The Young Reporters for the Environment Program: Impact, Methodologies, and Framework in the National and International Context

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Abstract. The Young Reporters for the Environment (YRE) program, coordinated by the Foundation for Environmental Education (FEE), is an initiative aimed at empowering young people from around the world to actively engage in addressing environmental issues, while also promoting scientific education among youth. Through the program, young individuals between the ages of 11 and 25, associated with a school or participating independently, develop skills in scientific research and communication, enabling them to take informed and conscious positions on various environmental topics of interest. The program provides a platform for them to express themselves through journalistic communication on science, in written article, photographic, or video form.

This article will address the international foundations of the YRE program, its methodology and objectives, its impact and reach at the national level, as well as highlighting relevant events and practical outcomes. It will categorize these aspects into various chronicles based on educational cycles, thematic focus, or types of communication. Furthermore, the article will discuss the future perspectives of the program and its alignment within the current educational context.

Thus, this article aims to emphasize the importance of science communication and scientific education for students' success in their academic journey. Additionally, it will present the YRE program, which has played a crucial role in promoting scientific education and nurturing young individuals with skills in science communication.

Keywords. Young Reporters for the Environment (YRE), Scientific Education, Journalistic Communication on Science, Scientific Education, Skills in Science Communication.

1. Introduction

Science is one of the main pillars of human development, responsible for the most significant advancements of our societies including in areas such as health, technology, and environmental protection. However, scientific knowledge often remains confined to experts in specific fields, making it difficult for the general public to access accurate and relevant scientific content. In this context, science communication emerges as a crucial tool to ensure that scientific knowledge is disseminated in a clear and objective manner, enabling citizens to access information that can contribute to informed decision-making and the development of freedom in critical thinking [1].

Practical scientific literacy means possessing a type of scientific and technological know-how that can be immediately applied to improve quality of life, addressing basic human needs such as food or health, as small fragments of scientific and technological information can make a difference in people's lives [2].

Scientific communication should be clear, precise, relevant, and accessible, allowing the public to understand and appreciate science and its contribution to human development [3]. It's a complex and challenging process that involves collaboration among scientists, science communicators, journalists, and other professionals, aiming to produce accurate and accessible scientific information. In order for science communication to be effective, it is imperative that different professionals work together to promote clear and accessible language without compromising the accuracy and relevance of the disseminated content, thereby avoiding the spread of inaccurate and/or incorrect information.

For this purpose, it is important for communicators to have access to reliable sources and receive proper guidance for research and writing of their communications. Additionally, science communication is important to stimulate the interest and participation of young people in science, aligning with the concept of scientific education by ensuring access to accurate and relevant

scientific information at formative ages. This can contribute to the development of skills and abilities and also the formation of future scientists and professionals in related fields.

In resume, this article aims to present the Youth Reporters for the Environment (YRE) program and highlight its importance in science communication, scientific education of students, and the formation of young individuals with science communication skills. Finally, the article will present the results and impact of the YRE program in shaping young science communicators and improving the quality of teaching and learning in the national context.

2. Scientific education in young people

Science education is a social practice that has been increasingly expanded and developed in what is known as non-formal education settings and through various media channels. There is a consensus regarding the importance and necessity of creating policies and pedagogical strategies that effectively assist in the understanding of scientific knowledge through experiences outside the traditional school environment. However, initiatives focusing on non-formal education and science communication are still limited in scope [4].

Table 1. Comparison between inquiry-based and traditional teaching methods

Characteristics	Inquiry-based	Traditional
Principle Learning Theory	Constructivism	Behaviourism
Student Participation	Active	Passive
Student Involvement in Outcomes	Increased Responsibility	Decreased Responsibility
Student Role	Problem solver	Direction follower
Curriculum Goals	Process oriented	Product oriented
Teachers Role	Guide/facilitator	Director/ transmitter

2.1. Inquiry Based Science Education (IBSE) methodology

The IBSE (Inquiry Based Science Education) methodology is recommended for fostering critical thinking in young individuals. IBSE is a pedagogical approach that emphasizes scientific inquiry, critical thinking, and hands-on active participation of students in the learning process [5]. By adopting the IBSE methodology in the JRA program, students are encouraged to explore scientific questions through experimentation, observation, formulation of questions, and development of evidence-based conclusions. This approach aims to develop scientific skills such as informed decision-making, critical thinking, and intellectual autonomy, contrasting with the traditional teaching model.

