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Generative AI as a source of information on environmental Problems: Understanding its influence on Generation Z

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ABSTRACT

Generative artificial intelligence (GenAI) is rapidly emerging as a transformative tool in digital information dissemination. However, its influence on environmental communication problems remains underexplored. This research examines whether exposure to information on an environmental problem provided by GenAI (namely ChatGPT) influences individuals' pro-environmental outcomes in terms of awareness of environmental consequences, moral obligation, and attitudes toward that problem. It addresses the research gap on GenAI's effectiveness compared to traditional sources (digital newspapers) in shaping environmental perceptions, as well as the underlying mechanisms behind this effectiveness. Two experimental studies were conducted with samples of Generation Z users given this demographic's high level of engagement with AI tools. Study 1 examined changes in pro-environmental outcomes when participants were exposed to ChatGPT-generated messages about water scarcity or messages in a digital newspaper. Study 2 focused on the underlying mechanisms of ChatGPT's influence. It examined how perceived usefulness of information mediates this influence and how individual characteristics (psychological distance to the problem and technological innovativeness) moderate this process. Exposure to messages about water scarcity significantly enhanced participants' awareness of consequences, moral obligation, and attitudes toward the problem, regardless of the source. In Study 2, emphasizing problem severity enhanced perceived usefulness, a key factor in shaping pro-environmental outcomes. However, this effect varied based on individual characteristics, with moderation by psychological distance and technological innovativeness. These findings contribute to the growing discussion about the role of GenAI in environmental communication. The paper discusses the potential implications of GenAI for fostering pro-environmental attitudes and behaviors. It emphasizes the need to consider audience-specific factors to maximize the effectiveness of GenAI.

1. Introduction

Generative artificial intelligence (GenAI) refers to a type of artificial intelligence (AI) that can produce content in the form of text, images, or other media (Susarla et al., 2023) based on instructions provided by a user (e.g., Dwivedi et al., 2024). Even though GenAI has existed for some time, the emergence and widespread adoption of ChatGPT has led to a seemingly unstoppable proliferation of GenAI applications that have greatly impacted individuals, organizations, and societies (Dwivedi et al., 2023; Susarla et al., 2023). After its launch, ChatGPT attracted 100 million users in just two months, reaching this milestone faster than any other application since the existence of the Internet. To put this growth into context, Instagram needed more than two years and TikTok about nine months to reach 100 million users (Milmo, 2023).

Given the novelty of GenAI, studies have mainly focused on its adoption for different purposes from a user perspective (e.g., Arce-Urriza et al., 2025; Fakfare et al., 2025). Meanwhile, other studies have developed theoretical proposals about the potential benefits, risks, and

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challenges associated with GenAI (e.g., Belanche, Belk, et al., 2024; Dwivedi et al., 2023; Puntoni et al., 2021). Some scholars suggest that GenAI tools can shape users' decision-making processes and preferences (Mogaji & Jain, 2024). However, there is still a need to understand how GenAI-produced content influences individuals' attitudes and behaviors (Gupta et al., 2024). For instance, individuals can use GenAI as an information source (e.g., Flavián et al., 2023) that provides them with relevant and accurate content to meet their specific needs (e.g., Puntoni et al., 2021). GenAI is continuously updating and improving as it incorporates new information and feedback. Hence, the content it produces is not only personalized but also continuously enriched (e.g., Dwivedi et al., 2023; Dwivedi et al., 2024).

Focusing on consumers, Flavián et al. (2023) reported that recommendations from GenAI-based applications (e.g., virtual assistants such as Siri, Alexa, and Google Assistant) are perceived as more credible than consumer online reviews and can foster the intention to follow such recommendations. Specifically, GenAI-based recommendations create value because of the associated benefits, namely convenience, compatibility, and personalization (Akdim & Casaló, 2023). However, GenAI may also lead to misinformation. For instance, GenAI's responses may be based on incorrect or incomplete data (Dwivedi et al., 2023). Hence, using GenAI tools as a source of information and advice may entail substantial risks (Oviedo-Trespalacios et al., 2023). Therefore, a better understanding of how GenAI affects users in contexts where misinformation could lead to harmful consequences is needed. One such context is the environment, specifically environmental communications. Moreover, recent research shows that GenAI-related ethical concerns are context-dependent, calling for more grounded and practice-based frameworks (Jeon et al., 2025).

This paper contributes to advancing the literature by offering, to the best of our knowledge, the first empirical examination of how GenAI, specifically ChatGPT, functions as a source of information in the context of environmental risk communication. While prior studies have explored the adoption and ethical implications of GenAI (e.g., Dwivedi et al., 2022; Nishant et al., 2020; Pan et al., 2022; Pan & Nishant, 2023), they have generally remained at a theoretical or conceptual level and have not investigated how GenAI-generated messages are processed by users when addressing environmental challenges. More specifically, this paper advances the literature on this topic in several ways. First, it empirically tests whether exposure to GenAI-produced information about an environmental problem affects individuals' awareness of consequences, moral obligation,[1] and attitude toward the problem. In this respect, prior research suggests that AI can foster individual pro-environmental behaviors and attitudes (e.g., Nishant et al., 2020). Additionally, the initial findings in this area suggest that including new technologies (i.e., AI and virtual reality) in the classroom improves environmental education (Cao & Jian, 2024). Building on previous studies (e.g., Flavián et al., 2023), this research further evaluates the effectiveness of AI in influencing individual attitudes and perceptions by comparing GenAI with a more well-established information source (digital newspapers). Second, this influence is explored in terms of the underlying mechanisms behind the impact of GenAI. To do so, the research analyzes the mediating role of perceived usefulness of the GenAI-produced information. This choice of mediator is motivated by the consistent view that usefulness is the most influential belief affecting behavior and attitudes (e.g., Bhattacherjee, 2001).

Third, to understand the impact of GenAI in more depth, this research analyzes whether different perceptions of environmental problem severity lead to different levels of pro-environmental outcomes. This consideration is important because environmental problem severity is a key information characteristic that shapes environmental attitudes (Siegrist, 2019). Additionally, the research examines the moderating role of individual characteristics to identify which users are most affected by GenAI and under what conditions its influence is strongest. Perceived distance to the problem is considered a key contextual moderating factor, as it can shape how individuals process information. According to construal level theory, psychologically distant problems tend to be perceived as more abstract, whereas closer problems are viewed as more concrete (Trope & Liberman, 2003). Furthermore, technological innovativeness is included as a relevant individual characteristic, given that innovative individuals are more likely to adopt new technologies and perceive them as useful, regardless of external circumstances (Bouteraa et al., 2024). In sum, this paper aims to answer the following research questions.

- RQ1: When used as a source of information on an environmental problem, does GenAI influence individual pro-environmental outcomes (i.e., awareness of consequences, moral obligation, and attitudes toward the problem)? If so, how does this influence compare to that of traditional information sources such as digital newspapers?
- RQ2: Is perceived usefulness of the information provided by GenAI the underlying mechanism explaining its impact on individuals?
- RQ3: How do informational characteristics (i.e., perceived severity of the problem) and individual characteristics (i.e., technological innovativeness and perceived distance to the problem) affect the influence of GenAI-driven pro-environmental communication?

Two experiments targeting Generation Z users were conducted to answer these research questions. Study 1 evaluated changes in key pro-environmental outcomes after individuals had been exposed to information about an environmental problem provided by either a digital newspaper or ChatGPT (to answer RQ1). Study 2, focusing on ChatGPT as the information source, evaluated potential mediation by perceived usefulness of information (to answer RQ2), as well as the role of problem severity and the moderating effects of psychological distance to the problem and technological innovativeness (to answer RQ3). Generation Z was chosen because people from this demographic are more likely to use GenAI for information and learning (McClain, 2024) and engage with GenAI more frequently (Fletcher & Nielsen, 2024). Moreover, fostering pro-environmental attitudes, actions, and values among young people is essential for mitigating environmental degradation and climate change (Cao & Jian, 2024). Finally, water scarcity was selected as the focal environmental problem. This problem is relevant because water is becoming a limited and increasingly valuable resource in many parts of the world. Day by day, water stress is growing, and it is expected to affect 31 % of the global population by 2050 (Melo, 2024). Similarly, ChatGPT was selected as the GenAI tool in this research because it is by far the most widely used GenAI application worldwide (Fletcher & Nielsen, 2024).

The remainder of the manuscript is structured as follows. Section 2 presents Study 1, including justification of the hypotheses related to RQ1, methodology, and results. Following the same structure, Section 3 describes Study 2 to answer RQ2 and RQ3. Finally, Section 4 discusses the main findings in relation to the previous literature. It also explains the implications for theory and practice and presents the main limitations, which in turn create opportunities for future research.

2. Study 1

2.1. Theoretical model and hypothesis development

Study 1 aimed to answer RQ1. It did so by exploring whether using GenAI for information about an environmental problem (under a loss frame) can affect key environmental outcomes (i.e., awareness of consequences, moral obligation, and attitude toward the problem). It also contributed to addressing RQ1 by evaluating how this impact compares to that observed when traditional information sources (i.e., a digital

[1] Moral obligation is defined in this study as an individual's personal sense of moral responsibility to engage in or refrain from behaviors that may cause harm to the environment (Ajzen, 1991).

newspaper) are used.

In environmental communication, message framing refers to how content is structured and presented (Kidd et al., 2019). It plays a crucial role in shaping perceptions and influencing sustainable consumer behavior (Sheng et al., 2023). While traditional strategies often rely on the knowledge deficit model, which assumes that providing more information will change behavior, growing evidence suggests that information alone is often insufficient (Abrahamse & Matthies, 2018; Lindenfeld et al., 2012).

One commonly used approach is loss framing, which is based on prospect theory (Tversky & Kahneman, 1992). It emphasizes the negative consequences of inaction to encourage behavioral change (Meyers-Levy & Maheswaran, 2004). Although research has produced mixed findings, some studies show that loss framing can be more effective than gain framing in environmental contexts (He et al., 2024; Homar & Cvelbar, 2021). These variations may be explained by the role of mediating psychological processes such as attitudes, emotions, or moral reasoning (Homar & Cvelbar, 2021; Stadlthanner et al., 2022).

Several studies suggest that loss-oriented information can enhance attitudes toward environmental issues (e.g., Chang et al., 2015; Craig & Allen, 2014). However, evidence on its impact on moral obligation and problem awareness is limited and inconclusive. Homar and Cvelbar (2021) note that the direct effects of loss framing remain unclear. For example, Spence and Pidgeon (2010) found that loss-framed climate change messages had little effect on perceived severity unless fear was induced. Similarly, Ngo et al. (2022) reported that gain-framed messages outperformed loss-framed ones in increasing farmers' perceptions of climate risk, behavioral intentions, responsibility, and efficacy. In contrast, more recent findings indicate a stronger influence of loss framing. Kang and Hong (2021) showed that loss-framed cost information boosted students' awareness by enhancing perceived certainty, danger, and importance of climate threats. Su and Li (2024) also found that such messages evoked guilt, which increased moral obligation and willingness to pay for eco-friendly services. These contrasting results underscore the need for further research to clarify how loss framing affects environmental awareness, moral responsibility and attitude toward the problem. Given these mixed findings, further research is needed to clarify the direct influence of loss framing on environmental awareness, moral obligation and attitude toward the problem. Based on this reasoning, the following hypothesis is proposed.

