Scientia cum Industria

*Special Issue*
7° CONGRESSO INTERNACIONAL DE TECNOLOGIAS PARA O MEIO AMBIENTE

PLATINUM OPEN ACCESS
eISSN 2318-5279

*Original Research*

# Enhancing student engagement with the SDGs through sustainability games: a case study in Brazil

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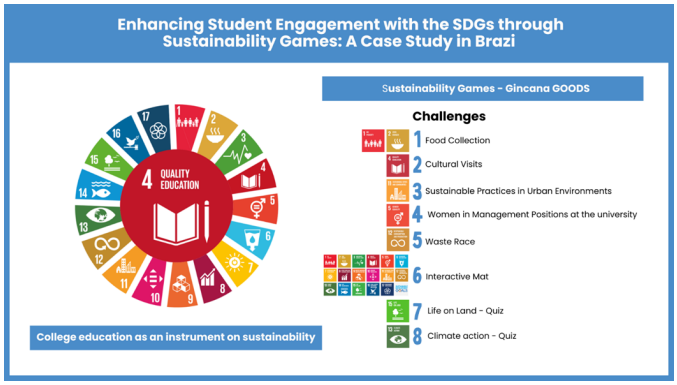


Received: November 20, 2023
Revised: November 22, 2024
Accepted: November 22, 2024
Published: February 5, 2025

**Abstract**: Higher education institutions, aligned with the principles of the 2030 Agenda and the Sustainable Development Goals (SDGs), play a crucial role in fostering student engagement through educational initiatives. This paper presents one such initiative from the Green Office at the University of Passo Fundo: the Sustainable Development Goals Games. The Games were conducted over a week, featuring daily online activities and an on-site marathon. Each activity aimed to foster knowledge generation and promote engagement with specific SDGs. Overall, the Games encouraged active learning by creating a space for knowledge sharing and collective engagement on sustainability and climate action within the university. In its inaugural edition, the event brought together 75 participants from diverse backgrounds, including students, faculty, staff, and representatives from NGOs, local government, and businesses.

**Keywords:** Sustainability, academic engagement, education for sustainability, educational games.

## Introduction

The 2030 Agenda is an action plan created by the United Nations in 2015 with the aim of achieving a better world for all peoples and nations by the year 2030 through sustainable development. This agenda comprises 17 Sustainable Development Goals (SDGs) and 169 targets, focusing on objectives such as eradicating poverty, promoting gender equality, ensuring quality education, mitigating climate change, and conserving marine and terrestrial ecosystems [1]. The SDGs require engagement from all sectors and stakeholders, with higher education institutions playing a key role. The most effective approach to raise awareness through environmental education is to ensure it is structured and interdisciplinary, incorporating these themes into the curriculum of several areas of knowledge [2].

Universities play a crucial role through education, shaping professionals who will contribute to social development. In addition to education, universities conduct basic and applied research that contributes to technological innovations [3]. Some of the SDG targets include scientific research for sustainable agriculture, vaccine development, and sustainable consumption and production [1]. Through extension projects and research grants, universities generate the knowledge necessary to contribute to achieving these targets [4]. The significant increase in scientific production, analyzing the relationship between sustainable development and higher education, indicates that the SDGs are reshaping the role of universities, giving greater responsibility and social impact to teaching, research, and outreach activities.

Students also play a central role in sustainability actions within universities, as they constitute the largest audience in higher education institutions. The connection with sustainability exists in all fields of study, and engagement in this subject prepares future professionals for leadership

positions equips them to be responsible citizens who recognize the importance of their contribution to issues such as climate change and the SDGs.

As the debate on sustainability and climate change evolves, the approach to these issues within universities tends to diversify, not only attracting students to the discussion but also playing an essential role in sustainable thinking in future careers [5]. The use of games as a method of unconventional teaching is widespread and can be an efficient mechanism for addressing sustainable development in the classroom [6]. An example of successful results in using games as enhancers of sustainable education is the application of the business simulator game BizArena at the University of Economics and Business in Poznan, Poland. By using a version of the simulator that incorporates environmental issues into business, the experience showed that games can be very effective in bringing a sustainability perspective, even in degrees where the subject is still challenging [7].

