

Article

Deploying SDG Knowledge to Foster Young People's Critical Values: A Study on Social Trends about SDGs in an Educational Online Activity

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Abstract: Educational tasks for the development of competencies on the Sustainable Development Goals (SDGs) pose a challenge to educators due to the multidisciplinary and complex nature of these goals. It is necessary to develop innovative educational resources and tools that holistically account for this complexity and highlight the environmental and social components of these goals on an equal footing. A learning tool based on the serious games methodology, called BotBusters, is used to inoculate this type of knowledge and skills among young Europeans through a specific news verification activity. This game has been designed to collect interaction data (logs) and thus perform an analysis of players' behavior, which allows us to understand their preferences and knowledge of the SDGs (specifically 3, 12, 13 and 15). The data collected yield interesting conclusions about the educational needs of young people in this field, showing their preferences for topics related to the environmental SDGs. This indicates that there is a need to promote awareness of the SDGs on social issues, especially those that require a more collective type of agreement and intervention.

Keywords: gamification; media literacy; visual disinformation; Sustainable Development Goals



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1. Introduction

The concept of sustainable development is often associated with the dichotomy between industrial/technological development and natural resources, bypassing the educational and social values that should be associated with social sustainability. Sustainable social development can be addressed in the Sustainable Development Goals (SDG) agenda tackling medioambiental and social issues at the same time. This is a way to improve the knowledge and competences about sustainability in a holistic style. In this regard, technological resources, essential in education nowadays, become an opportunity for new technologies and educational strategies to promote education on the SDGs with a critical point of view.

With these ideas in mind, we present an innovative design based on a gamified educational activity called BotBusters. Through an activity to verify news about the SDGs that appear in social networks, we offer content aimed at training and educating in the media literacy necessary to develop critical thinking about these topics. A serious game developed on the framework of European project YouVerify! (<https://youverify.eu/en/>, "URL (accessed on 1 February 2023)". will be used as an educational tool for those purposes that have reached a target of more than 5000 players so far. The training activity that is designed to stimulate critical thinking on issues os related to four of those goals. Participants were asked to give their opinions and check the veracity of a series of news items, both true and false, related to these SDGs, trying to shed light of their experience and knowledge about them in a real environment of social network contents.

Quantitative research is presented in which players' behavior is analyzed in order to understand their prior knowledge and preferences in relation to the Sustainable Development Goals.

The results obtained with the analysis reflect the medioambiental biases of the sustainability concept on the general public. So forth, it shows the necessity to increase the efforts on developing educational tools and content to improve the general knowledge about the social dimensions of the Sustainable Development Goals.

1.1. Education on SDG

Education in the post-digital society in which we live, where people are continuously participating in the cyberspace, needs to adapt to those vehicles of interaction, continuous feedback and visual activities. That is why it is increasingly common to use gamification strategies for social awareness. Specifically, we find many educational experiences where gamification is a resource applied to raise awareness about the Sustainable Development Goals (SDGs) through various tools related to participation. In fact, it is common to organize workshops called GAME SDGs with the aim of promoting the knowledge and social engagement of citizens and their applicability to everyday life [1].

Since September 2015, when the United Nations General Assembly accepted the 2030 Development Agenda where the 17 Sustainable Development Goals (SDGs) and their corresponding 169 associated targets were defined, we have been considering the need to act to improve social and personal habits. In fact, the 17 SDGs were born to change the way we live and aim to create in 2030 a sustainable future [2].

This topic is of great interest to the scientific community. Kumazawa [3] conducted a study on the general research trends in gamification within the fields of sustainability. For this purpose, he classified the scientific articles found, both original and review articles, from the perspective of the Sustainable Development Goals. In his studies, the various research approaches that incorporate a gamification mentality within the scientific literature on sustainability issues become evident. One of the great contributions of this author is the clarification of the types of gamification approach through the in-depth study of 21 articles.

Governments, in general, and their educational policies, in particular, react by trying to strengthen the social commitment of citizens to the SDGs through formal education. Thus, the culture of participation and the principle of intercreativity together with gamified strategies are beginning to be seen as an ally of social awareness [4]. We highlight the research by Sachs and his collaborators (2019) on the SDGs and the Paris Agreement on Climate Change. Their results demand profound transformations in all countries that will require the collaboration of civil society, science and business with governments and, to implement the actions in the 17 SDGs, they propose a concrete agenda and the creation of six blocks, where the achievements of all the SDGs are grouped: (1) education, gender and inequality; (2) health, well-being and demographics; (3) energy decarbonization and sustainable industry; (4) sustainable food, land, water and oceans; (5) sustainable cities and communities; and (6) digital revolution for sustainable development. Agreed actions between government and civil institutions will call for priority investments and regulatory challenges for each block (Sachs et al., 2019).

It is also important to consider the research of Nilson et al. (2018), who argue that understanding the interactions between the SDGs themselves, both negative (trade-offs) and positive (co-benefits), is critical to advancing the action on the SDGs [5]. These authors propose a new conceptual framework for mapping and assessing the interactions between the SDGs, bringing specific experiences and knowledge on the subject. Their findings show that the interactions between the SDGs depend on issues such as geographical context, resource endowment, time horizon and governance in each country.

1.2. Media and Informational Literacy (MIL) and SDGs

More than ever, it is necessary, in the post-truth society [6], to empower citizens and help them acquire the necessary media skills to access, understand, analyze, evaluate and

produce content as well as to discriminate between real and fake news [7]. In this sense, Kahne and Bowyer point out that those students taking courses on media literacy increase their ability to understand, assess and analyze media messages [8]. Along these lines, institutions such as Ithaca College created innovative projects such as Project Look Sharp (<https://www.projectlooksharp.org/#>, URL (accessed on 1 February 2023)) to develop and provide training, content, materials and support for integrating media literacy at all educational levels. Further initiatives, such as the News Literacy Project (<https://newslit.org/> URL (accessed on 1 February 2023)) are working with educators and journalists on teaching young people to discern fact from fiction in the digital age.

The applicability of MIL tools and strategies to combat fake news is essential, in order for citizens to learn the proper use of technology in order to identify fake news and thus eradicate it [9]. It is, therefore, important to carry out educommunicative projects, such as BotBusters, comprising both digital literacy that allows for verifying and contrasting the information to which citizens have access, and learning skills for critical and reflexive analysis when receiving and sharing information [9].

Much research has also been conducted on gamification and education, in general, and the results of integrating gamification and ODS processes in education are proving to be very promising, manifesting an increase in the motivation, engagement and participation rates of participants in the educational process. However, studies by Lusseau and Manciny [2] show reservations in this regard. After critically reviewing the scientific literature concerning gamification and its relationship with motivation and engagement, these authors conclude that this relationship is still limited on multiple levels, as there is still a large gap between theory and practice. On the contrary, there are other dissenting voices, such as Alsawaier [10], who claim that the use of gamification could provide a partial solution to the decline in student motivation and engagement faced by the school system today. The university environment could benefit greatly from gamification not only in its graduate recruitment strategies, but also in the content of university courses and curricula.

From the educational, communication and governmental spheres, practices to raise awareness of the SDGs through the use of gamification are highly considered in media and informational literacy (MIL) actions. It brings together contributions from 25 European media literacy experts from academic, policy and regulatory institutions on the state and future directions of media literacy research and policy in Europe. The recommendations of this document marked a breakthrough in the field, and gamification and SDGs have a perfect fit.

With the practical methodology of the game and the use of digital technologies, the aim is to motivate and encourage the participation and involvement of students to initiate this lifestyle change [1,4]. However, Wu et al. [11] conducted a literature review on the research conducted on the roles and opportunities of digital technologies in achieving the SDGs, identifying gaps in this research at the social, economic and environmental levels of sustainable development [11]. These authors suggest the essential and urgent need to raise awareness and draw attention to how to innovate and energize the use of technologies to better help all nations achieve the SDGs by 2030.

MIL insists on a non-instrumentalist approach to digital education, i.e., going beyond a binary view of digital media. It is necessary to analyze the risks and opportunities for citizens in order for them to acquire the digital skills and the level of social awareness they need [12,13]. This author proposes a broader and more critical approach, where the emergence of “digital capitalism” and the ubiquity of digital media in everyday life, including gamified strategies, should be contemplated within media education for life. In this sense, the (R)evolutiON Project of the University of Granada in Spain is a good example of good practices [14], whose backbone was the SDGs and fictional narratives within a gamified proposal for action. Its main elements were missions, feedback, scores, badges, etc., which were integrated for the joint construction of the knowledge of its participants under a Game-Based Learning (GBL) methodology. In the field of social sciences, and

specifically in the field of geography, we can highlight a transversal learning gamification experience based on challenges with ODS [15]. Their results show us how students have improved their knowledge about the SDGs, have detected interesting direct and indirect links between the contents of geography and the SDGs and believe that this methodology has helped them to know what the SDGs are.

The onset of the global COVID-19 pandemic has had a negative impact on sustainable learning in education, forcing schools to include innovative and flexible learning approaches such as flipped classrooms [16]. Gamification has become a new technopedagogy that has been integrated into flipped classrooms to promote student achievement and engagement. The results of these authors' study indicated that traditional gamified classrooms promote student achievement, and gamified flipped classrooms promote student engagement, on the one hand, and that the learning culture, such as teacher dependency, also influences student achievement and engagement [16]. They conclude that both gamified flipped classrooms and traditional gamified classrooms support sustainable learning in education, even during times of academic uncertainty during the COVID-19 pandemic. Meanwhile, Park and Kim (2021) also investigated in the same confinement period the effect of gamified virtual learning on 140 elementary and middle school students. In their findings, they concur that gamification in online learning has a positive impact on learner motivation and the understanding of educational content [17].

Finally, it is worth highlighting the research on the co-design of an educational video game aimed at promoting good eating habits in young people and promoting the Sustainable Development Goals (SDGs), such as SDG 3 (good health and well-being), SDG 10 (reducing inequalities) and SDG 17 (partnerships for the goals). For this research, three workshops with different gamification strategies were implemented to support a "participatory design" process [18].

There are very successful examples of gamification strategies being used to help students develop competences to fight fake news [19–23] but very few that have been used to simultaneously inoculate them with knowledge about the SDGs [24].

