International Journal of Communication 20(2026), 838–862 1932–8036/20260005

Enhancing Media Literacy in Higher Education: An Experimental Study on Misinformation Through a Gamified Intervention in Peru

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This experimental study assesses the effectiveness of a technology-based educational intervention aimed at countering misinformation among young Peruvian university students (aged 18–22), applying inoculation theory through the gamified intervention *Bad News*, adapted specifically for Latin America. As a conceptual replication of Basol et al., the study preserves the original experimental design while extending it to a Latin American, Spanish-speaking context. A total of 301 first- and second-year students from two private universities in Lima were randomly assigned to either a treatment or control group. Through pretest and posttest measurements and statistical analyses (Student's t-test, two-way ANOVA), findings demonstrate that playing *Bad News* significantly reduces the perceived reliability of misinformation content on social media. A significant interaction was found between the intervention and maternal education level. Although no statistically

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Date submitted: 2025-04-15

[1] This study was funded by the Scientific Research Institute (IDIC) of the Universidad de Lima (PI.55.007.2024).

significant interaction effects were found for self-perceived media literacy or trust in traditional and social media, both variables independently predicted more critical evaluations of misinformation. This research represents a pioneering effort in Latin America, a region lacking experimental studies that validate gamified interventions for critical thinking against misinformation.

Keywords: misinformation, inoculation theory, media literacy, fake news resilience, higher education, Bad News

Although misinformation is not a recent phenomenon, interest persists in understanding the causes and consequences of information disorders in digital contexts (Rodríguez Pérez, 2019), particularly to validate strategies addressing this phenomenon within formal educational settings. These strategies aim to strengthen citizens' media skills to manage and filter the abundant flows of information with which they interact (Huang et al., 2024).

Despite there being no single interpretation of the massive impact of misinformation, there is growing evidence of its harmful effects on democracies, particularly by eroding trust in key actors and institutions (Ecker et al., 2024; McKay & Tenove, 2020; van der Linden, 2022). This issue is especially problematic in today's media ecosystem, which is platformized, difficult to regulate, and characterized by a proliferation of synthetic content, hyper-segmented algorithms, and dynamics that facilitate the viral spread of deceptive information (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2023).

Misinformation requires users. According to philosopher Garcés (2017), it appeals to more vulnerable profiles who subscribe to a state of "voluntary credulity," where critique—historically the antidote to credulity—is neutralized by attention saturation and fragmentation. Among the reasons studied for why certain groups believe and share misleading content are ideological biases, confirmation bias, motivated reasoning, and distrust toward traditional media institutions (Altay et al., 2022; Sultan et al., 2024).

Although older adults have been shown to be more vulnerable to misinformation (Vargas-Bianchi et al., 2023), recent evidence indicates that adolescents and young adults are also highly susceptible, largely because of their predominantly digital and fragmented media consumption habits (Fernández Muñoz et al., 2024; Pérez-Escoda et al., 2024). A large-scale international study further identified Generation Z as the most vulnerable age group, despite reporting a high self-perceived ability to detect fake news (Kyrychenko et al., 2025). In this context, university students warrant focused attention (McGrew & Chinoy, 2022). Their high exposure to social media increases contact with misleading content (Baptista & Gradim, 2020; Galarza-Molina, 2023), while the emotional appeal of certain messages encourages impulsive sharing (Herrero-Diz et al., 2020). In parallel, declining trust in news and traditional media (Newman et al., 2024) fosters news avoidance and reliance on peer- or algorithm-driven information sources, reinforcing belief-consistent media diets and increasing vulnerability to biased or false content (Van der Meer et al., 2020), with these dynamics further shaped by educational level and political orientation (Kyrychenko et al., 2025).

https://doi.org/10.65476/znt4bq22

In the Latin American context, where diagnoses are abundant but empirical experimental studies are scarce, this research broadens the understanding of misinformation and its potential solutions among youth in the region. By using a media literacy approach grounded in inoculation theory, this experimental study evaluates the effectiveness of the *Bad News* (Roozenbeek & van der Linden, 2024) video game among Peruvian university students. A total of 301 first-year students from two universities in Lima were randomly assigned to either a treatment group or a control group to measure the inoculation effect on the perceived reliability of misinformation on social media. The study also analyzes moderating variables, such as self-perceived media literacy, trust in traditional media, and maternal education.

Interventions to Mitigate Misinformation: Media Literacy and the Bad News *Experience*

Among the most effective strategies to address the problem—such as fact-checking workshops, gamified interventions, or educational resources—are those grounded in the media literacy approach (Badrinathan, 2021; Nygren & Ecker, 2024). This approach promotes a critical understanding of how media and information are produced and circulated and aims to develop competencies that enable citizens to engage responsibly in producing and consuming media content, as well as to address the effects of misinformation—understood as the intentional or unintentional dissemination of false or misleading information that distorts public understanding and decision making (Bateman & Jackson, 2024; Blair et al., 2024; Huang et al., 2024). Within this framework, we evaluate a gamified inoculation intervention.