Another example is the recent Factory Heroes, a board game developed at Chalmers University of Technology in Switzerland. In this game, players become employees of a large manufacturing company at risk of closing due to serious environmental damage. The game addresses economic, marketing, and sustainability issues, illustrating the various sectors of a company engaging in the challenge of finding ecological alternatives for their activities. Thus, its application is not limited to a specific undergraduate course, becoming a broad and multidisciplinary tool [8].

Among the various ways universities act in the field of sustainability and student engagement, the development of games and contests is notable. While literature has extensively addressed the use of games, virtual reality, and digital tools in the classroom, less is discussed about the use of traditional games, such as contests.

In this context, this article aims to present the strategy of applying Sustainability Games and their potential to engage students from different areas and contribute to the SDGs. To achieve this, a case study of the University of Passo Fundo (UPF), located in southern Brazil, is presented.

UPF is a higher education institution located in the northern part of Rio Grande do Sul, Brazil. It has eight campuses in different municipalities, with Campus I located in Passo Fundo having the highest concentration of students. UPF has approximately 11,000 enrolled students in undergraduate, postgraduate, high school, technical education, and extension courses, with 684 professors and 851 staff members [9]. In addition to being a regional hub for education and research, commitment to the local community is part of the university's social responsibility, as UPF is also a community university [10].

## Experimental Section

This section outlines the methodology used to develop the first edition of the Sustainability Game Giancana GOODS. The event was organized by the UPF Green Office, an academic hub for sustainability and climate action at the university [11]. This inaugural edition took place in September 2022, spanning a week. Prior to the event, extensive publicity was carried out at the university, utilizing the Green Office and university Instagram accounts as dissemination channels and informing students via institutional email. Registrations were opened to all students, staff, and professors, allowing them to form teams of up to 10 people. The more diverse the group in terms of profiles, the more points the team could accumulate.

Gincana was structured as a series of challenges related to the Sustainable Development Goals (SDGs) and sustainability. The competition featured daily online tasks (Challenges 1, 2, 3, and 4), followed by an in-person marathon of challenges on the final day (Challenges 5, 6, 7, and 8).

Challenge 1 - Food Collection: This challenge addresses SDG 1 – No Poverty, SDG 2 - Zero Hunger, and SDG 10 - Reduced Inequalities. The objective is to collect as many non-perishable food items as possible, to be donated to charity institutions in Passo Fundo. Teams earn points for each food item collected, with a maximum of 300 points per team. Bonus points are awarded to teams that present greater variety (more than 7 different food items) and more evenly proportioned donations, receiving double the equivalent score.

Challenge 2 - Cultural Visits (museums and/or artistic, historical, and natural heritage exhibitions): This challenge aligns with SDG 4 (Quality Education), emphasizing learning beyond the classroom. Teams were required to visit museums or artistic, cultural, historical, and natural heritage exhibitions in their cities. Participants were asked to identify exhibits that contributed most to their learning, post at least one photo on their personal Instagram accounts, tag the Green Office, and describe their experience in the caption. Points increased with the number of participants completing the task.

Challenge 3 - Identification of Sustainable Practices in Urban Environments: This challenge corresponds to SDG 11 (Sustainable Cities and Communities). Team members had to identify sustainable practices in urban settings and submit a Word document detailing the city name, location, a photograph of the identified practice, and a brief explanation of its connection to sustainable urban communities.

Challenge 4 - Conversation with Women in Leadership Positions at the university: This challenge aligns with SDG 5 (Gender Equality). Participants were tasked with engaging in conversations with women in leadership roles (such as coordinators, directors, unit supervisors, or members of the rectorate) and taking photos with them. The photos, posted on any team member’s Instagram profile, had to include the leader's name, position, time in office, and her contribution to the university's development. Points were awarded for each qualifying photo.