Fake news can negatively impact the achievement of the Sustainable Development Goals (SDGs), including Goal 4 which aims to provide inclusive, equitable and quality education [25]. Taking into account this international concern, BotBusters represents an innovative design that addresses this problem by combining both the functions of serious gamification and teaching the SDGs in the context of fake news, using a holistic methodology oriented to develop proactive social values among young people.

1.3. Knowledge of Teenagers about SDGs

UNESCO considers that education for sustainable development should aim to empower and motivate young people to be sustainable and active citizens, able to think critically and participate in shaping a sustainable future [26]. Appropriate pedagogical approaches for sustainable development education should take into account the age of the target groups, as well as their contexts, preferences and interests [26]. Furthermore, education for sustainable development should aim at empowering young people to develop critical thinking that makes them question how they see and think about the world in order to better understand it [27,28].

Today's youth has a key role to play in the implementation of the SDGs, not only as beneficiaries of the actions and policies of the 2030 Agenda, but also as active participants [29]. The youth population sees the need to raise awareness of the SDGs, as well as to translate their fundamental ideas into understandable language [30]. In this context, it is necessary to know what the educational needs of young people are about the SDGs.

The BotBusters tool was designed to improve the knowledge of young people, and the population in general, about the verification of fake news related to the SDGs. This allowed, on the one hand, their skills and knowledge on the evaluation and understanding of this content on social networks to be improved. At the same time, the dynamics of the game allowed us to know the preferences and knowledge of young people in the set of

the SDGs and thus to compare their performance in the game, in a context in which they really had to demonstrate their knowledge and preferences, with the data obtained in other research or experiences.

The data published in the Flash 502 Eurobarometer [31] (p. 3) on the occasion of the European Year of Youth 2022 indicate as priority areas for young Europeans: physical and mental health, environmental protection, the fight against climate change and education and training [31]. In other words, the main concerns of young Europeans are related to SDG 3 (healthy living and promoting well-being), SDG 4 (inclusive, equitable and quality education), SDG 13 (take urgent action to combat climate change and its impacts), SDG 14 (conserve oceans, seas and marine resources) and SDG 15 (protect, restore and promote the sustainable use of terrestrial ecosystems).

1.4. Education for Sustainable Development

These findings indicate that young people's prior knowledge of the SDGs is more related to issues that concern them individually such as education, health and the environment. However, other SDGs more related to social issues and, more specifically, to critical thinking, are not reflected in the same way. Only this critical social awareness can lead to action, both individually and socially, and that step is the real challenge and reason for the SDGs. These type of data indicate that development education should holistically illustrate the SDGs through partnerships between institutions and organizations that open up new possibilities for learning and allow the target audience to benefit from the knowledge and experiences of the participating entities and, on the other hand, empower the participating institutions and thus increase their capacity as critical agents of change [26]. Therefore, it is necessary to propose educational activities that promote this holistic aspect, so that the education for sustainable development contributes to the achievement of the SDGs to the extent that it develops transversal competencies of critical thinking and social action. Only this can ensure sustainability, linking the SDGs together and providing practical tools and learning to address the societal challenges of the SDGs [26].

2. Materials and Methods

The pedagogical contribution of the project is the design of a gamification experience through the format of a serious game called *BotBusters*. Its design is based on the basic principles of gamified activities that are developed in non-formal contexts and with technological means, i.e., participation, proactivity, interactivity and entertainment. In addition, it is designed for users to develop reflective decision-making skills; in this case, on the veracity of the news raised [32].

BotBusters works with four Sustainable Development Goals (SDGs): SDG 3, SDG 12, SDG 13 and SDG 15. The choice of these four SDGs is due to the fact that three of them, SDG 3, SDG 12 and SDG 15, correspond to the SDGs that most concern young Europeans today [31]. It was also considered relevant to include SDG 12 because of its potential to make the population aware of the importance of moving towards sustainable means of consumption and production. The preferences of potential adolescent and/or young players were taken into account, since, although *BotBusters* is a game open to the entire population, the target audience for which it was designed is the European adolescent and young population [33].

The mechanics of the game is based on offering missions to verify fake news. Each mission suggests the use of the plug-in *InVID-WeVerify* in some of its tools or functions, so that the players' attention is drawn to this verification tool. It serves the digital literacy objectives of the *YouVerify!* project. However, more importantly, it offers an immersive game with various audiovisual materials that serve to introduce the users to current key controversies in issues related to the SDGs. This key feature of the game is providing users with the knowledge to understand SDG concepts related to real problems and topics. In this regard, the game has the potential to be used as a learning resource for SDG contents

because the game design and themes presented serve to enhance players' knowledge and skills on key issues related to the Sustainable Development Goals.

To articulate the serious content of the game (learning about fake news and about the InVID-WeVerify tool), the preferences of potential teenage and/or young adult players were taken into account, since, although *BotBusters* is a game open to the entire population, the target audience for which it was designed is the European teenage and young adult population. The interactive game shows a motivational animation to start the game which presents the need to use critical thinking in social networks to mitigate the effects of fake news.

In the design of the game, two structural elements can be distinguished: the game instructions and the missions. As far as the instructions are concerned, two characters have been designed to act as mentors and explain how to play the game. The media and information literacy mentor explains the importance of critical thinking when using the Internet and social networks. The technology mentor explains the use of the plug-in *InVID-WeVerify* on images and videos to detect fake news. During the missions, they guide players in their successes or failures as they face the real news verification missions that have been selected for the game.

Considering that the design of the game characters influences the player experience [34], the design of the two mentors has been made according to the players' preferences in relation to the game characters that provide feedback or clues: middle-aged characters, with a natural appearance and, in case the information they provide is of a technological nature, wearing glasses [35]. With these characteristics in mind, two mentors were designed, one of each gender, and both middle-aged, named Sarah and Amadou (see Figure 1).

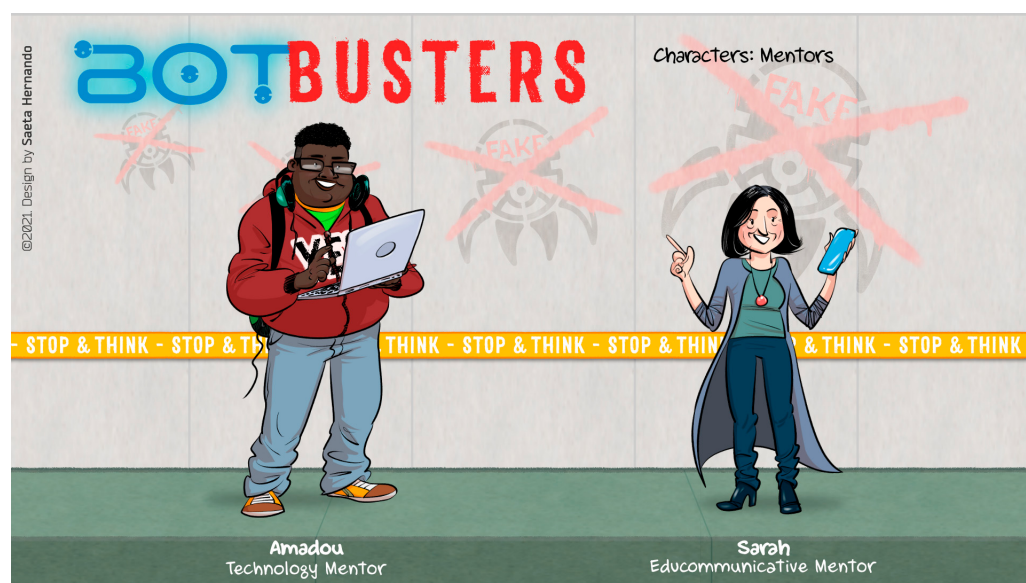


Figure 1. Mentors.

The female mentor, Sarah (Figure 2), is the media and information literacy mentor. She is a middle-aged, white woman, whose dress is casual and her appearance is natural, with no glasses or makeup, and who carries a smartphone in her hand.

Amadou (Figure 3) is the technology mentor who guides players through the installation of the *InVID-WeVerify* verification plug-in. Amadou is a black male, casually dressed, carrying a laptop computer and, since he provides technical information, wears glasses.



Figure 2. Sarah. Designed by Saeta Hernando.



Figure 3. Amadou. Designed by Saeta Hernando.

After the serious content on the instructions part, the *BotBusters* game is articulated around four missions related to four SDGs. Of the 17 SDGs set out in the 2030 Agenda, the serious game *BotBusters* addresses 4 of them: SDG 3, SDG 12, SDG 13 and SD15. These four goals are addressed in missions that are accessed from the mission panel by clicking on each of the characters representing each goal (Figure 4). Players participate in each mission which are designed in a non-linear order, i.e., they can choose which one to play in any order they wish.

Once inside each mission, the avatar representing it presents an introductory video of the SDG. This video constitutes a serious game learning element. Then, the avatar gives way to a news item that asks the player to identify it as true or false. Every mission is accompanied by educational commentary from mentors Sarah and Amadou. As the player completes the missions (yellow progress bar), the player is provided with a digit (number) that the player must write down and keep in the badge case (top right) until he completes all the missions. When completed, the player is entitled to receive the “Fake News *BotBusters*” Diploma awarded by the game as proof of the skills developed.

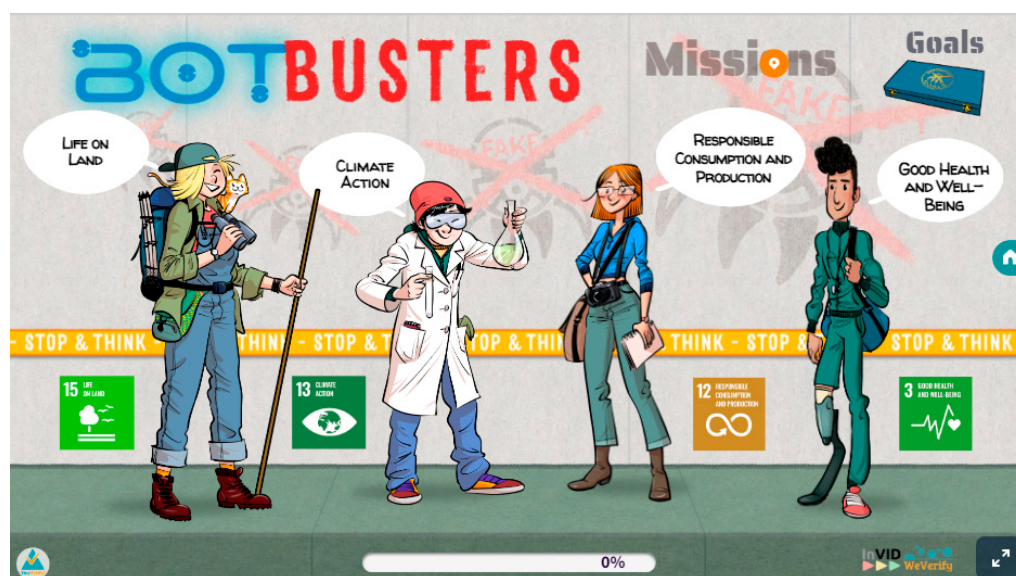


Figure 4. Missions. Designed by Saeta Hernando for *BotBusters*.

