P-ISSN: 2798-1088 | E-ISSN: 2776-4060 | DOI: 10.52562/jdle.2026.1922

Journal of Digital Learning and Education

https://journal.moripublishing.com/index.php/jdle

Evaluating Character-Based Gamification for Digital Literacy Education in Sri Lanka's Diverse Digital Landscape

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Received: 11 February 2026; Accepted: 15 April 2026; Published: 22 April 2026

Abstract: The surge of disinformation in Sri Lanka demands new strategies for digital literacy instruction. This study examines engagement with character-based gamification as a digital literacy intervention in Sri Lanka. Using a mixed-methods design, we examined data from over 1,100 users (60% female, 40% male; ages 18–40+) who interacted with "A Fishy Tale," a web-based gamified platform created in collaboration with LIRNEasia. The results indicated moderate to positive engagement across four dimensions (M = 3.74–3.82 on 4-point scales, SD ≈ 1.1). Satisfaction was highest among participants aged 25–29 years (M = 3.95) and lowest among those aged 40+ (M = 3.40), and it varied by region (Kurunegala, M = 4.18; Ratnapura, M = 2.95). The learning outcomes were primarily general (67.4%) rather than specific media literacy skills (29.3%), with negligible higher-order critical thinking outcomes (1.9%). The findings indicate that character-based gamification can successfully engage varied audiences in digital literacy content, although specific learning objectives and equitable outcomes across groups were harder to achieve.

Keywords: Digital literacy; gamification; misinformation; Sri Lanka; information disorder

INTRODUCTION

Information disorder, understood as the circulation of false, misleading and maliciously framed content, has become a structural feature of digitally mediated public life rather than an occasional disturbance of it. Its consequences are most acute where rapid growth in social media use has outpaced the development of public capacity to evaluate online content, a configuration common across South Asia (Badrinathan & Chauchard, 2024). In Sri Lanka, falsehoods and inflammatory rumours circulating on social media and encrypted messaging services have preceded episodes of intercommunal violence, and the principal state response has been the temporary restriction of platform access rather than investment in citizens' evaluative capacity. Restricting circulation suppresses a symptom for as long as the restriction lasts, but leaves the underlying vulnerability untouched. That places the burden on educational approaches capable of building durable resistance within the population itself.

Research on educational responses to information disorder has converged on prebunking: pre-emptively familiarising audiences with manipulation techniques so that those techniques are recognised on later encounter (Lewandowsky & van der Linden, 2021; Traberg et al., 2022). Gamified prebunking has attracted particular attention because it is inexpensive to distribute and requires no classroom. Bad News, in which players adopt the role of a disinformation producer, reduced the perceived reliability of manipulative headlines in a large voluntary sample (Roozenbeek & van der Linden, 2019a), and replications reported parallel gains in judgmental confidence (Basol et al., 2020). Subsequent titles extended the approach to political polarisation

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(Roozenbeek & van der Linden, 2020) and to pandemic misinformation across three languages (Basol et al., 2021), while short inoculation videos delivered as advertisements improved recognition of manipulation techniques at platform scale (Roozenbeek et al., 2022). Effects persist for approximately three months when respondents are retested at intervals, but decay within two months in the absence of such boosting (Maertens et al., 2021). A systematic review of games addressing misinformation found that most are grounded in inoculation theory, that median playing time is about fifteen minutes, and that studies have been conducted predominantly with adult participants in informal settings (Kiili et al., 2024).

The broader evidence on gamified learning is more measured than advocacy for it tends to suggest. Meta-analytic estimates place the effect of gamification on cognitive learning outcomes at a small-to-moderate magnitude, with smaller and less stable effects on motivational and behavioural outcomes (Sailer & Homner, 2020; Huang et al., 2020); narrative framing and informative feedback emerge as moderators distinguishing effective from ineffective designs (Sailer & Homner, 2020). Reanalysis of the gamified inoculation trials using receiver operating characteristic analysis raises a sharper objection: across the available datasets, these interventions shifted response bias towards rating all content as false rather than improving discrimination between true and false content (Modirrousta-Galian & Higham, 2023). Taken together, these findings indicate that engagement with a gamified intervention and the acquisition of transferable evaluative skill are separable outcomes, and that evidence of the former should not be read as evidence of the latter.

