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PRACTICE INSIGHTS

Reevaluating broadcast television news and current affairs programs for communicating scientific knowledge in everyday natural settings in Japan

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Abstract

This practice insight explores the potential of broadcast television news and current affairs programs for science communication in everyday viewing environments. Using the Japanese news program *Shinsō Hōdō Bankisha!* as a case study, we assessed its impact on public knowledge of "blue carbon", a relatively new scientific topic. The program aired on May 28, 2023, reaching an estimated 2.76 million viewers in the Kanto region. A survey revealed that viewers exposed to "blue carbon" through the broadcast showed significant knowledge gains compared to non-viewers, regardless of their interest in science. This included individuals with low scientific interest, a group often excluded by traditional science communication methods. Despite the rise in popularity of digital media formats, broadcast television news and current affairs programs showed their unique ability to disseminate scientific knowledge to diverse audiences, even in today's multitasking environments. These findings highlight the enduring relevance of television in science communication and its potential to complement digital platforms for broader public engagement.

Keywords

Popularization of science and technology; Public engagement with science and technology; Science and media

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1 ▪ Introduction

Recent research in science communication has increasingly focused on audience segmentation to better understand public perceptions [Füchslin, 2019]. Segments are typically identified based on factors such as interest in science, knowledge, and attitudes [Runge et al., 2018; Schäfer et al., 2018]. These segmentation studies offer valuable insights into audience characteristics, helping to develop more effective science communication strategies [Hine et al., 2014]. However, segmentation research also highlights a significant challenge: many science communication efforts only reach certain segments of the population, making it difficult to engage those with low interest in science and technology.

This issue is particularly evident in Japan. For example, science cafes — a common method of science communication [Nakamura, 2008] — tend to attract highly engaged audiences with interest in science and technology [Kano et al., 2013]. Given that the results of the 2015 PISA survey revealed that Japanese students' interest in scientific topics was significantly below the OECD average [OECD, 2016], Japan now faces the challenge of developing communication strategies that account for the considerable proportion of future generations with low scientific interest. As a result, Japan has become increasingly active in seeking ways to engage a broader audience [e.g., Goto & Kano, 2021; Kano et al., 2013]. These efforts may offer valuable lessons not only for Japan but for any country facing similar challenges in reaching low-interest groups.

2 ▪ Science communication via television

While many scholars have focused on exploring science communication strategies for individuals with low interest in science and technology [Dahlstrom, 2014; Humm & Schrögel, 2020], this paper explores the potential of broadcast television news and current affairs programs to reach a diverse range of citizens, including those with low scientific interest. In his seminal research, Gerbner [1987] argued that the role of television, particularly commercial television, in science communication is to "cultivate the most common interests, hopes, and fears of the largest groups of viewers", and noted that television "provides an abundance of information, mostly through entertainment, to all viewers, including those who seek no information" [p. 111]. Nearly 40 years ago, Gerbner emphasized that television is an effective tool for reaching a broad audience, including those with limited interest in science.

The media environment has changed dramatically since the days of Gerbner. Now, people can access on-demand science communication content at any time, not only through TV broadcasts but also through video distribution services such as YouTube or any streaming service. Erviti and Stengler [2016], through interviews with producers of online services, highlighted both the similarities and key differences between digital media and television, emphasizing the immense potential of digital platforms. However, on the other hand, research on science communication through traditional television is still being actively conducted [e.g., Dudo et al., 2011; Hut et al., 2016; León, 2008] and recognized as an important medium for science communication even in the digital media age [Koolstra et al., 2006]. One reason for this may be that we are beginning to understand that television may play different roles compared to newer science communication channels. Jang and Park [2012] found that the internet is more efficient than TV for cultivating expertise, transforming individuals into information specialists in a specific field, and demonstrated that the

knowledge gap may arise from differences in interest rather than educational background. On the other hand, Chang et al. [2018] emphasize the ability of television to equalize knowledge across the diverse people in society. While it is important to advance research on digital media as a new horizon of science communication, it is also necessary to re-examine and clarify the advantages and disadvantages of television.