As with the mentors, the design of the characters of the four missions corresponding to the four SDGs addressed in *BotBusters* was made according to the preferences of teenage serious game players, so that they could identify with them or have characteristics close to their ideal self: young and a natural appearance [36]. The characters were also designed in such a way that they can identify with the SDG that each one of them represents through their profession and their appropriate clothing and accessories [37].

- **SDG 03 Mission: Good Health and Well-being.** This SDG aims to ensure healthy lives and promote wellness at all ages, as this is essential for sustainable development. In the game, this SDG is presented by Ahmed (Figure 5) who is studying Sports Medicine. The character's clothing is in line with that of a person who represents physical health care, and Ahmed also makes a physical disability visible with his prosthetic leg.



Figure 5. Ahmed. Designed by Saeta Hernando for *BotBusters*.

- **SDG 12 Mission: Responsible Consumption and Production.** This SDG aims to do more and better with less, decoupling economic growth from environmental degradation, increasing resource efficiency and promoting sustainable lifestyles. In *BotBusters*, this SDG is presented by avatar Julia (Figure 6), an activist journalist who,

equipped with clothing and accessories typical of her profession such as a notebook and a camera, tries to make responsible production and consumption visible.



Figure 6. Julia. Designed by Saeta Hernando for BotBusters.

- **SDG 13 Mission: Climate Action.** This SDG aims to take urgent action to combat climate change and its impacts. In BotBusters, it is presented by avatar Chang (Figure 7) who studies Climate Science. Chang wears a white lab coat, the clothing of a scientist, and holds laboratory instruments in his hands.

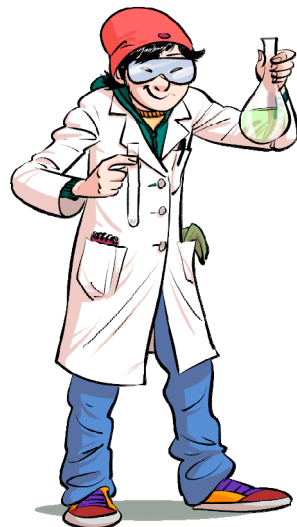


Figure 7. Chang. Designed by Saeta Hernando for BotBusters.

- **SDG 15 Mission: Life on Earth.** This SDG has as targets: to stop desertification; to sustainably manage forests, wetlands and other natural ecosystems; and to ensure the sustainable use of wild resources, flora and fauna. In BotBusters, it is presented by the avatar Sanda (Figure 8) who studies Biology and Environment. Sanda is dressed in clothing suitable for exploring terrestrial nature such as binoculars and mountain clothing, and is accompanied by a terrestrial animal.



Figure 8. Sanda. Designed by Saeta Hernando for BotBusters.

In summary, the game offers four missions whose theme has to do with the four Sustainable Development Goals that were considered as being the most appealing to the teenage population targeted by the game.

Each of the assignments includes as tasks the identification of two news items as true or false:

- SDG 3. News 1 (N1). Figure 9. The news item includes a video comparing the dirtiness of beards and toilets. When verifying the news item, it is found to be false, as it includes fragments of videos published on other websites and dates.
- SDG 3. News 2 (N2). Figure 10. The news item includes a photograph about the harmfulness to health of 5G antennas installed in 2020. The news item is false, as the date on the photograph (pre-2014) does not correspond to the date in the text of the news item (2020).
- SDG 12. News 1 (N1). Figure 11. The news item includes a video that relates to how technology may be influencing the cognitive and memory abilities of adolescents. The news item is true as can be seen by the fact that there are no fragments of the video that correspond to other videos from other websites or dates.
- SDG 12. News 2 (N2). Figure 12. The news item includes a video asking to detect if, according to the information in the video, sugar consumption can become a health problem. The news is true as it can be seen that there are no fragments of the video that correspond with other videos from other websites or dates.
- SDG 13. News 1 (N1). Figure 13. The news item includes a video stating that climate change is benefiting Chile's vineyards. The news is true as can be seen by the fact that there are no fragments of the video that correspond to other videos from other websites or dates.
- SDG 13. News 2 (N2). Figure 14. The news item includes a video about NASA creating artificial clouds to cause rain. The news item is false, as video fragments can be found in older ones, referring to other NASA projects.
- SDG 15. News 1 (N1). Figure 15. The news consists of identifying as true or false a photograph of the glittering wings of a butterfly. The news is false; it corresponds to a photomontage as indicated by the verification plug-in.
- SDG 15. News 2 (N2). Figure 16. The second news item of the SDG 15 mission refers to a tweet published with a photograph of a fire in 2019 in the ocean forest, with an allusion to the awareness of the care of the planet and the climate crisis affecting the Earth. The news is false as there are other previous images.



Figure 9. Mission SDG 3: N1. Designed by Saeta Hernando for BotBusters.

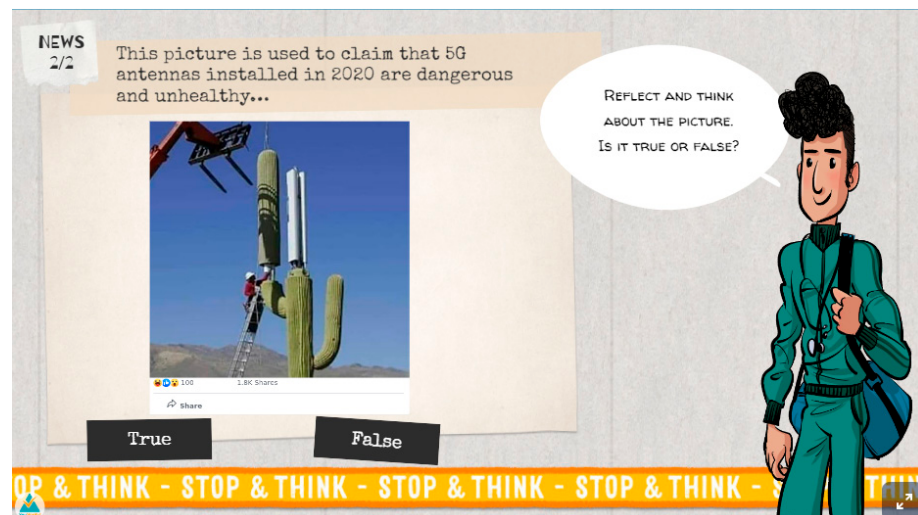


Figure 10. Mission SDG 3: N2. Designed by Saeta Hernando for BotBusters.



Figure 11. Mission SDG 12: N1. Designed by Saeta Hernando for BotBusters.



Figure 12. Mission SDG 12: N2. Designed by Saeta Hernando for BotBusters.



Figure 13. Mission SDG 13: N1. Designed by Saeta Hernando for BotBusters.



Figure 14. Mission SDG 13: N2. Designed by Saeta Hernando for BotBusters.



Figure 15. Mission SDG 15: N1. Designed by Saeta Hernando for BotBusters.

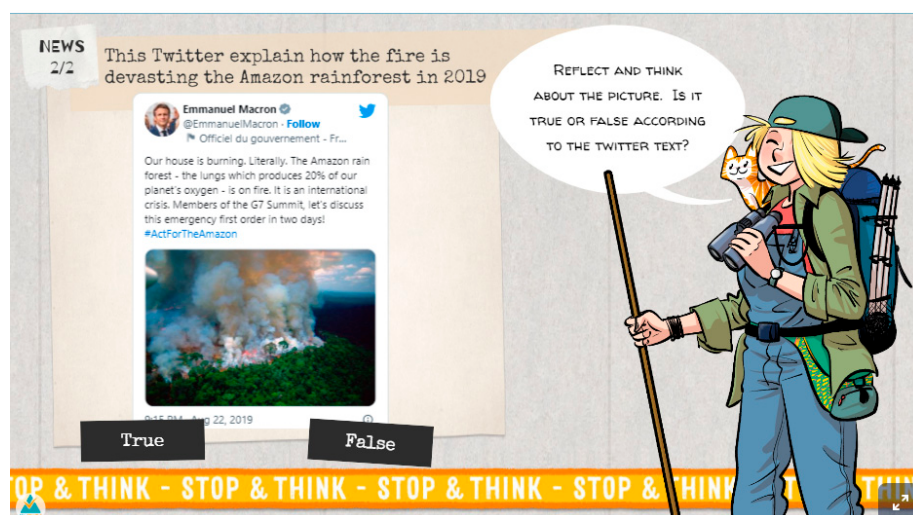


Figure 16. Mission SDG 15: N2. Designed by Saeta Hernando for BotBusters.

Of the eight news items included in the four missions, four of them, one per mission, appeal to environmental and social awareness and the importance of a collective effort for the SDGs:

- N2 of SDG 3: installation of telecommunication antennas.
- N1 of SDG 12: responsible consumption of technology.
- N2 of SDG 13: human intervention altering the climate.
- N2 of SDG 15: care for forests and jungles.

The other four news items, N1 from SDG 3, N2 from SDG 12, N1 from SDG 13 and N1 from SDG 15, have a more individual nuance. They refer to issues that affect each person and, although their solution may be collective, they generate in principle a concern or response based on individual well-being.

The first research hypothesis is to test the validity and usefulness of the game mechanics in probing and raising awareness of the SDGs among respondents. We will compare these results with those of the Eurobarometer [31] to corroborate this hypothesis. For this first hypothesis, data on the players' preferences in each of the four SDG-related missions will be used.

The second research hypothesis is to see whether young people's concerns are driven primarily by social or individual components. For this second hypothesis, data regarding the eight news items proposed in the game will be studied.

