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The Impact of Student-Curated Exhibitions about Socio-Scientific Issues on Students' Perceptions Regarding Their Competences and the Science Classes

Pedro Reis [1,*], Luís Tinoca [1], Mónica Baptista [1] and Elisabete Linhares [2]

[1] Instituto de Educação, Universidade de Lisboa, 1649-013 Lisbon, Portugal; ltinoca@ie.ulisboa.pt (L.T.); mbaptista@ie.ulisboa.pt (M.B.)

[2] Escola Superior de Educação, Instituto Politécnico de Santarém; Unidade de Investigação e Desenvolvimento em Educação, Instituto de Educação, Universidade de Lisboa–UIDEF, 1649-013 Lisbon, Portugal; Elisabete.Linhares@ese.ipsantarem.pt

* Correspondence: preis@ie.ulisboa.pt

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Abstract: The IRRESISTIBLE Project (FP7, Grant 612367) had the aim of involving teachers, students, and the public in the discussion on Responsible Research and Innovation (RRI), promoting both the construction of knowledge on cutting-edge (and controversial) research topics and the discussion about the criteria that these research/innovation processes should respect in order to be considered as responsible. These criteria also represent a strong contribution to a more sustainable future for all. This quantitative research evaluates the impact of IRRESISTIBLE's student-curated exhibitions–about the RRI dimensions of cutting-edge research topics (socio-scientific issues)–on students' perceptions regarding their scientific competences and the science classes. A pre- and post-test questionnaire was developed, validated, and applied to students from 10 countries. The overall results of the statistical analysis indicate that students improved their perceptions regarding their competences in developing exhibitions in science classes as a way of creating awareness on topics relating to science, technology, and society. This activity reinforced students' perceptions that in science classes they: (a) discuss current issues and how they impact their lives; (b) develop socially relevant projects; and (c) learn how to influence other citizens' decisions about social issues related to science, technology, and the environment with the aim of assuring a more sustainable future.

Keywords: student-curated exhibitions; socio-scientific issues; responsible research and innovation; science education; sustainable development goals; activism

1. Introduction

The IRRESISTIBLE Project (FP7-SCIENCE-IN-SOCIETY-2013-1, ACTIVITY 5.2.2; Grant agreement no. 612,367; more details at http://www.irresistible-project.eu/index.php/en/) had the aim of involving teachers, students, and the public in the process of Responsible Research and Innovation (RRI), promoting both the construction of knowledge on cutting-edge (and controversial) research topics and the discussion about the criteria that these research and innovation processes should respect in order to be considered as responsible [1]. Nowadays, humankind face many serious problems such as climate change, pollution caused by plastic waste, oceans' acidification, and lack of food security, all of which can be dealt with using responsible manufacturing processes [2].

Each of the 12 partners (from 10 different countries) developed a Learning Community—including science teachers, teacher educators, research scientists in selected scientific areas, and specialists from science centres and museums—with the aim of supporting students and teachers through an Inquiry-Based Science Education (IBSE) strategy, centered on a cutting-edge socio-scientific issue. These IBSE strategies—organized according to the 5E teaching model [3]: Engage, Explore, Explain, Elaborate, and Evaluate—allowed students to identify the controversial dimensions of each research topic, to raise their awareness of RRI and to obtain the necessary knowledge for the development of an interactive scientific exposition on that topic (an extra E—Exchange—added by the IRRESISTIBLE project to the 5E model [4].