Along these lines, Traberg et al. (2022) highlight the potential effectiveness of strategies based on informational accuracy nudges and inoculation—proposals originating in social psychology, but situated within the broader theoretical framework of media literacy, as developed in communication and media studies. These strategies, often referred to as news literacy or misinformation literacy, aim to foster critical and creative capacities for engaging with media (Bateman & Jackson, 2024; Blair et al., 2024). Passive inoculation interventions typically expose individuals to weakened examples of misinformation or manipulation techniques without active participation, often through brief educational videos, informational texts, or warnings preceding content (Roozenbeek et al., 2022). In contrast, gamified inoculation embeds these weakened doses within interactive, role-playing environments, where participants actively produce and identify misinformation techniques in a simulated setting. This active engagement has been shown to enhance retention and transfer of skills to real-world contexts (Hopkins et al., 2023; Leder et al., 2024). This study focuses on the gamified approach because it combines the theoretical underpinnings of inoculation with the motivation and attention that game-based learning can generate.

Specifically, the inoculation strategy, originally proposed by McGuire (1964), draws on the analogy of medical vaccines to cognitively resist persuasive attempts that challenge preexisting beliefs. Adapted to address misinformation, this strategy involves exposing individuals to weakened or small doses of manipulative techniques to increase their resistance to various forms of misinformation and enhance their critical response to future manipulations (van der Linden, 2022). Numerous global studies have demonstrated the effectiveness of such interventions, making them a viable option for educational settings (Lu et al., 2023), particularly within the scope of communication and media studies where this research is situated (Hameleers, 2024; Zhang & Pinto, 2025).

Several studies have confirmed the effectiveness of these interventions, especially gamified strategies that include systematic feedback and significantly improve participants' ability to distinguish between true and false information (Albaladejo-Ortega et al., 2024; Kiili et al., 2024; Leder et al., 2024). In particular, favorable results have been reported for *Bad News* (Roozenbeek & van der Linden, 2024), a free online game created by DROG and the University of Cambridge. The game teaches users six common techniques used to mislead: (1) discrediting opponents, (2) using emotional language, (3) increasing group polarization, (4) impersonating others through fake accounts, (5) spreading conspiracy theories, and (6) provoking outrage through trolling. In the game, players assume the role of fake news creators with the goal of building a media empire by gaining followers and maximizing credibility. Following the logic of inoculation theory, players are warned about the risks of misinformation and exposed to mild doses of these manipulative techniques. Studies have shown that the game enhances users' ability to identify manipulative posts on social media, with positive effects detectable up to 13 weeks after playing, especially when the intervention is reinforced periodically (Axelsson et al., 2024; Roozenbeek et al., 2020).

Although several international studies have validated inoculation-based interventions, significant methodological heterogeneity persists, making it difficult to compare results and accumulate coherent knowledge across studies (Bateman & Jakson, 2024; Etesse et al., 2025). Recent research has also highlighted important trade-offs related to veracity discernment processes. In particular, some gamified inoculation strategies have been shown to reduce trust not only in false content but also in nonmisleading news, raising concerns about the emergence of generalized skepticism (Modirrousta-Galian & Higham, 2023). Rather than invalidating these approaches, this line of work underscores the need to examine how such interventions affect perceptions of both misinformation and truthful information. Recent reviews further emphasize that inoculation-based strategies are most effective when embedded within broader pedagogical frameworks or combined with complementary interventions that help learners recalibrate trust in reliable information (Etesse et al., 2025). Experimental evidence suggests that design features, such as immediate feedback and booster interventions, can help to improve this discernment without undermining confidence in genuine news over an extended period (Leder et al., 2024; Maertens et al., 2025). From this perspective, assessing responses to nonmisinformation content is analytically relevant for understanding the scope and limits of gamified inoculation strategies within educational contexts.

The Latin American Context: Media Trust and Socioeducational Factors

According to the Digital News Report (Newman et al., 2024), news consumption routines in Latin America are marked by high engagement with short-form video news and increasing distrust toward traditional media, leading to a shift toward consuming information primarily via social media. These practices are more prevalent among young people, given their greater use of these platforms. In general, they tend to trust social media more—despite acknowledging that such platforms are more prone to spreading falsehoods (Fernández Muñoz et al., 2024). This reflects an overconfidence in their critical abilities to detect fake content (Londoño-Pardo et al., 2025; Martínez-Costa, 2022).

Although some studies in the region have analyzed the relationship between using social media for news and increased vulnerability to misinformation (Ceron et al., 2021; Valenzuela et al., 2019; Valenzuela

https://doi.org/10.65476/znt4bq22

et al., 2022), few employ experimental methods with randomized samples that allow for generalizable conclusions. In communication studies, experimental designs originating in Latin America remain marginal, as qualitative methods or quantitative techniques, such as surveys or content analysis, are more commonly used (Arroyave-Cabrera & Gonzalez-Pardo, 2022). Not in Latin America, but culturally relevant, a randomized control trial with Latinos in the United States shows that prebunking is effective, with culturally tailored videos outperforming originals in detecting manipulation and reducing sharing, underscoring the value of cross-cultural adaptation (Digital Democracy Institute of the Americas, 2024).