2.2. Importance of journalistic communication of science

With the increasing access to social media and unfiltered online sources of information, the ability to critically communicate and interpret information has become an increasingly important skill for society as a whole, but even more so for young individuals. Scientific education in young people ensures access to accurate and relevant scientific information at formative ages, which can contribute to the development of skills and abilities and the formation of future scientists and professionals in related fields. Therefore, journalism plays a crucial role in disseminating accurate and reliable information about important events and current issues in an impartial or selective manner. Thus, news production based on scientific topics must be done with rigour and precision, avoiding the spread of incorrect information or leaving room for misinterpretations of the disseminated subject matter [6].

It is crucial that young people be educated about the importance of accuracy and reliability in journalistic communication. They should have access to reliable sources and learn to interpret information critically to avoid being influenced by false and sensationalist news.

One way to ensure that young people are prepared for journalistic communication is through education. Schools can include education in critical communication skills and journalism in their curricula to teach students how to interpret and produce accurate and reliable information. Teachers can also encourage students to engage in communication activities such as writing articles, blogs, or participating in school newspapers.

This work will help demonstrate the impact of the JRA program has had and can have on future generations within this context, so that they have the necessary skills to interpret critical information and make informed choices, reinforcing the importance of scientific education for young people and accurate and reliable

journalistic communication, especially on scientific topics [7].

3. Methodology and international and national framework of the JRA program

This program aims to develop young people's knowledge about environmental issues, as well as competencies in communication, citizenship, individual initiative, teamwork, critical analysis, social responsibility, and leadership [7].

The JRA methodology uses a tried and tested four-step approach investigate, propose solutions, report, and disseminate (Figure 1):

I. The first step, investigate. Participants are encouraged to identify, define, and communicate a local environmental problem /issue. They should conduct original research using primary and secondary sources, and interview individuals or key groups to gather firsthand information. It is also important for participants to cover relevant historical, economic, social, and/or political implications and the potential consequences of the problem/issue. Lastly, they should link the local environmental problem and/or issue to the larger global framework [8].

II. The second step, propose solutions. Young reporters are challenged to identify possible solutions to the previously chosen problem, evaluating their likely effectiveness and presenting arguments for and against. They must develop and propose a solution based on facts and interview findings, without including personal opinions from the author.

III. The third step, report. Aims to communicate the local environmental issue and its possible solution through journalistic production. It is important for participants to identify the target audience and choose the best way to reach it, using the appropriate journalistic format and style. They should create a report in the form of an article, photograph, photo report with up to 12 photos, podcast, or video that documents the problem and/or issue related to the environment or sustainable development, whenever possible, suggesting a solution and presenting different perspectives. A positive approach focused on seeking change-inspiring solutions is adopted.

IV. The fourth step, disseminate the results to the local and global audience through various media [8].

Figure 1. YRE's 4-Step Methodology

To participate in the Young Reporters for the Environment (JRA) program, there are different registration options depending on the participant's profile. Two possible options are registration as a school group coordinated by at least one teacher and registration as a JRA Freelancer for young people over 15 years old. Additionally, it is now also possible to participate representing a Scout Group.

In the case of registration as a school group, a coordinating teacher must log in to the JRA portal and proceed with the school's registration. It is necessary to associate the project that will be the subject of investigation and reporting by the participating students. This way, the group will have the support and guidance of the teacher to develop activities related to environmental issues.

As a JRA Freelancer, registration is intended for independent participation of young people over 15 years old, not being affiliated with an educational institution. In this case, it is necessary to register on the JRA portal, indicating the project or theme that will be addressed in the publications. As a JRA Freelancer, it is possible to create and publish articles, photographs, or videos related to the project, as well as participate in national and international contests promoted by JRA [9].

Finally, there is also the possibility of participating representing a Scout Group. To do so, simply register on the JRA portal and specify that you are representing the respective Scout Group.

4. YRE (Young Reporters of the Environment) - International

The Young Reporters for the Environment (YRE) program, coordinated by the Foundation for Environmental Education (FEE), is an initiative that aims to empower young people from around the world to actively engage in addressing environmental issues. Through the program, young people between the ages of 11 and 25 are equipped to take a conscious stance on environmental issues of their interest, providing them with a platform to express themselves through writing, photography, or video.