In this study, we focused on the effects of television once again, because previous research on television in science communication has mainly focused on viewers' reactions, attitudes, and beliefs in response to science-related programs [e.g., Brewer & McKnight, 2015, 2017], with fewer studies quantitatively assessing how much information viewers actually retain — an essential measure of effective communication. Moreover, many studies have examined viewer interpretations in controlled, artificial environments, often overlooking the impact of multitasking behaviors, including media multitasking, which can significantly affect how viewers process TV content [e.g., Beuckels et al., 2021; Segijn et al., 2017; Van Cauwenberge et al., 2014]. Given that multitasking while watching TV is now common, especially in Japan [e.g., Saito et al., 2021], and can reduce information retention [e.g., Van Cauwenberge et al., 2014], it is more meaningful to measure the impact of specific broadcast television programs in real viewing environments where multitasking occurs daily, rather than in controlled settings.

With this context in mind, this paper addresses the following question: To what extent does a broadcast television news and current affairs program contribute to disseminating scientific information to diverse citizens with varying levels of interest in a real viewing environment?

3 ▪ Case

3.1 ▪ *Target program*

In order to answer our research question, we investigated the news program 'Shinsō Hōdō Bankisha!' (hereafter 'Bankisha'). Bankisha is currently broadcast every Sunday from 6:00 pm to 6:55 pm (JST) on the Nippon Television Network (NTV) [Shinsō Hōdō Bankisha!, n.d.], and covers a wide range of topics, including politics, economics and social issues, sometimes delving into matters related to science. Targeting this news program among the many television programs dealing with science has two distinct advantages for this research. First, TV viewing time tends to be longer on Sundays than on weekdays in Japan, [Watanabe et al., 2021] and Bankisha tends to have a particularly large audience for a Sunday TV program, with an average of several million viewers each week according to Video Research, a leading Japanese TV ratings company [Video Research, n.d.]. This huge number of viewers is expected to provide richer and relatively less biased data in the survey panel. Secondly, one of the authors has been the program's main anchor since April 2021, and a relationship of trust has been established with the production team. This relationship allowed us to obtain research cooperation from the program and access information on the broadcast schedule and content in advance. Typically, when measuring the effects of video on science education, the effects are assessed immediately after showing a video recording under controlled conditions. However, this unique advantage enabled us to conduct a social survey immediately after the broadcast, under conditions that closely resemble an experimental environment, with pre-prepared questions designed to measure knowledge acquisition. As previously noted, in today's society, where multitasking is commonplace, the effects of video

viewing on science communication observed in an experimental environment may not fully correspond to those in a real setting. However, this study may allow for a more accurate measurement of the effects on a natural viewing environment, providing valuable insights into the true impact of science communication through broadcast television news and current affairs programs.

3.2 ▪ *Scientific explanations in the program*

As an indicator of scientific information, we focused on the relatively new scientific topic of 'blue carbon'. Blue carbon refers to carbon absorbed and stored by marine ecosystems. Introduced by the United Nations Environment Programme [2009], this term emphasizes the important role of oceans and marine ecosystems in climate change countermeasures. Amid growing awareness of the need to reduce carbon dioxide emissions worldwide, Japan, a country surrounded by sea, has recently been promoting the conservation and restoration of blue carbon ecosystems [e.g. Kuwae et al., 2022]. However, as this topic remains unfamiliar to many citizens [Masu, 2023], media outlets, including television, often provide basic scientific information when covering blue carbon. This makes it a suitable indicator for our study, as it allows us to assess how effectively scientific information is communicated to the public.

Of the program "Bankisha", we chose the episode aired on May 28, 2023. On this day's broadcast, the program dedicated approximately 16 minutes to reporting on the efforts of Japanese high school students to restore eelgrass forests, a type of seagrass and one of the important species that forms blue carbon ecosystems. During the segment, the program introduced the term "blue carbon" and provided related scientific information, highlighting it as one of the environmental benefits of eelgrass. It had been planned months earlier that Bankisha would focus on "blue carbon" as its featured topic on that date.