H1. A (loss-framed) message about an environmental problem (water scarcity) significantly improves individuals' (a) awareness of consequences, (b) moral obligation, and (c) attitude toward the problem.

In addition to message content, the information source significantly shapes audience perception (Hurst & Stern, 2020). While the general public often relies on traditional media to understand environmental science and policy (Boykoff & Yulsman, 2013), younger audiences tend to use social media and digital tools such as ChatGPT (Chung et al., 2020; McClain, 2024). These AI-powered tools appeal due to their user-friendly interface and quick response time (Li et al., 2023).

Building trust in AI-generated content is a central challenge (Albahri et al., 2024; Park et al., 2024), particularly in risk communication, where credibility is essential (McGovern et al., 2024). Human-authored content is often seen as more credible due to its intentionality, expertise, and accountability, whereas AI-generated content raises concerns about accuracy, bias, and transparency (Jia et al., 2024; Huschens et al., 2023). Nonetheless, empirical findings on the credibility and trustworthiness of AI-generated content remain inconclusive.

In media contexts, Kreps et al. (2022) found that GPT-2-generated political news articles were nearly indistinguishable in credibility from those published by The New York Times. Likewise, Huschens et al. (2023) reported no significant differences in perceived competence and trustworthiness between ChatGPT-generated and human-written Wikipedia articles, with AI content rated clearer and more engaging on neutral topics. Conversely, in advertising, awareness of AI authorship reduced brand perceptions in CSR campaigns (Aljarah et al., 2024) and decreased donation intentions when AI-generated human faces were used in charity ads (Arango et al., 2023). These results emphasize the context-dependent nature of AI-generated content's credibility and effectiveness (Hofeditz et al., 2021). In sensitive domains like risk environmental communication, understanding these dynamics is essential, yet remains underexplored. Based on this reasoning, the following hypothesis is proposed.

H2. A (loss-framed) message about an environmental problem (water scarcity) in a digital newspaper increases individuals' (a) awareness of consequences, (b) moral obligation, and (c) attitude toward the problem more than a message generated by GenAI.

Fig. 1 summarizes the research model for Study 1.

2.2. Methodology

2.2.1. Study design

A one-factor between-subjects experimental design was used. In this design, the information source that provided a message about an environmental problem was manipulated (digital newspaper vs. GenAI). A fictitious digital newspaper was used in the stimuli material to control for any confounding effects due to brand knowledge and previous attitudes (Kumkale et al., 2010). This experimental feature was important because individuals are familiar with numerous, frequently visited digital newspapers with different editorial ideologies. The digital fictitious newspaper was called *The News*. As explained earlier, the GenAI tool selected for this research was ChatGPT because it is the most well-known and well-used GenAI tool in the world (Fletcher & Nielsen, 2024). Other GenAI applications with similar characteristics are much less widely used. Using a fictitious GenAI tool would have detracted from the realism of the scenario.

The chosen environmental problem was water scarcity. Participants felt close to this problem because the study was carried out in southeastern Spain, which has traditionally suffered from droughts. This area experienced drought during the last hydrological year (AEMET, 2024). The accumulated annual rainfall was less than 120 mm and as little as 80 mm in some areas (AEMET, 2024). The message was the same in both scenarios. The question that ChatGPT was asked was used as the headline in the newspaper. The aim was to expose participants to the same information (see Table 1). The scenarios are shown in Appendix A.

2.2.2. Procedure

Individuals' awareness of consequences, moral obligation, and attitude toward the problem were measured twice (initial and final) to assess changes after seeing the information about the environmental problem. After consenting to participate, participants were first asked about their awareness of consequences, moral obligation, and attitude toward the problem. Following the approach of previous studies (e.g., Swaminathan et al., 2007; Zemborain & Johar, 2007), participants then completed an unrelated task that asked them to find the seven differences between two images to clear their short-term memory. They were then randomly assigned to an information source condition. Participants were instructed to imagine that they were searching for information on the Internet about water scarcity in Spain and that they decided to consult ChatGPT or found a news story in a digital newspaper. Next, they were asked again about their awareness, moral obligation, and attitude. Participants then completed the rest of the questionnaire, manipulation checks, control measures, and sociodemographic profile.

A total of 123 students at two southeastern Spanish universities participated in the research (see Table 2). There were no significant differences between conditions in gender, age, or frequency of use of the information source. Ethical approval was granted by the university ethics committee for the data gathering procedures in both Study 1 and Study 2.

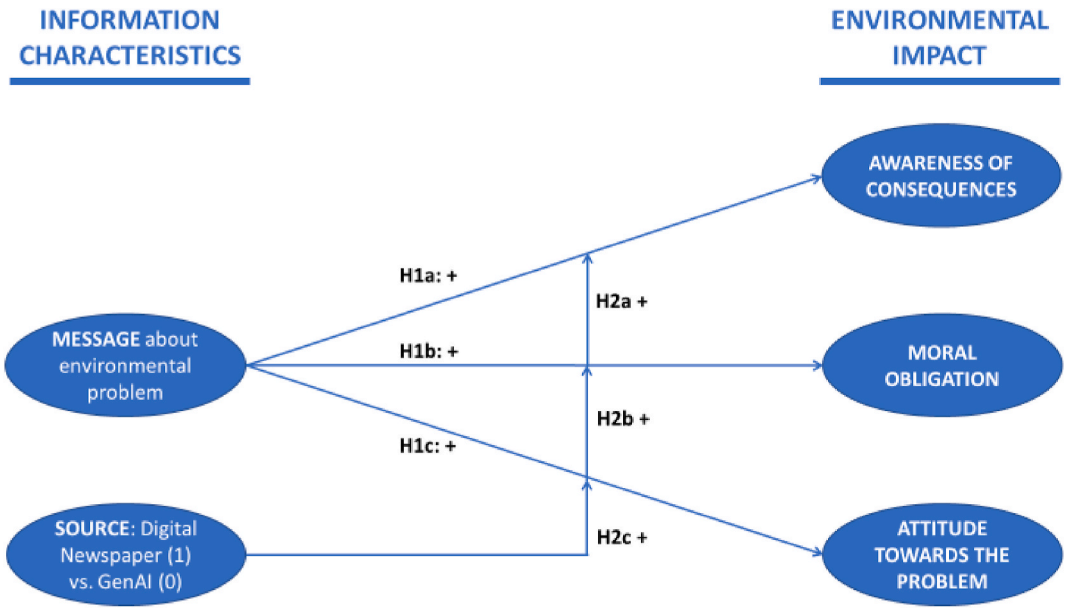

Fig. 1. Research model (Study 1).

Table 1
Message about an environmental problem used in the scenarios.

Question asked to GenAI/ digital newspaper headline	What is the water scarcity situation in Spain and what problems do we face if we do not use this resource responsibly?
GenAI's answer/body of text in the news item	Spain is one of the European countries with the lowest availability of fresh water per inhabitant (1000 cubic meters per year), below the UN water scarcity threshold. Spain experiences periodic droughts, which aggravate water scarcity in many regions such as southeastern Spain. In addition, the demand for water in Spain is high. Therefore, if water is not conserved in the near future, there will be serious problems such as a lack of availability of water for domestic consumption, a food crisis due to a lack of agricultural production, conflicts and migration to areas where there is less drought, and a significant loss of aquatic and terrestrial biodiversity.

Table 2
Sample descriptive statistics in Study 1.

Descriptive	Total	Scenarios		Statistic
		Digital newspaper	GenAI	
N	123	68	55	
Gender				
Male	30.9 %	33.8 %	27.3 %	$\chi^2 = 0.611^{ns}$
Female	69.1 %	66.2 %	72.7 %	
Age (mean)	22.4	22.4	22.5	$F(1, 122) = 0.052^{ns}$
Frequency using the source (mean 1–7)	4.5	4.4	4.5	$F(1,122) = 0.197^{ns}$

2.2.3. Measurement

Awareness of consequences was measured using three items from a study by Gregory and Di Leo (2003): Cronbach's alpha of initial awareness = 0.850; Cronbach's alpha of final awareness = 0.933. Moral obligation was measured with four items from a study by Van der Werff et al. (2013): Cronbach's alpha of initial moral obligation = 0.893; Cronbach's alpha of final moral obligation = 0.936. Attitude toward the problem was measured using the scale from a study by Casado-Díaz et al. (2022) consisting of five items: Cronbach's alpha of initial attitude = 0.864; Cronbach's alpha of final attitude = 0.906. Two items were used to check the manipulation. First, participants used a Likert scale to indicate the extent to which the information about an environmental problem was provided by digital newspapers. Second, they were asked the same question about GenAI. The participants also had to remember the scenario to which they had been allocated by indicating which source they saw. As a control variable, source frequency of use was measured on a 7-point scale ranging from 1 (*never*) to 7 (*every day*). All measurements in the questionnaire used 7-point scales. The scales are shown in Appendix B.

2.3. Results

The manipulation checks worked as expected. Individuals who were exposed to the digital newspaper reported that it was more likely that the information was provided by a digital newspaper: $M_{digital\ newspaper} = 5.49$, $M_{GenAI} = 2.84$, $F(1,122) = 62.583$, $p < 0.01$. In contrast, individuals exposed to GenAI reported that it was more likely that the information source was GenAI: $M_{digital\ newspaper} = 3.46$, $M_{GenAI} = 5.49$, $F(1,122) = 34.425$, $p < 0.01$. Finally, most participants remembered the allocated scenario: 80.6 % for digital newspaper; 70.5 % for GenAI. As explained earlier, credibility is typically crucial for understanding differences in the impact of information on the dependent variables, depending on whether the message source is a digital newspaper article or ChatGPT. However, the information sources did not differ in terms of their credibility: $M_{digital\ newspaper} = 5.00$, $M_{GenAI} = 4.76$, $F(1,122) = 1.381$, $p = 0.242$.

The next step was to conduct three repeated-measures analysis of covariance (ANCOVA) models (one for each dependent variable). The information source was the between-subjects factor, and the scores for awareness of consequences, moral obligation, and attitude toward the problem at two time points (initial and final) were the dependent variable. Information source frequency of use was the covariate to control for the potential effect of this variable on the results. However, this variable did not exert a significant effect on the dependent variables.