The implementation of YRE is carried out by National Operators in over 40 countries worldwide. Young people can join the program through their schools, youth groups, or individually by contacting the relevant National Operator. Depending on the country, National Operators organize workshops and events for YRE students, as well as national YRE competitions [10].

The international coordination of the FEE program is based in Denmark. This coordination organizes the annual International YRE Competition, develops opportunities for its YRE students, and sends YRE students to high-level conferences such as the Conference of the Parties (COP) and World Environmental Education Congress (WEEC). It also coordinates a range of partnerships and projects, including the highly recognized Litter Less Campaign conducted through YRE and Eco-Schools.

The mission of YRE is to empower young people to develop tools to have their voice heard on environmental issues in their region that they feel are not adequately addressed and reported on in the form of news, reporting, photography, etc. This approach creates a purpose for applying their knowledge in the dissemination of information. Additionally, the YRE program helps participants develop skills and acquire knowledge that will be useful throughout their lives, such as communication skills, individual initiative, teamwork, critical analysis, social responsibility, and leadership skills.

The program also aims to unite young people from all backgrounds with a sense of common purpose and encourages them to become environmental leaders in their communities. Every year, a competition is held to encourage young people from around the world to investigate and address a story that can clearly and succinctly explain an issue related to local, current, and real environmental development. Through all this work, YRE helps create a generation of environmentally committed leaders dedicated to sustainable development, with communication and critical competence.

In 2012-22, 22,763 works were selected and submitted by the 43 national operators, involving 336,263 students, 27,946 teachers, and reaching 4,907,374 people [10].

5. YRE - Portugal

As mentioned earlier, the Young Reporters for the Environment (YRE) program is an international program by the Foundation for Environmental Education, implemented in Portugal by the Association *Bandeira Azul da Europa* (ABAE). Its main objective is to contribute to the training of active and participatory citizenship, with a focus on environmental journalism. Through interviews, surveys, and other journalistic techniques, young people investigate and interpret relevant environmental and sustainability issues at the local level, developing skills in the areas of environment, foreign languages, new technologies, communication, citizenship, individual initiative, teamwork, critical analysis, social responsibility, and leadership.

The program begins with a local project in which young people investigate, report, and communicate through various media channels, including newspapers and the internet. Schools and young people in the YRE network have the opportunity to participate in various challenges, competitions, and activities, such as multi-day missions, as well as exchange opportunities with young people from other regions of Portugal and other countries within the international YRE network.

6. Goals of the program

In this chapter, we will briefly and specifically address the main objectives of the YRE program. The YRE program aims to educate for sustainability by encouraging the development of local projects that identify, investigate, and propose solutions to sustainability-related

issues or environmental problems. It also focuses on developing skills in the areas of communication, journalism, exchange, and citizenship.

The program goal is to contribute to the development of active and participatory citizenship, with focus on environmental journalism. Young people involved in the program investigate and interpret relevant environmental and sustainability issues at the local level, using journalistic techniques such as interviews and surveys to deepen their knowledge in the areas of environment, foreign languages, and communication technologies. Furthermore, the YRE program aims to develop skills in citizenship, individual initiative, teamwork, critical analysis, social responsibility, and leadership.

The program begins with the implementation of a local project in which young people investigate, report, and communicate their findings through newspapers, the internet, and other media channels. ABAE also organizes field activities and training for the network of enrolled teachers and students, such as national YRE seminars and missions, as well as competitions and applications for international missions.

7. Participation of Portuguese Schools in the YRE program: Results of the School year 2021-22

The current chapter presents the results achieved by the YRE program in the academic year 2021-22, focusing on school participation, reporting modalities, topics addressed, and geographical distribution of activities. In the mentioned academic year, the YRE program had the participation of approximately 85 schools in Portugal, covering different levels of education, from the 2nd cycle to higher education (Figure 2).

In terms of geography, the municipalities of Lisbon, Braga, and Porto stood out as the locations with the highest number of reports produced by the *Jovens Reporters para o Ambiente* (JRA/YRE), according to the ABAE's activity report for the 2021-22 school year.

The presented results highlight the significant participation of schools, teachers, freelancers, and students in the *Jovens Reporters para o Ambiente* program in Portugal during the 2021-22 academic year. The chosen reporting modalities, the addressed topics (Figure 3), and the geographic distribution of activities reflect the young reporters' interest and commitment to current and relevant environmental issues.