The program that day was made up of three main segments, each of which covered an important news topic of the week. The first two segments were unrelated to blue carbon, and the third segment, which ran from 6:38:54 pm to 6:55:00 pm, was a 16-minute segment dedicated to news related to blue carbon. It did not focus on blue carbon itself, but instead was broadcast as a human-interest story featuring high school students, with the main anchor reporting on activities being undertaken by students to regenerate seagrass populations on the coast of Japan. During the broadcast, there were several scientific explanations of blue carbon, but they only accounted for a limited amount of broadcast time. For example, the mechanism of the carbon storage process of eelgrass was explained in about 17 seconds, spanning from 6:47:44 PM to 6:48:01 PM, with the following narration and illustration (Figure 1).

Narration: Eelgrass absorbs carbon dioxide and converts it to oxygen and carbon. While it releases oxygen, it retains carbon in its body. Once it dies, it deposits on the seafloor while keeping carbon in its body. In essence, eelgrass stores carbon in the marine soil and helps to isolate it.

In addition, scientific explanations such as the fact that eelgrass is a seed plant and that eelgrass beds provide a nursery for other creatures accounted for a total of about 3-minutes of the 16-minute program. The rest of the program mainly showed the background to the students' activities, scenes of them carrying out the activities, and their interactions with the main anchor.

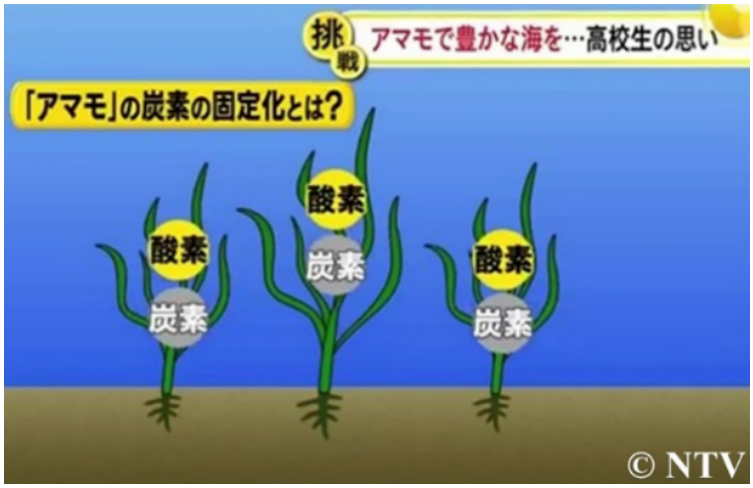

Figure 1. An illustration that explains the process of how eelgrass absorbs and stores Carbon. This is by © NTV and partially modified with their permission.

4 ▪ Materials and methods

4.1 ▪ *Respondents*

Much research on television audiences' knowledge development has used panel surveys to track changes in knowledge levels within the same group [e.g., Yasumoto et al., 2021]. However, within-group experimental design has some limitations [e.g. Kitamura, 1990]. In particular, as in this study, when researching changes in knowledge of relatively new scientific concepts in as natural a viewing environment as possible, participants encounter the term "blue carbon" in the pre-survey before watching the related television program. This exposure makes it challenging to isolate its influence on knowledge acquisition from the program. For this reason, we deliberately avoided panel surveys and opted for inter-group comparisons. In addition, there are six major terrestrial television stations that can be viewed in the Kanto region of Japan, and there was concern that respondents' memories of which programs they viewed on which stations become hazy over time, so we adopted a web survey in order to collect responses quickly after broadcasting.