Challenge 5 - Race against waste: In this activity, which addresses SDG 12 (Responsible Consumption and Production), teams had to correctly sort waste items into the appropriate bins (dry waste, compostable waste, and general waste) during a race. Each team selected three members for the challenge, who had to pick an item from a pile, run a specified distance, and place it in the correct bin. The team with the most correct disposals won.

Challenge 6 - Interactive Mat: This challenge covers all 17 SDGs. The interactive mat is a life-sized board game following the "Go Goals" game developed by the UN (https://go-goals.org/). The Green Office printed the game on a life-sized board, allowing participants to act as game pieces. Players advanced by rolling dice and answering SDG-related questions. If a participant answered incorrectly, they had to pass their turn. The team with the most points at the finish line won.

Challenge 7 - SDG 15 - Life on Land. Quiz: Teams must answer a quiz with images through the Quizur platform, based on the targets of SDG 15. Each question contains 4 answer options, with only 1 correct. Each player has 1 minute to answer each question. Points are rewarded based on correct answers. The questions were based on native wildlife and invasive species, as well as their consequences for the ecosystem. We discussed how the introduction of non-native species can affect local biodiversity by altering habitats and competing for resources. Additionally, we explored ways to preserve native wildlife and mitigate the impacts of invasive species.

Challenge 8 - SDG 13 - Climate action. Quiz: In this competition, the leader of each team chooses a number corresponding to a question, and the team has 10 seconds to answer. The questions focus on the theme of climate change, and each team chooses 3 numbers, answering 3 questions. In this challenge, teams can score from 0 to 3 points (1 point per correct answer). The team with the most points is the winner of the challenge. In case of a tie, sudden-death rounds are conducted until only one winning team remains (in this case, each team answers 1 question, and the team that answers incorrectly is disqualified). The questions were objective, and the quiz was designed to be both educational and engaging, encouraging teams to collaborate and share their knowledge. By covering a range of topics such as renewable energy, greenhouse gases, and environmental impacts, participants deepened their understanding of climate change and its global implications.

## Results and Discussion

In the first edition of the Gincana GOODS, a total of 75 participants were registered, distributed among 9 teams. As depicted in Figure 1, the majority consisted of students, totaling 55 participants, representing 73% of the overall participation. Teachers constituted 13% with 10 participants, employees accounted for 5% (4 individuals), 3 were affiliated with companies in the UPF Technological Park (4%), and 2 were stakeholders from the Green Office (3%). Regarding the students, their academic backgrounds were diverse, including both undergraduate and postgraduate courses across various fields. However, the vast majority (91%) were graduate students. Among them, 31% were from the Architecture and Urbanism program, while participants from Production Engineering comprised 12%, followed by Dentistry (11%), the Integrated High School Center of UPF (9%), Biological Sciences (5%), Graduate Program in Civil and Environmental Engineering (4%), Literature (4%), Graphic Design (3%), Philosophy (3%), Environmental Engineering (3%), Physics (3%), and Journalism (1%).

A total of 1,126 non-perishable food items were collected and distributed into basic food baskets, totaling 72 baskets, with an approximate weight of around 500 kg. According to participants, this was one of the most engaging challenges, emphasizing the importance of actions for sustainability. One participant stated, "Our team was very successful that day. Being able to contribute to people in vulnerability was one of the actions we considered very important in the event.".

In Challenge 2 (cultural visitation), the outcome was achieved through cultural education and information dissemination via social media, addressing Goal 4. This goal focuses on the development and improvement of education in all forms, including cultural education that enhances personal, moral, and intellectual development, as well as the ability to relate to others. Encouraging visits to museums and exhibitions is crucial in the current Brazilian context.

