, n.d.)
Week 4	SDGs (3 hours)	• Group exercise for SDGs: Prepare a newspaper article (see subchapter "Exercises") • Lecture on SDGs	• Read articles on socio-ecological systems (McGinnis & Ostrom, 2014; Ostrom, 2009)
Week 5	Systems thinking (3 hours)	• Group exercise: Understand socio-ecological systems • Guest: Systems thinking	• Gather secondary information about the organisation and sustainability-related problems in the relevant industry
Week 6	Field trip (3 hours)	• Field trip: Visit the organisation of the consulting project	• Evaluation 1 (first six weeks)
Week 7	PBL (3 hours)	• Discussion about the evaluation of the first six weeks • Understanding the problem • PBL: Design thinking	• Understand the problem using complementary resources (secondary data)
Week 8	PBL (3 hours)	• Discussion and mentoring with the professor for each group	• Prepare the first deliverable
Week 9	PBL (3 hours)	• Presentation of each group: Identified problems • Feedback for each group	• Read about examples of sustainability-related practices
Week 10	Sustainability-related practices (3 hours)	• PBL: Analysing sustainability-related practices for different organisations	• Watch videos developed by the professor on circular economy as well as the group self-assessment and peer assessment procedures
Week 11	Circular economy (3 hours)	• Lecture: Circular economy • Guest: Lifecycle analysis	• PBL
Week 12	Developing ideas (3 hours)	• Lecture: Developing ideas • PBL: Developing ideas	• PBL: Developing ideas
Week 13	Indicators for sustainability (3 hours)	• Lecture: Indicators for sustainability • Discussion and mentoring with the professor for each group	• PBL: Defining indicators • Prepare for the exam
Week 14	Exam (3 hours)	• Individual exam	• PBL
Week 15	Mentoring (3 hours)	• Discussion and mentoring with the professor for each group	• PBL
Week 16	Final presentation (3 hours)	• Final presentation with the organisation	

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10.5. TEACHING APPROACHES AND METHODS

Active learning is emphasised in this course. Active pedagogies are rooted in constructivism, an approach that yields deeper understandings, particularly when teaching about sustainability (Armstrong, 2011). The teaching process for this course focuses on PBL, a self-directed learning approach that is guided by a tutor, which, in this case, is the teacher (de Graaf & Kolmos, 2003). PBL implicitly includes experiential learning, which is considered a pedagogical approach whereby learning occurs through experience (Lewis & Williams, 1994). PBL is suitable for teaching about sustainability issues because PBL is connected to problematisation, problem solving and critical reflection (MacVaugh & Norton, 2012).

In this course, students address real problems in small groups under the supervision of the teacher, who facilitates the learning process. The teacher serves as a guide and accompanies the students, who are each responsible for their individual learning process. Working in small groups is central to this type of methodology because small groups enable students to actively contribute not only to the learning process but also to the development of group activities by utilising their attitudes and soft skills.

Students work in multidisciplinary groups (the teacher defines the groups to ensure multidisciplinarity) to propose solutions and create a proposal for solving one sustainability-related problem faced by a specific organisation (McPherson et al., 2016). Working in groups composed of students from various disciplines (in this case, biology, engineering, design, economy and business students) fosters critical and reflective thinking (Howlett et al., 2016). In the face of the so-called grand challenges such as climate change, inequality and biodiversity loss, there has been an increased interest in interdisciplinarity. This is particularly true in the context of natural resource management, which requires collaboration across multiple disciplines and different stakeholders (Roy et al., 2020).

The objective of the course is not to focus on actions already developed by the organisation, but to propose methods for solving sustainability issues. The teacher's guidance helps students understand the context, define the problem and develop solutions. Students must present their proposals to the organisation at the end of the semester.

The course lessons combine lectures with guest visits. Guests are invited to speak further about certain topics (e.g. biodiversity) that might be useful for the development of the projects. During the development of the projects, the teacher provides tools to help students assess, understand and solve the problem. Examples of tools are iceberg analysis (Ellis & Black, 2018) and materiality analysis (GRI, n.d.).

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Before each class, students read assigned texts or watch assigned videos. During class time, students must actively participate in discussions and exercises to understand the methodological tools proposed while reflecting on sustainability issues. Some lectures given by the professor or guests will help strengthen students' understanding of key concepts. These lectures are useful because students come from different backgrounds and have not necessarily taken sustainability-related courses previously. During the class, the teacher mentors students on their project development. After class, students mainly work on their projects and complete the necessary work to advance the development of their sustainability proposal.

10.6. EXERCISES

Exercise 1: Sustainability in the food industry

Students are given a question that they must research using different sources. They must identify problems that make the agri-food industry unsustainable. They must present their results using a conceptual map. The map clarifies the relationships between different variables by identifying causes and effects. For instance, a conceptual map can link the use of fossil fuels with the rise of food prices or dependency between countries. Students must also identify the different effects of the intensive use of natural resources or explain how the marketing of certain products and the idealisation of certain lifestyles impacts health and obesity rates. With this activity, students get an introduction to the PBL methodology.

Exercise 2: Newspaper article

In this activity, students must choose a SDG and write a short newspaper article. This exercise is carried out in partnership with a local newspaper. Students can choose to write an opinion column for the newspaper or research a topic related to a SDG. Articles are short (around 800 words). The teacher and the newspaper editor provide feedback before accepting the final versions.

Exercise 3: PBL

The main exercise of the course is the consultancy project using PBL (see subchapter "Teaching Approaches and Methods"). Once a tool, such as iceberg analysis, is explained, students are given time during the lesson to use the tool in their analysis of the organisation.

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10.7. ASSESSMENT

Table 10–5

Evaluation type	Percentage (%)
Newspaper article (see subchapter "Exercises")	10
Evaluation 1	10
Individual exam	30
PBL project (group evaluation and individual evaluation)	50
Total	**100**

Evaluation 1 covers the first six weeks of the course. It evaluates the first objective of the course (i.e. explaining the concept of sustainable development and SDGs). This evaluation is conceptual and includes multiple choice questions.

The *individual exam* covers the entire course. Students should be able to analyse a problem using the reflections and tools of the course. The exam presents a situation that involves different organisations and relates to different SDGs. Students are asked to understand the main problems and reflect on the causes.

The *PBL* assessment includes two deliverables. The first deliverable is a written report describing the situation and the identified problems. This report is not graded, but it is used to provide feedback to students. The second deliverable is an oral presentation where students briefly summarise the problems identified and present their solutions for solving these problems. It is evaluated in terms of the quality of the analysis, the creativity of the solutions proposed and the form of the presentation. Instead of a presentation, students can also produce a video. An assessment rubric is created and distributed to students. Students evaluate their peers in terms of both the quality of the analysis and their contribution to the group. The peer evaluation is done in weeks 10 and 16. Students also complete a self-assessment on their contribution to the project.

10.8. PREREQUISITES

- Required prior knowledge from students: basics of organisational management
- Required core competencies for teachers:
  - Sustainability and design thinking
  - Understanding the principles of PBL

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- Required tools:
  - Online collaboration platforms (e.g. Zoom, Miro, Mural and Padlet)
  - Video and presentation development tools (e.g. Canva, Filmora, Adobe Pro and PowerPoint)

10.9. RECOMMENDED RESOURCES

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10.10. GENERAL TIPS FOR TEACHERS

Using PBL with undergraduate students who are accustomed to being passive recipients of a teacher's knowledge is challenging. Therefore, it is important to explain to students the differences between PBL and traditional, lecture-based classes. Students often forget the principles of PBL; therefore, it is recommended to remind them of these principles throughout the course.

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