Some scholars suggest that the spread of fake news and misinformation is directly linked to the level of public trust in the media (Hameleers et al., 2022; Lee, 2024; Wasserman & Madrid-Morales, 2019). Specifically, studies have found a negative relationship between the perceived severity of the misinformation problem and overall trust in the media (Lee, 2024). This may indicate that distrust toward traditional media is associated with more critical evaluations of information. However, the relationship between media distrust and the ability to discern fake news has not been sufficiently explored. While distrust in media may foster an initial critical attitude, it may also drive individuals to seek alternative sources that are not necessarily reliable, thereby increasing their vulnerability to misinformation (Swart & Broersma, 2022; Zimmermann & Kohring, 2020). Conversely, misinformation itself—as well as news fatigue and the polarizing way news is framed—may fuel media distrust, especially among younger audiences (Fernández Muñoz et al., 2024).

Given the sociocultural characteristics of the region, it is important to consider differences in gender and maternal education level. On the one hand, there is a gender gap in self-confidence concerning the ability to detect misinformation and AI-generated content, with men more likely to believe they possess such skills (Ipsos, 2024). Other studies report no significant differences in self-reported ability to identify fake news (Almenar et al., 2021; Mansoori et al., 2023), but they find differences in concern about misinformation and the types of fake news received. For example, Almenar et al. (2021) found that in Spain, women express greater concern about the social impact of misinformation and are more likely to receive fake news about celebrities, while men more often encounter false news about politics and sports. Similarly, Gurgun et al. (2024) found that, in the United Kingdom, users are generally reluctant to confront misinformation, although men are slightly more likely to challenge it.

Parental education level influences children's cognitive and critical development, as well as their academic performance (Espejel García & Jiménez García, 2019). Parents with higher education levels tend to foster more stimulating learning environments (Grolnick & Pomerantz, 2022) and provide their children with intangible resources that enhance their academic experiences (Benavides & Etesse, 2012, 2016). Moreover, the maternal role is particularly important in developing countries (Cuenca, 2016). In the Peruvian context, maternal education level has been directly linked to mothers' involvement in school-related activities and has indirect effects on the quality of the parent-child relationship (León et al., 2020). This is particularly relevant in evaluating perceptions of reliability concerning misinformation on social media, where critical judgment and cognitive autonomy are essential. Against this backdrop, the present study examines the effects of a gamified inoculation intervention not only on perceptions of misleading content but also on broader sociocultural and perceptual factors relevant to the Latin American context.

Research Hypotheses

To address these critical gaps, this study experimentally evaluates a gamified educational intervention based on inoculation theory, implemented through an adapted version of the *Bad News* (Roozenbeek & van der Linden, 2024) video game. Based on the preceding literature, this study proposes five hypotheses that explore relationships between the perceived reliability of content employing misinformation strategies on social media and various sociodemographic and perceptual variables:

H1: Participation in the Bad News video game significantly reduces the perceived reliability of misleading social media content compared with those who did not participate in the intervention.

H2: Students with higher levels of self-perceived media literacy report lower perceived reliability of misleading social media content following the intervention.

H3: Students with lower trust in the media report lower perceived reliability of misleading social media content following the intervention.

H4: The effectiveness of the Bad News video game in reducing the perceived reliability of misinformation varies according to the participant's maternal education level.

H5: Gender-based differences exist in the perceived reliability of misinformation on social media following the Bad News intervention.

Method

Methodological Design

To test these hypotheses, a between-groups experimental design with pretest-posttest measurements was implemented, with participants randomly assigned to treatment or control conditions and balanced by gender (Creswell, 2015). Randomization was conducted at the participant level using anonymized student lists. Five minutes before starting the session, an automatic e-mail was sent to each student with a link indicating the corresponding route to follow. A double-blind procedure was implemented to ensure that the allocation to the corresponding group remained confidential for both participants and the field team.

The intervention occurred between October and November 2024 within regular first-and second-year courses at two private universities in Lima, Peru, attended by students from upper-middle-income backgrounds. Faculty participation was managed through an open call, and interested instructors voluntarily included their courses. The study was conducted during regular class hours and comprised two in-person sessions held in faculty classrooms, separated by at least one week.

https://doi.org/10.65476/znt4bq22

In each session, students accessed questionnaires and activities through e-mail links and were asked not to interact with one another during the application. The questionnaires were administered via Google Forms and completed on mobile devices (smartphones, tablets, or laptops).

The experimental protocol was standardized across all classrooms. During the first session, a pretest questionnaire was administered, lasting approximately 25 minutes. In the second session, the treatment group participated in the *Bad News* (Roozenbeek & van der Linden, 2024) game, while the control group completed a placebo task: playing *Tetris* (Pajitnov, 1984), following the setup used in Basol et al.'s (2020) experiment. At the end of the session, participants in both groups were required to report their final score in the assigned activity, which served as an indirect attention check to verify completion. Immediately afterward, both groups completed the posttest questionnaire, extending the average duration of the second session to approximately 55 minutes.

