

# CHALLENGE BASED LEARNING AND SUSTAINABILITY: ZERO WASTE PROGRAMME APPLIED TO THE UNIVERSITY

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## Abstract

Challenge Based Learning (CBL) is an engaging multidisciplinary approach to teach and learn that promotes students to use it and take advantage of technology in their day to day to deal with real problems. The approach is collaborative and hands-on, students work with other students, their teachers, and experts in their communities and around the world to develop deeper knowledge of the subjects, accept and solve challenges, take action, share their experience, and enter into a global discussion about important issues. Based on the problem that we produce twice as much plastic waste as two decades ago, almost half of which comes from OECD countries, and considering that only 9% is successfully recycled, a program called “Zero Waste” is proposed. The objective of the program is to know and analyze the problem that there is with recycling within the University of Basque Country UPV-EHU, specifically in the Faculty of Business and Economics. The initial results showed a lack of recycling among students and teachers, a lack of organization of garbage containers, as well as a lack of specific containers for recycling. Based on the results of the previous year, we propose a second school year focusing our efforts on solving the aforementioned problems.

**Keywords:** *Challenge Based Learning (CBL), sustainability, University of Basque Country UPV-EHU, Zero Waste programme.*

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## 1. Introduction

The need for change in traditional methodologies for learning is increasingly necessary. It is an issue that has been worrying for decades. Some authors (Blumenfeld et al., 1991; Bleviss, 2010) have stressed the importance of tasks as an element that links student motivation, student cognition, instruction, and learning. We live in a society based more and more on information and knowledge, which must be reflected in our students and their learning in order to achieve an optimal professional development.

There is, therefore, a continuing need in many education systems to empower students with real skills for their success in the future, and no other way than by solving collaborative problems in practical classes. It is precisely through CLB that we approach the common goal in education. The implementation of CLB allows the students to further develop and advance the technology, leading to industrial advancements; in short, it allows students to engage in learning goals through meaningful contexts.

Thus, it is necessary the development of such strategies and educational tools implementation is paramount, as one of the main challenges of the transition into the digitalization systems, due to the lack of qualified employees in the companies.

Starting from the one of the main problem of plastic use in the world, where 259 million tons of plastic was produced in 2018, compared to a million and a half tons in 1950, the need for a program to reduce the use of plastic in the university is raised, encompassed within the sustainable development goals of the 2030 Agenda from OCDE.

The propose programme is aimed at promoting environmental sustainability linked to SDG 13 (climate action). For that, a programme called "Zero Waste" is proposed. The objective of the program is to know and analyse the problem that there is with recycling within the University of Basque Country UPV-EHU, specifically in the Faculty of Business and Economics.

In order to carry out the program, the challenge-based Learning (CBL) methodology is used, being the main objective of the program to know and analysed the problem related to the use of plastic. Therefore, we could improve the environmental impact of the Faculty of Economics and Business.

The research work is structured in several parts: in the second part, it discusses what the CBL methodology consists of and the relevance and the importance it has been gaining in recent years. The

third section will be based on explaining the importance of the use of this methodology in the university environment. The fourth part relates to explaining the methodology followed, the fifth part explains the main results obtained, and finally, we will expose the conclusions of the study.

## **2. Challenge Based Learning (CBL): Concept and relevance in educational system**

Challenge-based Learning is a learning methodology based on a real experience, where participants face a real problem and deal with it, after working with other students and teachers; they explore possible options for improvement, coming up with the proposal of a solution, which is eventually implemented and evaluated (Gallagher & Savage, 2020 and 2022; Johnson & Adams, 2011). In fact, it focuses on addressing learning from of a generic topic and raise a series of challenges related to this issue, which students must reach (Kohn, et al. 2018).

There are three fundamental pillars (Ramírez-Montoya et al., 2021) on which challenge-based learning is based, as we can see in figure 1: investigate, engage and act.

1. Engage: Personal and accessible by prompting learners to identify and connect with personally relevant challenges.
2. Investigate: Authentic and challenging by supporting learners to conduct rigorous content- and concept-based research.
3. Act: Collaborative and connected by encouraging learners to collaborate on creating and implementing a solution.

