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# Communicating science matters: positive evidence from the BASCOE study, a quantitative study from Brain Awareness Week outreach activities

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**Introduction:** While the importance of science communication and outreach is widely acknowledged, their impact is often overlooked or not measured. To address this question we carried a study aimed to quantitatively assess the influence of science communication and outreach activities on knowledge acquisition and retention by secondary school students during Brain Awareness Week (BAW) 2023 in Lisbon, Portugal.

**Methods:** A population of 428 students ranging from 6th to 12th grade (6–12 years of formal education), was involved in this study.

**Results:** Analysis of pre- and post-event questionnaire data revealed a significant improvement in participant knowledge scores 7 days post-activity compared to the baseline.

**Discussion:** These findings highlight the importance of such quantitative evaluations and underscore the pivotal role of science communication in enhancing scientific knowledge in schoolchildren.

### KEYWORDS

impact measurement, multidisciplinary, non-formal education, school-aged children, science communication

## 1 Context

As science and technology have become increasingly embedded in every aspect of modern life, the need for effective communication of science and outreach has grown. Nevertheless, even with the recognition of these activities as integral components of every research project, there is still a notable scarcity of quantitative studies assessing their impact, especially on the outreach activities involving schoolchildren. This deficit in empirical data hinders our understanding of science communication genuine effectiveness in enhancing public knowledge, scientific literacy, and appreciation of scientific development. Besides the scarcity of studies assessing the effectiveness of science communication activities, the challenge in science communication research lies in collecting and analyzing data to provide valid and reliable evidence of outcomes and indicators. Although evaluations of science communication and outreach events highlight an interest in impact-oriented outcomes, the methods chosen rarely allow for scientifically valid assessments of effects. Key issues in this regard include the lack of comparative reference points and the partially unsuitable use of self-report measures. In practice, evaluation is mostly carried out “summatively” (Ziegler et al., 2021). For example, in 76% of analyzed science communication and outreach projects, participants self-reported whether they have learned something after participating in an activity and had to assess their knowledge gain themselves (Fu et al., 2016; Volk, 2024). However, to reliably measure changes in participants’ knowledge, pre- and post-test designs, along with a comparison of the results before and after the activity, are inevitably required. In order to objectively and quantitatively track the impact of a science outreach activity, we created BASCOE (Brain Awareness Science Communication & Outreach Evaluation) Study, developed under the scope of Brain Awareness Week 2023 (BAW 2023), to evaluate whether the literacy about brain and brain health could be improved among secondary school students through a school-based, interactive science communication outreach activity. We chose to assess knowledge gain as an outcome as it provides a straightforward and objective measure, yielding quantifiable data that is easy to interpret. Within the BASCOE study, we used the point-based pre- and post-activity questionnaire and compared the results obtained in order to have objective and quantitative data. Given that our science communication outreach targeted schoolchildren, measuring knowledge acquisition and retention is particularly valuable as it indicates whether integrating informal educational approaches alongside formal ones can enhance learning outcomes, validating further investment in scientific outreach.

## 2 Objective

The main aim of this study was to evaluate the impact of Science Communication and outreach activities on enhancing knowledge and promoting brain literacy among school children. Our secondary objective was to make a valuable contribution to the fields of Science Communication and Education by offering quantitative evidence of the effectiveness of science communication and outreach activities.

## 3 Methods

### 3.1 Setting

The BASCOE case study focused on assessing the effectiveness of Science Communication and Outreach during Brain Awareness Week (BAW), a global initiative with funding from the Federation of European Neuroscience Societies (FENS) and Dana Foundation aimed at increasing public awareness of brain research. The study involved data collection through surveys conducted over 4 days during BAW 2023 in two public schools in Lisbon, Portugal.

A total of six neuroscience research groups at NOVA Medical School, NOVA University of Lisbon, Portugal participated in BAW 2023, all presenting their research under the umbrella of the topic: “Can we keep our brains healthy to live better and longer?”. Each group implemented a standardized science program consisting of short talks tailored for a younger audience (10–15 min per research group) for an audience of 60–80 students. Afterwards, a “speed dating” format was chosen in order to engage in a more direct scientist-student dialogue (~10 min per research group; 5–20 students per scientist), in addition to live experiments or demonstrations (~10 min per research group), with smaller groups (5–8 students per group). All events occurred in the same day. The format of each session in both schools remained consistent throughout the entire BAW program as shown in Figure 1.