The research has analyzed the behavior of players in each of the missions related to the four SDGs of the game. The data have been obtained through the analytic tools embedded in the software used to build up the game. These data allows use of different game elements by players to be investigated [38]. The game design allows quantitative data regarding the buttons clicked as well as the interactions of special relevance to be collected. These methodologies of web analytics techniques can be used in the analysis of learning as reported in the different research on trend analysis and effectiveness of educational content based on the frequency of access of students [39] or the relationship between students' web activity in Learning Management Systems (LMS) and their academic performance [40]. The *BotBusters* research collected the behavior of the players by recording their interactions with the game buttons with which they consulted educational content, answered the proposed questions or advanced in the missions. Specifically, for the purposes of this specific research on ODS, the interactions with the buttons corresponding to playing the mission, response to the news item (whether it was true or fake) and verification or not of the news item were recorded. In this way, it was possible to count the number of players who participated in each of the four missions of the game, and their behavior in each of the two news items of each mission.

The analysis of the data was carried out both in terms of the total players and by differentiating the players by the language chosen to play (English, French or Spanish) in order to identify the possible differences depending on the language chosen. The French, Spanish and Romanian organizations that participated in the YouVerify! project carried out activities to disseminate the game. Some of them were openly disseminated through the press and social networks and others were more specific among young people (secondary school and university students) in their respective countries and educational institutions. The French versions were especially publicized among secondary school students, in some cases with classroom-based activities, and the Spanish versions preferably among university students. These activities provide a general idea of the types of players in the French and Spanish versions; however, as the game is openly available, it is not possible to determine the exact age range of all the players. The English version especially had the least specific broadcasting.

3. Results

3.1. General Game Details

Out of the more than 5000 visitors to the game website, a sum of 2483 decided to start the educational sequence of the *BotBusters* game and start consulting its strategy and contents. This group is verified because they pressed the Start button (Figure 17). In total, 185 players did so in English, 498 in Spanish and 1800 in French (Figure 17). Among the total number of players who accessed the game, 2220 decided to start playing it, i.e., they pressed the Game On button to start the missions (Figure 17), being 175 of those who played in English, 430 in Spanish and 1615 in French (Figure 17).

After this first phase, 1495 completed at least one of the *BotBusters* missions (Table 1).

Table 1. Number of players who played at least one mission.

Play in English	Play in French	Play in Spanish	Total Players
118	1160	217	1495

These data about players choosing at least one mission means that, due to the higher number of French players (78% of the total number of players), the behavior of these players influences the total game data as can be seen in Figure 18.

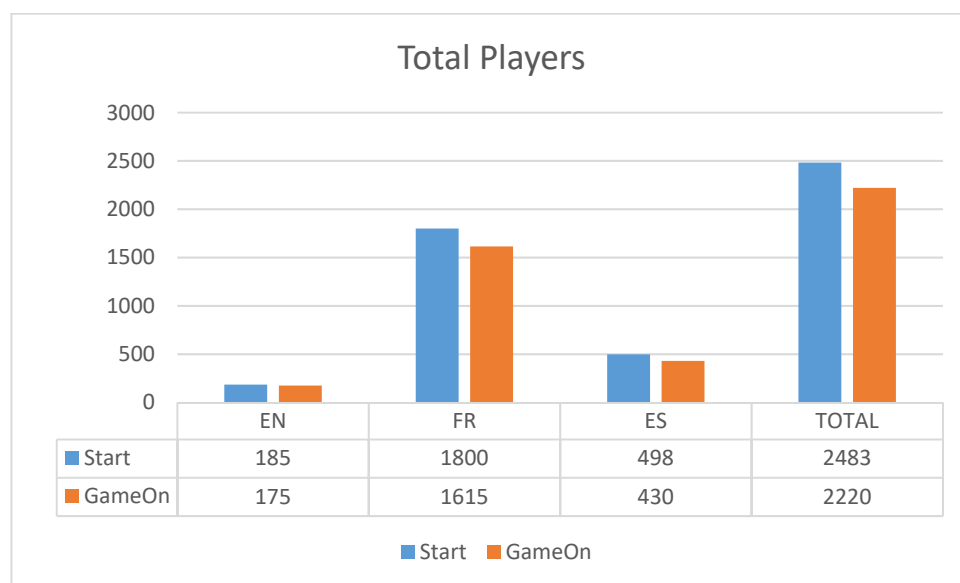


Figure 17. Total number of players who accessed the game and started playing it. Total data by game language.

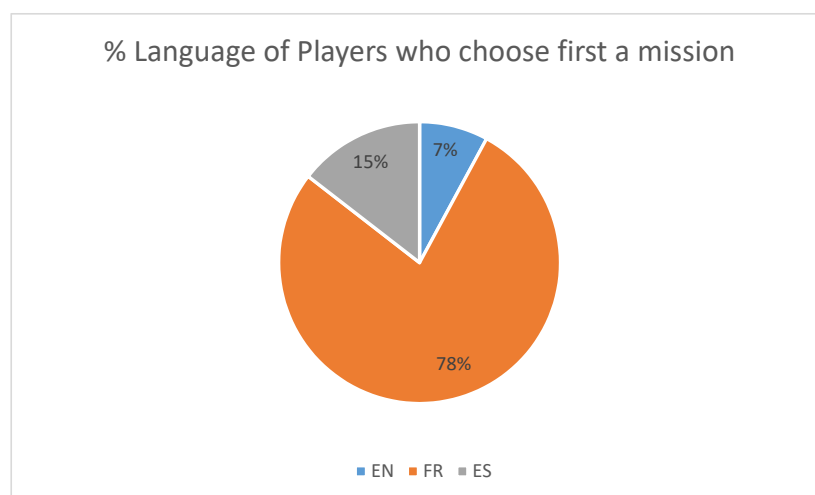


Figure 18. Percentage of players by language, taking into account the first mission chosen by each player.

3.2. Mission Preferences

Upon arrival at the mission panel (Figure 4), players could choose one of four characters, Sanda, Chang, Julia or Ahmed, corresponding to each of the four SDGs they represent, i.e., SDG 15, SDG 13, SDG 12 and SDG 03, respectively. Because there is no linear order to the game, being able to choose any of the missions both on arrival at the mission panel and after the completion of each mission, in the preferences for playing each mission we only take into account the access data to the first mission chosen by each participant.

3.2.1. Total Preferences

As can be seen in Table 2, the most chosen missions as the first choice were the SDG 15 mission (547 players) and the SDG 3 mission (487). The SDG 12 mission was chosen as the first choice by 141 players and SDG 13 by 320 (Table 2).

Table 2. Choose first each mission.

Mission	Total Players	% Players Who Choose First
Choose First SDG 03	487	32.58%
Choose First SDG 12	141	9.43%
Choose First SDG 13	320	21.40%
Choose First SDG 15	547	36.59%

The two objectives referred to in the two most frequently chosen missions, SDG 15 and SDG 3, correspond to the problems that are indicated by the *Flash Eurobarometer 502* [31] in Figure 19. SDG 15 and SDG 3 correspond to the problems that, as indicated by the *Flash Eurobarometer 502* data in Figure 19, the young population considers that the focus should be placed on: improving mental and physical health and well-being, i.e., aspects directly related to SDG 3; and protecting the environment and fighting climate change, i.e., aspects related to SDG 13 and 15 (*Flash Eurobarometer 502* [31] groups the issues related to SDG 13 and SDG 15 under the same item).

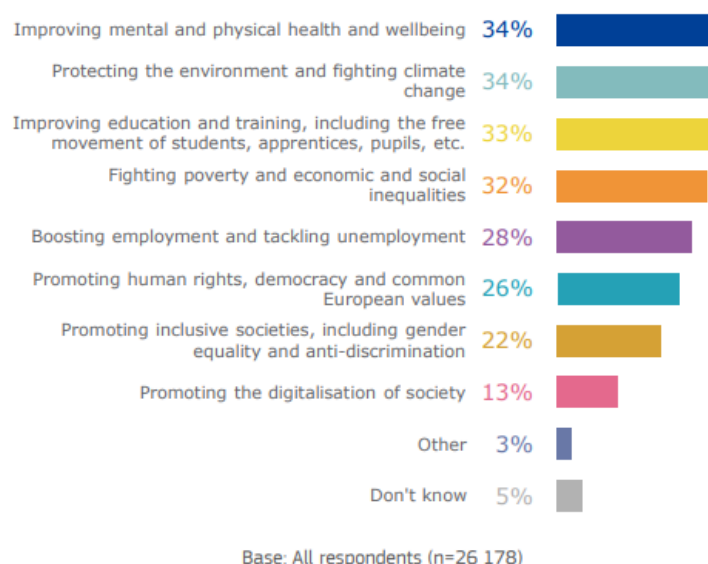


Figure 19. Taken from *Flash Eurobarometer 502* [31]: “Q12 The European Commission has decided to make 2022 the ‘European Year of Youth’ to support the generation that has sacrificed the most during the COVID-19 pandemic. What are the key themes you think the European Year of Youth should focus on? You can select up to three answers. [MULTIPLE ANSWERS] (%-EU27)”.

3.2.2. Preferences According to the Chosen Game Language

The mission corresponding to SDG 15 was the preferred option for players who played in English (37.29% of the players) and Spanish (45.62% of the players), and the second option for those who played in French (34.83% of the players). The most chosen option by the players who played in French was the one corresponding to SDG 3 (35.86%), with this mission being the second option for players in Spanish (20.74%) and English (22.03%, with the same score as SDG 13), Figure 20 and Table 3.

Table 3. Number of players, classified by language, who choose each mission first.

Missions	Play in English	Play in French	Play in Spanish
Choose First SDG 03	26	416	45
Choose First SDG 12	22	187	35
Choose First SDG 13	26	153	38
Choose First SDG 15	44	404	99

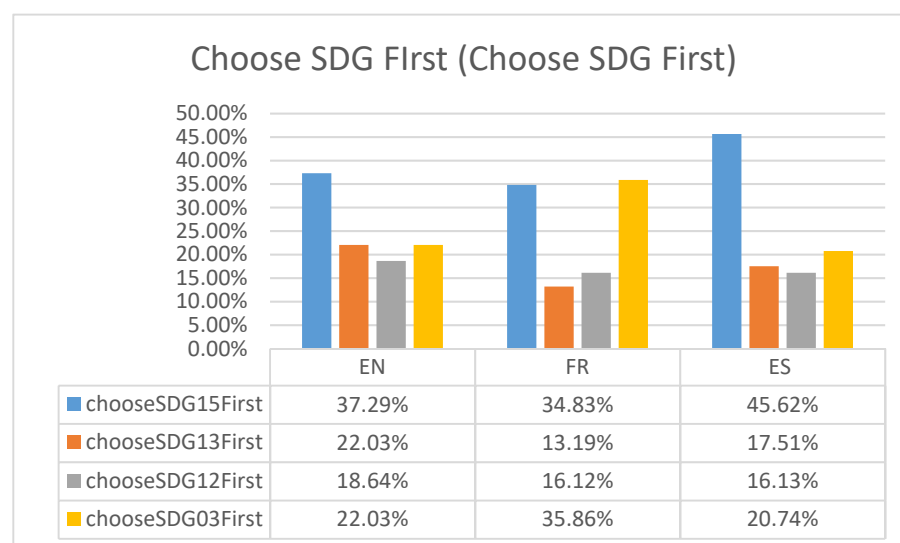


Figure 20. Percentages of players per language in each choice of missions played first.