The scientific communication promoted by JRA contributes to disseminating knowledge about the environment and raising awareness in society about the importance of environmental protection and sustainability (Report on the Activity of the Mobility Teachers Network 2023) [11].

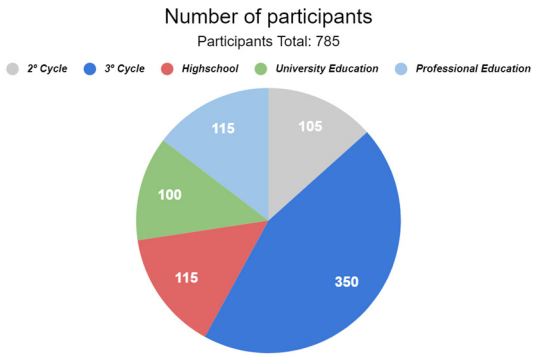

Figure 2. Work submissions by school cycle

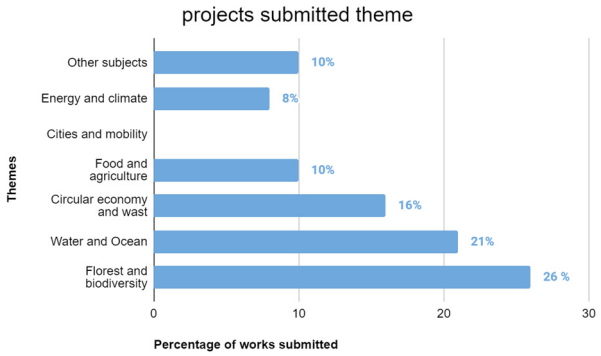

Figure 3. Work submissions by school cycle

8. Training within the scope of the JRA program

8.1. Mission Web Summit 2021

A *Missão* Web Summit, which took place from November 1st to 4th, 2021, targeted young people between the ages of 18 and 25. Students who were proficient in English and familiar with the *Jovens Repórteres para o Ambiente* (JRA) methodology were selected and were required to be available before, during, and after the event to conduct research on the speakers and

produce reports. In this context, in partnership with Web Summit, the *Escola Superior de Tecnologia da Saúde de Lisboa* (ESTeSL), and Hyundai, four young individuals participated in this international event as accredited journalists.

The objectives of the Web Summit Mission were to develop skills in research, information gathering and processing, and communication among young people, within the framework of the *Jovens Repórteres para o Ambiente* program, to an excellent level. During the event, the young journalists had the opportunity to attend various talks, press conferences, and interview renowned participants. As a result, they produced 12 journalistic reports, including six articles and six video reports.

The Web Summit event is one of the world's largest technology summits, attracting thousands of attendees, speakers, and startups from various countries. The evaluation of the Web Summit Mission was very positive and impactful for the participating young reporters, as they had the opportunity to gain journalistic experience and produce content about an internationally significant event.

8.2. National JRA/YRE Seminar 2021

The National JRA Seminar, held in Braga on November 26th and 27th, 2021, targeted students and teachers from different levels of education who aspire to become *Jovens Repórteres para o Ambiente* (Young Reporters for the Environment). The event focused on providing training for students and teachers, with a total duration of 14 hours divided into 10 hours on the first day and 4 hours on the second day.

The main objectives of the seminar were to bring together students and coordinating teachers of the JRA Project, encourage communication (Figure 4), facilitate the sharing of common goals and experiences, implement the JRA project methodology through workshops based on a case study investigation, and develop articles for online publication. Additionally, the event aimed to discuss strategies and methodologies of the JRA project, with a special emphasis on research, journalism and the internet, photography, and multimedia. It also aimed to recognize and award the best reports of the year 2021.

In total, the event gathered 150 participants, including teachers from different levels of education such as, lower secondary school (2nd and 3rd cycle), upper secondary school, universities, polytechnics, and vocational education. Furthermore, other professionals with a multiplier effect, such as after-school activity monitors, employees of entities involved in the promotion of Environmental Education, and environmental technicians, were also present, totalling 15 participants. The event also had 40 participants whose category was not specified (Figure 5).