This study was not preregistered. It was approved by the Research Integrity and Ethics Committee of the School of Communication, Universidad de Lima (Approval No. 005-CIEI-FCOM-ULIMA-2024). Informed consent was obtained from all participants, and a confidential procedure was offered to those who chose not to participate. With permission from the original developers (DROG), we were allowed to regionalize the content while preserving the game's tone, structure, and the six manipulation techniques. Rather than a literal translation, the research team reauthored all in-game text in neutral Latin American Spanish recognizable across the region (not only Peru), removed country-specific slang and political references, and crafted the social media-style examples inspired by Basol et al. (2020). To preserve ecological validity without identifying real accounts, items displayed fictitious profile names and pictures created for the study.

Sample Characteristics

A total of 512 first- and second-year university students participated in at least one stage of the study. Of these, 312 completed both the pretest and posttest (39.0% attrition). After applying careless-response checks (Meade & Craig, 2012)—including consistency and outlier analyses—11 cases were removed (5 from the control group and 6 from the treatment group), yielding an analytic sample of 301 students (41.2% final attrition). The final sample comprised 165 participants in the control group (54.8%) and 136 in the treatment group (45.2%). The marginal difference between the groups is attributable to random attrition during data collection.

Participants ranged in age from 15 to 30 years, with a mean age of 18. For fields of study, most participants were enrolled in law (n = 108, 35.9%), communication (n = 97, 32.3%), psychology (n = 32, 10.6%), and economics (n = 17, 5.7%). The remaining participants (n = 47, 15.6%) came from other disciplines, such as management, political science, government, and international relations (see Table 1).

Table 1. Summary of Instances and Participants in the Study.

	Participants (pretest or posttest)	Participants (pretest and posttest)	Distribution of Participants (pretest and posttest)
Control	257	165	54.8%
Treatment	255	136	45.2%
Field of study			
Law	179	108	35.9%
Communication	180	97	32.3%
Psychology	51	32	10.6%
Economics	27	17	5.7%
Other fields	75	47	15.6%
Total	**512**	**301**	

Note. Percentages based on valid observations (n = 301).

Variable Measurement

Perceived Reliability of Misinformation (PRM)

This variable refers to the individual-level perception of reliability concerning misleading content. It was measured in both study sessions (pretest and posttest). The six manipulation techniques embedded in the *Bad News* (Roozenbeek & van der Linden, 2024) game—(1) discrediting opponents, (2) using emotional language, (3) increasing group polarization, (4) impersonating others through fake accounts, (5) spreading conspiracy theories, and (6) provoking outrage through trolling—were incorporated into the text-based posts. Each post was adapted into Latin American Spanish by the research team, following the validated instrument style developed by Basol et al. (2020). In addition, two nonmisinformation (true news) items were included as control stimuli. These items were not included in the PRM index and were analyzed separately to assess participants' responses to nonmisleading content.

A pilot test (N = 34) using the identical protocol and instrument as the full study was conducted before the fieldwork. Feedback led to minor refinements to participant instructions and timing/logistical cues; no changes were made to item content or measurement. Raw data (pilot and main study) are available (see Data Availability Statement). The instrument comprised eight items (six misinformation posts emulating X/Twitter and two truthful control posts). To preserve ecological validity while avoiding identification with real accounts, posts displayed a profile name and a profile picture created for the study (see Figure 1). The truthful posts were not part of the main analysis and served to monitor potential generalized skepticism.

https://doi.org/10.65476/znt4bq22

Figure 1. Examples of text-based posts.[2]

Participants rated each post using a 7-point Likert scale (1 = "very little trust," 7 = "a lot of trust"). Individual scores were calculated as the simple average of the misinformation items, excluding the control items. The Cronbach's alpha for this construct was 0.803.

Our primary outcome was a reduction in the perceived reliability of misinformation (i.e., lower trust ratings for misleading posts) among participants who played *Bad News* (Roozenbeek & van der Linden, 2024), relative to the control group, from pretest to posttest. The intervention was not intended to reduce trust in truthful information. The eight-item instrument comprised six misinformation posts and two truthful control posts; the control items were included solely to monitor potential generalized skepticism and were neither used to compute the PRM score nor to test the hypotheses. Participants were not informed about item veracity; they simply rated perceived reliability. Accordingly, all analyses focus on the six misinformation posts.

The Spanish item stem asked participants to rate "the extent to which you find this post reliable" (7-point scale: 1 = "very little trust," 7 = "a lot of trust"). We refer to the construct as Perceived Reliability of Misinformation (PRM) for continuity with prior work (e.g., Axelsson et al., 2024). A pilot test confirmed comprehension (see Supplementary Material[3] for the full wording of all items in Spanish and English).

[2] English translation: (1) "BREAKING! Baby formula related to a terrible outbreak of a new and terrifying illness among helpless babies. Parents are desperate." (2) "Same IQ between people on the left and the right is a myth. Scientists found differences in intelligence according to their political preference." (3) "The Russian influence could have been stronger during the U.S. election in 2020 than in 2016." (4) "We are sorry for #GameOfThrones season 8, this fall we will broadcast a final season 9."

[3] Link to supplementary material: https://osf.io/6zxby/overview?view_only=1ac4811f4b464b3d894897ad9032f33b

Self-Perceived Media Literacy

Based on Mateus et al. (2019), the pretest included six questions, each containing three items, designed to assess different dimensions of media literacy as perceived by the participants. These dimensions included an understanding of language, technology, interaction, aesthetics, ideology/values, and media production/distribution.