Challenged Based Learning methodology, therefore, it is considered a real way to improve knowledge, skills and attitude. In fact, Smith and Van Doren (2004, p. 1) says: “professors will find that they can truly make a difference in their students ‘transferability of knowledge, skills, and attitudes from the confines of a classroom to their interactions in the broader world”.

There are several studies (Xu & Liu, 2010; Zavirov, 2013; Carrión et al., 2015; Agüero Pérez et al., 2019) that reveal how the use of this methodology enhances the results of students. Communication and expression skills are also improved. Academic development acquires an important support with the implementation of this methodology, where students complement the academic contents with the implementation of real cases. Besides, CBL helps in bringing the professional world closer to the academic and improves the employability of participating students. There is no doubt that Challenge based Learning builds a true relationship between the academic world and the professional world, fostering a greater ability of students to solve problems (Membrillo-Hernández, 2018).

After analysing previous studies, we could conclude that the outstanding benefits that students perceived as resulting from the participation in CBL-based programs were leadership, approach to the world professional, improvement of oral and written communication skills, knowledge more in-depth on the topics addressed in the challenges, practical application of concepts and frustration tolerance. In addition, CBL has shown itself to be a program easily applicable to different areas of knowledge and scalable to a large number of students, and, therefore, with an important potential for growth at an international level due to its implementation in the most important universities in the world.

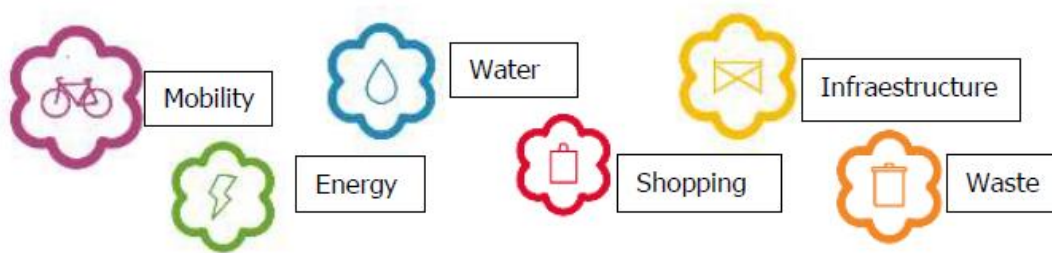
## **3. CBL applied to university system: Analysis monitoring**

### **3.1. Environmental management of sustainability: Climate Action**

Climate change is a phenomenon that affects every country and person in the world. For Antonio Gutiérrez, Secretary-General of the UN, “it is the greatest systemic risk at the global level for the near future”. Global warming is increasing at a much faster rate than anticipated, becoming one of humanity's greatest challenges. SDG 13 aims to introduce climate change as a central issue in the policies, strategies and plans of countries, companies and civil society. The objective, among others, is to manage the transition to a low-carbon economy, which will significantly reduce the risks and impact of climate change (Pacto Mundial, 2023)

Delivering climate solutions through innovation and long-term investments in energy efficiency and low-carbon development can fight climate change. There are six aspects in which to act in the fight against climate change: mobility, energy, water, purchasing, infrastructure and waste. We reflect these six aspects in figure 1.

Figure 1. Relevant aspects to act against climate change.



Source: own.

It is precisely the last point, the waste, where we will put our attention. Twice as much plastic waste is produced as two decades ago and almost half of it comes from OECD countries, yet only 9% is successfully recycled. According to a new OECD report (OECD, 2022), the amount of plastic waste produced globally is on track to almost triple by 2060, with around half ending up in landfill and less than a fifth recycled; this situation being completely unsustainable. For that, it is urgent to make the lifecycle of plastics more circular. This means an expansion of national policies and improved international co-operation to mitigate environmental impacts all along the value chain. Circularity and climate neutrality of the plastics industry is possible. It is from what we propose our main goal of the work: to know the environmental impact of plastic waste generated at the university, specifically at the Faculty of Economics and Business.

### 3.2. Methodology of the challenge

Within the framework of the I3KD22-36 Erronka on project, a collective challenge is proposed for the students of the Faculty of Economics and Business (Headquarters) in which they can develop and acquire skills in sustainability. The challenge that is proposed is aimed at promoting environmental sustainability linked to SDG 13 (climate action). The challenge that students must face is the analysis of the waste generated in the Faculty of Economics and Business (headquarters) within the University of Basque Country UPV-EHU, analysing its composition and calculating the Carbon, Water and Environmental Footprint. A plan to reduce the volume of waste and with it its environmental impact.