We conducted an online questionnaire in partnership with Dentsu Macromill Insight Inc., a Japanese research company, immediately after Bankisha aired in the Kanto region on May 28 from 6:00 pm to 6:55 pm. The research company publicly invited participation through the internet to its panel network of approximately 36 million people in Japan, and respondents who participated in the survey were asked if they watched any TV programs during that time. From the respondents, 1,000 people who indicated that they either: watched "Bankisha" live, or watched it through a missed online broadcast, or watched it via a recording were selected to reflect the age and gender distribution of the population of the Kanto region. Participants were not screened or selected for any other demographics. In the same way, another 1,000 people who indicated they did not watch Bankisha during that time were selected. All 2,000 respondents consisted of 50.3% males and 49.7% females, with age distribution as follows: 5.5% in their 10s, 13.6% in their 20s, 15.2% in their 30s, 19.3% in their 40s, 17.3% in their 50s, and 29.1% aged 60 or over. The mean age was 48.0 ($SD = 17.2$). These respondents then promptly answered the questions described in the following

sections. All data collection was completed within 24 hours of the program broadcast, by May 29 at 02:13 PM.

4.2 ▪ *Grouping for comparison*

For inter-group comparison, the 1,000 individuals who watched the program were then asked whether they were aware of the term "blue carbon" and when they first became aware of it. Of these, 445 respondents indicated that they were aware of the term "blue carbon" and had first heard the term through the Bankisha program on that day. These respondents were selected as the "TV-affected" group. The 1,000 individuals who did not watch the program were also asked the same questions. Of these, 667 respondents indicated that they had never heard of the term, blue carbon. They were selected as the "TV-non-affected" group. Both groups of selected respondents indicated that they were unaware of the term, blue carbon, before the program was broadcast. However, the TV-affected group became aware of and gained knowledge of the term, blue carbon through program viewing. Furthermore, by consulting metadata provided by M Data Corporation (which collects and analyzes data on TV programs in Japan), we confirmed that the term, blue carbon was not mentioned in any other TV programs during the data collection period in the Kanto region. It is therefore reasonable to conclude that the TV-affected group's knowledge of blue carbon was most likely brought about by their exposure to the program. If there was a difference in levels of awareness and knowledge between the groups, then it was likely to be mainly due to the effect of program viewing.

The TV-affected group of 445 respondents consisted of 51.7 % males and 48.3% females, with age distribution as follows: 7.6% in their 10s, 14.6% in their 20s, 15.5% in their 30s, 18.7% in their 40s, 16.2% in their 50s, and 27.4% aged 60 or over. The mean age was 46.5 ($SD = 17.7$). The TV-non-affected group of 667 respondents consisted of 49.5 % males and 50.5 % females, with age distribution as follows: 5.8% in their 10s, 14.4 % in their 20s, 15.4% in their 30s, 18.3% in their 40s, 17.4% in their 50s, and 28.6% aged 60 or over. The mean age was 47.5 ($SD = 17.2$). There were no notable differences in the gender and age ratio between the two groups, and there were also no notable differences compared to the all 2,000 respondents mentioned above.

4.3 ▪ *Classification by scientific interest*

We further segmented the individuals of the two groups based on their interest levels in science and technology using the Victorian Segmentation (VSEG) method. This approach was originally developed by the government of the State of Victoria in Australia and later validated in Japan [Goto et al., 2014]. According to a report from Framework for Broad Public Engagement in Science, Technology and Innovation Policy [Kano, 2016], which was developed by Japanese university professors, the original 6 segments of the VSEG method can be classified into 3 categories on their level of interest in science and technology: Interest, Potential Interest, and Low Interest. This classification is determined by analyzing respondents' answers to just three straightforward questions, so it is suitable for surveys of large numbers of people as in this study [Kano, 2016]. The items were as follows: (Q1) "Are you interested in science and technology? Please choose the option that best describes your level of interest" (A1: Very interested, A2: Interested, A3: Neither interested nor uninterested, A4: Not interested, A5: Not at all interested); (Q2) "Do you actively search for information

about science and technology? Please choose the option that best describes you" (A1: Yes, A2: No); (Q3) "Have you been able to find the information you were looking for when researching science and technology? Please choose the option that best describes your experience"(A1: "I found it. Usually, the content is easy to understand", A2: "I found it. However, in most cases, the content is difficult to understand", A3: "I couldn't find it. In most cases, I am unable to find the information I am looking for"). The classification for the responses is shown in Table 1.