Time had a significant effect on awareness of consequences ($M_{initial} = 5.26$, $M_{final} = 5.84$; $F(1,120) = 7.471$, $p < 0.01$), moral obligation ($M_{initial} = 4.60$, $M_{final} = 5.05$; $F(1,120) = 7.644$, $p < 0.01$), and attitude toward the problem ($M_{initial} = 5.53$, $M_{final} = 5.83$; $F(1,120) = 12.513$, $p < 0.01$). These results mean that exposure to a message about an

environmental problem increased the previous value of these three variables (see Table 3). Thus, H1 is supported. However, the interaction effects between information source (between-subjects factor) and time (within-subjects factor) on awareness of consequences ($F(1,120) = 0.002$, $p = 0.966$), moral obligation ($F(1,120) = 0.481$, $p = 0.489$), and attitude toward problem ($F(1,120) = 1.025$, $p = 0.313$) were not significant. Thus, both information sources had similar effects on the improvement of individuals' awareness of consequences, moral obligation, and attitude toward the problem. Hence, H2 is rejected. This result is consistent with the findings regarding the source credibility variable.

3. Study 2

3.1. Theoretical model and hypothesis development

Study 2 addressed RQ2 and RQ3 by examining how informational and individual characteristics affected key pro-environmental outcomes (awareness of consequences, moral obligation, and attitude) after participants read an AI-generated pro-environmental communication. Like Study 1, Study 2 used information generated by ChatGPT. In particular, it explored how the perceived severity of an environmental problem (informational characteristic) influenced the outcome variables through mediation by perceived information usefulness. Additionally, it examined the moderating role of individual characteristics (perceived distance to the problem and technological innovativeness). This comprehensive approach aimed to shed light on the mechanisms through which GenAI-produced pro-environmental communication affects key environmental outcomes.

The perceived severity of environmental problems is a core dimension of individuals' risk perception (Rodriguez-Sanchez & Sarabia-Sanchez, 2017; Siegrist & Árvai, 2020). It significantly shapes environmental attitudes, perceptions, and pro-environmental intentions (Siegrist, 2019). In risk communication, the impact of problem severity on environmental outcomes may be mediated by the perceived usefulness of the information provided.

According to the health belief model (Rosenstock, 2005), originally developed in the health domain, individuals who perceive a health issue as severe are more likely to evaluate related information as useful, which in turn encourages preventive behaviors. This mechanism extends to the environmental domain, where perceived severity can enhance the perceived usefulness of information, ultimately influencing attitudes and behavioral intentions. Empirical evidence supports this relationship. For example, McDowell et al. (2021) found that private well owners facing water contamination risks were driven by perceived severity to seek and use information they deemed useful. Similarly, Huang et al. (2024) found that, in the context of air pollution, higher perceived severity increased the perceived usefulness of information, which in turn shaped individuals' engagement with the issue.

Once information is perceived as useful, it is more likely to attract attention and undergo deeper cognitive processing, thereby strengthening awareness and attitudes (Petty & Cacioppo, 1986). For example, Lee-Kan et al. (2024) showed that framing information to highlight its usefulness (e.g., linking carbon emissions to cost savings) positively influenced attitudes and promoted pro-environmental behavior. Additionally, theoretical frameworks such as the values-attitudes-behavior model (Homer & Kahle, 1988) suggest that useful information can activate moral values, reinforcing moral obligation and attitudes. Kollmuss and Agyeman (2002) built on this idea by noting that values and moral norms are more likely to be activated when individuals perceive information as useful in addressing environmental problems and offering potential solutions. Based on this reasoning, the following hypothesis is proposed.

H3. The severity of an environmental problem presented in a message created by GenAI positively influences individuals' (a) awareness of consequences, (b) moral obligation, and (c) attitude toward the problem through mediation by the perceived usefulness of information.

Individual-related variables such as perceived distance to the problem may moderate the relationship between problem severity and the perceived usefulness of information. According to construal level theory (Trope & Liberman, 2003), psychologically distant events in spatial terms are perceived more abstractly, whereas closer events are perceived more concretely and personally. This abstraction reduces the perceived relevance and usefulness of high-level strategic information when problems are framed as distant (Balžekienė et al., 2024).

Empirical evidence supports this effect. Spence and Pidgeon (2010) found that geographical distance moderates the impact of problem severity on information usefulness. When environmental issues such as flooding were framed as local for the participants (e.g., Cardiff), higher perceived severity enhanced the information's relevance and usefulness because of its immediate personal applicability. In contrast, when framed as distant (e.g., Rome), severity was acknowledged, but relevance and perceived usefulness declined because of the abstract nature of the threat. Similarly, Kusmanoff et al. (2020) highlighted the importance of perceived geographical distance in biodiversity conservation threats (e.g., habitat loss, land clearing, and species extinction). Their findings suggest that when these environmental threats are perceived as geographically distant, the problem's severity has a weaker effect on the perceived relevance and usefulness of the information because abstraction reduces its immediacy and applicability. Building on this reasoning, the following hypothesis is proposed.

H4. The effect of message severity on the perceived usefulness of information is strengthened when the environmental problem is perceived as psychologically close.

Finally, technological innovativeness, which is defined as an individual's willingness to try new technologies (Agarwal & Prasad, 1998), may also moderate the relationship between problem severity and the perceived usefulness of information. In the context of GenAI, various studies have cited personal innovativeness as a key factor in understanding the adoption and perceived usefulness of tools such as ChatGPT (Bouteraa et al., 2024; Yusuf et al., 2024). For instance, Bouteraa et al. (2024) found that individuals with higher technological innovativeness are more inclined to explore and experiment with new tools, which can positively influence their perception of usefulness. Similarly, in the environmental domain, Adnan et al. (2024) highlighted the role of AI tools in addressing severe environmental challenges such as pollution and climate change. Although their findings indicate that individuals who are more inclined to explore new technologies are likely to adopt AI solutions to deal with environmental problems, further research is needed to determine whether this predisposition influences the perceived usefulness of GenAI-produced information in this context. Therefore, although there do not appear to be any empirical studies that have directly tested the moderating role of technological innovativeness in the relationship between problem severity and perceived usefulness, it is reasonable to assume that individuals who inherently value GenAI tools may rely less on external cues such as problem severity to assess information usefulness. Whereas less innovative individuals may require a stronger sense of problem severity to perceive information as useful, highly innovative individuals are more likely to find intrinsic usefulness

Table 3
Results of H1 and H2.

Dependent variables	Time	Scenarios		F	p
		Digital newspaper	GenAI		
Awareness of consequences	Initial	5.260	5.259	0.007	0.931
	Final	5.84	5.84	0.015	0.902
Moral obligation	Initial	4.63	4.56	0.040	0.842
	Final	5.04	5.08	0.036	0.851
Attitude toward the problem	Initial	5.67	5.35	2.457	0.120
	Final	5.93	5.70	1.071	0.303

within the technology itself, making severity less influential.

One study that is aligned with this reasoning is that of Pang et al. (2024), who found that technological innovativeness moderated key relationships within the extended technology acceptance model (E-TAM). Technological innovativeness was observed to strengthen the links of relative advantage, image, and result demonstrability with perceived usefulness, as well as between compatibility and perceived ease of use. Their findings suggest that more innovative individuals quickly recognize the benefits of AI-generated information, whereas less innovative individuals rely more on external factors for assessment. Applying these conclusions to the current research, innovative individuals are expected to be more likely to appreciate the advantages of GenAI tools, regardless of the perceived urgency of the environmental problem. In contrast, less innovative individuals are expected to rely more on external cues such as problem severity to evaluate the usefulness of the information. In summary, personal innovativeness is expected to shape how individuals interpret and value AI-generated outputs, reducing the extent to which problem severity influences perceived usefulness. Based on this reasoning, the following hypothesis is proposed.

H5. The effect of message severity on the perceived usefulness of information is lower when an individual is more technologically innovative.

Fig. 2 summarizes the research model for Study 2, which evaluated the influence of perceived problem severity on individuals' awareness of consequences, moral obligation, and attitude toward an environmental problem. It also evaluated the mediating role of perceived usefulness and the moderating role of individual characteristics (i.e., psychological distance to the problem and technological innovativeness).

3.2. Methodology

3.2.1. Study design

A 2 x 2 between-subjects experimental design was developed. Problem severity (severe vs. non-severe) and psychological distance of the environmental problem (close vs. distant) were manipulated to enhance variability in participants' perceptions.

As in Study 1, ChatGPT was used as the GenAI tool, and water scarcity was used as the environmental problem. Problem severity was manipulated through the text provided by ChatGPT. In the severe problem condition, the text presented a more critical scenario. In the non-severe problem condition, the content was largely similar but was adjusted by removing certain words or presenting less extreme figures to lessen the severity (see details in Table 4 and scenarios in Appendix A). Regarding the manipulation of psychological distance, following Shwom et al. (2008), the problem was presented as a national problem. Psychological distance was manipulated using samples from regions that experience the problem differently.

Spain is made up of different regions with very different climates. Whereas northern regions have low temperatures and high rainfall, southern regions experience high summer temperatures and low rainfall. This lack of rainfall is especially pronounced in the southeast of Spain. According to the Spanish Meteorological Agency (AEMET, 2024), the average value of accumulated rainfall in the northern regions from October 1, 2023 to September 24, 2024 was approximately 1200 mm. In contrast, in southern areas, it was approximately 120 mm. These areas are accustomed to drought prevention measures such as water restrictions and awareness campaigns to ensure that water is not wasted. Therefore, two different samples were used to manipulate psychological distance in spatial terms. In the condition of distant, a sample from a Spanish northern area (Asturias) was used. In the condition of close distance, a sample from a Spanish southeastern area (Murcia) was used.

3.2.2. Procedure

The procedure was similar to the procedure for Study 1. Individuals' awareness, moral obligation, and attitude were measured twice (the initial one was measured before the stimulus, and the final one after). Participants also completed an unrelated task (seven differences game) to clear their short-term memory after answering the questions used to measure the dependent variables the first time. Individuals were contacted through an online panel. Data were collected by Netquest, a panel marketing research agency, using a non-random quota sampling method to ensure representativeness by gender and education level (see Table 5). To participate in the study, participants had to (1) be aged between 18 and 27 years (to ensure that they were members of Generation Z) and (2) live in Asturias or Murcia. A total of 241 individuals participated in the study (see Table 5). There were no significant differences between conditions in gender, age, education, or frequency of use of the information source.