The development of the collective challenge is planned to develop in several academic years in such a way that progress in the research is progressive. As we can see in table 1, during the first two year of the challenge, we completed phase 1 and 2.

Table 1. Phases of the CHALLENGE.

ACADEMIC YEAR	PHASES
2022/2023 & 2023/2024	Phase 1: main idea, questions, design of the challenge Phase 2 (Research): guiding questions, activities and resources.
2024/2025	Phase 3: improvement measures for the reduction and recycling of waste, reduction of environmental impact
2025/2026	Phase 3: involvement of all faculty groups

Source: own.

### 3.3. Main results

The first step supposes to involve the affected people, in this case, the university students. To this end, *Aguas Alzola Company* held a conference<sup>1</sup>. The topic of the conference was the eco-design of containers and packaging, very useful to develop the programme. Later, during the investigate step, we could carry out our work using different modalities: two face-to-face sessions for collaborative work, collaborative work and non-face-to-face activities. For that, we followed five steps: firstly, we developed guiding questions to a better identify the solution to the challenge. For this, we applied the brainstorming technique. Secondly, we reviewed the questions posed; the similar ones were combined, categorized and prioritized. Thirdly, a list of activities and resources that will be used to answer the guiding questions was made. Once the activity resource was identified, a process of searching was made. Fourthly, a summary of the finding found was carried out and the foundation for the solution was created. In addition, finally, a solution concept is proposed.

<sup>1</sup>*Aguas Alzola* is a Basque company considered socially sustainable.

Table 2. Step forwards of the challenge (2022/2023 &amp; 2023/2024 academic year).

Phases	Modality	Activity
Step 1: Involve	Face to face session	Conference Waters of Alzola Topic: Ecodesign of containers and packaging
Step 2: Investigate	Two face-to-face sessions for collaborative work	Design of the guiding questions: what we should know GUIDE ACTIVITIES (Learning activities, research, experimentation, exploration (how we obtain information) GUIDE RESOURCES (Web pages, podcasts, movies and documentaries, talks, books)
	Collaborative work	Individual work
	Non-presential activities	Team work
Step 3: Act	Final assessment	Learning outcomes
	Assessment	Environmental impact

Source: own.

The main results of this first contact with the programme are the followings:

1. There is a lack of identification of the types of containers used for recycling, which makes it difficult to use them correctly. Many of them do not specify what needs to be recycled in each of them.

2. There is a disorganization in terms of the placement of containers. They are located separately and without any apparent logic. We found containers to recycle organic, plastic and paper together, but a container for scraps is missing. However, in other areas of the faculty, there is only organic bin, no container for plastic or remains, which means that recycling is not carried out.

3. There is a lack of identification of containers, which makes it difficult to know which material is recycled in each one. To this problem is added the lack of bags of their respective colours for the correct identification of the containers. There is even an incorrect use of coloured bags, using all the same colour for all containers.

4. There is a lack of respect for the use of study rooms, where, even if eating is not allowed, there are organic containers full of all kinds of garbage.

#### 4. Conclusions

It is important to highlight the continuous need for the correct use of available material, such as plastic or paper, among others. As we have commented along this paper, every time we use more plastic and, despite talking about recycling, what is clear is that we are still far from doing it correctly.

The main aim of this paper is to introduce a waste program call “Zero waste”, and to know and analyse the problem that there is with recycling within the University of Basque Country UPV-EHU, specifically in the Faculty of Business and Economics. To carry out this work, CBL methodology has been carried out so that students face a real problem and can work as a team and based on a specific challenge.

After the analysis, we could say there is lack of identification of the types of containers used for recycling, a disorganization in terms of the placement of bins, a lack of identification of containers and a lack of respect for the use of study rooms.

As a pilot test of the “Zero Waste” programme, the results have been satisfactory in terms of participation by teachers and students. It is true that the results in terms of efficiency in the use and recycling of plastic have been very poor. Reality indicates an urgent need for recycling within the faculty. To this end, we propose two proposals that are very easy to implement: a reorganization of garbage containers and a talk to first year students about the need for recycling and the correct use of containers.

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