Table 1. The original six segments of VSEG and the modified three categories.

Answer			*Segments*	*Categories*
Q1	*Q2*	*Q3*		
1 or 2	1	1	2	Interest
1 or 2	1	2 or 3	3	
1 or 2	2	–	1	Potential Interest
3 or 4 or 5	1	–	6	
3	2	–	4	
4 or 5	2	–	5	Low Interest

The results of the classification are shown in Table 2. The TV-affected group of 445 respondents consisted of 52.1% with Interest, 41.1% with Potential Interest, and 6.7% with Low Interest. In contrast, the TV-non-affected group of 667 respondents consisted of 18.7% with Interest, 52.0% with Potential Interest, and 29.2% with Low Interest. According to Kano [2016], the overall Japanese population consisted of 16.1% with Interest, 61.4% with Potential Interest, and 22.6% with Low Interest. Therefore, the TV-affected group indicated a higher proportion of individuals interested in science and technology compared to both the TV-non-affected group and the general Japanese population.

Table 2. Classification by level of scientific interest.

	Interest		*Potential Interest*		*Low Interest*		*Total*
	n	(%)	n	(%)	n	(%)	N
TV-affected	232	(52.1)	183	(41.1)	30	(6.7)	445
TV-non-affected	125	(18.7)	347	(52.0)	195	(29.2)	667
Japanese population		(16.1)		(61.4)		(22.6)	

Note: the data for the Japanese population are sourced from Kano [2016].

4.4 ▪ *Measuring the amount of scientific knowledge*

We measured respondents' scientific knowledge regarding blue carbon by crafting five items. The items were as follows: (a) "Eelgrass, which is one of the species shaping blue carbon ecosystems, belongs to the same seaweed taxonomic family as wakame and kelp", (b) "Eelgrass beds also play a role in enhancing the diversity of other living creatures", (c) "Plants growing in the sea cannot absorb carbon dioxide (CO_2) unlike plants on land", (d) "Eelgrass reproduces not through seeds but by spores", (e) "Due to the functioning of eelgrass, a portion of carbon (C) is sequestered from the ecosystem's material cycle for an extended period". Responses were given three options to indicate their agreement (1 = Incorrect, 2 = Don't Know, 3 = Correct), and instructed to "It doesn't matter if you get it

wrong or don't know. Please choose the answer you think is right without searching for it". The total number of correct responses (ranging from 0 to 5) served as the score of their scientific knowledge about blue carbon.

These items were created based on prior discussions about content with a blue carbon researcher, a marine science expert, and one of the authors. All knew about the content of the broadcast in advance. This enabled us to tailor the questions to closely follow the scientific explanations that were broadcast in the program. This approach helped us precisely measure the direct impact of the broadcast on respondents' knowledge rather than asking broadly about blue carbon in general.

4.5 ▪ *Statics analysis*

Because the knowledge score in this study is discrete data ranging from 0 to 5 and normality cannot be assumed, we performed a log transformation to fit the data to normal distribution. Then, with scientific knowledge as the dependent variable, a two-way analysis of variance (ANOVA) followed by Bonferroni's multiple comparisons was conducted to examine the main effects of TV-affect and the level of scientific interest and their interaction. Differences were statistically considered significant when p-value was < 0.05. All analyses were conducted using IBM SPSS Statistics 29 software.

5 ▪ Results

The descriptive statistics are shown in Table 3.

Table 3. Descriptive statistics.

	TV-affected		*TV-non-affected*	
Level of scientific interest	*Score of scientific knowledge*	*n*	*Score of scientific knowledge*	*n*
Interest	2.34 (1.31)	232	1.56 (1.38)	125
Potential Interest	2.08 (1.34)	183	0.95 (1.10)	347
Low Interest	1.33 (0.99)	30	0.54 (0.89)	195
All	2.16 (1.32)	445	0.95 (1.15)	667

Note: entries are mean scores with standard deviations in parentheses.