The outreach activities were conducted independently of the formal school curriculum. The neuroscience topics addressed during BAW were not part of the participating schools’ curricular programs, nor were they revisited during regular classroom instruction. As such, all participating students were exposed to these topics for the first time.

This design allowed us to assess the impact of a single, stand-alone science outreach intervention on short-term knowledge acquisition and retention, without confounding effects from prior formal instruction or repeated exposure.

### 3.2 Data collection

For this study, a questionnaire was developed, consisting of six questions, each offering multiple-choice response options, with only one correct response. Each research group participating in the BAW sessions contributed to the questionnaire by formulating one question related to their presentation topic, subsequently normalized for similar complexity. We chose the standard multiple-choice questionnaire as schoolchildren are accustomed to and comfortable with this form of assessment.

Prior to the beginning of the BAW academic talks and activities, all students were requested to complete the questionnaire *in loco*. The responses collected from these pre-BAW questionnaires were considered baseline data. One week after the BAW activities, the same students who attended these events were invited to complete the identical questionnaire once more. Students were informed that they would complete an initial questionnaire to assess their baseline knowledge of neuroscience-related topics. However, they were not informed that a second questionnaire would be administered. The follow-up questionnaire, conducted 7 days after participation in the outreach activities, was intentionally designed as a surprise assessment, in order to minimize the likelihood of self-directed study or revision of the topics in the intervening period.

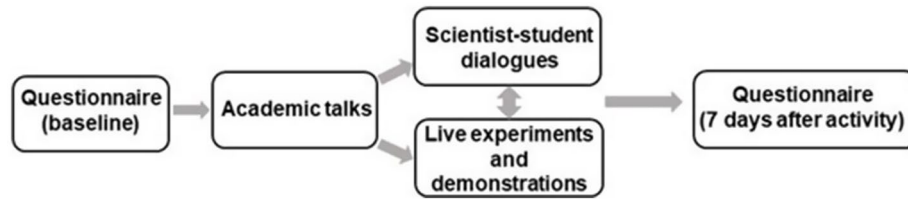


FIGURE 1  
Representation of the line of the activities held by researchers during BAW 2023.

The questionnaires administered before the activities and 7 days later were identical, allowing for a direct comparison of knowledge acquisition and short-term retention.

Student participation in this survey was voluntary, and no financial incentives were provided. The questionnaire required an average of 5–7 min to complete. To ensure anonymity, the survey only requested school name, grade, and gender information from the participants.

### 3.3 Handling of incomplete data

Before performing the data analysis, the exclusion criteria were set for the questionnaires. If there was no information about the gender and/or the grade of the student, the questionnaire was excluded. Also, the questionnaires with multiple answers to a single question were considered non-valid and were excluded from the survey. Missing values for total score were considered as missing completely at random.

### 3.4 Scoring and statistical analysis

Since there were a total of six questions within the questionnaire, we set up the scoring system where each correct answer was valued as 1 point (score 0–6). The pre-criterion was set up as if the question was not answered, it was considered an incorrect answer. If there were no correct answers within the entire questionnaire, the total score of that questionnaire was zero. Categorical data are presented as percentages (%) with the corresponding frequency ( $n$ ), and total questionnaire scores as medians (25th, 75th percentile). Total questionnaire scores between pre- (baseline) and post (7 days afterward) intervention (short talks, speed dating, and live experiments) for all students, per gender and per grade are shown as a series of whisker plots using the ggplot2 package v3.4.2 (Wickham, 2016). Normality was assessed visually with histograms and Q-Q plots, and with the Shapiro–Wilk test. To statistically compare the questionnaire's median total scores between pre- and post-BAW activities a Wilcoxon rank sum test was used. Absolute differences between scores, test statistics, and  $p$ -values were used to evaluate statistical and clinical significance. Data management and analyses were performed in R v4.1.2 (R Core Team, 2023).