Reflection on the RRI dimensions of each cutting-edge research topic was guided by the aspects defined by Hilary Sutcliffe in her report on Responsible Research and Innovation [5]: (a) Engagement—the joint participation of researchers, industry and civil society in the research and innovation process; (b) gender equality—equal involvement of both men and women; (c) science education—creative education to foster the future needs of society; (d) ethics—the necessity of respecting fundamental rights and the highest ethical standards; (e) open access—assuring free online access to the results of publicly funded research; (f) governance—the responsibility of policy makers to develop harmonious models for RRI. Several of these aspects represent a strong contribution not only to RRI but also to a better and more sustainable future for all, addressing some of the sustainable development goals proposed by the 2030 Agenda for Sustainable Development [6,7]: Goal 4—quality education as a requirement to equip citizens with the tools required to develop and to discuss innovative solutions to the world's greatest problems; Goal 5—gender equality as a fundamental human right assuring women and girls participation in all levels of society; Goal 9—technology and innovation, orientated by responsibility, are the foundation of development; Goal 13—climate action requires responsible research and innovation orientated towards renewable energy and a low-carbon economy.

According to the Science and Society Action Plan [8], joint and inclusive participation of all social actors is a fundamental condition to assure the compatibility between the processes and products of research and innovation, and the values, needs, and expectations of European society. Because of the public funding of many research programs, it is assumed that governments and other entities have the moral responsibility to allow (and promote) their citizens' involvement in decision-making processes regarding the meaning and purpose of research and innovation.

Critical in this model, student-curated exhibitions took place in different contexts—schools, universities, science centres, museums, and public places—and were assumed as a strategy for activism. Through these exhibitions, students informed and alerted the community about the socio-scientific issues they had researched, and triggered discussion on the necessary conditions to assure responsible research and innovation practices in those areas. The exhibitions took place as collective actions of democratic problem-solving, enabling students as critics and producers of knowledge, instead of placing them in the simple role of knowledge consumers [9–13].

Socio-scientific issues can be defined as 'hot science', focused on the symmetry between various interests or perspectives related to controversial issues [14–16]. Exhibitions about socio-scientific issues are a consequence of the shift in scientific literacy meaning from (1) the understanding of the products and processes of science to (2) the understanding of the complex interactions between science, technology, and society that allows citizens' critical analysis and engagement in socio-scientific issues and informed decision-making processes [17–21]. These exhibitions represent a challenge for those involved in their development [22]. Their emphasis in the understanding of complex issues and in decision-making competences require exhibitions questioning the social, economic, political, and ethical impacts of scientific and technological proposals in visitors' daily lives and presenting the opinions of different social stakeholders regarding those issues [23]. Visitors are invited to engage actively in the development of their own critical perspectives and challenged to participate in collective action [16,22,24–27]. This type of exhibition doesn't provide correct answers; it raises questions, in-depth discussion, and critical thinking [16,25,27,28]. It represents a context and a pretext for discussion between curators, visitors, and other social stakeholders, transforming all of them into learners [29].

Asking students to curate an exhibition on a socio-scientific issue can be particularly useful in terms of: (a) learning about the contents, the processes, and the nature of science and technology [30,31]; (b) highlighting a borderline science, that is controversial, preliminary, uncertain, and under debate [32]; (c) developing students' skills of inquiry, questioning, discussion, collaboration, autonomy, creativity, communication, project management, and media production [33,34]; (d) promoting students' cognitive, social, political, moral, and ethical development [31,35,36]; (e) creating an opportunity for students to participate in (and to instigate) community action on socio-scientific issues [9]—a major dimension of scientific literacy [18,37]; (f) moving assessment from a product to a process [9,38].

During the last 20 years, several studies have focused on how to develop socio-scientific issue-based exhibitions, suggesting some design guidelines or principles such as raising curiosity, presenting an interesting narrative, challenging the visitors, and stimulating their participation [15,26,27,39,40]. Within the IRRESISTIBLE project, and having in mind the novelty of exhibition development for the majority of the partners, a guide was developed through a design-based research approach. This methodology, based on collaboration among researchers and practitioners—the project members—was used to develop a tool that could help improving educational practices in real-world settings [41]. Along this process, a sequence of several iterations—literature analysis; testing and evaluation of the different interactive scenarios, proposed in the guide's prototype by science educators, science teachers and science museum experts from the different countries involved in the project; and testing and evaluation of the guide's prototype by all the IRRESISTIBLE partners—led from a prototype to the final version of the guide [42]. Each iteration allowed for the gathering of feedback and suggestions for improvement. The final version—made available in several formats: pdf, electronic magazine, and e-book—was organized around the following sections: (1) the potential of student-curated exhibits about Responsible Research and Innovation; (2) different stages in developing an exhibition; (3) characteristics of an interactive exhibition and of an interactive object; (4) possible interactivity scenarios for exhibits; (5) general guidelines for all scenarios; (6) how to evaluate the impact of IRRESISTIBLE exhibitions on teachers, students, and visitors.