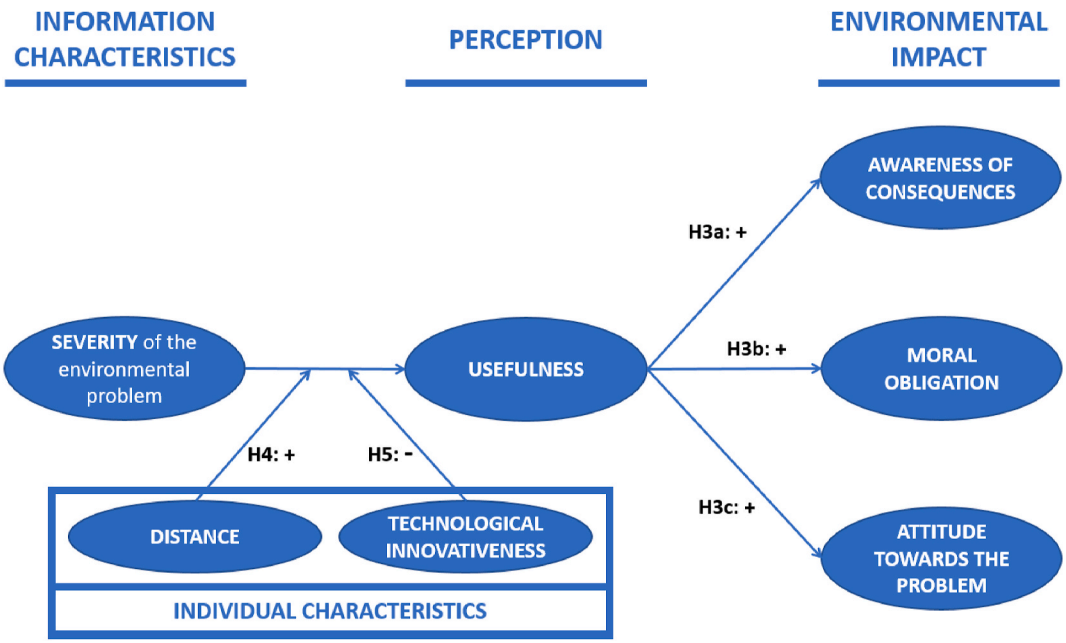

Fig. 2. Research model (Study 2).

Table 4
Message used in the scenarios and problem severity manipulation.

Spain is *the European country/one of the European countries* with the lowest availability of fresh water per inhabitant (1000 cubic meters per year), (*far*) below the UN water scarcity threshold. Currently, Spanish reservoirs are at *10 %/50 %* of their total capacity. Spain experiences periodic droughts, which aggravate water scarcity in many regions. In addition, the demand for water in Spain is high. Therefore, if water is not conserved in the near future, there will be (*serious*) problems such as a lack of availability of water for domestic consumption, a food crisis due to a lack of agricultural production, conflicts and migration to areas where there is less drought, and a significant loss of aquatic and terrestrial biodiversity.

Note: Words in italics were used to manipulate the severity of the problem. The words before the forward slash were used in the severe problem scenario, whereas the words after were used in non-severe problem scenario. Words in italics inside parentheses were only added to the severe problem scenario. The scenarios were presented in Spanish because of participants' nationality.

Table 5
Sample descriptive statistics in Study 2.

Descriptive	Total	Scenarios				Statistic
		Close/non-severe problem	Distant/non-severe problem	Close/severe problem	Distant/severe problem	
N	241	61	60	60	60	
Gender						
Male	49.8 %	49.2 %	50 %	50 %	50 %	$\chi^2 = 2.963^{ns}$
Female	49.8 %	49.2 %	50 %	50 %	50 %	
Non-binary	0.4 %	1,6 %	0 %	0 %	0 %	
Age (mean)	22.8	22.9	22.5	22.6	23.1	$F(3, 237) = 0.558^{ns}$
Education						
Less than high school graduate	4.6 %	3.3 %	6.7 %	5 %	3.3 %	$\chi^2 = 23.238^{ns}$
High school graduate or some college education but no degree	55.2 %	54.1	53.3 %	53.3 %	60 %	
Bachelor's degree	29.8 %	34.5 %	33.3 %	30 %	21.7 %	
Master's degree	10 %	8.2 %	5 %	11.7 %	15 %	
PhD	0.4 %	0 %	0 %	0 %	1.7 %	
Frequency using the source (mean 1–7)	3.86	3.54	3.62	3.95	4.35	$F(3, 237) = 2.234^{ns}$

3.2.3. Measurement

The same scales as in Study 1 were used in Study 2 to measure awareness of consequences (Cronbach's alpha of initial awareness = 0.798; Cronbach's alpha of final awareness = 0.868), moral obligation (Cronbach's alpha of initial moral obligation = 0.829; Cronbach's alpha of final moral obligation = 0.894), and attitude toward the problem (Cronbach's alpha of initial attitude = 0.829; Cronbach's alpha of final attitude = 0.878). Perceived information usefulness was measured using four items from a study by Flavián et al. (2023): Cronbach's alpha = 0.852. Technological innovativeness was measured using six items from a study by Thakur et al. (2016): Cronbach's alpha = 0.866. The three-item scale of problem severity perception presented by Rodriguez-Sanchez and Sarabia-Sanchez (2017) was used as a manipulation check of problem severity: Cronbach's alpha = 0.866. Three items from the scale proposed by Loy and Spence (2020) were used as a manipulation check for psychological distance to the problem: Cronbach's alpha = 0.814. As a control variable, the frequency of use of GenAI was measured on a 7-point scale ranging from 1 (*never*) to 7 (*everyday*). Sociodemographic data were also collected. All measurements in the questionnaire used 7-point scales (see Appendix B).

3.3. Results

The manipulation checks worked as expected. Individuals who saw the message describing a severe problem perceived a higher severity of the problem than individuals who were exposed to a message about a non-severe problem: $M_{severe} = 5.50$, $M_{non\text{-}severe} = 5.18$, $F(3,237) = 3.059$, $p = 0.082$. In addition, individuals from the southeast of Spain perceived the problem as closer than individuals from northern Spain $M_{close} = 3.96$, $M_{distant} = 4.36$, $F(3,237) = 4.353$, $p < 0.05$.

The mediation effects proposed in H3 were tested using PROCESS Model 4 (Hayes, 2022). Following Sicilia et al. (2020), the continuous variable "problem severity" (used as manipulation check) was included in the model. This variable more effectively measured participants' perceptions of problem severity, offering richer data for regression analysis than categorical variable (Hair et al., 2010). Three regressions were performed, one for each dependent variable. Problem severity was the independent variable, information usefulness was the mediator, and the final values (i.e., after the manipulation was applied) for awareness of consequences, moral obligation, and attitude toward the problem were the dependent variables. The initial value of the dependent variables (i.e., prior to the manipulation) and the frequency of use of GenAI were included as control variables. The data in Table 6 show that problem severity had a positive effect on information usefulness. Information usefulness also had a positive effect on the final value of awareness of consequences ($\beta = 0.301$, $p < 0.01$), moral obligation ($\beta = 0.21$, $p < 0.01$), and attitude toward the problem ($\beta = 0.205$, $p < 0.01$). The indirect effects of problem severity on the dependent variables through information usefulness were as follows: DV final awareness of consequences: $\beta' = 0.069$, (0.061/0.175); DV final moral obligation: $\beta' = 0.046$, (0.015/0.091); DV final attitude toward the problem: $\beta' = 0.050$, (0.017/0.095). Thus, H3 is supported.

The moderation effects proposed in H4 and H5 were tested using PROCESS Model 1 (Hayes, 2022). The continuous perceived problem severity variable was the independent variable, information usefulness was the dependent variable, and the continuous psychological distance and technological innovativeness variables were moderators. Two models were tested, one for each moderator. Table 7 shows that psychological distance ($\beta = -0.077$, $p < 0.05$) and technological innovativeness ($\beta = -0.099$, $p < 0.05$) moderated the relationship between problem severity and information usefulness. Specifically, these moderating effects suggest that the effectiveness of the GenAI message is higher: 1) when the environmental problem is perceived as psychologically closer, and (2) for users with lower technological innovativeness.

For a better understanding of the moderation by psychological distance and technological innovativeness, the conditional effects were analyzed at values of the moderator following the recommendations of Preacher et al. (2007). The values of the moderator were its mean plus

Table 6
Results of testing of H3 (direct and indirect effects).

DV final awareness of consequences				
Direct effects	Coefficient	Standard error	*t*	*p*
Problem severity → Information usefulness	0.231	0.049	4.711	0.00
Information usefulness → Final awareness of consequences	0.301	0.051	5.851	0.00
Control effects	**Coefficient**	**Standard error**	**t**	**p**
GenAI use frequency → Information usefulness	0.158	0.034	4.631	0.00
GenAI use frequency → Final awareness of consequences	−0.015	0.028	−0.523	0.60
Initial awareness of consequences → Information usefulness	0.238	0.050	4.744	0.00
Initial awareness of consequences → Final awareness of consequences	0.543	0.042	13.059	0.00
Indirect effect	**Coefficient**	**Standard error**	**Bias-corrected bootstrapped confidence interval**	
Problem severity → Information usefulness → Final awareness of consequences	0.069	0.026	(0.061/0.175)	
DV final moral obligation				
Direct effects	**Coefficient**	**Standard error**	***t***	***p***
Problem severity → Information usefulness	0.213	0.047	4.565	0.00
Information usefulness → Final moral obligation	0.217	0.045	4.814	0.00
Control effects	**Coefficient**	**Standard error**	***t***	***p***
GenAI use frequency → Information usefulness	0.139	0.033	4.220	0.00
GenAI use frequency → Final moral obligation	−0.017	0.0237	−0.698	0.486
Initial moral obligation → Information usefulness	0.335	0.0510	6.586	0.00
Initial moral obligation → Final awareness of consequences	0.744	0.039	19.336	0.00
Indirect effect	**Coefficient**	**Standard error**	**Bias-corrected bootstrapped confidence interval**	
Problem severity → Information usefulness → Final moral obligation	0.046	0.020	(0.015/0.091)	
DV final attitude toward the problem				
Direct effects	**Coefficient**	**Standard error**	***t***	***p***
Problem severity → Information usefulness	0.245	0.050	4.892	0.00
Information usefulness → Final attitude toward the problem	0.205	0.0464	4.422	0.00
Control effects	**Coefficient**	**Standard error**	***t***	***p***
GenAI use frequency → Information usefulness	0.164	0.035	4.728	0.00
GenAI use frequency → Final attitude toward the problem	0.005	0.026	0.183	0.855
Initial attitude toward the problem → Information usefulness	0.207	0.056	3.675	0.00
Initial attitude toward the problem → Final attitude toward the problem	0.597	0.042	14.388	0.00
Indirect effect	**Coefficient**	**Standard error**	**Bias-corrected bootstrapped confidence interval**	
Problem severity → Information usefulness → Final moral obligation	0.050	0.020	(0.017/0.095)	

Table 7
Results of testing of H4 and H5 (conditional effects at values of the moderator).

Path	Values of the moderator (psychological distance)	Effect	*t*	*p*
Problem severity*Psychological distance → Information usefulness		−0.077	−2.728	0.01
Problem severity → Information usefulness	2.64 (close)	0.448	7.029	0.00
	4.16 (medium)	0.332	7.141	0.00
	5.67 (far)	0.216	3.460	0.00
Path	**Values of the moderator (technological innovativeness)**	**Effect**	***t***	***p***
Problem severity*Technological innovativeness → Information usefulness		−0.099	−3.157	0.00
Problem severity → Information usefulness	2.34 (low)	0.478	7.143	0.00
	3.91 (medium)	0.321	6.751	0.00
	5.48 (high)	0.164	2.325	0.02

and minus its standard deviation. Regarding the interaction effect of psychological distance, Table 7 and Fig. 3 show that the effect of problem severity on information usefulness was higher when individuals perceived the problem as close ($\beta_{close} = 0.448$, $p < 0.01$; $\beta_{distant} = 0.216$, $p < 0.05$). Thus, H4 is supported. In addition, problem severity had a greater effect on information usefulness for individuals with low technological innovativeness ($\beta_{low} = 0.478$, $p < 0.01$; $\beta_{high} = 0.164$, $p < 0.05$) (see Fig. 4). Hence, H5 is supported.