### 3.5 Participants

A total of 428 students from two distinct secondary schools participated in the BAW activities and completed the questionnaire. These students spanning from grades 6 to 12, corresponding to an age range of approximately 12–18 years in the Portuguese education system. Stratification of students that underwent knowledge

assessment before and after the BAW is presented in Table 1, as a percentage and the raw values regarding the gender and grade. It is worth mentioning that 21% of students who completed the pre-BAW questionnaire did not respond to the post-BAW questionnaire, which is a factor to consider in this study.

## 4 Results

There was a significant difference of 1 point between test scores for all students at baseline (score 2.00 [1.00, 3.00]) and post-BAW (score 3.00 [2.00, 5.00]) ( $p < 0.001$ ) as shown in Figure 2.

Further stratification also revealed notable differences:

**Gender stratification:** Both female and male students exhibited knowledge gain as observed in the post-BAW questionnaire score that was 4.00 [2.00, 5.00] for female and 3.00 [2.00, 5.00] for male students ( $p < 0.001$ ) when compared to baseline scores of 3.00 [2.00, 4.00] for female and 2.00 [1.00, 3.00] for male students as presented in Figure 3. However, what should be noted is that in the baseline test itself, female students demonstrated higher knowledge with the score of 3.00 [2.00, 4.00], as compared with the male students that had the score of 2.00 [1.00, 3.00] ( $p = 0.002$ ), demonstrating higher level of previous knowledge of female as compared to male students as shown in the Supplementary Table 1.

**Grade stratification:** An increase in post-BAW scores was evident across all grades except for the 8th grade as shown in Figure 4. The magnitude of knowledge gain varied among grades. In the 6th grade the median of the baseline and the post-BAW test score was the same with the same median value of 2.00 in the baseline and in the post-BAW test. However, the distributions for the baseline test score (25th–75th: 1.00, 2.00) and the post-BAW test score (25th–75th, 1.00, 3.00) are different (see Figure 4). In the 9th, 10th, and 11th grades, median test scores improved by 2, 1 and 1 points, respectively (Figure 4). Although 12th grade showed an increase of 2 points in the median scores between baseline (3.00 [2.00, 4.00]) and post-BAW (5.00 [5.00, 6.00]) statistical analysis was not conducted due to limited observations for this group as shown in Figure 4.

These findings highlight the overall effectiveness of the activity in improving students' knowledge, with variations based on gender and grade level.