In other words, the SDGs most chosen by the three languages, SDG 3 and SDG 15, correspond to the aspects on which young Europeans consider that attention should be focused. This corroborates with the *Flash Eurobarometer 502* [31] data shown in Figure 19.

The SDG 12 mission was the least chosen mission as a first choice for English (18.64% of English players) and Spanish (16.13% of Spanish players) players as can be seen in Figure 20. French players do not choose the SDG 12 mission as a last choice, but only 16.12% of the players choose it as the first choice, which is less than half of those who choose SDG 3 (35.86%) and SDG 15 (34.83%) as first choices. The behavior of Spanish-language gamers in relation to SDG 12 corresponds to the lower interest of young Spaniards of the Z and millennial generations in sustainability [41]. Despite the lower interest in this goal by young Europeans [31], the young population considers its promotion important [33].

3.3. Player Behavior during Each Mission

In each mission, the most verified news item is the first one, since the path is linear, i.e., the first news item is accessed first and once it is successful, access to the second news item is allowed.

3.3.1. Total Verification of the Missions

The mission with more total verifications is the one corresponding to SDG 15 (1946 verifications), which means 39% from the total verifications, and SDG 13 is second in the number of verifications (22%) (Figure 21). Therefore, the mission of SDG 15 is the mission with the highest number of checks, which corresponds to the mission chosen by more players in the first place (Table 2) and to the topics that young Europeans consider that require more attention according to the *Flash Eurobarometer 502* [31] and as shown in Figure 19.

On the contrary, the mission corresponding to SDG 12 is the one with the lowest total verifications (Figure 21), which corresponds to the absence of the themes related to this SDG in the *Flash Eurobarometer 502* [31] data in Figure 19. On the contrary, the mission corresponding to SDG 12 is the one with the lowest total verifications (Figure 21), which corresponds to the absence of the themes related to this SDG in the *Flash Eurobarometer 502* [31] data in Figure 19.

3.3.2. Total Verification of Missions According to Game Language

The mission with the highest number of total verifications (Figure 22) in French (1561 verifications) and Spanish (242 verifications) is the one corresponding to SDG 15. As for the SDG 12 mission (Figure 22), it is the most verified mission in English (161 verifications), and the least verified in French (693 verifications) and Spanish (106 verifications).

The verification data in English are similar in all the missions, with 18 verifications separating the most verified (SDG 12) from the least verified (SDG 13), and only one verification separating the first most verified mission (SDG 12) from the second (SDG 13). In the case of the French language, the verification of SDG 15 is much higher than that of the other three missions, accounting for more than twice as many verifications as the next most verified mission (Figure 22). French players, therefore, prefer SDG 3 as the first option to play (Figure 20) and check SDG 15 and SDG 13 more. In the case of Spanish players, they check the news related to the mission they most often choose as first option to play more (Figure 20) and the mission they check the least is SDG 12, coinciding with the mission they least often choose as the first option (Figure 20) and with the SDGs for which the Spanish youngsters feel appealed.

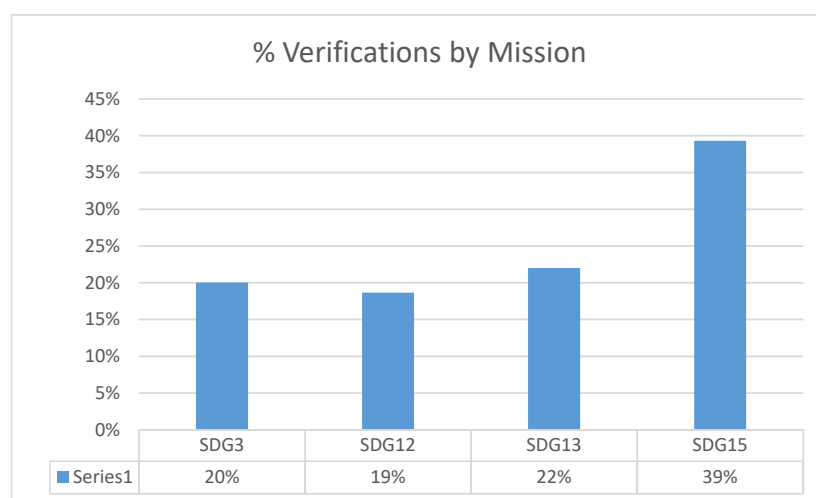


Figure 21. % Verifications by Mission.

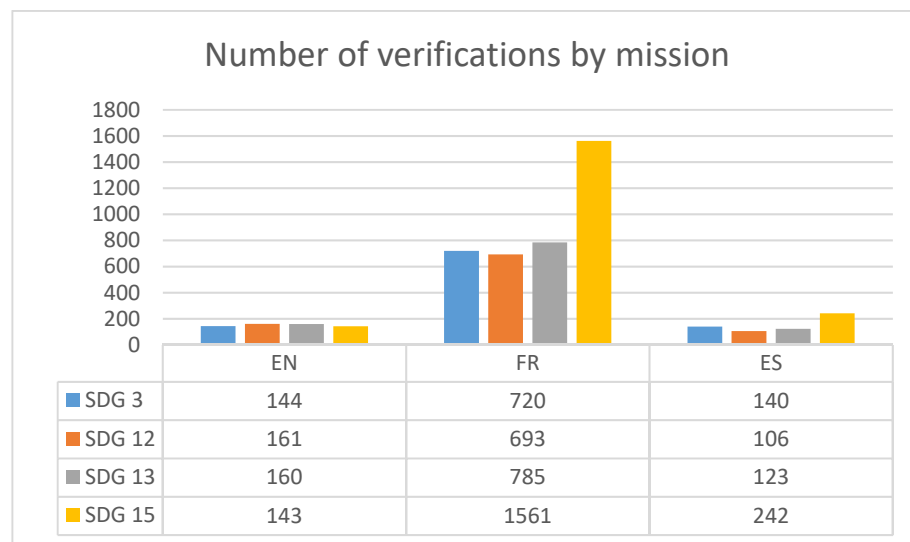


Figure 22. Number of verifications by mission.

3.3.3. Total Verifications of the First News Item for Each Mission

Taking into account that N1 is the most verified in each mission, the verification of N1 in each of the four missions has been compared (Figure 23).

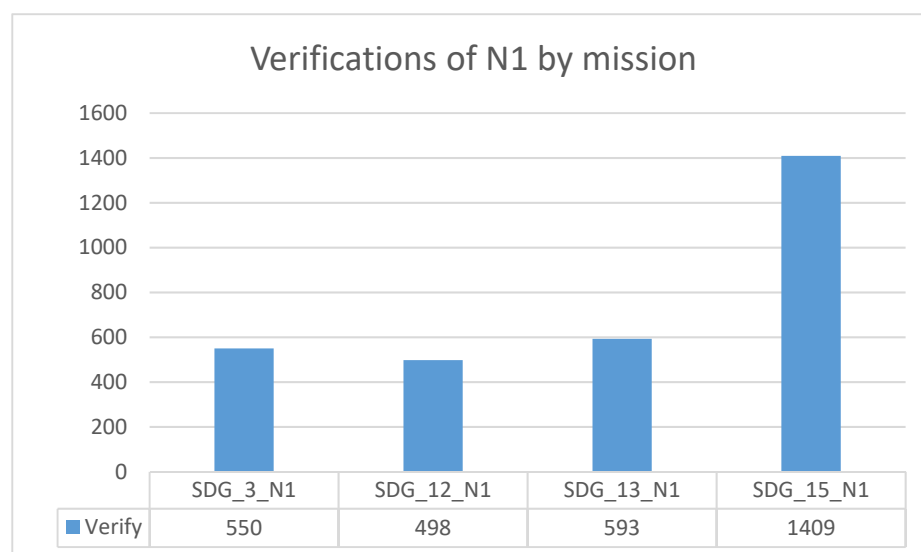


Figure 23. Total number of verifications in each mission.

Thus, it is observed that N1 of the SDG 15 mission is the most verified by the total number of players (1409 verifications). Therefore, N1 of SDG 15 is the most chosen N1, which corresponds both to the most chosen mission (Table 2) by players as the first choice to play (547 players) and to the themes that, according to the Flash Eurobarometer 502 [31], 34% of young Europeans think should be given more attention.

The second most verified is N1 of the SDG 13 mission (593 verifications), i.e., the mission least chosen as the first choice (Table 2). N1 of the SDG 3 has 550 verifications

The least verified N1 corresponds to SDG 12 (498 verifications), even though it is not the mission that is least often chosen as the first mission to play (Table 2), since that position corresponds to the mission of SDG 13.

3.3.4. Verification of the First News Item According to the Language of the Game

Taking into account the language of play, the verifications of the first news items (N1 of SDG 3, N1 of SDG 12, N1 of SDG 13 and N1 of SDG 15), indicate that N1 of SDG 15 was the most verified in all languages (Figure 24), even in the case of the French language, which, as the first choice of play, chose SDG 3 more often (Figure 20).