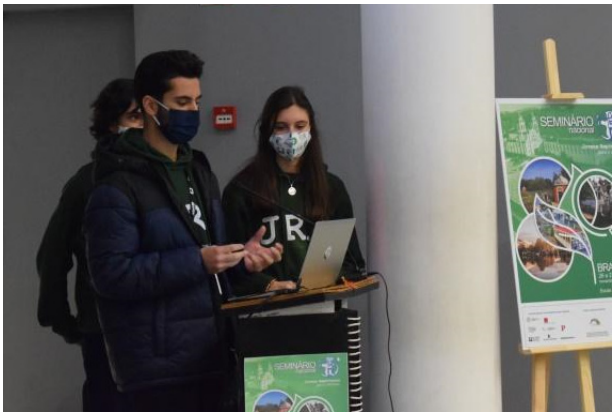

Figure 4. JRA communication presentations during the 2021 National Seminar

Figure 5. Representatives of entities involved in the promotion of Environmental Education

The event's website provided detailed information about the National JRA Seminar, as well as news and evaluation results of the event. During the seminar, over 80 young people and teachers from different regions of the country had the opportunity to explore and report on various aspects of sustainability in Braga, resulting in the production of 17 reports.

The event provided an important opportunity for students and teachers involved in the JRA Project to share knowledge, experiences, and

contribute to the promotion of Environmental Education/Science through journalism and research

8.3. Webinars

Webinars as a training tool for the Young Reporters for the Environment (JRA) project have become a popular way to offer online training in various areas, such as environmental education, communication, and journalism techniques. Within the scope of the JRA project, a series of webinars was conducted with the aim of equipping students and teachers interested in participating in the project as Young Reporters for the Environment. In this chapter, the details of the conducted webinars will be discussed, including dates, target audience, format, objectives, partners, and the number of participants.

A total of four webinars were held on the following dates: October 28th and November 17th, 2021, January 17th and 18th, and February 23rd, 2022. They targeted students and teachers from various educational levels who were interested in becoming Young Reporters for the Environment.

The webinars were conducted in an online training format, allowing participants to access the content from anywhere with internet access. Each session had a duration of 1 hour and 30 minutes, totalling 6 hours of training across the four webinars. The primary objective of these webinars was to provide online training for students and teachers interested in participating in the JRA project. The main goals were to encourage project communication, facilitate the sharing of common objectives, and exchange experiences among participants. Additionally, the webinars aimed to implement the methodology inherent to the JRA project through workshops based on the investigation of a case study. Strategies and methodologies of the JRA project were also addressed, with a particular emphasis on research, journalism and the internet, photography, and multimedia aspects.

The webinars were conducted in partnership with the Politécnico de Lisboa, ESTeSL, Jornal Observador, Jornal Público, Escola Secundária São Pedro do Sul (ESSPS), and Gerador. These partnerships provided a diversified and knowledge-rich approach for the participants of the webinars.

A total of 200 participants, including students and teachers interested in joining the JRA initiative, took part in the webinars. The participants came from different educational levels, including preschool education, 1st cycle of basic education, 2nd cycle of basic education, 3rd cycle of basic education, secondary education, universities and polytechnics, and vocational education. Additionally, other professionals with a multiplier effect, such as ATL monitors, employees of entities involved in the promotion of environmental education, environmental technicians, among others, also participated in the webinars [11].

8.4. *Ex-situ* Conservation Mission

The *Ex-situ* Conservation Mission took place from April 8th to 10th, 2022, as part of the JRA Program aimed at students aged 15 to 25 interested in environmental research and communication. The mission was carried out in partnership with the *Junta de Freguesia de Benfica*, the Lisbon Zoo, and Hyundai, and involved the participation of 17 young reporters. Over the course of 24 hours, the participants had the opportunity to develop skills in various areas such as research, writing, photography, video, teamwork, journalism, and communication, while investigating best practices related to sustainable development and the importance of zoos in biodiversity preservation.

During the *Ex-situ* Conservation Mission, the participants conducted fieldwork, interviews, group work, and ultimately presented their reports. The main focus of their investigations was the role of the zoo in *ex-situ* conservation, which refers to the conservation of species outside their natural habitat. They also explored the environmental enrichment efforts undertaken by the zoo in recent years and their success stories.