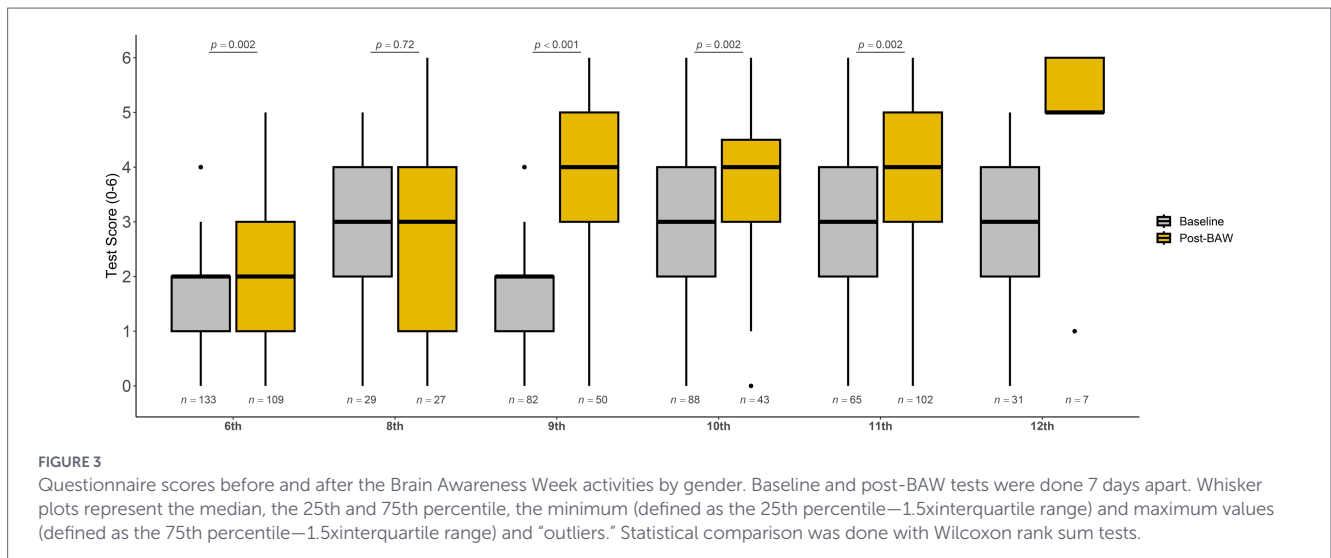
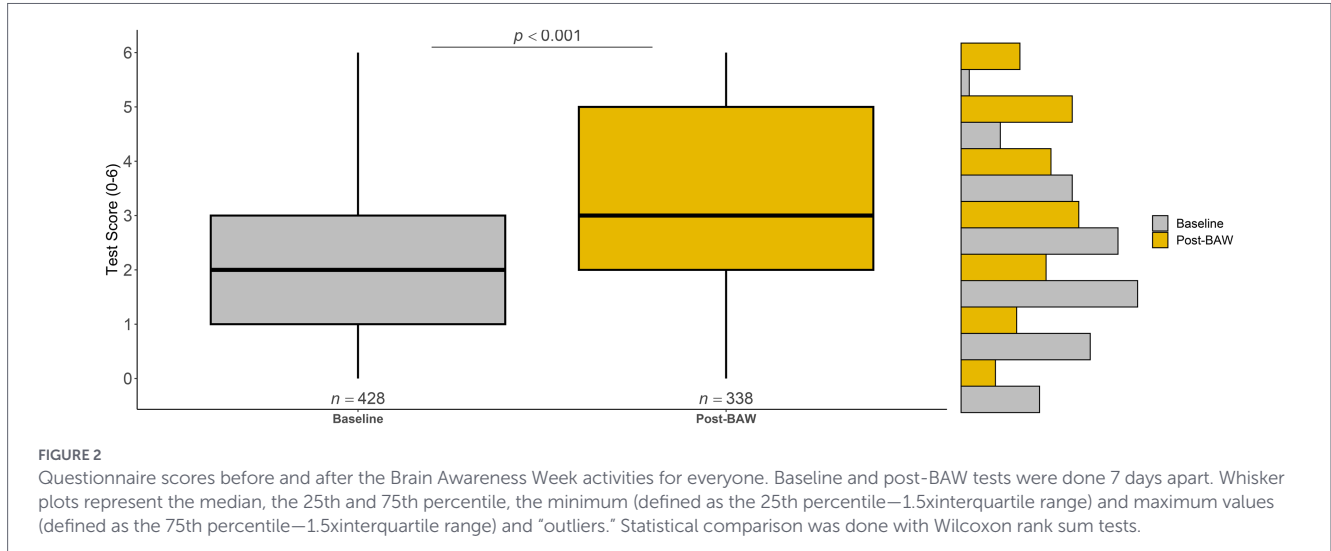
## 5 Discussion

The data obtained from the BASCOE study clearly demonstrate a significant improvement in students' knowledge following the BAW

TABLE 1 Characteristics of children that underwent knowledge assessment before and after the BAW 2023.

n	Gender	Female	Male	Other	Grade	6th	8th	9th	10th	11th	12th
428	% (n)	50% (214)	45% (194)	5% (20)	% (n)	31% (133)	7% (29)	19% (82)	21% (88)	15% (65)	7% (31)

Categorical data are presented as percentages (%) with the corresponding frequency (n); 5% of the students declared their gender as 'other'.



activities. This provides strong evidence that students were actively engaged throughout the interactive outreach activities and were able to absorb and utilize the presented information at the post-activity test. Other studies, such as that of Broadbent et al. (2014) which attempted to improve student information regarding the brain, also found significant improvements at post- activity test. However, in this study, the post-activity test was done immediately after the outreach activities, proving learning information only immediately after the event. The strength and importance of the BASCOE study results lies in the fact that the post-activity test was done 7 days after the students were participating in the BAW outreach activities. Although learning success is often measured by how well students grasp taught concepts, evaluating the effectiveness of the learning model requires analyzing whether these concepts are retained in long-term memory (retention) (Listiana et al., 2023). Drawing from Ebbinghaus’ (1913) hypothesis,

reinforced by Murre and Dros (2015), the decay of learned material over time is inevitable, especially when there is no repetition of learning sessions. Research by Slamecka and McElree (1983) underscores this concept, demonstrating diminished retention the material is not revisited within a 5-day period. Although decay may be slower with high-content learning, Loftus (1985) hypothesized that the total decay occurs by day 5 for low-content and day 7 for high-content learning.