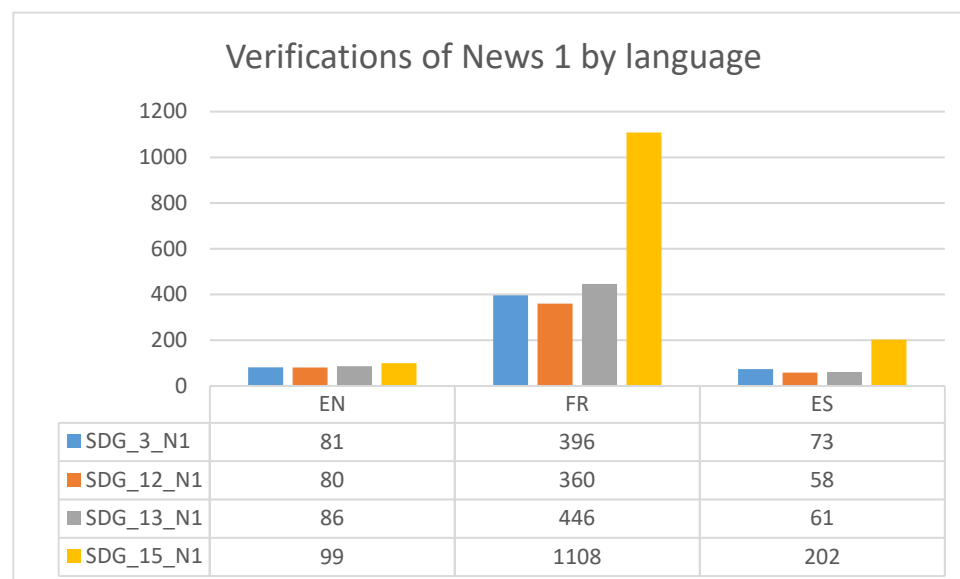


Figure 24. Total number of verifications of each news item per language.

In the case of the French language, N1 of SDG 3, the mission most chosen first by the French, obtained 396 verifications in this language, behind the verifications of N1 of SDG 15 (1108 verifications) and SDG 13 (446 verifications). N1 of SDG 12 had the least number of verifications.

The N1 with the least number of verifications in the three languages is that of SDG 12 (Figure 24), which corresponds to the mission with the least number of verifications in French and Spanish, but with the mission with the most verifications in English (Figure 22).

3.4. Behavior during News Verification

In the analysis of players' behavior in the news, we distinguish:

- The news from each mission related to the collective awareness at the environmental level and activism for the SDGs:
 - N2 of SDG 3: installation of telecommunication antennas.
 - N1 of SDG 12: responsibility in technology consumption.
 - N2 of SDG 13: human intervention to alter the climate.
 - N2 of SDG 15: care for forests and jungles.
- The other four news items, N1 from SDG 3 (characteristics of beards), N2 from SDG 12 (individual consumption of sugar), N1 from SDG 13 (influence of climate change on wine harvests in Chile) and N1 from SDG 15 (appearance of butterfly wings), refer to topics in which no intervention can be made as a society either because of their purely environmental characteristics or because their behavior is individual.

3.4.1. Total Verification of Each News Item Related to Collective Environmental Awareness and Activism for the SDGs

- N2 of SDG 3 (installation of telecommunication antennas) is the least verified of all the news items in the set (Figure 25).

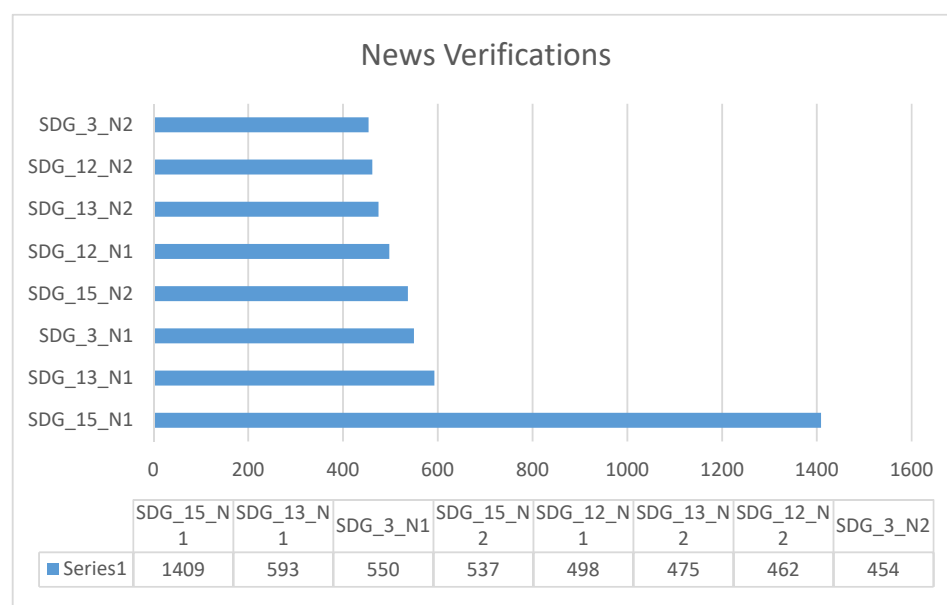


Figure 25. Total number of verifications of each news item.

- N1 of SDG 12 (responsibility in technology consumption) is the fifth most verified news item of all the news items in the game (Figure 25).
- N2 of SDG 13 (human intervention to alter the weather) is the sixth most verified news item of all the news items in the game (Figure 25).
- N2 of SDG 15 (care of forests and jungles) is the fourth most verified news item of those appearing in the game (Figure 25).

That is, the four news items categorized as those that appeal to the group consciousness of activism in favor of the SDGs occupy the fourth, fifth, sixth and eighth positions in the number of verifications made, so that with the exception of N2 of SDG 12 (sugar consumption), the highest number of verifications is given in the news items where people have no scope for collective action on the impacts related to the SDGs.

3.4.2. News Verification Distinguishing Environmental and Social Awareness by Language

N2 of SDG 3 (installation of telecommunication antennas) is the seventh most verified news item in English (63 verifications), the least verified in French (324 verifications) and the third most verified in Spanish (67 verifications), Table 3.

N1 of SDG 12 (responsibility in technology consumption) is the fifth most verified news item in English (80 verifications) and French (360 verifications) and the sixth most verified in Spanish (58 verifications), Table 3.

N2 of SDG 13 (human intervention to alter the climate) is the sixth most verified news item in English (74 verifications), the sixth in French (339 verifications) and the fourth most verified in Spanish (62 verifications), Table 3.

N2 of SDG 15 (care of forests and jungles) is the least verified news item in English (44 verifications) and Spanish (40 verifications) and the second most verified news item in French. Table 3.

The most verified news item in all the languages is N1 of SDG 15, i.e., a news item where people have no scope for collective action on the impacts related to the SDGs. The data for this news item stand out in the French language, where it reaches 1108 verifications. This represents 244.6% more verifications than the next most verified news item in that language (N2 of SDG 15), Table 4.

Table 4. News verification by language.

News	English	French	Spanish
N1_SDG 3	81	396	73
N2_SDG 3	63	324	67
N1_SDG 12	80	360	58
N2_SDG 12	81	333	48
N1_SDG 13	86	446	61
N2_SDG 13	74	339	62
N1_SDG 15	99	1108	202
N2_SDG 15	44	453	40

3.4.3. Total Hits for News Item Related to Collective Environmental Awareness and Activism for the SDGs

N2 of SDG 3 (installation of telecommunication antennas) is the second news item with the second highest percentage of hits (80%) as reflected in Figure 26 (see Table 4 to fully understand the axis labels). This news item corresponds to the second mission that most players choose as the first mission to play (Table 2), and is one of the topics that young Europeans identify as one to pay more attention to, as reflected in Figure 19 referring to the *Flash Eurobarometer 502* data [31].

N1 of SDG 12 (responsibility in technology consumption) is the fourth news item, tied with the other news item of its mission (N2 of SDG 12) in correct answers (78%), as seen in Figure 26 (in this figure, “verify” means: the game asks you to perform the verification; “Verify&Right” means: the player performs the verification by answering in such a way that he/she guesses the truth or falsehood of the news; “Fake&Right” means the players answered “fake” before performing the verification and the news were fakes). This news item belongs to the mission chosen in third place as the first option to play (Table 2), and is not identified with the topics considered of main attention by young Europeans, as reflected in Figure 19 referring to the *Flash Eurobarometer 502* data [31].

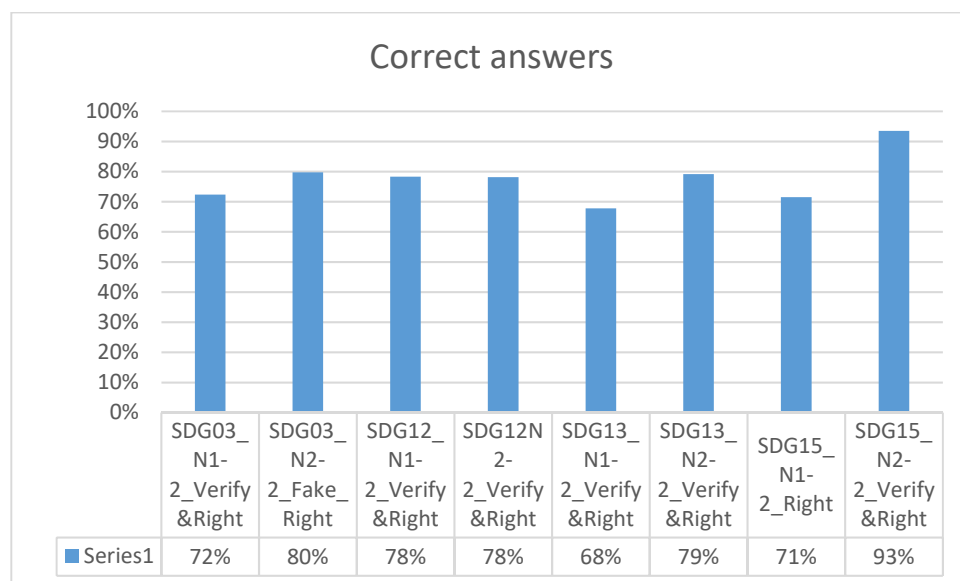


Figure 26. % Total correct answers by News.

N2 of SDG 13 (human intervention to alter the climate) is the third news item with the highest percentage of correct answers (79%) as shown in Figure 26. This news item belongs to the mission chosen as the first option to play on fewer occasions (Table 2), and is identified with one of the topics identified by young Europeans one that should be paid more attention to, as shown in Figure 19 referring to the *Flash Eurobarometer 502 data* [31].

N2 of SDG 15 (care of forests and jungles) is the news item with the highest percentage of hits (93%) as shown in Figure 26. This news item belongs to the SDG most chosen as the first mission to play (Table 2) and is identified with one of the topics identified by young Europeans on which more attention should be paid, as shown in Figure 19 referring to the *Flash Eurobarometer 502 data* [31].