Examples of items include: "I am able to identify persuasive techniques used in language" (language dimension) and "I am able to install and configure a digital application account efficiently" (technology dimension). Responses were rated on a 7-point scale (1 = "Not capable at all," 7 = "Very capable"). The Cronbach's alpha for this construct was 0.879. The final score was calculated as the average of all items and categorized into quintiles.

Trust in Media and Social Media

This variable measures perceived confidence in the authenticity of news on communication platforms. During the pretest, trust in media and social media was assessed through an 11-item composite question adapted from Brosius et al. (2022). A 7-point Likert scale was used (1 = "Very little trust," 7 = "A lot of trust"). The total score was calculated as the simple average of the items, and the variable was categorized into quintiles. The Cronbach's alpha for this construct was 0.761. This measure was collected at pretest only and used as a moderator; it was not administered at posttest and was not analyzed as an outcome.

Parental Education and Participant Gender

The pretest questionnaire included an item about the educational level attained by the participant's mother. Responses were numerically coded from 1 ("No formal education") to 12 ("Doctoral degree"). Another item captured the participants' gender.

Analytical Plan

We conducted the analyses in three steps.

(1) Data preparation and assumptions: The primary outcome, perceived reliability of misinformation (PRM), was computed as the mean of the six misinformation items (7-point scale); the two truthful items were excluded from the index and used only as controls to monitor generalized skepticism. Distributional assumptions were checked before inference.

(2) Main effect (H1): To test whether playing *Bad News* (Roozenbeek & van der Linden, 2024) reduced PRM relative to the control activity, we estimated an independent-samples t-test on posttest PRM (treatment vs. control). We also report the pretest between-group comparison to assess baseline equivalence.

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(3) Moderation tests (H2–H5): We estimated two-way ANOVAs with posttest PRM as the dependent variable and group (treatment vs. control) crossed with each moderator in turn: (H2) media literacy (quintiles), (H3) trust in media/social media (quintiles), (H4) mother's educational level (categorical levels as collected), and (H5) sex (female/male). Each model reports main effects and the group × moderator interaction (Full two-way ANOVA outputs (Stata logs) are provided in Supplementary Material—Figures S2–S4d.

Robustness checks: In addition, as robustness checks, we estimated a linear regression model with covariates and pretest scores. All analyses were conducted in Stata 16. Full ANOVA outputs are provided in Supplementary Tables S4a–S4d.

Data availability: Raw and cleaned data (pilot and main study), codebook, and analysis code are deposited in a public repository; the persistent link is anonymized for review. Descriptive statistics are provided in the supplementary information.

Results

Table 2 summarizes baseline, time-invariant sample characteristics; therefore, statistics are not split by pre/post. For the media literacy index, the mean was 5.1 (SD = 0.9; median = 5.2). Valid observations totaled 286; 15 cases were coded as missing because respondents selected "Don't know/Don't remember" on at least one item. Mean scores by quintile were Q1 = 3.7, Q2 = 4.7, Q3 = 5.2, Q4 = 5.6, and Q5 = 6.2.

For trust in media and social media, the average score was 3.5, falling between "Low trust" and "Moderate trust." 14 responses had missing values because participants selected "Don't know/Don't remember" for at least one item in the questionnaire. The median was 3.5, with a standard deviation of 0.9. The average score by quintile was as follows: The first quintile scored 2.3, the second 3.1, the third 3.6, the fourth 4.0, and the fifth 4.8.

For gender, 63.5% of the participants identified as female (n = 191) and 36.5% as male (n = 110), indicating a greater female presence in the sample.

For maternal education level, 294 valid responses were recorded. Most students reported that their mothers had received higher education (63.5%): 26.9% had completed a university degree, 22.4% held a master's degree, 12.2% had completed nonuniversity higher education, and 2.0% held a doctoral degree. Additionally, 18.0% of the students indicated that their mothers had completed secondary education, while 4.7% reported less than secondary education.

Table 2. Descriptive Statistics of the Sample.

Variable		Absolute Frequency	Relative Frequency	Mean	Median	Standard Deviation
Media Literacy						
	Quintile 1 (lowest)	62	21.7%	3.7	3.9	0.7
	Quintile 2	55	19.2%	4.7	4.7	0.1
	Quintile 3	56	19.6%	5.2	5.2	0.1
	Quintile 4	57	19.9%	5.6	5.7	0.1
	Quintile 5	56	19.6%	6.2	6.3	0.3
	Missing Values	15				
	Valid Observations	286		5.1	5.2	0.9
Trust in media and social media						
	Quintile 1	59	20.6%	2.3	2.5	0.5
	Quintile 2	64	22.3%	3.1	3.1	0.1
	Quintile 3	52	18.1%	3.6	3.6	0.1
	Quintile 4	60	20.9%	4.0	4.0	0.1
	Quintile 5	52	18.1%	4.8	4.7	0.5
	Missing Values	14				
	Valid observations	287		3.5	3.5	0.9
Sex						
	Female	191	63.5%			
	Male	110	36.5%			
	Total	301				
Mother's educational level						
	No Schooling	1	0.3%			
	Early childhood education	1	0.3%			
	Incomplete primary education	4	1.4%			
	Complete primary education	1	0.3%			

https://doi.org/10.65476/znt4bq22

Incomplete secondary education	7	2.4%
Complete secondary education	53	18.0%
Incomplete nonuniversity higher education	22	7.5%
Complete nonuniversity higher education	36	12.2%
Incomplete university higher education	18	6.1%
Complete university higher education	79	26.9%
Master's degree	66	22.4%
PhD	6	2.0%
Missing Values	7	
Valid observations	294	

Note. Values were calculated based on valid observations (n = 301).