Hence, in our BASCOE study, we conducted a post-survey 7 days after the outreach activity, aligning with the quantity of content students were exposed to, akin to high-content learning. Remarkably, significantly improved scores were observed in all but one tested group after the BAW 2023 activities, indicating that the methods used to deliver the neuroscience concepts and topics about brain health were sufficiently engaging and successful in ensuring understanding and retention of learned concepts, as initially designed. The use of

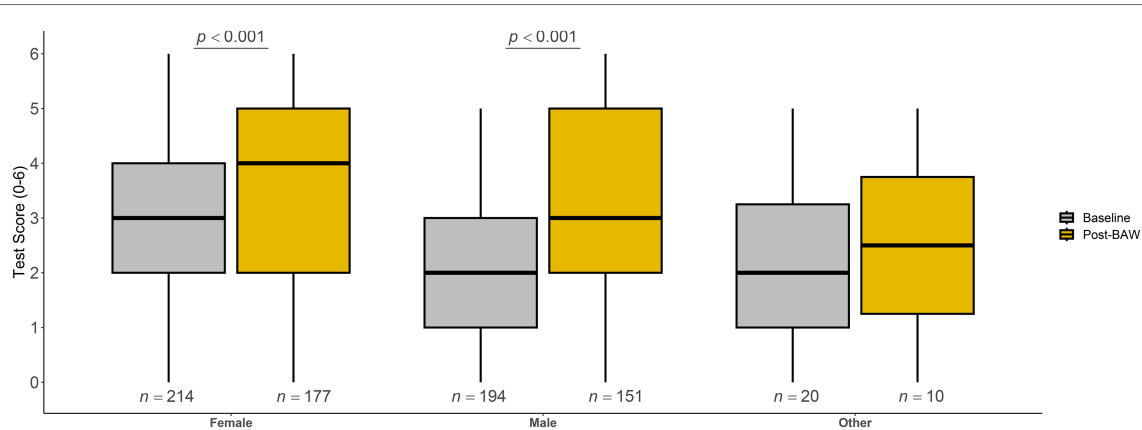


FIGURE 4

Questionnaire scores before and after the Brain Awareness Week activities by school grade. Baseline and post-BAW tests were done 7 days apart. Whisker plots represent the median, the 25th and 75th percentile, the minimum (defined as the 25th percentile  $-1.5 \times$  interquartile range) and maximum values (defined as the 75th percentile  $+1.5 \times$  interquartile range) and "outliers." Statistical comparison was done with Wilcoxon rank sum tests.

various media such as interactive talks, PowerPoint presentations, group discussions, experiments and activities, enabled students to connect with the information, put them into a receptive frame of mind. This approach allowed them to organize the ideas and information presented, build on and challenge their pre-existing knowledge and develop long-lasting knowledge about the learned topics. Such as interactive talks, PowerPoint presentations, group discussions, experiments and activities, enabled students to connect with the information, put them into a receptive frame of mind. This approach allowed them to organize the ideas and information presented, build on and challenge their pre-existing knowledge and develop long-lasting knowledge about the learned topics. Moreover, the absence of curricular integration and repetition is likely to have contributed to the observed decline in knowledge retention over time, which is consistent with well-established learning theories indicating that memory decay is expected when information is not reinforced. While curricular alignment and teacher involvement may enhance longer-term retention, the present study intentionally focused on measuring the effect of a single outreach exposure, providing insight into the immediate and short-term educational impact of such initiatives.