4. Discussion and conclusions

This research provides valuable insight into the effectiveness of GenAI (specifically ChatGPT) in shaping environmental perceptions and explores how its influence compares with that of traditional digital newspapers. Exposure to messages about an environmental problem (water scarcity) significantly enhanced participants' awareness of consequences, moral obligation, and attitude toward the problem, regardless of the source. This result underscores the potential of GenAI to foster pro-environmental perceptions. Furthermore, the exploration of ChatGPT in Study 2 revealed that emphasizing problem severity enhanced the perceived usefulness of information, which is crucial in shaping these perceptions. The observed moderating effects of individual characteristics (psychological distance and technological innovativeness) in this relationship highlight the importance of using tailored

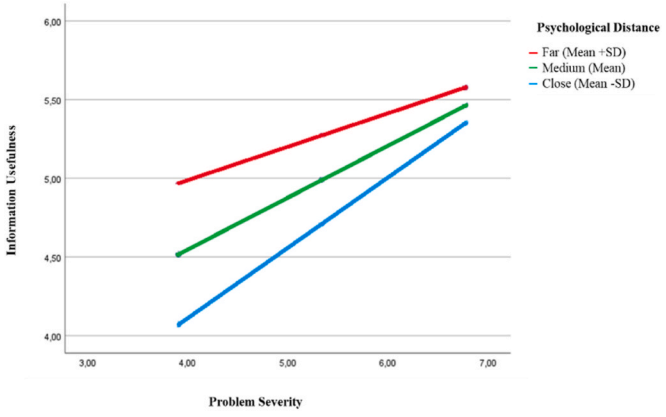

Fig. 3. Conditional effect of problem severity on information usefulness at values of psychological distance.

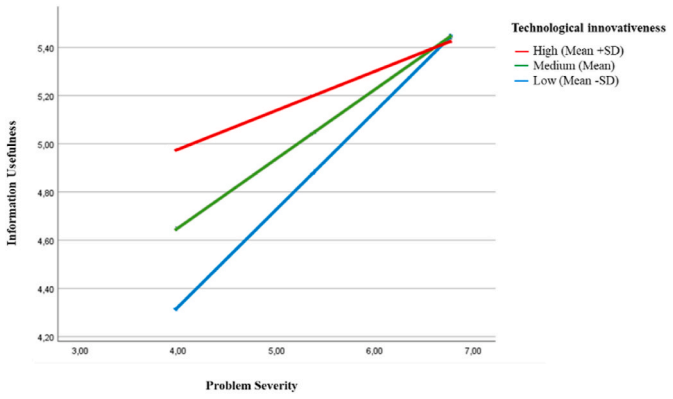

Fig. 4. Conditional effect of problem severity on information usefulness at values of technological innovativeness.

communication strategies.

Consistent with previous research on loss-framed messaging (e.g., Liang et al., 2017), exposure to messages about water scarcity significantly increased participants' awareness of consequences, moral obligation, and attitude toward the problem, supporting H1. This finding highlights the effectiveness of loss-framed communication in emphasizing the negative consequences of inaction, consistent with prospect theory (Tversky & Kahneman, 1992). Specifically, targeting individuals' sensitivity to potential losses through environmental messages that emphasize negative outcomes proves effective. This strategy is not observed to be an inhibitor that paralyzes individuals due to the excess of negative emotions such as fear, as suggested in some studies (e.g., Bilandzic et al., 2017).

Contrary to expectations, no significant differences were found between ChatGPT and digital newspapers in terms of their impact on the environmental perceptions under study, leading to the rejection of H2. It was hypothesized that because digital newspapers are traditional sources with human authorship, they would have higher perceived credibility and would therefore exert a stronger effect (Jia et al., 2024). In reality, the lack of significant differences may reflect shifting perceptions of the trustworthiness of digital information. This finding is in line with previous studies that have shown that ChatGPT can be perceived as equally competent and trustworthy as human-authored content, particularly when the information is neutral or factual (e.g., Huschens et al., 2023).

This finding is also aligned with the control question about source credibility, with no significant differences in credibility ratings between the two sources. One possible explanation for these findings is the demographic profile of the participants (i.e., individuals aged 18–27 years old). Younger generations are known for their comfort with digital tools (Culp-Roche et al., 2020). Hence, they may perceive ChatGPT as an efficient and accessible source of information, reducing the importance of traditional credibility markers (McClain, 2024). Their familiarity with AI tools probably reduces skepticism toward GenAI content, particularly when presented clearly and factually, as in this study. This reasoning is aligned with research indicating that younger audiences increasingly rely on fast, interactive, and user-friendly tools such as ChatGPT for information retrieval (Aminah et al., 2023; Marquis et al., 2024). However, this reliance highlights the need to foster critical evaluation skills because GenAI remains susceptible to bias and misinformation (Dwivedi et al., 2023).

Furthermore, this research delves into the mechanisms through which environmental messages generated by AI (ChatGPT) influence pro-environmental outcomes. The perceived severity of environmental problems positively affected awareness of consequences, moral obligation, and attitude toward the problem, under mediation by perceived information usefulness. These results support H3. This finding is aligned with prior research in risk and health communication (e.g., Huang et al., 2024; McDowell et al., 2021), which shows that problem severity enhances the perceived usefulness of information. Emphasizing the urgency and seriousness of environmental problems can increase the involvement of individuals by enhancing the motivational salience of the issue (Sarabia-Sánchez et al., 2014). This process captures attention, triggers deeper cognitive processing (Lu & Qiu, 2024), and can lead individuals to view information as more valuable. However, this relationship appears not to be consistent because it is influenced by individual factors. This finding is aligned with those of recent studies of GenAI tools such as ChatGPT, which highlight the potential of personalizing messages to match recipients' psychological profiles and thus significantly enhance their persuasiveness (Matz et al., 2024).

Specifically, psychological distance moderated the effect of problem severity on information usefulness, supporting H4. When participants perceived the environmental problem as being closer in distance, the severity of the problem had a stronger impact on information usefulness. This finding is aligned with construal level theory (Trope & Liberman, 2003), which suggests that close events are interpreted in more concrete and personally relevant terms, thereby enhancing their perceived importance and usefulness. As highlighted by research in risk communication (e.g., Van der Linden, 2014), personal experience with an environmental problem plays a key role in increasing engagement with that problem.

Finally, technological innovativeness moderated the relationship between problem severity and information usefulness, supporting H5. The findings indicate that highly innovative individuals are less likely to rely on the perceived severity of a problem as a heuristic for evaluating the usefulness of content (Bouteraa et al., 2024). This tendency may be due to their inherent curiosity and adaptability to emerging technologies (Thakur et al., 2016). These characteristics predispose them to perceive GenAI tools such as ChatGPT as more credible sources of information. The literature on innovation diffusion theory (Rogers, 1995) explains that early technology adopters are more willing to experiment with novel tools (e.g., Catalini & Tucker, 2017). This willingness might explain why this segment is influenced by ChatGPT's potential more than by contextual factors. Hence, highly innovative individuals may be more predisposed to trust and engage with GenAI tools such as ChatGPT, as observed in prior research on technology acceptance models (Pang et al., 2024). However, for less innovative individuals, the strength with which message framing emphasizes urgency or negative consequences seems to be more important in shaping their perceptions of the usefulness of information from ChatGPT. This finding is aligned with studies showing that individuals with lower technological literacy often need stronger external motivators to engage with digital tools or content (Yu et al., 2017). Beyond individual-level factors, recent empirical research suggests that rigid digital strategies can limit the capacity of AI to deliver social and environmental value, emphasizing the importance of context-sensitive and flexible approaches to GenAI implementation (Torrent-Sellens et al., 2025).

4.1. Theoretical implications

The theoretical implications of this research are especially relevant given the growing presence of AI technologies in everyday communication, since it proposes a novel framework that links message and user characteristics to explain how GenAI content shapes pro-environmental perceptions. By extending established psychological theories to a new technological context, the research lays the groundwork for future studies on the communicative and ethical dimensions of AI-generated information.

This contribution goes beyond existing theoretical proposals (e.g., Belanche, Belk, et al., 2024; Dwivedi et al., 2023) and GenAI adoption studies (e.g., Arce-Urriza et al., 2025; Fakfare et al., 2025) that dominate this emerging field of inquiry. Instead, it addresses the call for a deeper understanding of how GenAI-produced content influences individuals' behavior (Gupta et al., 2024). Specifically, it empirically confirms that,

among Generation Z users, exposure to information provided by GenAI affects their awareness of consequences, moral obligation, and attitude toward an environmental problem. This finding is in line with and extends previous studies in a commercial context (e.g., Akdim & Casaló, 2023; Flavián et al., 2023) that suggest that consumers are affected by product or service recommendations by GenAI. This finding also confirms previous theoretical proposals suggesting that AI may improve individual pro-environmental behaviors (Nishant et al., 2020). This research not only confirms this influence but also shows that it is similar to the influence of a traditional information source such as a digital newspaper. This finding is aligned with those of Flavián et al. (2023) in a commercial context, where AI-based recommendations were found to influence consumer behavioral intentions at least as much as human recommendations in the form of online reviews.

Another important theoretical implication lies in identifying perceived usefulness as the mechanism that explains the impact of GenAI-produced information on users' pro-environmental outcomes. This finding regarding the role of perceived usefulness is consistent with the existing literature. Perceived usefulness has generally been considered a crucial variable in the context of new technology use, and it is the most influential belief affecting behavior (e.g., Bhattacherjee, 2001). This research also confirms that perceived usefulness plays a vital role in a new context (communication of environmental problems) in order to understand the impact of GenAI-produced information on users' attitudes and perceptions. More specifically, the perceived usefulness of information has been proposed as one of the major benefits of GenAI. As Puntoni et al. (2021) noted, AI can provide users with relevant and accurate content according to their specific needs. In other words, it can provide more useful information, which may explain its adoption, as suggested by the findings of this research.

Finally, the study shows that informational characteristics, specifically perceived problem severity, affect individuals' levels of awareness of consequences, moral obligation, and attitude toward the problem through the perceived usefulness of information. This finding is unsurprising given the prominent role of perceived problem severity in risk communication and perception (e.g., Rodriguez-Sanchez & Sarabia-Sanchez, 2017). Indeed, perceived severity makes individuals value information about a problem as useful, subsequently fostering preventive behaviors (e.g., Rosenstock, 2005). Similarly, this research also underscores the moderating effects of individual-related variables, which can be used to identify the individuals who are most affected by GenAI and the situations where this influence is greatest. For instance, this research confirms that personal traits (i.e., technological innovativeness) and individual contextual factors (i.e., psychological distance to the problem) both play a moderating role in this context. This moderating role echoes those reported in widely cited studies of consumer behavior and technology adoption (e.g., Dabholkar & Bagozzi, 2002; Sun & Zhang, 2006).