The subjective reliability of misinformation was then analyzed (see Table 3). During the pretest, the overall mean score for subjective reliability was 2.9—slightly below the "Somewhat trust" category on the Likert scale. The median was 2.8, with a standard deviation of 1.0. Observed scores ranged from a minimum of 1 to a maximum of 6 (see Figure S1 in Supplementary Materials).

Tests confirmed that this variable did not deviate significantly from a normal distribution (Shapiro-Wilk: p-value = 0.069). The variance within each group was not significantly different (standard deviations around 1.0), thus satisfying assumptions for subsequent parametric analysis.

Table 3. Descriptive Statistics on Participants' PRM in Pretest.

	Max	Min	Mean	Median	SD
Total					
Control group (*n* = 165)	6.0	1.0	3.0	2.8	1.1
Treatment group (*n* = 136)	5.7	1.0	2.9	2.8	0.9
Total Pretest	6.0	1.0	2.9	2.8	1.0

Based on valid observations (n = 301).

(H1) The Bad News Game Reduces Perceived Reliability of Misinformation (PRM) on Social Media

Before the treatment, mean PRM scores were 2.97 for the control group and 2.89 for the treatment group (*ns*; $p = .505$; see Table 4; distribution shown in Figure 2 and in Supplementary Figure S1). At posttest, the control group increased to 3.37, whereas the treatment group decreased slightly to 2.85 (see Figure 3). The between-group difference at posttest was significant ($t = 4.727$, $p < .001$; Table 4), supporting H1: Students who played *Bad News* rated misinformation as less reliable than those in the control condition.

Importantly, we also observed that the two nonmisinformation items (control item 1 and control item 2) exhibited a significant effect of the intervention, reflected in lower PRM scores in the treatment group. Specifically, for control item 1, the difference was significant ($t = 3.27$, $p < .005$), as well as for control item 2 ($t = 5.31$, $p < .001$). Detailed results, including group means for these items, are reported in the Supplementary Materials (Table S3).

Table 4. Comparison of Means With Student's t-test Between Control and Treatment Groups in Pretest and Posttest.

Period	Comparison	*t*-value	*p*-value
Pretest	Control vs treatment	0.667	0.505
Posttest	Control vs treatment	4.727	0.000

Note. Indicator is calculated as the average of noncontrol items. $N = 301$.

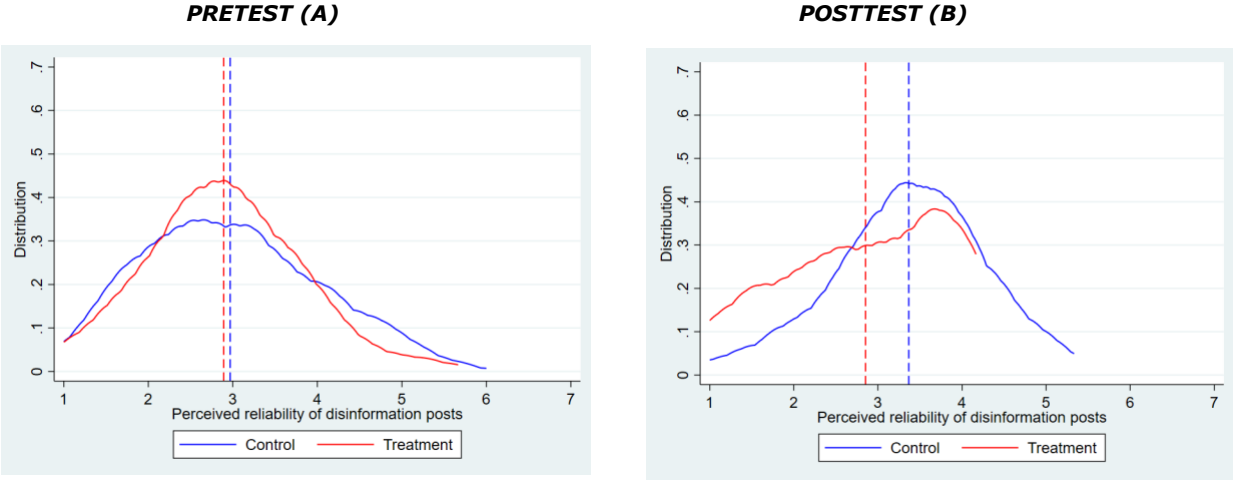

Figure 2. Distribution of PRM posts in the pretest by group (treatment/control).