This discovery is very valuable and encouraging since it shows that communicating science in a non-formal way can have a profound impact on the way schoolchildren understand and memorize scientific concepts. Unfortunately, recent research indicates that only 60% of lecturers actively seek to implement learning strategies conducive to long-term memory retention (Listiana et al., 2023). Given that comprehension and retention are directly influenced by learning models and strategies (Listiana et al., 2023), introducing innovative and engaging techniques such as interactive lectures, demonstrations, quizzes, and knowledge games can significantly enhance understanding and memorization. Therefore, it is imperative for school educators and science communicators to adopt the most effective methods for communicating scientific concepts to schoolchildren. Noteworthy is a result we obtained within this study that the female students demonstrated a higher level of knowledge in both pre- and post-activity. Observed differences in performance by gender and grade level warrant careful interpretation and may reflect variations in cognitive development, prior exposure to related concepts, attentional factors, or learning strategies. Similar patterns have been reported in previous studies examining knowledge retention during adolescence

(Alaniz-Álvarez et al., 2018), suggesting that such differences may be developmentally mediated rather than indicative of unequal learning capacity.

These findings highlight the importance of considering age- and gender-related factors in the design of inclusive and effective science outreach activities and point to the need for further research to better understand how different student groups engage with and retain scientific information. Tests underscores the necessity and importance of providing equal educational opportunities worldwide, regardless of gender.

Besides the knowledge gain, science communication and outreach activities have another very important roles like increasing scientific literacy and interest in scientific topics, but also in shaping general public perception about science and science-related work, like fundamental and translational research in an academic environment. Data obtained by science communication researchers in the past has revealed that media consumers vary in their knowledge about and interest in science and technology news (Krieghbaum, 1967). Despite the perceived significance of science and technology information by scientists and science communicators, many adults demonstrated limited interest in scientific topics (Miller, 1986). Prewitt (1982) and Miller (1986) have both contended that only a minority of adults display sufficient interest for science to engage with and digest scientific communication. However, Patterson (1982) observed that young adults typically exhibit support for and interest in scientific subjects. Today, merely 40 years later, we are facing a reversed situation. Namely, Eurobarometer data (from 2021) indicate that 9 in 10 European Union citizens (86%) think that the overall influence of science and technology is positive (Eurobarometer, 2021 Survey). Moreover, interest in new medical discoveries increased from 82 to 86% since 2010. However, extensive research conducted and published in 2023 reveals that young people (aged 14–18 years) generally harbor negative perceptions toward science and experience a sense of disconnection from it (British Science Association, 2022). Merely 12% believe that scientists genuinely represent their views and values, with an even smaller fraction (8%) feeling that scientists are relatable to them, indicating a perceived lack of representation within the scientific community. As young individuals mature, their relationship with science becomes increasingly dichotomous, with some feeling deeply engaged while others grow disinterested/uninterested (British

Science Association, 2023). Notably, nearly half of young people (45%) develop heightened concerns about science-related issues as they gain more knowledge about them (British Science Association, 2022).

Our findings demonstrate that participation in a one-day science outreach event can lead to measurable short-term gains in knowledge and retention among secondary school students. However, these results should be interpreted cautiously. This study does not allow conclusions to be drawn about long-term scientific literacy, sustained interest in science, or trust in science during adulthood.

While science outreach activities are an important component of public engagement, their long-term impact likely depends on repeated exposure, curricular reinforcement, and broader educational and societal contexts. Future studies should explore longitudinal designs and stronger integration with formal education systems to better assess these long-term outcomes. The following axioms outlined by Novak (1988): (i) concepts, both scientific and social, are acquired (very) early in life; (ii) misconceptions are often acquired early and prove resistant to modification; and (iii) prior knowledge significantly influences new learning, are still widely supported by researchers in education and psychology. Therefore, both school educators and scientists should make a special effort in science communication, to avoid missing the 'golden opportunity' to engage the next generation with science, as it can profoundly enhance students' comprehension of scientific concepts and overall scientific knowledge, consequently benefiting the broader community and society.

An important direction for future outreach initiatives will be the active involvement of schoolteachers in the co-design and implementation of activities, with the aim of reinforcing learning outcomes and strengthening links between informal science communication and formal education. We are currently developing new outreach programs that incorporate this collaborative approach.

## 6 Conclusion

The BASCOE Study yielded very important results showing that informal science education through carefully tailored, interactive activities can significantly increase the gain of scientific knowledge and can be a powerful tool in school children's formal science education. Evidence collected within the BASCOE Study also serves individuals and organizations planning similar initiatives, offering a solid reference point for the planning and execution of impactful science communication and outreach endeavors.