The concept of interactivity used in this project does not, necessarily, require the presence of technology, but, instead, does certainly require the interaction between the visitors within the exhibit and between them and the objects that are being exhibited [43–45]. This interaction does not require any physical movement; the interaction between the visitor and the object exists even if the visitor is only thinking and reflecting on the stimulus from the object [46,47].

2. Materials and Methods

This quantitative research was aimed at evaluating the impact of IRRESISTIBLE's student-curated exhibitions—about the RRI dimensions of cutting-edge research topics (socio-scientific issues)—on students' perceptions regarding their scientific competences and the science classes. A pre- and post-test questionnaire was developed, validated, and applied to the students participating in the project [48]. The questionnaire was answered by a total of 3368 students on the pre-test (applied before the development of the student-curated exhibitions) and 2433 on the post-test (applied after the entire process of student-curated exhibitions' development) (see Table 1), from a total of 7340 students involved in IRRESISTIBLE. Turkey, Poland, and Greece were the most represented countries, but Italy and Portugal also had more than 500 respondents each.

Table 1. Number of questionnaires answered from each participating country.

Country	Pre-Test	Post-Test	Total Per Country
Finland	277	90	367
Germany	226	206	432
Greece	617	483	1100
Israel	153	59	212
Italy	513	185	698
Netherlands	36	85	121
Poland	607	501	1108
Portugal	269	276	545
Romania	47	43	90
Turkey	623	505	1128
Total	3368	2433	5801

Participants were distributed across all age groups as is illustrated by Table 2, with the majority being 15 or 16 years old, but also with very large numbers from ages 11–14 and 17.

Table 2. Participants distribution per country/age group.

Country	Age										
	8–	9	10	11	12	13	14	15	16	17	18+
Finland	0	0	20	121	173	34	0	0	0	2	4
Germany	0	0	0	0	0	15	67	57	110	106	75
Greece	0	0	1	256	176	76	95	203	156	100	8
Israel	0	0	0	0	0	10	2	30	118	31	0
Italy	0	0	0	0	0	0	19	211	120	137	196
Netherlands	0	0	0	0	0	0	23	47	14	26	5
Poland	0	0	0	0	7	88	199	183	230	234	100
Portugal	41	7	30	14	3	104	83	142	93	12	1
Romania	0	0	0	0	0	0	0	3	39	16	28
Turkey	0	0	8	116	310	217	132	150	124	64	7
Total	41	7	59	507	669	544	620	1026	1007	728	424

The online pre- and post-test questionnaire comprised 16 items, to be evaluated by students through a five-point Likert scale (ranging from *totally agree* to *totally disagree*):

1. I'm capable of planning and constructing a science exhibit about a current and relevant scientific theme.
2. Planning and constructing a science exhibit is motivating.
3. The development of a science exhibit about a given subject allows me to learn more about that subject.
4. The construction of science exhibits improves the relationships amongst students.
5. The construction of science exhibits improves the relationship between students and the teacher.
6. Information and Communications Technologies (ICTs) are great tools to support the development of science exhibits.
7. I'm capable of creating science exhibits as a way to raise awareness in the community for current and relevant scientific issues.
8. Through the development of science exhibits I can influence the decisions and behaviors of other citizen's related to social issues concerning science, technology and environment.
9. In my science classes I discuss current problems and how they affect my life.
10. In my science classes I develop competences that allow me to have a more active role in society.
11. In my science classes I'm encouraged to ask questions.
12. In my science classes I carry out projects that I consider important and socially relevant.
13. In my science classes I learn to act in a socially responsible way.