Note. Values were calculated based on the valid observations ($n = 301$). PRM = mean of the six misinformation items (1–7; higher values indicate greater perceived reliability). Groups: treatment = Bad News; control = Tetris. Sample sizes are identical at pretest and posttest (control: $n = 165$; treatment: $n = 136$). Panel B shows the posttest divergence between groups.

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(H2) Students With Higher Levels of Self-Perceived Media Literacy Report Lower Perceived Reliability of Misinformation

The results of the two-way analysis of variance (ANOVA) support H2. Higher levels of self-perceived media literacy were associated with lower levels of perceived reliability attributed to misleading content (see Table 5). These findings indicate that both factors—media literacy and experimental condition—independently influence the dependent variable.

Table 5. Two-Way ANOVA Results by Variables Used.

Variable	Source	*df*	F	*p*-value
Media Literacy				
	Group (treatment/control)	1	20.85	0.001
	Media Literacy	4	3.34	0.011
	Interaction	4	0.59	0.670
	Valid observations	286		
Trust in Media and Social Media				
	Group (treatment/control)	1	20.25	0.000
	Trust	4	4.09	0.003
	Interaction	4	1.45	0.219
	Valid observations	287		
Mother's Educational Level				
	Group (treatment/control)	1	3.01	0.084
	Mother's education	11	1.73	0.068
	Interaction	7	2.54	0.015
	Valid observations	294		
Sex				
	Group (treatment/control)	1	20.22	0.000
	Sex	1	0.20	0.657
	Interaction	1	0.04	0.839
	Valid observations	301		

Note. Author's elaboration. Values were calculated based on the valid observations (n = 301).

However, no statistically significant interaction was found between the group (treatment vs. control) and levels of media literacy (p = 0.67).

(H3) Students With Lower Trust in the Media Perceive Lower Reliability of Misinformation on Social Media

As expected, baseline trust in media/social media negatively predicted PRM: Higher trust was associated with higher perceived reliability of misleading content. A two-way ANOVA on posttest PRM with Group × Trust (quintiles) showed main effects of Group, $F(1, 277) = 20.25$, $p < .001$, and Trust, $F(4, 277) = 4.09$, $p = .003$, but no interaction, $F(4, 277) = 1.45$, $p = .219$; $N = 287$ (see Table 5). Thus, the treatment effect did not depend on baseline trust. Note: Trust in media/social media was measured at pretest only and used as a moderator, not as an outcome.

(H4) The Effectiveness of the Bad News Video Game in Reducing Perceived Reliability of Misinformation Varies by Maternal Education Level

The results provide partial support for H4. A trend was observed in which higher levels of maternal education were associated with a lower perceived reliability of misleading content. The two-way ANOVA showed that neither the treatment effect ($p = 0.084$) nor the maternal education level ($p = 0.068$) reached conventional levels of statistical significance. However, a significant interaction was found between the treatment and maternal education level ($p = 0.015$), suggesting that the effectiveness of the intervention varies depending on this sociocultural variable.

In other words, the impact of the experimental condition on reducing the perceived reliability of misinformation appears to be moderated by the mother's education level.

(H5) Women Are More Capable Than Men of Detecting False Information

The results do not support H5. The gender variable showed no significant effect on the perception of misinformation reliability ($p = 0.657$), nor was a significant interaction found between the treatment and gender ($p = 0.839$). This indicates that, within this sample, there were no significant differences between male and female participants in evaluating the reliability of misinformation, so the effect of the intervention was independent of gender.

Discussion

The findings of this study provide empirical evidence for the effectiveness of a gamified educational intervention based on inoculation theory in a Latin American context. In particular, the results confirm that the *Bad News* (Roozenbeek & van der Linden, 2024) video game can significantly reduce the perceived reliability of misinformation among university students, reinforcing its value as an educational tool in digital environments. Our findings extend prior evidence on prebunking by showing that a gamified inoculation intervention lowers the perceived reliability of misinformation among first- and second-year university students in Lima, thereby adding experimental validation from a Latin American, Spanish-speaking context (Axelsson et al., 2024; Roozenbeek et al., 2020). This finding aligns with Latin American scholarship on the intergenerational effects of maternal education on critical capacities (León et al., 2020) and underscores the importance of considering socioeconomic variables when implementing media literacy

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interventions beyond Global North contexts. Therefore, regional linguistic and cultural adaptations and attention to structural conditions (e.g., university students' profile) can sustain the impact of prebunking strategies across diverse contexts.

At the same time, the intervention also affected participants' perceptions of nonmisinformation content, as reflected in the lower perceived reliability of true news among students in the treatment condition. Although this effect is based on only two nonmisinformation items and therefore does not allow firm conclusions, it is consistent with concerns about potential generalized skepticism raised in prior work (Modirrousta-Galian & Higham, 2023). This pattern underscores the need for future studies to include a larger set of true-news items and designs explicitly aimed at assessing trade-offs in veracity discernment, particularly the balance between heightened sensitivity to manipulation and trust in accurate information (Leder et al., 2024). From an educational perspective, this highlights the importance of embedding gamified inoculation tools within broader media literacy frameworks that support the development of critical judgment (Etesse et al., 2025).