## 7 Limitations

The BASCOE study provided new, and very valuable insights into the success of Science Communication and Outreach, however, it also suffered from some limitations. First limitation is that students were not assigned a unique ID and therefore, even though they are mostly paired, we had to assume independence between pre- and post- test

to conduct the statistical test (they are not independent) because all the tests for paired data require a unique ID that can be followed.

Secondly, this research was essentially a case study performed in two Lisbon secondary schools. Moreover, both schools where the survey was performed are in the Lisbon city center, the capital city of Portugal. This implies that the students at these schools have far more opportunities to get in touch with scientific concepts and knowledge through the science fairs and various science outreach activities, frequently organized in the capital city center, than the school kids from outside of the Lisbon area, or from the more rural parts of the country. To discover whether the findings are generalizable, more schools from diverse socioeconomic backgrounds should be involved in the survey, particularly schools outside of the capital city from underappreciated schools.

Also, we used a baseline questionnaire as a control within this study. Namely, the questionnaire of the same group of students performed before the BAW 2023 activities served as a control for the knowledge gain estimation 7 days after the activities. Ideally, we would have a control group of students that would fill out the questionnaire and fill out the same questionnaire 7 days later without having BAW 2023 activities, which was not the case in our study. For this we would need significantly larger number of students involved in this study. We are aware that the absence of a control group remains a limitation of the present study and restricts causal inference. However, the use of an unannounced follow-up assessment 7 days after the BAW activities was intended to reduce potential bias introduced by self-study between testing points, thereby strengthening the interpretation of short-term retention effects following participation in the outreach activities.

One important note is that during the activities, school teachers accompanied their students and were present on site; however, they were not involved in the design or development of the outreach activities. This is a limitation that we are now correcting in our ongoing outreach activities by always involving schoolteachers in co-creation of the activities that students are going to participate in.

Despite these limitations, the study yielded useful exploratory insights on the effectiveness of science communication and outreach, giving a clue to educators and science communicators on how engaging and interactive science communication can result in lasting knowledge gain in school children.

## Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of kin

in accordance with the national legislation and the institutional requirements.

## Author contributions

CP: Software, Formal analysis, Conceptualization, Methodology, Investigation, Writing – review & editing, Data curation. IS: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. ACo: Project administration, Methodology, Writing – review & editing. MB: Project administration, Methodology, Writing – review & editing. BF: Methodology, Project administration, Writing – review & editing. BN: Writing – review & editing, Project administration, Methodology. OC: Methodology, Writing – review & editing, Project administration. AF: Writing – review & editing, Methodology, Project administration. MCa: Project administration, Methodology, Writing – review & editing. ACa: Writing – review & editing, Project administration, Methodology. GM: Methodology, Writing – review & editing, Project administration. FM: Writing – review & editing, Methodology, Project administration. GR: Project administration, Methodology, Writing – review & editing. CC: Writing – review & editing. ST: Writing – review & editing. VH: Writing – review & editing. SC: Writing – review & editing. CM: Writing – review & editing. CS: Writing – review & editing. NM: Writing – review & editing, Data curation, Writing – original draft, Formal analysis, Validation. MCo: Validation, Investigation, Writing – review & editing, Conceptualization, Funding acquisition, Methodology. NG: Conceptualization, Writing – original draft, Writing – review & editing, Validation, Supervision, Investigation. NL: Validation, Conceptualization, Methodology, Writing – review & editing, Supervision, Investigation, Writing – original draft.