3.4.4. Hits per Language of Each News Item Related to Collective Environmental Awareness and Activism for the SDG

N2 of SDG 3 (installation of telecommunication antennas), as can be seen in Figure 2 (see Table 4 to fully understand the axis labels), is the news item with the highest percentage of correct answers in English (84%), the fourth news item with the highest percentage of correct answers in French (75%) and the second news item with the second highest percentage of correct answers, tied with N2 of SDG 13, in Spanish (97%).

N1 of SDG 12 (responsibility in technology consumption), as can be seen in Figure 27, is the news item with the second highest percentage of hits in English (79%), the third news item with the highest percentage of hits in French (76%) and the news item with the lowest percentage of hits in Spanish (90%). In English, the mission to which the news item corresponds, SDG 12, is the mission with the highest number of verifications (Figure 22). In the Spanish language, it coincides with those who declare less interest in sustainability due to a lack of information or because they do not feel interested or appealed by it [18], and with the least chosen option as the first option to play (Table 2).

N2 of SDG 13 (human intervention to alter the climate) is the third most successful news item in English (76%), the second most successful news item in French (77%) and the second most successful news item, tied with N2 of SDG 3, in Spanish (97%), as can be seen in Figure 27.

N2 of SDG 15 (care of forests and jungles) is the news item with the least hits in English (56%), the seventh news item with the most hits in French (68%) and the news item with the most hits in Spanish (98%), as can be seen in Figure 27. This news item corresponds to the mission most chosen as the first option by players in English and Spanish (Figure 20) and the mission most verified by players in French and Spanish.

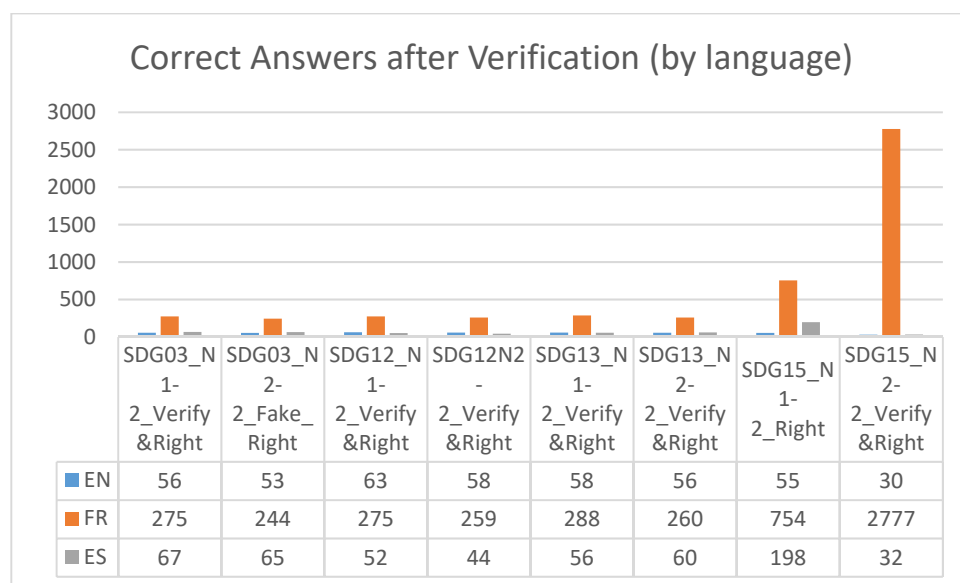


Figure 27. Correct answers after verification (by language).

4. Discussion

To make a first general analysis of the most popular SDG among players, we will first check and relate the data of the SDGs that are chosen on the first time with the data of the most verified news.

Then, we are going to study those same data to compare the results across languages to check for differences in SDG interest and game dynamics between the language areas.

Finally, it may be interesting to check the prior knowledge of the players in each SDG. For that purpose, and at the same time as we do the previous analyses, we will quote some data about the players' correctness in the first screen of each news item (the one in which they show their opinion before checking).

4.1. Discussion on Overall Results

The SDG most chosen as the first choice of mission to play is SDG 15 (it is the first choice for 547 players). This mission is also the most verified (1970 verifications, which represents 39% of the total verifications performed in the game). These data concerning the most chosen option are in line with the preferences expressed by young Europeans in the *Flash Eurobarometer 502* [31], so that their interest in the subject matter makes them choose it and verify it on more occasions due to their interest in answering it correctly. In addition, it is given the circumstance that N2 of SDG 15 is a news item that is complex in its correctness by prior knowledge, since it is a mismatch between the text of the news item and the image that is difficult to guess by mere intuition, so they fail when they respond to the news item without verifying it (without detecting that it is a fake news) and must proceed to verify it to be able to guess that it is a fake news item without giving up the attempt to do so. This can be explained by the fact that it is news that appeals to the group conscience and responsibility that each person has in the conservation of life on Earth, as reflected in the aforementioned N2 which referred to a fire in the Amazon jungle.

SDG 3 is chosen as the second option (487 players). This SDG is also the mission with the second highest number of verifications (20% of the total verifications), but far from the 39% accumulated by the mission corresponding to SDG 15. These data are consistent both with the interests expressed in the *Flash Eurobarometer 502* [31] and with the global pandemic context on the occasion of COVID-19 in which the game data were collected in BotBuster and which was therefore a topical issue that young people consider as the SDG most affected by the pandemic, considering as key the importance of the restoration of national health systems to achieve their goals [33].

SDG 13 was the least chosen mission (219 players) but the percentage of verifications represents 19% of the total. This indicates that interest in this SDG is outweighed in choice by SDG 3 by the pandemic context, but the verifications of both SDGs are even in total terms. These data are again in line with the interests expressed by young Europeans in the *Flash Eurobarometer 502* [31], as SDGs 3, 13 and 15 are the ones they are most interested in.

As for SDG 12, this mission was chosen by 244 players as their first choice and accumulated only 12% of the total verifications of the game. These data seem to indicate a lower interest regarding SDG 12, responsible consumption and production, despite the fact that the involvement of the young population in campaigns related to this SDG is very important in the progress towards its achievement [42], since at that age, they begin to develop certain consumption patterns that will have long-term effects [43]. The regular, meaningful and consistent involvement of adolescents and youth as producers of knowledge and agents of change in relation to this OS influences both their behaviors and social norms and those of their households and communities [42].

4.2. Discussion of Results by Language of Play

In this section, we discuss some significant differences observed among players who have entered the game in one of its three languages of English, Spanish and French, focusing the analysis on some remarkable cases that occur among the different news proposed by the game. The aim is to find data that explain the prior knowledge and interest of players in the different SDGs.

In the presentation of game results, it has been observed that the mission based on SDG 15 is the most visited and the most verified, but not in all cases. Differentiating by language, we see that, although in the total statistics of the game the French trend defines the statistics in total terms (Figure 18), if we analyze separately the data of the players who have played the game in the different languages, the players who have played the game in English prefer the mission of SDG 15 (care of life on earth) as the first to play, while the one they choose the least is the one corresponding to SDG 12 (responsible production and consumption). SDG 15 N2 (care for forests and jungles) is the least verified news item in English (44 verifications) and the one with the fewest hits for English players (56%).

The English players choose SDG 15 first, although the most verified mission is SDG 12. The news item they correctly verify the most is the N1 of SDG 3.

When the players play in French, the most chosen mission in the first place, with 416 cases, is the one referring to SDG 3 (health), with very little difference on SDG 15 with 404 cases. Despite this greater preference for the health topic, probably conditioned by the situation of the COVID-19 pandemic, when it came to showing an interest in checking the news, their choices were the same as the other languages. In the case of the French language, the most verified missions are also those of SDG 15 (life on earth) and SDG 13 (climate change), also coinciding with the *Flash Eurobarometer 502* [31]. As in the Spanish case, the N1 that they verify the least is SDG 12, showing a great disinterest in issues related to responsible consumption.

This provides us with some interesting data on the dynamics of the game and its ability to attract players. First, it is clear that on the issue of preferences for SDGs, players have chosen the mission according to the interests they have also shown in other instruments such as the aforementioned *Flash Eurobarometer 502* [31]. The failures and hits in SDG 15 show that the difficulty of news analysis has been the determining factor for the failures, indicating that the use of the *InVID-WeVerify* plug-in was scarce. The first news item in SDG 15, a simple manipulated photograph, was easier to analyze at a glance than news item 2, whose manipulation was more subtle and was due to the fact that the illustrative photograph did not correspond to the Twitter text.

In relation to SDG 12, we observed interesting differences between the different languages which may help to understand the hypothesis of the article that an interest in the environmental SDGs is higher than an interest in the more social SDGs. While all agree in showing less interest in the analysis of SDG 12 news (responsible production and

consumption), there is a significant difference in terms of verifications. While the French and Spanish players choose these SDG 12 missions last and, moreover, they are the ones they are least concerned about when they check, this is a curious case for the English players. Despite the fact that SDG 12 is the mission least chosen by players who play in English, it is this mission that accumulates the most verifications in the English language. In this mission, the hits in N1 of SDG 12 (responsibility in technology consumption), as can be seen in Figure 27, is the second news with a higher percentage of hits in English (79%); this may be due to the fact that there is a greater lack of knowledge about SDG 12 so they need more verifications. In addition, this fact coincides with other data collected in the game that indicate that players who have finished the English version of the game have achieved as much with more interest and rigor. This is shown by the fact that the two SDG 12 news items produce very obvious and easy-to-understand results in the plug-in (more N1 than N2). It is feasible to assume that the 80 or so players who have reached this stage of the game were, for the most part, using the plug-in. This is the reason for their level of success.

In the case of the Spanish language, on the contrary, the hits on N1 of SDG 12 (responsibility in technology consumption), as can be seen in Figure 27, is the news item with the lowest percentage of hits in Spanish (90%). This is a complex news item that is not so easy to verify with the use of common sense, so we can assume that most of these players did not show an interest in this SDG and did not use the plug-in. In the Spanish language, it coincides with those who declare less interest in sustainability due to a lack of information or because they do not feel interested or appealed by it [41], and with the least chosen option as the first option to play (Table 2).