The participants were divided into teams and had the opportunity to interview experts and zoo staff, as well as make observations and gather information on-site. They investigated the different species present in the zoo, the conservation measures implemented, captive breeding programs, and the reintroduction of species into the wild. In addition, the young reporters learned about the challenges faced in ex-situ conservation and the proposed solutions, such as environmental education, scientific research, and public awareness [11].

The participants also had the opportunity to learn about other best practices related to sustainable development, such as waste management, energy efficiency, and biodiversity conservation education. They highlighted the importance of zoos in conserving endangered species, raising public awareness about the importance of biodiversity, and promoting environmental education. The young reporters also emphasized the need for more ex-situ conservation actions to protect endangered species and contribute to biodiversity preservation.

The results of their investigations were presented in different formats, including written articles, photo reports, and videos. The participants demonstrated communication, writing, photography, and video editing skills, as well as the ability to work as a team and meet deadlines. The reports addressed relevant issues related to *ex-situ* conservation, highlighting the successful measures implemented by the Lisbon Zoo and the knowledge gained.

8.5. Rock in Rio Mission 2022

The Rock in Rio Mission, held on June 16th, 17th, 18th, 19th, and 20th, 2022, was an initiative promoted by the JRA Program aimed at students between the ages of 15 and 25, with the goal of addressing sustainability concerns associated with the organization and participants of a music festival. The mission was conducted in a journalistic format, and participants had the opportunity to apply the program's methodology, involving environmental research and communication, as well as develop various skills such as research, writing, teamwork, and English proficiency. The Rock in Rio Mission was carried out in partnership with Rock in Rio Lisbon, Colégio Valsassina, and Hyundai, and involved a total of 20 participants from different educational levels.

The Rock in Rio Mission had a total duration of 34 hours, spread over the four days of the festival, with different activities planned for each day. On the first day, participants had 10 hours of work, which included field research activities, interviews with festival organizers and participants, and group work to identify the main sustainability concerns related to the event. On the second and third days, participants also had 10 hours of work each, with similar activities but focusing on researching sustainable development best practices associated with the festival. On the fourth day, with a reduced workload of 4 hours, participants had the opportunity to finalize their work and prepare the reports that would be presented at the end of the mission.

Throughout the four days of intense work, the 20 participants of the Rock in Rio Mission produced a total of 27 report works, including 12 articles, 10 photo reports, and 5 videos. The reports covered a wide range of sustainability issues, such as waste management, natural resource consumption, sustainable mobility, circular economy promotion, environmental education, and raising awareness among festival participants about the importance of sustainability. The reports were presented in digital format, through the event's website and the social media channels of the JRA Program, reaching a wide audience interested in environmental and sustainability issues [11].

The Rock in Rio Mission provided participants with a unique opportunity to experience environmental journalism in practice, applying the methodology of the JRA Program in a real and current context, such as a large-scale music festival. Participants were able to develop different skills, such as research, writing, teamwork, and communication, and had the opportunity to interact with other young people from different regions of Portugal, promoting exchange and the sharing of experiences (Figure 6).

Figure 6. JRA working as a team to create reports

9. Impact of the program

The main impact of the Young Reporters for the Environment (JRA) Program is to give young people a voice for sustainability, and it is realized

through the development of skills in students, particularly in terms of communication, autonomy, teamwork, and research (JRA 2023). Based on the results obtained from the Young Reporters for the Environment (JRA) program and the Young Reporters for the Environment International (YRE) program, it can be stated that initiatives that promote autonomy and stimulate collective creativity are fundamental for the development of cultural and social changes. These programs provide an environment free from rigid curriculum content, allowing teachers to promote activities focused on reflective science teaching and its applicability in society [12].

Within these programs, the scientific spirit of investigation and communication is introduced to be combined with the knowledge acquired in school. Students are encouraged to investigate, search for sources and information, and present them officially to the school community and the Association for Environmental Education (ABAE), using active learning methodologies such as Problem-Based Learning (PBL) or Inquiry-Based Science Education (IBSE) [4]. This requires students to respect guidelines, support everything presented, work in teams, and adhere to a schedule. Furthermore, the need to justify a report or work leads students to promote critical reflection on everything they read and to listen to and debate all sides of the issues under study.