Three limitations in this literature motivate the present study. First, the evidence base is concentrated in high-income, largely Western settings, and its findings do not transfer automatically to contexts with different media ecologies, literacy profiles and patterns of information sharing (Badrinathan & Chauchard, 2024; Blair et al., 2024). Where interventions have been tested in South Asia, results have been uneven: a digital media literacy intervention improved discernment in a highly educated Indian online sample but produced no detectable effect in a largely rural northern Indian sample (Guess et al., 2020); an hour-long educative treatment in Bihar proved insufficient on its own (Badrinathan, 2021); and in urban Pakistan a general educational video had no significant effect unless augmented with personalised feedback (Ali & Qazi, 2023). Effectiveness in these settings appears to depend on how closely delivery is matched to the target population. Second, existing games are built mainly around manipulation-technique typologies, whereas character-driven narrative, which the gamification literature identifies as a moderator of effect, has been less systematically examined as the organising principle of a digital literacy intervention. Third, and most consequentially for practice, studies typically report aggregate effects without asking whether engagement and learning are distributed evenly across the population reached. The digital divide literature gives reason to expect that they are not: differences in internet skills, and in the outcomes people obtain from internet use, track age, education and geography independently of access itself (Scheerder et al., 2017), and the assumption that younger users are competent evaluators of online information by virtue of growing up with digital media has no empirical support (Kirschner & De Bruyckere, 2017). An intervention that performs well on average may therefore reproduce the very inequalities it is intended to redress.

This study examines engagement with A Fishy Tale, a web-based character-based gamified platform developed for Sri Lankan audiences in collaboration with LIRNEasia. The platform organises digital literacy content around a three-character narrative framework in which decisions taken at branching points model encounters with information disorder drawn from authentic Sri Lankan cases, and it is available in Sinhala, Tamil and English. The study treats distributional questions as central rather than incidental, and pursues four objectives: (1) to characterise user engagement and satisfaction across four dimensions of the gameplay experience; (2) to determine whether and how engagement and satisfaction vary by age, gender and geographic region; (3) to assess the quality and distribution of the learning outcomes users articulate after playing; and (4) to identify what the resulting pattern implies for the design of digital literacy interventions in linguistically and geographically heterogeneous settings. Correspondingly, the study asks whether a character-based gamified platform engages a varied audience, whether that engagement is equitably distributed,

and whether it translates into articulated media literacy competence rather than general awareness. These questions are addressed through a mixed-methods design combining a post-experience survey of four engagement dimensions, platform analytics on session duration and narrative choices, and thematic coding of open-ended learning statements from more than 1,100 voluntary users who interacted with the platform between July 2024 and January 2025. The quantitative and qualitative strands are analysed separately and then integrated through convergent triangulation, as set out in the METHOD section.

Theoretical Framework

This study synthesizes several theoretical frameworks to elucidate how character-driven gamification can improve digital literacy and bolster resilience against disinformation. The framework integrates four complementary theoretical perspectives that collectively address persuasive impact, cognitive resilience, active learning, and motivational processes.

Narrative Transportation Theory (Green & Brock, 2000) justifies the use of character-driven narrative as a persuasive pedagogical tool. This theory posits that immersive narratives transport people into fictional worlds, diminishing counterarguments and enhancing the absorption of integrated ideas. When learners engage deeply with a narrative, they establish emotional bonds with characters, mentally visualize the progression of events, and exhibit less skepticism towards information that aligns with the plot. Narrative transportation in digital literacy teaching enables learners to vicariously engage with information disorder events through characters, promoting enhanced cognitive and emotional processing compared with abstract instruction alone.

Inoculation theory, widely used in modern misinformation studies, explains how exposure to attenuated manipulation tactics fosters cognitive resistance. Current formulations prioritize psychological immunization via pre-emptive warnings and refutational engagement, rather than depending on the initial biological comparison (Compton, 2013; Roozenbeek & van der Linden, 2019b). Empirical research indicates that interactive interventions familiarizing users with prevalent misinformation strategies, including emotional manipulation, scapegoating, and false dichotomies, can reduce vulnerability to deceptive content (Basol et al., 2020; Roozenbeek et al., 2020). This study incorporates inoculation principles through character-based scenarios that illustrate realistic disinformation encounters and demonstrate verification solutions via character decision-making.

The framework is also informed by constructivist and experiential learning concepts. Experiential Learning Theory emphasizes that learning occurs through cycles of concrete experience, reflection, conceptualization, and exploration. In business and applied learning environments, Segers and Van der Haar (2012) explain that real activities and reflective involvement facilitate deeper skill development. Gamified interventions inherently facilitate experiencing cycles by offering decision-making scenarios, delivering feedback on results, presenting conceptual clarifications, and allowing for repeated interaction with diverse settings. This active approach is consistent with evidence that critical evaluation skills are enhanced by genuine decision-making practice, as evidenced by studies on civic reasoning and online information assessment (McGrew et al., 2017).

Self-Determination Theory (Ryan & Deci, 2024) explains the motivational basis for the enhancement of engagement and learning through gamification. The theory identifies three fundamental psychological needs—autonomy, competence, and relatedness—that foster intrinsic motivation when satisfied. Character-driven gamification can address these requirements by offering meaningful narrative choices (autonomy), incrementally challenging tasks accompanied by feedback (competence), and fostering identification with narrative characters (relatedness). Nonetheless, superficial gamification features without genuine choice or meaningful feedback may reduce intrinsic motivation, a warning corroborated by research on ineffective gamification design (Nicholson, 2015).