14. In my science classes I learn to respect my colleagues' opinions.
15. In my science classes I learn about ways to influence other people's decisions about social issues related to science, technology, and society.
16. In my science classes I'm responsible for initiatives that allow me to influence other people's decisions about social issues related to science, technology, and society.

The questionnaire was organized in two sections, each one with eight questions: the first section about the student-curated exhibitions (items 1–8); the second section about the students' science classes (items 9–16). In order to validate the developed sections, the Cronbach's Alpha Index was calculated for both. The attained values for Cronbach's Alpha on the sections was respectively 0.853 and 0.876, indicating that the internal consistency of both topics was high (Cronbach's Alpha larger than 0.8) and illustrating the reliability of the proposed topics [48].

The overall improvement of the sample was calculated—using the ANOVA test—in order to detect significant statistical differences between the students' perceptions before and after the participation in the project.

3. Results

3.1. Student-Curated Exhibitions

Within the three-year span of the IRRESISTIBLE project, a total of 218 exhibitions were developed by the partners, centered on different cutting-edge (and controversial) research topics: (a) nanotechnology (N = 131); (b) plastic pollution in oceans (N = 32); (c) carbohydrates in breast milk (N = 21); (d) climate change (N = 13); (e) oceanography (N = 7); (f) polar science (N = 7); (g) climate geoengineering (N = 6); (h) extension of the Portuguese continental shelf (N = 1). These exhibitions took place mainly in schools and science centres: (a) school (N = 139); (b) science center/museum (N = 70); (c) university (N = 3); (d) other (N = 5). A total of 7340 students were involved in the development of the exhibitions.

Regarding the type of exhibition, and taking into account also the interactivity scenarios presented in the IRRESISTIBLE Exhibition Development Guide that was used by all partners, a great variety of artefacts were produced. Some exhibitions were more homogeneous concerning the type of artefacts; others more eclectic. Table 3 presents the type of artefacts produced within the 218 developed exhibitions.

Table 3. Occurrences of types of artefacts within the 218 exhibitions.

Type of Artefact		Number of Exhibitions with This Type of Artefact	% of Exhibitions with This Type of Artefact
Game	Physical (e.g., table-game, soccer table)	66	38
	Digital (e.g., quizzes)	14	8
Poster	Physical	67	39
	Physical but 3D (cubes, objects …)	37	22
	Digital	13	8
Multimedia presentations (e.g., video, audio)		37	22
Web-integrated exhibit /website/blog		10	6
Cartoons (digital or printed)		6	3
Models		32	19
Experiments/demonstrations/simulations		32	19
Digital application		3	2
Newspaper		1	1
Book		6	3
Play		1	1
Hologram		1	1
Prototype		1	1
IKEA bookshelf (EXPOneer system)		31	18

As we can see from Table 3, the prevalence of posters, games, multimedia presentations, models, and experiments/demonstrations/simulations as the main types of artefacts presented within the exhibitions is clear. The most frequent type of artefact produced within IRRESISTIBLE exhibitions was the poster (with physical formats of 2D and also 3D). When we think of a poster, what comes into our minds is something static, that does not imply manipulation by the reader, full of text, with some images—thinking of a poster as something interactive is, perhaps, a hard task. Nevertheless, with the help of the IRRESISTIBLE Exhibitions Development Guide in combination with students' remarkable creativity, the posters developed within the IRRESISTIBLE exhibitions were, indeed, interactive, and fulfilled the goal of actively engaging the visitors. Indeed, these posters assumed several formats and required from the visitor different responses (e.g., write opinions/comments, organize pictures and sentences in groups).