Beyond the main effect of the intervention, this study contributes to the field by examining individual and contextual variables that may modulate susceptibility to misinformation. First, a significant interaction was found between the game intervention and maternal education level. This finding suggests that familial and educational environments may influence the effectiveness and reception of digital inoculation strategies—an area that remains underexplored in existing literature. As mentioned, these results are consistent with previous studies indicating that maternal educational trajectories shape children's cognitive and critical dispositions (León et al., 2020). In other words, a home environment with greater educational capital may foster the internalization of critical attitudes toward digital information. This pattern presents important challenges for designing more inclusive and equitable interventions that benefit youth from less-advantaged educational backgrounds.

The data also show that students with higher levels of self-perceived media literacy were more likely to evaluate manipulative content with skepticism—an effect consistent across both experimental groups. This supports previous findings by Herrero-Diz et al. (2020) and Zozaya-Durazo et al. (2023), who argue that confidence in one's critical abilities can protect against misinformation. Here, the results suggest a functional form of media literacy, distinguishable from overconfidence, which may have adverse effects. Inoculation-based strategies work as an "educational vaccine" for diverse audiences and are as effective as other forms of media literacy acquired through prior experience, formal education, or gamified activities. However, the game should not be seen as a replacement for other literacy methods, but rather as a complementary, accessible, and effective approach in the short term—particularly in formal educational settings where digital tools enable new learning dynamics.

The study also found that regardless of treatment conditions, students with lower trust in traditional and social media were less likely to perceive misinformation as reliable. This finding is consistent with previous research linking media distrust with more critical attitudes toward information (Lee, 2024; Wasserman & Madrid-Morales, 2019). This is especially relevant in the Latin American context, where distrust in media institutions coexists with high consumption of information via social media (Newman et al., 2024). Although the literature notes that distrust can have ambivalent effects—ranging from healthy

skepticism to reliance on unreliable alternative sources (Zimmermann & Kohring, 2020)—in this study, it appears to have acted as a cognitive filter that strengthened resistance to misinformation.

On the other hand, no significant differences were found based on gender. This finding aligns with studies reporting no substantial gender-based differences in the ability to detect misinformation (Mansoori et al., 2023), although it contrasts with research suggesting differences in perception or concern based on the type of content (Almenar et al., 2021; Gurgun et al., 2024). In the present study, the intervention functioned similarly for male and female participants, suggesting that its effectiveness is gender-neutral when measured by perceived reliability.

Nonetheless, some caveats should be made. A small upward shift in the control group's ratings is noteworthy: mean PRM increased from 2.97 (pretest) to 3.37 (posttest), whereas the treatment group decreased slightly from 2.89 to 2.85. Two nonexclusive interpretations are plausible. First, engaging in a neutral, unrelated task (*Tetris;* Pajitnov, 1984) immediately before the posttest may have reduced vigilance in the absence of inoculation cues. Second, contextual and measurement factors typical of repeated ratings (e.g., session timing, minor classroom variation) can produce modest fluctuations when no intervention is applied. As affect and attentional states were not measured, we treat these as limitations and avenues for future work (e.g., recording mood/attention and adding a no-activity control). Importantly, the between-group contrast—corroborated by our robustness checks—consistently indicates that the inoculation-based intervention reduces perceived reliability of misinformation relative to the control condition.

This study has several other limitations. First, the assessment focused exclusively on the perceived reliability of textual misinformation and, therefore, could not be generalized to other formats, such as manipulated images, videos, or audio clips. Additionally, although the sample was randomized, it comprised first- and second-year students from private universities in Lima. These results should be cautiously extrapolated to other age groups, regions, or young people with different educational opportunities, ethnic backgrounds, and socioeconomic contexts. Third, media literacy was also measured via self-perception, which may introduce bias about participants' skills. Moreover, we did not measure mood or attentional states, and the design did not include a no-activity control, which limits our ability to adjudicate mechanisms behind the control-group increase; new studies should incorporate these measures and conditions. These limitations highlight the need for future studies to assess the durability of these effects and the role of booster interventions in recalibrating trust in truthful information (Maertens et al., 2025).

In conclusion, in a randomized classroom experiment with first- and second-year university students in Lima, the experimental condition significantly attenuated the growth in perceived reliability of misinformation observed in the placebo control. Posttest ratings in the treatment group remained close to baseline, yielding a significant between-group difference at posttest. These effects held irrespective of baseline media trust, self-perceived media literacy, and sex, with exploratory moderation by maternal education. Taken together, the results indicate that a culturally localized, gamified inoculation activity can function as a practical, scalable classroom resource to help sustain skepticism toward misleading content in similar student populations.

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At the same time, the findings invite a more nuanced understanding of prebunking interventions. Rather than operating as precision tools with narrowly bounded effects, such interventions function more like educational vaccines, whose effectiveness depends on the pedagogical ecosystems in which they are embedded. This underscores the importance of developing more fine-grained measurement tools capable of disentangling the specific mechanisms through which these interventions operate, particularly to better estimate differentiated impacts among individuals with varying capacities for veracity discernment.

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