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## References

Alaniz-Álvarez, S. A., Cruz-Alaniz, Y., and Nieto-Samaniego, A. (2018). Gender differences in retention of information shown in science video to adolescents from Mexico. *Int. J. Acad. Dev.* 2018, 1–12. [https://www.researchgate.net/profile/Sa-Alaniz-Alvarez/publication/330898122\\_Gender\\_Differences\\_in\\_Retention\\_of\\_Information\\_Shown\\_in\\_Science\\_Video\\_to\\_Adolescents\\_from\\_Mexico/links/5c5a3bfda6fdccb608aafcbd/Gender-Differences-in-Retention-of-Information-Shown-in-Science-Video-to-Adolescents-from-Mexico.pdf](https://www.researchgate.net/profile/Sa-Alaniz-Alvarez/publication/330898122_Gender_Differences_in_Retention_of_Information_Shown_in_Science_Video_to_Adolescents_from_Mexico/links/5c5a3bfda6fdccb608aafcbd/Gender-Differences-in-Retention-of-Information-Shown-in-Science-Video-to-Adolescents-from-Mexico.pdf)

British Science Association (2022). Science sector risks missing 'golden opportunity to engage young people'. Available online at: <https://www.britishsocietyassociation.org/news/science-sector-risks-missing-golden-opportunity-engage-young-people> (Accessed Aug 21, 2024).

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## Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2026.1721770/full#supplementary-material>

British Science Association (2023). New findings: how young people feel about science, society, and the future. Available online at: <https://www.britishsocietyassociation.org/news/new-findings-young-people-feel-about-science-society-future>

Broadbent, J., Sitka, N., Macfarlane, S., McGillivray, J., and Tye, S. (2014). Informing brain health behaviour choices: the efficacy of a high-school brain awareness pilot study. *J. Educ. Soc. Behav. Sci.* 4, 755–767. doi: 10.9734/BJESBS/2014/6694

Ebbinghaus, H. (1913). *Memory: a contribution to experimental psychology* (H. Ruger & C. Bussenius, Trans.). New York, NY: Teachers College, Columbia University.

Eurobarometer. (2021). Survey. Available online at: <https://europa.eu/eurobarometer/surveys/detail/2237>

- Fu, A. C., Kannan, A., Shavelson, R. J., Peterson, L., and Kurpius, A. (2016). Room for rigor: designs and methods in informal science education evaluation. *Vis. Stud.* 19, 12–38. doi: 10.1080/10645578.2016.1144025
- Kriehbaum, H. (1967). *Science and the mass media*. New York, NY: New York University Press.
- Listiana, L., Bahri, A., Jamaluddin, A., Muharni, A., and Malik, W. (2023). “Enhancing cognitive retention of different academic abilities undergraduate students through PBLRQA strategy” in *Proceedings of the 3rd international conference on education management and information technology*. eds. A. Sunyoto, S. Ramdhani and A. Nugroho (Atlantis Press), 197–201.
- Loftus, G. R. (1985). Evaluating forgetting curves. *J. Exp. Psychol. Learn. Mem. Cogn.* 11, 397–406. doi: 10.1037/0278-7393.11.2.397
- Miller, J. (1986). “Reaching the attentive and interested publics for science” in *Scientists and journalists: reporting science as news*. eds. S. M. Friedman, S. Dunwoody and C. L. Rogers (New York, NY: Free Press), 55–69.
- Murre, J. M. J., and Dros, J. (2015). Replication and analysis of Ebbinghaus’ forgetting curve. *PLoS One* 10:e0120644. doi: 10.1371/journal.pone.0120644
- Novak, J. (1988). Learning science and the science of learning. *Stud. Sci. Educ.* 15, 77–101. doi: 10.1080/03057268808559949
- Patterson, J. (1982). A study of attitudes of young adults about science news. *Journal. Q.* 59, 406–413.
- Prewitt, K. (1982). The public and science policy. *Sci. Technol. Hum. Values* 7, 5–14. doi: 10.1177/016224398200700203
- R Core Team (2023). *R: a language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.
- Slamecka, N. J., and McElree, B. (1983). Normal forgetting of verbal lists as a function of their degree of learning. *J. Exp. Psychol. Learn. Mem. Cogn.* 9, 384–397. doi: 10.1037/0278-7393.9.3.384
- Volk, S. C. (2024). Assessing the outputs, outcomes, and impacts of science communication: a quantitative content analysis of 128 science communication projects. *Sci. Commun.* doi: 10.1177/10755470241253858
- Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis*. New York, NY: Springer-Verlag.
- Ziegler, R., Hedder, I. R., and Fischer, L. (2021). Evaluation of science communication: current practices, challenges, and future implications. *Front. Commun.* 6:669744. doi: 10.3389/fcomm.2021.669744