The option for developing physical games was chosen by many students involved in the development of the interactive exhibitions. Indeed, games can be a very powerful strategy for stimulating the participation of visitors, allowing for their interaction and creating an atmosphere where discussion and reflection about important issues can be accomplished in a more playful manner.

Multimedia presentations, such as videos or other presentations were also chosen by many students involved in the project. Although this type of artefacts requires a dispositive (PC screen, tablet, or other) for their visualization (and that may not be a valid option for some schools), their development is normally felt by students as a very enjoyable task, contributing for their motivation towards the exhibition production.

The development of models was another popular option for some students, especially when their exhibitions focused on physical and chemical concepts and phenomena.

3.2. The Impact of the Exhibitions' Development on Students' Perceptions Regarding their Competences and the Science Classes

The impact of the exhibitions' development on students' perceptions regarding their competences and the science classes was calculated comparing students' answers to the pre- and post-test questionnaires.

The overall progression of the sample was calculated. Table 4 shows the average mean score and standard deviation for each of the analyzed questions (both pre- and post-test), as well as the ANOVA results indicating whether there is a significant difference between pre- and post-test results. As can be illustrated by this table, almost all questions (with the exception of questions number 3 and 6) showed a significant rise in their scores favoring the post-test results (considering $p < 0{,}05$). The results of items 3 and 6 in the pre- and post-test were not statistically different, probably because the average mean score was very high in both tests, producing a ceiling effect. In reality, these two items attained the highest average mean scores from all items, showing a very high perception of students regarding: (a) the positive impact of the exhibitions' development on their learning about scientific topics; and (b) the importance of Information and Communications Technology (ICT) tools in the development of exhibitions.

Table 4. Pre- and post-test results for the whole sample with ANOVA.

Questions	Pre-Test			Post-Test			F	Sig.
	N	Mean	Std. Deviation	N	Mean	Std. Deviation		
1. I can plan and develop a scientific exhibit about a current and relevant science topic	3117	3.41	1.128	2283	3.90	1.020	269.261	0.000*
2. To plan and develop a scientific exhibit is something that motivates me	3128	3,824	1.0980	2281	3.952	1.0762	18.208	0.000*
3. Developing a scientific exhibit about a given topic allows me to learn more about it	3110	4.225	0.9714	2270	4.254	0.9806	1.129	0.282
4. Developing a scientific exhibit improves the relationships among students	3120	3.874	1.0693	2272	4.015	1.0631	23.196	0.000*
5. Developing a scientific exhibit improves the relationship between students and the teacher	3119	3.916	1.0428	2272	4.033	1.0560	16.464	0.000*
6. ICT (Information and Communication Technologies) are a good tool to support the development of scientific exhibits	3106	4.101	0.9583	2268	4.116	0.9508	0.351	0.554
7. I am able to develop scientific exhibits that raise awareness in the community of current and relevant scientific issues	3105	3.455	1.1143	2268	3.784	1.0510	119.516	0.000*
8. Through the development of scientific exhibits I am able to influence other citizens' decisions and behaviors about issues related to science, technology, and the environment	3112	3.545	1.0697	2267	3.732	1.0468	40.732	0.000*
9. In my science classes I discuss current issues and how they impact my life	3100	3.345	1.1853	2259	3.534	1.1504	34.343	0.000*
10. In my science classes I develop competences that allow me to have a more active role in society	3106	3.496	1.1282	2264	3.652	1.0830	25.790	0.000*
11. In my science classes I am encouraged to ask questions	3097	3.628	1.1600	2264	3.738	1.1238	12.059	0.001*
12. In my science classes I develop important and socially relevant projects	3097	3.265	1.1768	2258	3.561	1.1281	85.368	0.000*
13. In my science classes I learn how to act in a socially responsible manner	3089	3.604	1.1470	2259	3.796	1.0756	38.639	0.000*
14. In my science classes I learn how to respect my colleagues' opinions	3097	3.931	1.1201	2256	4.015	1.0414	7.877	0.005*
15. In my science classes I learn how to influence other citizens' decisions about social issues related to science, technology, and the environment	3093	3.405	1.1073	2261	3.632	1.0717	56.354	0.000*
16. In my science classes I am responsible for initiatives that allow me to impact other citizens' decisions about social issues related to science, technology, and the environment	3089	3.340	1.1462	2260	3.565	1.0854	52.798	0.000*

* Significant difference between pre- and post-test results.