The results of two-way ANOVA showed that the effect of TV exposure was significant ($F(1, 1106) = 100.69$, $p < .001$, $\eta_p^2 = 0.08$), and the effect of scientific interest was also significant ($F(2, 1106) = 28.15$, $p < .001$, partial $\eta_p^2 = 0.05$). On the other hand, there was no significant interaction between TV-affect and the level of scientific interest ($F(2, 1106) = 2.10$, $p = 0.123$, $\eta_p^2 = 0.004$). (Table 4, Figure 2) The score of scientific knowledge of the TV-affected group was significantly higher than the TV-non-affected group, and the post-hoc Bonferroni's multiple comparisons showed that both the Interest group and the Potential Interest group had significantly higher scores than the Low Interest group, and the Interest group had significantly higher scores than the Potential Interest group (all $p < .001$). In other words, the higher the level of scientific interest, the higher the score.

Table 4. Results of two-way ANOVA.

	Type III Sum of Squares	*df*	*Mean Square*	*F*	*Significance*	*Partial* η^2
Scientific Interest	14.92	2	7.46	28.14	<.001	.048
TV-affect	26.68	1	26.7	100.68	<.001	.083
Scientific Interest × TV-affect	1.11	2	0.56	2.10	.123	.004

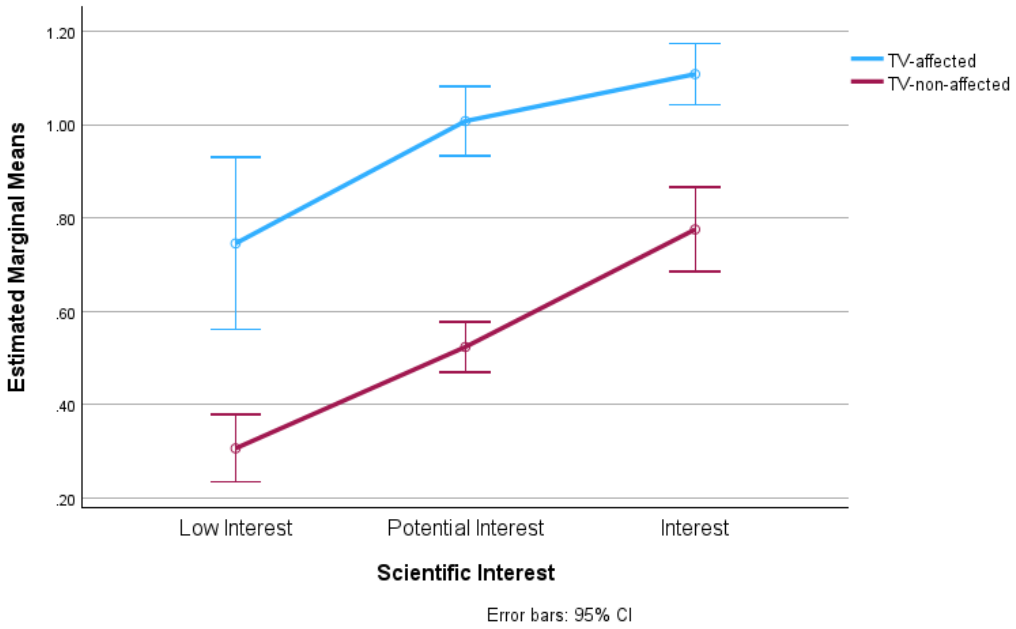

Figure 2. Estimated marginal means of scientific knowledge score for the TV-affected group and the TV-non-affected group with different levels of interest.