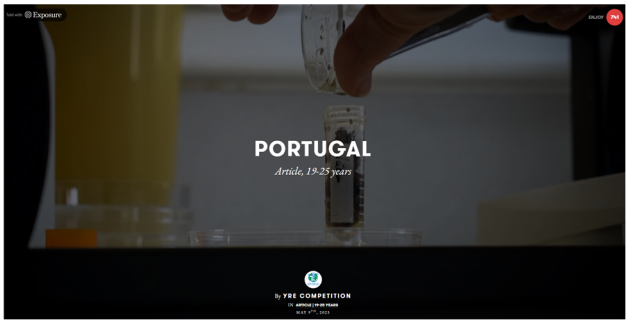

Figure 7. Article on environmental DNA selected for the international YRE Competition

An important aspect is the national and international competition present in the project, with international collaborations carried out by the students themselves. This competition encourages students to showcase the quality of their reports, representing and valuing their own work before the school and the jury (Figure 7). Learning becomes a metacognitive experience when students are encouraged to develop clear intentionality in their actions, becoming reflective in the planning, execution, and evaluation of activities [13].

Being an investigative activity, the use of PBL or IBSE throughout the process of carrying out the activities adds meaning to the concepts addressed, as well as providing a clear representation of them. This allows students to acquire critical and reflective skills, providing the necessary means for mobilizing thinking and facilitating the dynamics of constructing their own knowledge. Additionally, the self-reflection stimulated by the programs is promising in promoting self-esteem, enabling students to develop assumptions and seek to support them, thus promoting the construction of knowledge and skills in a comprehensive manner [5].

Programs like JRA and YRE can be instrumental in promoting science communication in schools. These programs provide an environment free from rigid curriculum content, encourage collective creativity and the scientific spirit of investigation and communication, as well as fostering critical reflection and self-reflection. The results obtained from JRA and YRE are significant for the development of critical and reflective skills in students, providing the necessary means for mobilizing thinking and facilitating the dynamics of constructing their own knowledge.

The use of active learning methodologies such as PBL and IBSE throughout the process of carrying out the activities adds meaning to the concepts addressed and provides a clear representation of them. This allows students to acquire critical and reflective skills, providing the necessary means for mobilizing thinking and facilitating the dynamics of constructing their own knowledge. Additionally, the self-reflection stimulated by the programs is promising in promoting self-esteem, enabling students to develop assumptions and seek to support them, thus promoting the construction of knowledge and skills in a comprehensive and observation-supported manner.

The Young Reporters for the Environment Program and the Young Reporters for the Environment International Program have a significant impact on the development of scientific and social skills in students, promoting science communication in schools, and encouraging collective creativity and the

scientific spirit of investigation and communication.

10. Conclusion

It is recognized that science and communication are critical development factors. Depending on the attitude and behaviour of each individual it may allow to reach the highest standards of personal achievement while simultaneously contributing to the development of the societies they are part of. Following the reasoning of how science and the communication of the knowledge generated by it can transform human lives, it must be taken into account that science also has a role in promoting reflection on how its achievements are impacting society [14].

Therefore, science education in schools, through its curriculum, can develop knowledge, techniques, attitudes, and values that allow students to interpret, understand, and act in a scientifically informed manner about the physical and social reality that surrounds them.

The implementation of the JRA and YRE programs in schools has allowed for student engagement and mobilization to investigate, think, and create something scientifically supported and communicable. It has been observed that collaborative construction is interconnected with other areas of knowledge, and that mental structuring and verbalization are processes that trigger valid metacognitive processes. The use of active learning methodologies, such as PBL and IBSE, contributes to the acquisition of critical and reflective skills and to the construction of one's own knowledge in a comprehensive manner, supported by the observation and verbalization of their investigations. The development of reports has allowed for the development of skills in presenting ideas, defending and arguing, as well as adopting the most appropriate strategies for specific tasks, which are relevant for the construction of logical and scientific reasoning.

The implementation of this program has revealed great advantages for the intellectual development of students, resulting in a clear improvement in logical and scientific reasoning processes, the construction of mentally consistent connections, and the validation of knowledge by the students themselves, contributing to the success of the teaching-learning task. The research, construction, and dissemination of reports based on scientific processes confer positive competencies, and the use of science and communication enhances mental connectivity [15]. The transposition of scientific concepts to a situation of investigation and communication provides lasting knowledge that is firmly rooted in scientific understanding, empowering students with the concrete ability to create, understand, criticize and communicate everyday situations.

11. Acknowledgements

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