The overall results indicate that students improved their perceptions in the following ways:

- Their competences for developing exhibitions in science classes as a way of creating awareness on topics relating to science, technology, society, and the environment: at the end of the project, they feel capable of attaining this goal;
- The strong motivational impact of student-curated exhibitions;
- The positive impact of student-curated exhibitions on the relationships among students and between them and the teachers;
- Their competences of influencing other citizens' decisions and behaviors about issues related to science, technology, and the environment, through the development of scientific exhibits.

Concerning their science classes, the project contributed to students' improved perceptions that in that context:

- They discuss current issues and how they impact their lives;
- They develop important and socially relevant projects;
- They are encouraged to ask questions and to respect their colleagues' opinions;
- They are empowered to have a more active and responsible role in society, developing initiatives that allow them to influence other citizens' decisions about social issues related to science, technology, and the environment.

An analysis per country was also conducted in order to identify possible differences. Table 5 summarizes the ANOVA results for every country, identifying the questions where there was a significant difference between pre- and post-test results ($p < 0{,}05$).

It becomes clear from this analysis by country that participants from different contexts had diverse perceptions regarding the topics covered by the questionnaire. Romania, Israel, and Turkey were noticeably the ones where more significant differences were observed (16–14 out of possible 16). Greece, Portugal, Germany, and Poland also had several questions with significant differences (9–6). The Netherlands, Italy, and Finland were the countries with the least significant differences (1–4). These results indicate different reactions to the development of scientific exhibitions, suggesting that this kind of activity—in spite of the global positive evaluation by the students—didn't constitute a complete innovation for the students from some countries. Possibly, the impact on students' perceptions was low in those countries where this activity didn't represent a novelty.

From the analysis of Table 5 it also becomes clear that questions 1, 7, and 9 were the ones with more significant statistical differences in this group of countries (9–8 out of possible 10). Questions 5, 12, 15, and 16 were also questions with an important number of countries with statistical differences (5–6 out of possible 10). Questions 6 and 11 were the ones with the least amount of differences (only two countries each). So, the highest impact shared by IRRESISTIBLE countries was perceived in: (a) the competence to plan and develop a scientific exhibit about a current and relevant science topic that can raise the community's awareness regarding that issue; and (b) the students' recognition that in science classes they discuss current issues and the ways they impact their lives.

Table 5. ANOVA significant results for all participating countries (only statistically significant results are reported).

Questions	Finland	Germany	Greece	Israel	Italy	Netherlands	Poland	Portugal	Romania	Turkey	Total
1. I can plan and develop a scientific exhibit about a current and relevant science topic	0.001	0.000	0.000	0.000	0.043		0.000	0.001	0.000	0.000	9
2. To plan and develop a scientific exhibit is something that motivates me		0.000		0.000					0.000	0.000	4
3. Developing a scientific exhibit about a given topic allows me to learn more about it	0.002						0.010	0.000	0.000		4
4. Developing a scientific exhibit improves the relationships among students			0.008	0.004					0.000	0.000	4
5. Developing a scientific exhibit improves the relationship between students and the teacher		0.001	0.000	0.001					0.003	0.012	5
6. ICT (Information and Communication Technologies) are a good tool to support the development of scientific exhibits			0.031						0.013		2
7. I am able to develop scientific exhibits that raise awareness in the community of current and relevant scientific issues		0.000	0.010	0.002	0.003		0.000	0.038	0.000	0.000	8
8. Through the development of scientific exhibits I am able to influence other citizens' decisions and behaviors about issues related to science, technology, and the environment		0.018		0.003					0.000	0.002	4
9. In my science classes I discuss current issues and how they impact my life	0.013	0.033	0.009	0.011			0.021	0.000	0.000	0.000	8
10. In my science classes I develop competences that allow me to have a more active role in society		0.017		0.000					0.000	0.000	4
11. In my science classes I am encouraged to ask questions									0.000	0.004	2
12. In my science classes I develop important and socially relevant projects			0.002	0.002			0.005	0.002	0.000	0.000	6