Regarding the activities, each challenge directly or indirectly contributed to one or more Sustainable Development Goals (SDGs).

Challenge 1 (food collection) primarily contributed to SDGs 1 and 2, targeting the eradication of poverty and zero hunger, respectively. The issues of poverty and hunger in Brazil, as well as globally, pose significant challenges. According to the 2022 Multidimensional Poverty Index (MPI), approximately 1.2 billion people live in poverty, with 828 million affected by hunger, accounting for 9.8% of the world's population. As indicated by the Be the Change initiative [12] there is considerable value in social assistance and support actions. The first challenge of the Giancana GOODS aimed to raise awareness among participants about the challenges associated with poverty and hunger, encouraging contributions through food collection and distribution to charities.

The abandonment of such artistic and cultural expressions is increasing, as evidenced by the globally reported fire at the National Museum in 2018, resulting in the loss of historical and biological material [13].

In Challenge 4 (conversation and recording with women in management positions), encompassing Goal 5, the theme focused on women's empowerment in the workforce and the promotion of women in managerial roles within UPF. 53 women were interviewed and showcased, highlighting their importance in their workplaces and the community at large. The elevation of women in management and leadership

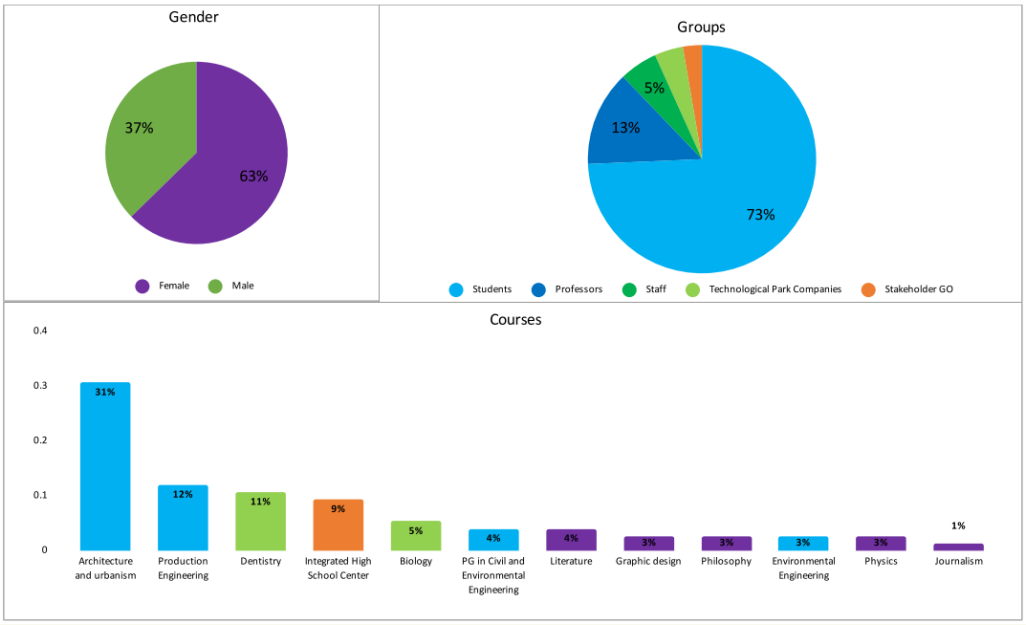


**Figure 1.** Characterization of the participants in the Gincana.

positions is essential in combating gender stereotypes in the workplace. According to data released by the Brazilian Institute of Geography and Statistics (IBGE) and the UN, women still earn less than men and hold fewer positions in the management of companies, politics, and science, despite achieving higher levels of education [14, 15]. Both Challenge 4 and 2 aimed at disseminating the discussed themes on social media, totaling 79 posts on Instagram.