In relation to SDG 12, responsible consumption and production, the involvement of the young population in campaigns related to this SDG advances its achievement [42], since at that age, they begin to develop certain consumption patterns that will have long-term effects [43]. The regular, meaningful and consistent involvement of adolescents and young people as producers of knowledge and agents of change in relation to this SDG influences both their behaviors and social norms and those of their homes and communities [42]. In Spain, young people from generation Z and millennials are the ones who declare the least interest in sustainability due to a lack of information or because they do not feel interested or appealed by it [41]. Young people consider that the emergency situation resulting from COVID-19 can make the population aware of the importance of moving towards sustainable means of consumption and production [33]. Young people consider that the main reason for the lack of responsible consumption and production behaviors is due to a lack of knowledge and awareness of the impact of consumption practices on society and the environment, and they consider that new technologies can remedy this lack of knowledge [33]. Likewise, young people consider that the higher price of sustainable products influences the fact that responsible consumption behaviors are not more common [33]. All these data seem to justify a lack of interest in SDG 12. While, in the case of the English language, gamification strategies have managed to maintain the interest in SDG 12 to finish the game among the few players who reached this point, in the cases in French and Spanish, the increase in the number of players or their, presumably, older age, the data on disinterest have already surpassed the data concerning the motivation of the game. In any case, the data from the English version are encouraging and encourage the improvement of gamification strategies as a means of increasing the players' interest in more social and collective issues, as in the case of responsible consumption.

4.3. Discussion of Hits with and without Verification

In general, these data on prior knowledge support the hypothesis raised with the news selection, i.e., the difference between the interest and knowledge about the proposed news that appealed to sustainability awareness from a more individual perspective or from a more social perspective, of commitment to social action. We have seen that the differences between these two groups of news items are very accentuated in SDG 15, the mission in

which there is a greater number of players, which was chosen in the first instance and which, in many cases, was the only one that was resolved (with an average of 500 interactions per news item). The difference between the hits in the “social” and “individual” news is almost 8% (Figures 28 and 29). This SDG 15 mission, in particular, reflects very well the difficulties of the players to understand manipulations that are related with the social perception of environmental disasters. In the rest of the missions, these differences are much narrower. This is because there has been a selection of players and the remaining players, complying with the dynamics of the game and learning with its serious contents, show greater equality as the differences are of the order of 2–3%. In the case of SDG 12, as in the previous cases, it shows some particular data since, in it, the prior knowledge and hits on the most socially related news (effects of the use of technology) are slightly higher than those produced in the more individually oriented news (sugar consumption). We have already seen particular results in the case of the English language (in which SDG 12 is the mission with the most correct verifications), and these data point to the same conclusion: the selection made by the game itself and its learning tools means that players who have reached the later stages of the game already have more knowledge and better criteria when it comes to verifying or giving their opinions. Although the data are not conclusive, they suggest that the game has fulfilled its mission of raising awareness of the social components of the SDGs, at least among the players who completed it.

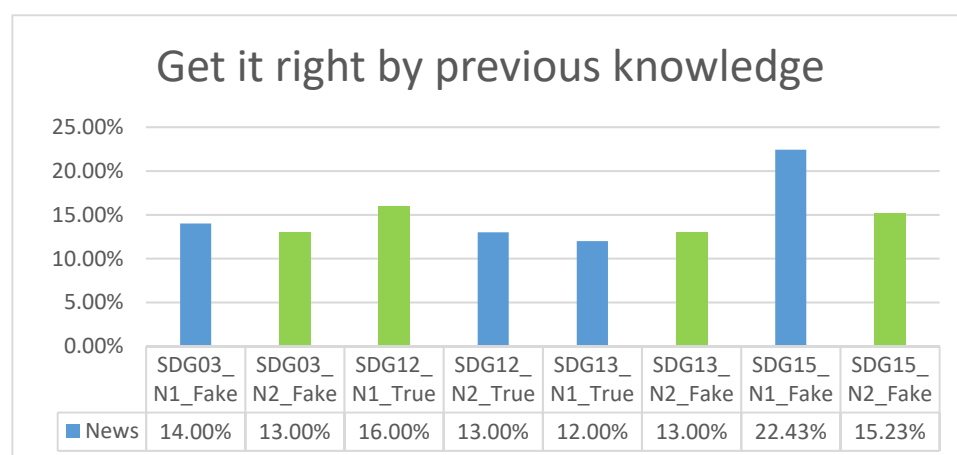


Figure 28. Get it right by previous knowledge.

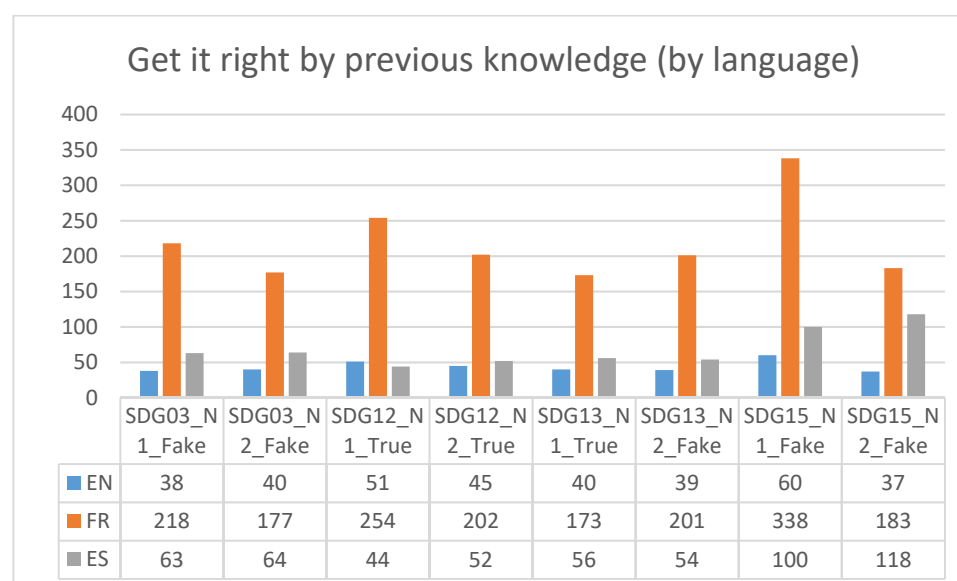


Figure 29. Get it right by previous knowledge (by language).

5. Conclusions

The main hypothesis of this paper is that students recognize the concept of SDGs associated with environmental issues, while their knowledge and preference for more social goals is lower. The data help us to understand that their preferences when choosing news and their preliminary knowledge about them respond to these hypotheses.

On the other hand, the study of some particular cases in the analysis of the differences by language, especially with regard to the intuitive hits and the checks in each news item, help us to check whether young Europeans have a greater or lesser tendency to consider the problems as social facts that affect everyone or as issues that affect them individually. In this sense, we can show their knowledge of the relationship between the SDGs and collective action and solidarity.

The data obtained in a specific activity such as the news check proposed by the game corroborate our first hypothesis. That is, young Europeans are aware of the SDGs for their environmental issues and not so much for their social implications. This is verified both in the preference when choosing the news because almost 36% of the total number of players who started the game choose SDG 15 (life on earth) first, and almost 22% choose SDG 13 (climate change) first, i.e., those most related to the environment. This adds up to a total of 58% compared to 42% for the other two goals, i.e., 32% for SDG 3 (health) and SDG 12 (responsible consumption) which are chosen first by 9% of the players.

Although the difference is not very large, we consider it significant since SDG 3 was chosen first in a context still marked by the COVID-19 pandemic, which undoubtedly led many players to choose this objective in the first place. It would be interesting to repeat the experience at a time when health concerns were not so marked in public opinion or by social circumstances.

The data that do corroborate our hypothesis about the greater interest in environmental news are shown when we check the news verification statistics. The mission that was verified the most often was SDG 15 with a total of 39% of verifications and SDG 13 with 22%, i.e., 61% compared to the total of 39% of verifications in the news of SDGs 12 and 3.

Whether we collect their opinions, as in the Eurobarometer data cited above, or we set a specific task, as in the case of BotBusters, young Europeans show more interest and constancy in news and SDGs related to the environment.

The hypothesis that could not be corroborated by our study is that of the social or individual components of young people's concerns. While in the case of SDG 15 that their greater prior knowledge (by the level of correctness) on issues that affect them individually has been corroborated in the other three SDGs studied, the data are not conclusive. In fact, we saw how in the case of those who chose the English language, the data in SDG 12 are contrary to this hypothesis. Undoubtedly, the choice of fake news conditions this study as these differences between social or individual components are very subtle and too many external factors intervene when analyzing the news. It would be interesting to find some kind of more limited experimental test to study this hypothesis. What the data have made clear is that the players who have shown the greatest interest in the game and in consulting its serious contents are those who have shown the least bias when evaluating news with a more individual or social component, which shows that the game has had certain positive effects in improving this social perspective of the SDGs.

The analyses presented and the conclusions drawn have much room for improvement from an analytical point of view. On the one hand, the completely open nature of the game, which did not require any personal data from the players, meant that no independent variables were available to allow for more advanced statistical analysis. The players were not asked for any identifying data nor were they asked, within the game, for any type of tool or interaction to interpret their prior knowledge of the SDGs. The research assessed their level of interest in commenting on SDG-related news and took anonymous quantitative data about the number of interactions studied and their differences in the different missions (SDG) proposed. Additionally, the quantitative data about their level of success in the

different news proposed (some more oriented by social values than others) are indicative of the type of learning that develops in the game.

On the other hand, a study and a proposal like this, with a holistic component which mixes different objectives such as the study of the SDGs and media literacy, has negative consequences from an analytical point of view because it is very difficult to distinguish the factors by which players make decisions. However, if one wants to understand the social factors associated with the SDGs and how their controversies and news, fake or true, flood the media, it is necessary to embrace this complexity and try to understand and contextualize the data even if they are not so analytically accurate. Verifying news is an activity that, on the one hand, contributes to increasing their knowledge about the SDGs and, on the other hand, has a social value in itself, as it activates critical thinking in the participants. The mere fact of playing and entering into the dynamics proposed by the game already indicates that the players who developed all the phases were interested in the SDGs and were modifying their behavior and improving their knowledge in the verification process.

This experience can be completed if the game is used by narrowing down its dynamics and putting them into action in more closed contexts. New research can be conducted in which to introduce mechanisms for personal data collection. This will allow for more accurate conclusions to be drawn, although it will undoubtedly not achieve the excellent dissemination results of the open methodology of the experience presented, which was one of the main objectives of the European *YouVerify!* project.

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