4.2. Managerial implications

From a practical perspective, several implications arise from these findings and suggest that, while GenAI has the potential to be a transformative environmental education and communication tool, its integration must be guided by strategic tailoring, ethical safeguards, and evidence-based program design. More specifically, we offer meaningful actions for three key actors seeking to leverage GenAI in environmental communication and education: educators, policymakers, and AI developers.

First, focusing on educators, the findings indicate that GenAI can serve as an effective tool to enhance environmental awareness among Gen Z students. Given that GenAI has been shown to exert a pro-environmental impact on Generation Z users, it could be integrated into high school and university programs in environmental education. For example, to promote critical thinking about AI-generated content, classroom activities could imply student's interaction with GenAI to generate and evaluate GenAI outputs about specific environment issues. Similarly, GenAI could be used to simulate environmental scenarios (e.g., "What would happen if global average temperatures rose by 2 °C?"). However, in order to maximize its impact, the content delivered by GenAI systems should emphasize locally relevant and severe environmental problems, which were shown to trigger stronger reactions. For example, educational prompts could be customized to highlight flooding risks in Mediterranean regions or Arctic melting in northern countries. These contextualized narratives are more likely to resonate emotionally and cognitively among students, increasing their engagement and the likelihood of behavioral change (e.g., Collado et al., 2017; Escario et al., 2020).

Importantly, these initiatives should particularly focus on students with low technological innovativeness, who our findings suggest are more sensitive to the framing and content of AI-generated messages. In contrast, highly innovative students, who already use GenAI as an information source in general, could be employed in novel "peer mentoring programs" where they could act as peer facilitators or digital ambassadors to support and mentor others in the correct use of GenAI and make a better use of the AI-generated content.

For policymakers, our results underline the potential of GenAI as a scalable and cost-effective tool to promote environmental literacy. However, policymakers should consider applying GenAI not only for education but also to other contexts such as public risk communication, especially in areas vulnerable to climate-related disasters. These programs could contribute to make citizens more prepared and better respond in crisis scenarios such as pandemics, wildfires, earthquakes, or extreme weather events (e.g., tsunamis …). In parallel, regulatory bodies must prioritize the ethical governance of GenAI systems, especially given their persuasive power. Dwivedi et al. (2023) also suggest that there is a risk of intentional misuse such as producing fake news or spreading disinformation. This intentional misuse can be used to manipulate individuals' perceptions (in the present case, perceptions about environmental problems). Therefore, even though some voices argue that regulations may discourage the development and use of GenAI, there is a strong case for the need to regulate these tools effectively. Also, users often take GenAI outputs at face value (even erroneous responses), which could have harmful consequences (Christensen et al., 2025) and magnifies the risks of misinformation (e.g., Dwivedi et al., 2023). To counteract this, developers and regulators should work together to implement transparency protocols, bias-detection audits, and certification schemes that ensure GenAI tools used in education and public communication are trustworthy and evidence-based (Dwivedi et al., 2023; Christensen et al., 2025).

Finally, for AI developers, the focus should be placed on the training of GenAI because "generative AI's outputs will only be as good as the training data on which its learning was based" (Dwivedi et al., 2023, p. 40). This will also serve to minimize the unintentional propagation of false information and avoid biases (Puntoni et al., 2021). We also suggest integrating interface features to flag uncertainty levels in GenAI responses (e.g., "This information is based on climate projections with medium scientific certainty") and prioritize verified environmental data over speculative responses. This would help users distinguish between factual information and speculative content, increasing their awareness of potential biases or limitations. This is particularly relevant when dealing with sensitive topics such as climate change, where there is a sense of urgency, but scientific accuracy is also needed. In addition, it would be interesting if AI systems could be developed to tailor environmental content dynamically based on users' geography to show, as aforementioned, locally important environmental issues.

4.3. Limitations and future research

Future studies should address certain limitations. First, this research used a sample of young Spanish people. Therefore, the findings may not be generalizable to other countries or age groups, particularly those with

less familiarity or trust in AI-generated content. Future studies could replicate this research using samples from different countries and older individuals. Second, experiments have advantages such as isolating the effect of independent variables on dependent variables through the manipulation of independent variables. However, they also have disadvantages. For instance, this research was not conducted in a real-life environment. Individuals did not really perform a query using GenAI chat. Instead, they were asked to imagine what they were looking for and the answer was displayed. This aspect may have altered the realism of the research. Future research should analyze the effect of GenAI answers when individuals interact directly with a GenAI chat tool. Third, the research focused on a specific environmental problem, namely water scarcity. On the one hand, while this limits generalizability, it allows for conceptual clarity, as prior research shows that communication drivers and behavioral motivators vary by environmental issue (e.g., Rodriguez-Sanchez, 2023). Water scarcity was selected due to its global relevance, but we encourage future research to explore other environmental contexts. On the other hand, the prior values of individuals' awareness of the consequences, moral obligation, and attitude toward water scarcity were generally high, as reflected by the averages in Study 1. Thus, it would be of interest to replicate the study using an environmental problem where the initial values for awareness of consequences, moral obligation, and attitude were low. This initially low baseline could provide insight into whether GenAI helps raise awareness of environmental problems where such awareness is limited. Fourth, future research should explore why no significant differences in credibility were observed, focusing on underlying factors such as digital literacy, prior AI exposure, and cognitive processing mechanisms (Ou et al., 2024). Finally, we would like to note that future research may also consider the role of perceived AI explainability, transparency, hallucinations or potential bias in GenAI-generated content. Taking into account the increasing public awareness of issues like algorithmic bias or hallucinated outputs (e.g., Belanche, Casaló, & Flavián, 2024), it is essential to investigate how these perceptions influence trust in GenAI-generated content, credibility of GenAI as an information source, and ultimately users' behavioral responses.

CRediT authorship contribution statement

Carla Rodriguez-Sanchez: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Franco Manuel Sancho-Esper:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Luis Vicente Casaló:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Manuela López:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration on the use of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used ChatGPT to improve English language quality and address writing-related issues such as grammar, clarity, and style. After using this tool, the author(s) carefully reviewed and edited the content as needed and take full responsibility for the content of this publication.

Declaration of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.techsoc.2025.103036.

Data availability

The authors do not have permission to share data.

References

Abrahamse, W., & Matthies, E. (2018). Changing knowledge, awareness, and attitudes. In L. Steg, & J. I. M. de Groot (Eds.), *Environmental psychology: An introduction* (2nd ed.). Wiley. https://doi.org/10.1002/9781119241072.ch26 (Chapter 26)).

Adnan, M., Xiao, B., Ali, M. U., Bibi, S., Yu, H., Xiao, P., … An, X. (2024). Human inventions and its environmental challenges, especially artificial intelligence: New challenges require new thinking. *Environmental Challenges*. , Article 100976. https://doi.org/10.1016/j.envc.2024.100976

AEMET. (2024). El año hidrológico 2023-2024 deja una distribución desigual de las lluvias en España. Retrieved from https://www.aemet.es/es/noticias/2024/10/hidrologico23_24. (Accessed 27 March 2025).

Agarwal, R., & Prasad, J. (1998). A conceptual and operational definition of personal innovativeness in the domain of information technology. *Information Systems Research, 9*(2), 204–215. https://doi.org/10.1287/isre.9.2.204

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

Akdim, K., & Casaló, L. V. (2023). Perceived value of AI-based recommendations service: The case of voice assistants. *Service Business, 17*(1), 81–112. https://doi.org/10.1007/s11628-023-00527-x

Albahri, A. S., Khaleel, Y. L., Habeeb, M. A., Ismael, R. D., Hameed, Q. A., Deveci, M., Homod, R. Z., Albahri, O. S., Alamoodi, A. H., & Alzubaidi, L. (2024). A systematic review of trustworthy artificial intelligence applications in natural disasters. *Computers & Electrical Engineering, 118*(Part B), Article 109409. https://doi.org/10.1016/j.compeleceng.2024.109409

Aljarah, A., Ibrahim, B., & López, M. (2024). In AI, we do not trust! The nexus between awareness of falsity in AI-generated CSR ads and online brand engagement. *Internet Research*. https://doi.org/10.1108/INTR-12-2023-1156. *ahead-of-print*(ahead-of-print).

Aminah, S., Hidayah, N., & Ramli, M. (2023). Considering ChatGPT to be the first aid for young adults on mental health issues. *Journal of Public Health, 45*(3), e615–e616. https://doi.org/10.1093/pubmed/fdad065

Arango, L., Singaraju, S. P., & Niininen, O. (2023). Consumer responses to AI-generated charitable giving ads. *Journal of Advertising, 52*(4), 486–503. https://doi.org/10.1080/00913367.2023.2183285

Arce-Urriza, M., Chocarro, R., Cortiñas, M., & Marcos-Matás, G. (2025). From familiarity to acceptance: The impact of Generative Artificial Intelligence on consumer adoption of retail chatbots. *Journal of Retailing and Consumer Services, 84*, Article 104234. https://doi.org/10.1016/j.jretconser.2025.104234

Balžekienė, A., Echavarren, J. M., & Telešienė, A. (2024). The effect of proximity on risk perception: A systematic literature review. *Current Sociology, 0*(0). https://doi.org/10.1177/00113921241250047

Belanche, D., Belk, R. W., Casaló, L. V., & Flavián, C. (2024). The dark side of artificial intelligence in services. *Service Industries Journal, 44*(3–4), 149–172. https://doi.org/10.1080/02642069.2024.2305451

Belanche, D., Casaló, L. V., & Flavián, C. (2024). Alucinación de la Inteligencia Artificial y sus efectos negativos para el usuario de servicios basados en IA Generativa. *XXXV Congreso Internacional de Marketing AEMARK 2024, Cuenca (Spain)*, 11–13. September 2024.