In Challenge 3 (Identification of sustainable practices in the urban environment), SDG 11 was addressed, aiming to establish sustainable cities and communities. Through its development, a total of 12 cities were visited or mentioned for engaging in sustainable activities, including Passo Fundo, Casca, Santa Maria, Marau, Porto Alegre, Carazinho, Ibiaçá, Serafina Corrêa, Soledade, Sarandi, Dois Lajeados, and Vila Lângaro. The challenge played an important role in bringing visibility to existing sustainability actions, as such initiatives by cities in this field are often underreported.

During the in-person challenges, there was greater interaction with participants. The waste race stimulated participants to think and demonstrate their knowledge of waste selective collection, addressing important topics of responsible consumption and production outlined in SDG 12. This is a crucial issue in Brazil, where a quarter of Brazilian cities lack waste segregation, as indicated in the latest edition of the Solid Waste Overview recently published by the Brazilian Association of Public Cleaning and Waste Companies [16].

With the interactive mat, which is already a proposed activity by the UN, participants' knowledge of all SDGs was tested. The interactive board game offered a dynamic and engaging learning experience about the SDGs. The life-sized format of the game made the experience captivating and stimulating, enabling participants to move and progress through spaces as they correctly answered questions. This approach created a physical and interactive dimension that significantly enhanced active participation.

Challenge 7 addressed issues outlined in the targets of SDG 15, seeking to protect, restore, and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and stop biodiversity loss. This topic is discussed globally but is particularly relevant to Brazil, considered the country with the highest biodiversity in the world [17], largely due to being the birthplace of the largest part of the world's largest tropical forest, the Amazon Rainforest. However, Brazil is also the country that experiences the most biodiversity loss. In 2021, 40% of the total loss of native forests worldwide occurred in Brazil, resulting in severe consequences for groups dependent on these ecosystems [18].

**Figure 2.** Challenges completed in the Sustainability Game – Gincana GOODS.

In the final challenge, Challenge 8, the quiz tested participants' knowledge with multiple-choice questions addressing subjects related to climate change, such as "which country is responsible for the highest per capita carbon emission?" and "how many plastic particles do we ingest weekly due to plastic pollution in the environment?" among others. In this Challenge it was identified that knowledge about climate change and climate science are still unfamiliar to the participants, however, the learning opportunity promoted awareness and opened up possibilities for more discussion on the topic to occur.

## Conclusion

This work aimed to present the Sustainable Development Goals Games of the UPF Green Office (Gincana GOODS) as a strategy to foster student engagement with the SDGs. Through eight challenges, directly and indirectly linked to the 17 goals, the Green Office engaged 75 participants, organized into teams. The event also generated content and information for other members of the academic community, who followed the activities through the Green Office's social media and through interactions with colleagues and professors.

Despite the challenges faced in this first edition, such as determining the best outreach strategy to engage students, designing effective challenges, and implementing them cohesively—the outcomes were overwhelmingly positive. Gincana yielded strong results, most notably in the feedback provided by the team representatives. Participants expressed satisfaction in contributing to social causes and in their role in raising awareness around the sustainable development agenda. The social impact of food donations stood out as the most significant outcome of the event. Additionally, the interaction among participants, the sharing of knowledge, and the innovative approach to the SDGs in a creative, collective manner were recognized as key highlights.

Moreover, an important outcome was the opportunity for learning and capacity building among the student members of the Green Office. Gincana also allowed the student team to recognize their leadership within the community and their potential to organize future activities both within and beyond the university.

### *Authors Contribution*

L. L. Brandli: Supervision, Project Administration, Conclusion; A. L. Salvia: Conceptualization, Writing-Review & Editing; G. Rodrigues: Writing-Original Draft, Writing-Review & Editing;. V. L. Sensolo: Writing-Original Draft; J. P. Poletto: Writing-Original Draft; J. Mazutti: Analysis, Writing-Review & Editing; E. R. Porto: Methodology; G. Reginatto: Methodology. All authors have read and agreed to the published version of the manuscript.

### *Conflicts of Interest*

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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