Table 5. *Cont.*

Questions	**Finland**	**Germany**	**Greece**	**Israel**	**Italy**	**Netherlands**	**Poland**	**Portugal**	**Romania**	**Turkey**	**Total**
13. In my science classes I learn how to act in a socially responsible manner				0.000		0.005			0.000	0.000	4
14. In my science classes I learn how to respect my colleagues' opinions	0.024			0.000					0.000	0.000	4
15. In my science classes I learn how to influence other citizens' decisions about social issues related to science, technology, and the environment			0.027	0.000			0.001	0.038	0.000	0.000	6
16. In my science classes I am responsible for initiatives that allow me to impact other citizens' decisions about social issues related to science, technology, and the environment			0.020	0.000				0.000	0.000	0.000	5
Total	4	7	9	14	2	1	6	7	16	14	

4. Discussion

The development of student-curated exhibitions about socio-scientific issues represented both a challenge and a learning opportunity for many of the teachers and students involved in the IRRESISTIBLE Project, especially regarding time management, the novelty of the scientific topic and RRI, group work management, and exhibition planning and construction [48,49]. With the help of the IRRESISTIBLE Exhibitions Development Guide, students were quite competent in the development of interactive exhibitions that fulfilled the goal of actively engaging the visitors as proposed by literature [47,48]. The student-curated exhibitions developed within IRRESISTIBLE confirmed that interactivity doesn't, necessarily, require the presence of technology. Several artefacts, like physical posters, table-games, and models, were quite effective in promoting the interaction between the visitors within the exhibit and between them and the objects that are being exposed [49]—all fundamental aspects of an interactive exhibition proposed by literature [44–46].

According to the students involved in IRRESISTIBLE, their participation in the curation of an exhibition on a socio-scientific issue was particularly useful in strengthening: (a) their knowledge about those issues and how they impact their lives; (b) their relationships with other students and the teachers; and (c) their perceptions about the social relevance of science classes, allowing the discussion of important current issues.

Student-curated exhibitions were assumed by students as a strategy of activism, allowing them to have a more active and responsible role in society, influencing other citizens' decisions and behaviors about controversial issues related to science, technology, and the environment that are relevant to society. The attained results support the power of student-curated exhibitions on cutting-edge (and controversial) research topics as a context for students' empowerment as decision-makers and activists regarding the process of Responsible Research and Innovation. Through these exhibitions, students felt more competent in (1) informing other citizens about the socio-scientific issue they have investigated, (2) engaging them in discussion on the necessary conditions to assure responsible research and innovation practices in those areas, and even (3) challenging them to participate in collective action aimed at promoting those responsible practices. In this way, the IRRESISTIBLE student-curated exhibitions constituted an opportunity for students to participate in (and to instigate) community action on socio-scientific issues—a major characteristic of exhibitions on controversial issues [16,22,24–27] and a major dimension of scientific literacy [11,12,18,37,50,51].

The student-curated exhibitions developed within the IRRESISTIBLE project represent an educational approach adequate for the promotion of sustainable development, enabling students to understand (and to cope with) the complexities and uncertainties of socio-scientific issues [52]. They also contribute to students' reflections on their personal responsibilities regarding responsible research and innovation, capable of assuring a sustainable development and a sustainable future.

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