6 ▪ Discussion and conclusion

The results of this study demonstrated that in natural viewing environments, viewers of the weekly broadcast television news program became aware of, and increased their scientific knowledge about, a new scientific term, blue carbon, compared with non-viewers. Considering that over 70% of Japanese people are doing other things while watching TV [Saito et al., 2021], this finding suggests that broadcast television news and current affairs programs retain potential as an effective science communication tool, even in the multi-tasking media viewing landscape. Notably, with estimated viewers of approximately 2.76 million in the Kanto region according to Video Research, the program reached a broad audience. This highlights broadcast television's capacity to engage audiences with scientific content on a large scale and emphasizes the need to re-consider broadcast television's role, in light of the current focus in science communication research on digital media [Koolstra et al., 2006]. In fact, the results of a survey on the distribution of information about COVID-19 by the Japanese government [Sōmushō Sōgō Tsūshin Kibankyoku Denki Tsūshin Jigyōbu Shōhisha Gyōsei Dainika, 2020] showed that commercial television broadcasts were the most common medium through which the general public saw and heard information about COVID-19, accounting for over 70% of respondents. Given the results of our study,

showing gains in viewers' awareness and knowledge about a scientific topic, it is possible that broadcast television had a significant impact on the public's knowledge about science during that pandemic. At the same time, it may also highlight the serious social responsibility that television news and current affairs broadcasters bear for accurately conveying scientific information. Tsuda et al. [2016] pointed out that if mass media fails to provide accurate information or conveys misleading content, it may undermine the effectiveness of other efforts to communicate science. The results of our study suggest that the issues of communicating science through television that have been studied up to now [e.g., Markl, 2003; Schiele, 2020] will continue to need to be discussed and improved upon.

The fact that the higher the level of scientific interest, the higher the knowledge score, suggests that the questions in our survey may have been answered correctly by people with basic scientific knowledge, regardless of whether they had knowledge of blue carbon itself, and that questions in this survey may not have been able to capture the impacts of confounding factors, such as exposure to existing scientific knowledge and reasoning, to accurately measure levels of knowledge of blue carbon. However, it is worth noting that the TV-affected group included 41.1% with Potential Interest and 6.7% with Low Interest, and that their scientific knowledge improved. This result suggests that broadcast television news and current affairs programs might have potential for reaching segments of the population with relatively low interest in science, at least in terms of disseminating scientific information. By using the same segmentation method, Kano et al. [2020] have already shown that, of the 168 participants in 10 science cafes, which have been considered the mainstream of science communication in Japan, over 80% were "Interested", the remainder were "Potential Interested", and the "Low Interested" did not participate at all. Although the TV program in this study did not reach the entire population with low interest in Japan, it still connected with a significant portion compared with science cafes and brought a certain amount of scientific knowledge to people with low interest in science and technology. While Goto and Kano [2021] are concerned about the bias in the target audience of informal science communication in Japan, it may be necessary to reconsider television as one of the potential solutions.

This study has a number of methodological limitations and room for improvement. Firstly, this study focused exclusively on a single genre of television, the weekly news program, and did not consider other genres such as entertainment, which may play a different role in science communication. To fully understand television's impact, it will be important to examine how different genres contribute to viewers' knowledge of scientific topics. Secondly, as the survey was conducted immediately after the broadcast, it did not consider the possibility that viewers may not remember or accurately recall what they watched after a certain period of time. Previous studies such as Albertson and Lawrence [2009] have shown that it is unclear to what extent viewers remember the content of TV programs. Therefore, future research needs to examine the longevity of scientific knowledge gained from TV broadcasts. In addition, because the questionnaire used in this study did not control various multitasking situations, it is unclear what kind of multitasking affects knowledge improvement. Furthermore, although this study focused only on the quantitative impact of television news and current affairs, the qualitative impact is equally important. Tsai et al. [2024] pointed out that communicating ocean science requires more than just sharing facts about science, and it is necessary to consider the unique science communication strategies of specific broadcast television programs and whether they provided viewers with more than just knowledge sharing.

Despite these limitations, this study is one of the first to investigate whether broadcast television news and current affairs programs contribute to the dissemination of audience knowledge about new scientific terms such as 'blue carbon' in real-world settings. It calls for a reevaluation of the role of broadcast television news and current affairs programs in the current era of media diversification, and a collaboration with digital media by leveraging its unique advantage. We hope that these findings will provide valuable insights for future research in science communication and guide media practices that encourage more inclusive engagement with scientific content.

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