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly, 25*(3), 351–370. https://doi.org/10.2307/3250921

Bilandzic, H., Kalch, A., & Soentgen, J. (2017). Effects of goal framing and emotions on perceived threat and willingness to sacrifice for climate change. *Science Communication, 39*(4), 466–491. https://doi.org/10.1177/1075547017718553

Bouteraa, M., Chekima, B., Thurasamy, R., Bin-Nashwan, S. A., Al-Daihani, M., Baddou, A., … Ansar, R. (2024). Open innovation in the financial sector: A mixed-methods approach to assess bankers' willingness to embrace open-AI ChatGPT. *Journal of Open Innovation: Technology, Market, and Complexity, 10*(1), Article 100216. https://doi.org/10.1016/j.joitmc.2024.100216

Boykoff, M. T., & Yulsman, T. (2013). Political economy, media, and climate change: Sinews of modern life. *WIREs Climate Change, 4*(5), 359–371. https://doi.org/10.1002/wcc.233

Cao, F., & Jian, Y. (2024). The Role of integrating AI and VR in fostering environmental awareness and enhancing activism among college students. *Science of the Total Environment, 908*, Article 168200. https://doi.org/10.1016/j.scitotenv.2023.168200

Casado-Díaz, A. B., Sancho-Esper, F., Rodriguez-Sanchez, C., & Sellers-Rubio, R. (2022). Tourists' water conservation behavior in hotels: The role of gender. *Journal of Sustainable Tourism, 30*(7), 1518–1538. https://doi.org/10.1080/09669582.2020.1839758

Catalini, C., & Tucker, C. (2017). When early adopters don't adopt. *Science, 357*(6347), 135–136. https://doi.org/10.1126/science.aal4476

Chang, H., Zhang, L., & Xie, G.-X. (2015). Message framing in green advertising: The effect of construal level and consumer environmental concern. *International Journal of Advertising, 34*(1), 158–176. https://doi.org/10.1080/02650487.2014.994731

Christensen, J., Hansen, J. M., & Wilson, P. (2025). Understanding the role and impact of Generative Artificial Intelligence (AI) hallucination within consumers' tourism decision-making processes. *Current Issues in Tourism, 28*(4), 545–560. https://doi.org/10.1080/13683500.2023.2300032

Chung, C. H., Chiu, D. K., Ho, K. K., & Au, C. H. (2020). Applying social media to environmental education: Is it more impactful than traditional media. *?. Information Discovery and Delivery, 48*(4), 255–266. https://doi.org/10.1108/IDD-04-2020-0047

Collado, S., Staats, H., Corraliza, J. A., & Hartig, T. (2017). Restorative environments and health. In O. Navarro, G. Fleury-Bahi, & E. Pol (Eds.), *Handbook of environmental psychology and quality of life research* (pp. 127–148). New York: Springer. https://doi.org/10.1007/978-3-319-31416-7_7.

Craig, C. A., & Allen, M. W. (2014). Enhanced understanding of energy ratepayers: Factors influencing perceptions of government energy efficiency subsidies and utility alternative energy use. *Energy Policy, 66*, 224–233. https://doi.org/10.1016/j.enpol.2013.10.074

Culp-Roche, A., Hampton, D., Hensley, A., Wilson, J., Thaxton-Wiggins, A., Otts, J. A., Fruh, S., & Moser, D. K. (2020). Generational differences in faculty and student comfort with technology use. *SAGE Open Nursing, 6*, 1–6. https://doi.org/10.1177/2377960820941394

Dabholkar, P. A., & Bagozzi, R. P. (2002). An attitudinal model of technology-based self-service: Moderating effects of consumer traits and situational factors. *Journal of the Academy of Marketing Science, 30*, 184–201. https://doi.org/10.1177/0092070302303001

Dwivedi, Y. K., Hughes, L., Kar, A. K., Baabdullah, A. M., Grover, P., Abbas, R., … Wade, M. (2022). Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action. *International Journal of Information Management, 63*, Article 102456. https://doi.org/10.1016/j.ijinfomgt.2021.102456

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management, 71*, Article 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642

Dwivedi, Y. K., Pandey, N., Currie, W., & Micu, A. (2024). Leveraging ChatGPT and other generative artificial intelligence (AI)-based applications in the hospitality and tourism industry: Practices, challenges and research agenda. *International Journal of Contemporary Hospitality Management, 36*(1), 1–12. https://doi.org/10.1108/IJCHM-05-2023-0686

Escario, J. J., Rodriguez-Sanchez, C., & Casaló, L. V. (2020). The influence of environmental attitudes and perceived effectiveness on recycling, reducing, and reusing packaging materials in Spain. *Waste Management, 113*, 251–260. https://doi.org/10.1016/j.wasman.2020.05.043

Fakfare, P., Manosuthi, N., Lee, J. S., Han, H., & Jin, M. (2025). Customer word-of-mouth for generative AI: Innovation and adoption in hospitality and tourism. *International Journal of Hospitality Management, 126*, Article 104070. https://doi.org/10.1016/j.ijhm.2024.104070

Flavián, C., Akdim, K., & Casaló, L. V. (2023). Effects of voice assistant recommendations on consumer behavior. *Psychology and Marketing, 40*(2), 328–346. https://doi.org/10.1002/mar.21765

Fletcher, R., & Nielsen, R. K. (2024). What does the public in six countries think of generative AI in news? *Reuters Institute*. Retrieved from https://reutersinstitute.politics.ox.ac.uk/what-does-public-six-countries-think-generative-ai-news. (Accessed 27 March 2025).

Gregory, G. D., & Di Leo, M. (2003). Repeated behavior and environmental psychology: The role of personal involvement and habit formation in explaining water consumption. *Journal of Applied Social Psychology, 33*(6), 1261–1296. https://doi.org/10.1111/j.1559-1816.2003.tb01949.x

Gupta, R., Nair, K., Mishra, M., Ibrahim, B., & Bhardwaj, S. (2024). Adoption and impacts of generative artificial intelligence: Theoretical underpinnings and research agenda. *International Journal of Information Management Data Insights, 4*(1), Article 100232. https://doi.org/10.1016/j.jjimei.2024.100232

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis*. New York: Pearson Prentice Hall.

Hayes, A. F. (2022). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (3rd ed.). New York: Guilford Publications.

He, X., Ye, C., Huang, S. S., & Su, L. (2024). The "green persuasion effect" of negative messages: How and when message framing influences tourists' environmentally responsible behavior. *Journal of Travel Research*, 1–19. https://doi.org/10.1177/00472875241289571

Hofeditz, L., Mirbabaie, M., Holstein, J., & Stieglitz, S. (2021). Do you trust an AIjournalist? A credibility analysis of news content with AI-authorship" (2021). *ECIS 2021 Research Papers, 50*. Retrieved from https://aisel.aisnet.org/ecis2021_rp/50. (Accessed 27 March 2025).

Homar, A. R., & Cvelbar, L. K. (2021). The effects of framing on environmental decisions: A systematic literature review. *Ecological Economics, 183*, Article 106950. https://doi.org/10.1016/j.ecolecon.2021.106950

Homer, P. M., & Kahle, L. R. (1988). A structural equation test of the value-attitude-behavior hierarchy. *Journal of Personality and Social Psychology, 54*(4), 638–646. https://doi.org/10.1037/0022-3514.54.4.638

Huang, Y. J., Lee, P. H., Hsieh, S. H., Chiu, Y. C., & Chan, T. C. (2024). Understanding factors influencing adoption of air pollution protective measures using the knowledge-attitude-behavior model. *Nature Scientific Reports, 14*(1), Article 28414. https://doi.org/10.1038/s41598-024-79905-y

Hurst, K., & Stern, M. J. (2020). Messaging for environmental action: The role of moral framing and message source. *Journal of Environmental Psychology, 68*, Article 101394. https://doi.org/10.1016/j.jenvp.2020.101394

Huschens, M., Briesch, M., Sobania, D., & Rothlauf, F. (2023). Do you trust ChatGPT?–perceived credibility of human and AI-generated content. *arXiv preprint arXiv: 2309.02524*. Retrieved from https://arxiv.org/abs/2309.02524. (Accessed 27 March 2025).

Jeon, J., Kim, L., & Park, J. (2025). The ethics of generative AI in social science research: A qualitative approach for institutionally grounded AI research ethics. *Technology in Society*. , Article 102836. https://doi.org/10.1016/j.techsoc.2025.102836

Jia, H., Appelman, A., Wu, M., & Bien-Aimé, S. (2024). News bylines and perceived AI authorship: Effects on source and message credibility. *Computers in Human Behavior: Artificial Humans, 2*(2), Article 100093. https://doi.org/10.1016/j.chbah.2024.100093

Kang, J., & Hong, J. H. (2021). Framing effect of environmental cost information on environmental awareness among high school students. *Environmental Education Research, 27*(6), 936–953. https://doi.org/10.1080/13504622.2021.1928607

Kidd, L. R., Garrard, G. E., Bekessy, S. A., Mills, M., Camilleri, A. R., Fidler, F., … Adams, V. M. (2019). Messaging matters: A systematic review of the conservation messaging literature. *Biological Conservation, 236*, 92–99. https://doi.org/10.1016/j.biocon.2019.05.020

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research, 8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Kreps, S., McCain, R. M., & Brundage, M. (2022). All the news that's fit to fabricate: AI-generated text as a tool of media misinformation. *Journal of Experimental Political Science, 9*(1), 104–117. https://doi.org/10.1017/XPS.2020.37

Kumkale, G. T., Albarracín, D., & Seignourel, P. J. (2010). The effects of source credibility in the presence or absence of prior attitudes: Implications for the design of persuasive communication campaigns. *Journal of Applied Social Psychology, 40*(6), 1325–1356. https://doi.org/10.1111/j.1559-1816.2010.00620.x

Kusmanoff, A. M., Fidler, F., Gordon, A., Garrard, G. E., & Bekessy, S. A. (2020). Five lessons to guide more effective biodiversity conservation message framing. *Conservation Biology, 34*(5), 1131–1141. https://doi.org/10.1111/cobi.13482

Lee-Kan, S. M., Bravo, N., Hogan, C., Filipowicz, A., & Shamma, D. A. (2024). *Assessing and enhancing the perceived utility of sustainable driving information. Osf* Retrieved from. https://osf.io/w9cpq/download/?format=pdf. (Accessed 27 March 2025).

Li, X., Jiang, Y., & Mostafavi, A. (2023). AI-Assisted protective action: Study of ChatGPT as an information source for a population facing climate hazards. arXiv preprint. Retrieved from https://doi.org/10.48550/arXiv.2304.06124. (Accessed 27 March 2025).

Liang, Y. J., Henderson, L. K., & Kee, K. F. (2017). Running out of water! Developing a message typology and evaluating message effects on attitude toward water conservation. *Environmental Communication, 11*(6), 818–835. https://doi.org/10.1080/17524032.2017.1288648

Lindenfeld, L. A., Hall, D. M., McGreavy, B., Silka, L., & Hart, D. (2012). Creating a place for environmental communication research in sustainability science. *Environmental Communication, 6*(1), 23–43. https://doi.org/10.1080/17524032.2011.640702

Loy, L. S., & Spence, A. (2020). Reducing, and bridging, the psychological distance of climate change. *Journal of Environmental Psychology, 67*, Article 101388. https://doi.org/10.1016/j.jenvp.2020.101388. Citas: 133.

Lu, Y., & Qiu, J. (2024). Influence of severity and susceptibility information content on users' psychological response in emergencies—the moderating effect of regulatory focus. *Basic and Applied Social Psychology, 46*(4), 266–284. https://doi.org/10.1080/01973533.2024.2352538

Marquis, Y. A., Oladoyinbo, T. O., Olabanji, S. O., Olaniyi, O. O., & Ajayi, S. A. (2024). Proliferation of AI tools: A multifaceted evaluation of user perceptions and emerging trends. *Asian Journal of Advanced Research and Reports, 18*(1), 30–55.

Matz, S. C., Teeny, J. D., Vaid, S. S., Peters, H., Harari, G. M., & Cerf, M. (2024). The potential of generative AI for personalized persuasion at scale. *Nature Scientific Reports, 14*(4692). https://doi.org/10.1038/s41598-024-53755-0

McClain, C. (2024). *Americans' use of ChatGPT is ticking up, but few trust its election information*. Pew Research Center. Retrieved from https://www.pewresearch.org/short-reads/2024/03/26/americans-use-of-chatgpt-is-ticking-up-but-few-trust-its-election-information/. (Accessed 27 March 2025).

McDowell, C. P., Andrade, L., Re, V., O'Dwyer, J., Hynds, P. D., & O'Neill, E. (2021). Exploring risk perception and behaviours at the intersection of flood events and private groundwater supplies: A qualitative focus group study. *Water, 13*(23), 3467. https://doi.org/10.3390/w13233467

McGovern, A., Demuth, J., Bostrom, A., Wirz, C. D., Tissot, P. E., Cains, M. G., & Musgrave, K. D. (2024). The value of convergence research for developing trustworthy AI for weather, climate, and ocean hazards. *Npj Natural Hazards, 1*. https://doi.org/10.1038/s44184-024-00013-w. Article 13.

Melo, M. F. (2024). *Dónde será mayor el estrés hídrico en 2050*. Statista. Retrieved from https://es.statista.com/grafico/31943/relacion-proyectada-entre-la-demanda-y-la-disponibilidad-de-agua–nivel-de-estres-hidrico-/. (Accessed 27 March 2025).

Meyers-Levy, J., & Maheswaran, D. (2004). Exploring message framing outcomes when systematic, heuristic, or both types of processing occur. *Journal of Consumer Psychology, 14*(1–2), 159–167. https://doi.org/10.1207/s15327663jcp1401&2_18

Milmo, D. (2023). ChatGPT reaches 100 million users two months after launch. *The Guardian*. Retrieved from https://www.theguardian.com/technology/2023/feb/02/chatgpt-100-million-users-open-ai-fastest-growing-app. (Accessed 27 March 2025).

Mogaji, E., & Jain, V. (2024). How generative AI is (will) change consumer behaviour: Postulating the potential impact and implications for research, practice, and policy. *Journal of Consumer Behaviour, 23*(5), 2379–2389. https://doi.org/10.1002/cb.2345

Ngo, C. C., Poortvliet, P. M., & Klerkx, L. (2022). The persuasiveness of gain vs. loss framed messages on farmers' perceptions and decisions to climate change: A case study in coastal communities of vietnam. *Climate Risk Management, 35*, Article 100409. https://doi.org/10.1016/j.crm.2022.100409

Nishant, R., Kennedy, M., & Corbett, J. (2020). Artificial intelligence for sustainability: Challenges, opportunities, and a research agenda. *International Journal of Information Management, 53*, Article 102104. https://doi.org/10.1016/j.ijinfomgt.2020.102104

Ou, M., Zheng, H., & Hansen, P. (2024). Trust it or not: Understanding users' motivations and strategies for assessing the credibility of AI-generated information. *New Media & Society*, 1–23. https://doi.org/10.1177/14614448241293154

Oviedo-Trespalacios, O., Peden, A. E., Cole-Hunter, T., Costantini, A., Haghani, M., Rod, J. E., … Reniers, G. (2023). The risks of using ChatGPT to obtain common safety-related information and advice. *Safety Science, 167*, Article 106244. https://doi.org/10.1016/j.ssci.2023.106244

Pan, S. L., Carter, L., Tim, Y., & Sandeep, M. S. (2022). Digital sustainability, climate change, and information systems solutions: Opportunities for future research. *International Journal of Information Management, 63*, Article 102444. https://doi.org/10.1016/j.ijinfomgt.2021.102444

Pan, S. L., & Nishant, R. (2023). Artificial intelligence for digital sustainability: An insight into domain-specific research and future directions. *International Journal of Information Management, 72*, Article 102668. https://doi.org/10.1016/j.ijinfomgt.2023.102668

Pang, Q., Zhang, M., Yuen, K. F., & Fang, M. (2024). When the winds of change blow: An empirical investigation of ChatGPT's usage behaviour. *Technology Analysis & Strategic Management*, 1–15. https://doi.org/10.1080/09537325.2024.2394783

Park, J., Oh, C., & Kim, H. Y. (2024). AI vs. human-generated content and accounts on Instagram: User preferences, evaluations, and ethical considerations. *Technology in Society, 79*, Article 102705. https://doi.org/10.1016/j.techsoc.2024.102705

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in Experimental Social Psychology, 19*, 123–205. https://doi.org/10.1016/S0065-2601(08)60214-2

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*(1), 185–227. https://doi.org/10.1080/00273170701341316

Puntoni, S., Reczek, R. W., Giesler, M., & Botti, S. (2021). Consumers and artificial intelligence: An experiential perspective. *Journal of Marketing, 85*(1), 131–151. https://doi.org/10.1177/0022242920953847

Rodriguez-Sanchez, C. (2023). The role of social marketing in achieving the planet sustainable development goals (SDGs). *International Review on Public and Nonprofit Marketing, 20*(3), 559–571. https://doi.org/10.1007/s12208-023-00385-3

Rodriguez-Sanchez, C., & Sarabia-Sanchez, F. J. (2017). Perceived risk of urban water consumption: Scale development, validation and characterisation in Spain. *Urban Water Journal, 14*(4), 354–360. https://doi.org/10.1080/1573062X.2017.1301503

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

Rosenstock, I. M. (2005). Why people use health services. *The Milbank Quarterly, 83*(4). https://doi.org/10.1111/j.1468-0009.2005.00425.x

Sarabia-Sánchez, F. J., Rodríguez-Sánchez, C., & Hyder, A. (2014). The role of personal involvement, credibility, and efficacy of conduct in reported water conservation behaviour. *Journal of Environmental Psychology, 38*, 206–216. https://doi.org/10.1016/j.jenvp.2014.02.003

Sheng, X., Zhang, X., & Zhou, X. (2023). Show me the impact: Communicating "behavioral impact message" to promote pro-environmental consumer behavior. *Sustainable Production and Consumption, 35*, 709–723. https://doi.org/10.1016/j.spc.2022.12.012

Shwom, R., Dan, A., & Dietz, T. (2008). The effects of information and state of residence on climate change policy preferences. *Climatic Change, 90*(4), 343–358. https://doi.org/10.1007/s10584-008-9428-7

Sicilia, M., Palazón, M., & López, M. (2020). Intentional vs. unintentional influences of social media friends. *Electronic Commerce Research and Applications, 42*, Article 100979. https://doi.org/10.1016/j.elerap.2020.100979

Siegrist, M. (2019). Risk perception: Reflections and future directions. *Risk Analysis, 41*(3), 480–490. https://doi.org/10.1111/risa.13325

Siegrist, M., & Árvai, J. (2020). Risk perception: Reflections on 40 years of research. *Risk Analysis, 40*(S1), 2191–2206. https://doi.org/10.1111/risa.13599

Spence, A., & Pidgeon, N. (2010). Framing and communicating climate change: The effects of distance and outcome frame manipulations. *Global Environmental Change, 20*(4), 656–667. https://doi.org/10.1016/j.gloenvcha.2010.07.002

Stadlthanner, K. A., Andreu, L., Ribeiro, M. A., Font, X., & Mattila, A. S. (2022). The effects of message framing in CSR advertising on consumers' emotions, attitudes, and behavioral intentions. *Journal of Hospitality Marketing & Management, 31*(7), 777–796. https://doi.org/10.1080/19368623.2022.2065399

Su, Q., & Li, F. (2024). Gain or loss? The congruence effect of message framing and mindset on consumers' willingness to pay a premium for pro-environmental hotels. *Journal of Sustainable Tourism, 32*(4), 713–736. https://doi.org/10.1080/09669582.2022.2159420

Sun, H., & Zhang, P. (2006). The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies, 64*(2), 53–78. https://doi.org/10.1016/j.ijhcs.2005.04.013

Susarla, A., Gopal, R., Thatcher, J. B., & Sarker, S. (2023). The Janus effect of generative AI: Charting the path for responsible conduct of scholarly activities in information systems. *Information Systems Research, 34*(2), 399–408. https://doi.org/10.1287/isre.2023.ed.v34.n2

Swaminathan, V., Page, K. L., & Gürhan-Canli, Z. (2007). "My" brand or "our" brand: The effects of brand relationship dimensions and self-construal on brand evaluations. *Journal of Consumer Research, 34*(2), 248–259. https://doi.org/10.1086/518539

Thakur, R., Angriawan, A., & Summey, J. H. (2016). Technological opinion leadership: The role of personal innovativeness, gadget love, and technological innovativeness. *Journal of Business Research, 69*(8), 2764–2773. https://doi.org/10.1016/j.jbusres.2015.11.012

Torrent-Sellens, J., Enache-Zegheru, M., & Ficapal-Cusí, P. (2025). Twin transitions or a meeting of strangers? Unravelling the effects of AI and innovations on economic, social and environmental MSMEs sustainability. *Technology in Society, 81*, Article 102866. https://doi.org/10.1016/j.techsoc.2025.102866

Trope, Y., & Liberman, N. (2003). Temporal construal. *Psychological Review, 110*(3), 403–421. https://doi.org/10.1037/0033-295X.110.3.403

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty, 5*, 297–323. https://doi.org/10.1007/BF00122574

Van der Linden, S. (2014). On the relationship between personal experience, affect and risk perception: The case of climate change. *European Journal of Social Psychology, 44*(5), 430–440. https://doi.org/10.1002/ejsp.2008

Van der Werff, E., Steg, L., & Keizer, K. (2013). It is a moral issue: The relationship between environmental self-identity, obligation-based intrinsic motivation and pro-environmental behaviour. *Global Environmental Change, 23*(5), 1258–1265. https://doi.org/10.1016/j.gloenvcha.2013.07.018

Yu, T.-K., Lin, M.-L., & Liao, Y.-K. (2017). Understanding factors influencing information communication technology adoption behavior: The moderators of information literacy and digital skills. *Computers in Human Behavior, 71*, 196–208. https://doi.org/10.1016/j.chb.2017.02.005

Yusuf, A., Pervin, N., Román-González, M., & Noor, N. M. (2024). Generative AI in education and research: A systematic mapping review. *The Review of Education, 12*(2), Article e3489. https://doi.org/10.1002/rev3.3489

Zemborain, M. R., & Johar, G. V. (2007). Attitudinal ambivalence and openness to persuasion: A framework for interpersonal influence. *Journal of Consumer Research, 33*(4), 506–514. https://doi.org/10.1086/510224