Collectively, these theories indicate that character-driven gamification targeting misinformation resilience should (1) use engaging narratives that enhance transportation and identification, (2) proactively familiarize learners with misinformation tactics accompanied by embedded refutation, (3) offer authentic decision-making scenarios that encourage experiential learning, and (4) address learners' psychological needs through thoughtfully crafted game mechanics. This integrated

framework guided the development of A Fishy Tale and provides a conceptual foundation for evaluating the intervention's efficacy across demographic categories and usage scenarios.

METHOD

Sampling Strategy and Recruitment

Participants were recruited through a multi-channel voluntary sampling approach between July 2024 and January 2025. Recruitment channels included: (1) social media campaigns on Facebook and Twitter targeting Sri Lankan users interested in media literacy, (2) partnerships with civil society organizations and educational institutions who shared the platform link with their networks, (3) direct outreach to community organizations across all provinces, and (4) organic discovery through web searches and media coverage of the platform launch. The platform itself was developed in five stages, summarised in Table 1.

This recruitment strategy resulted in a convenience sample of voluntary participants (N = 1,100+), which introduces inherent self-selection bias favoring individuals with: (a) internet access and digital literacy baseline competencies, (b) pre-existing interest in media literacy topics, (c) sufficient time and motivation to engage voluntarily with educational content, and (d) comfort with web-based interactive platforms.

Geographic Distribution and Sampling Limitations

Participants were distributed across Sri Lankan provinces, with notable geographic concentration:

a. Western Province: approximately 45% of participants
b. Other provinces: 55% distributed across Kurunegala, Gampaha, Matara, Kandy, Colombo, Kalutara, Hambantota, and Ratnapura

This geographic skew toward the Western Province (which includes the capital Colombo and surrounding areas) may reflect structural inequalities in internet access, device ownership, and digital platform familiarity. The overrepresentation of Western Province participants limits generalizability to rural and underserved populations, who may face different information disorder challenges and have distinct educational needs. This sampling limitation is acknowledged as affecting the interpretation of regional performance differences discussed in the Result and Discussion section.

Table 1. Game Development Stages

Stage	Timeline	Activities	Outputs
1. Needs Assessment & Conceptualization	Month 1–2	Conducted stakeholder consultations with educators, civil society, and community representatives	Identified key requirements: cultural relevance, linguistic accessibility, emotional engagement
2. Design & Prototyping	Month 3–5	Developed three-character narrative framework; Created branching scenario structures; Designed user interface	Initial prototype with character storylines and decision points
3. Content Development	Month 5–7	Wrote narrative scenarios based on authentic Sri Lankan misinformation cases; Developed verification examples; Created multilingual content (Sinhala, Tamil, English)	Complete narrative content and educational materials
4. Technical Development	Month 6–8	Built web-based platform; Implemented analytics tracking; Integrated feedback mechanisms	Functional platform with data collection capabilities
5. Pilot Testing & Optimization	Month 9	Conducted pilot tests with representative user groups	Collected user feedback and made final adjustments to interface and instructions

Quantitative Measures

Participants completed a post-experience survey assessing four dimensions on 4-point Likert scales (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree):

1. Gameplay Satisfaction: "I found the interactive experience enjoyable and engaging"
2. Conceptual Understanding: "The scenarios helped me understand information verification concepts"
3. Theme Relatability: "The situations depicted felt relevant to my real-life experiences"
4. Gameplay Interest: "I would engage with similar educational platforms in the future"

Platform analytics automatically captured:

a. Session duration per narrative segment (seconds)
b. Decision choices at branching narrative points
c. Completion rates for each character storyline
d. Timestamp data for temporal engagement patterns

Qualitative Coding Framework

Open-ended responses to "What did you learn from this experience?" were analyzed using systematic thematic coding:

Coding Categories (with operational definitions):

1. Media Literacy (29.3% of coded responses): Responses explicitly mentioning source evaluation, verification strategies, misinformation recognition techniques, or information ecosystem understanding. Examples: "I learned to check multiple sources before sharing," "Understanding how false information spreads on social media."
2. General Learning (67.4%): Non-specific educational benefits, awareness-raising, or general interest statements without articulating specific competencies. Examples: "It was educational," "I learned something new," "Very informative experience."
3. Critical Thinking (1.9%): Responses demonstrating analytical reasoning, evaluation of evidence, logical assessment, or metacognitive awareness. Examples: "I now question why information is presented in certain ways," "Analyzing claims before accepting them."
4. Communication (1.4%): References to information sharing practices, communication ethics, or social responsibility. Examples: "Being careful what I forward to family groups," "Thinking about consequences before sharing."
5. Comprehension Issues (37.3% of all responses): Blank responses, irrelevant symbols (e.g., "!!!!", "..."), explicit confusion statements ("No idea," "Don't understand"), or responses indicating misunderstanding of questions. Figure 1 shows the distribution of these coding categories across the coded responses.

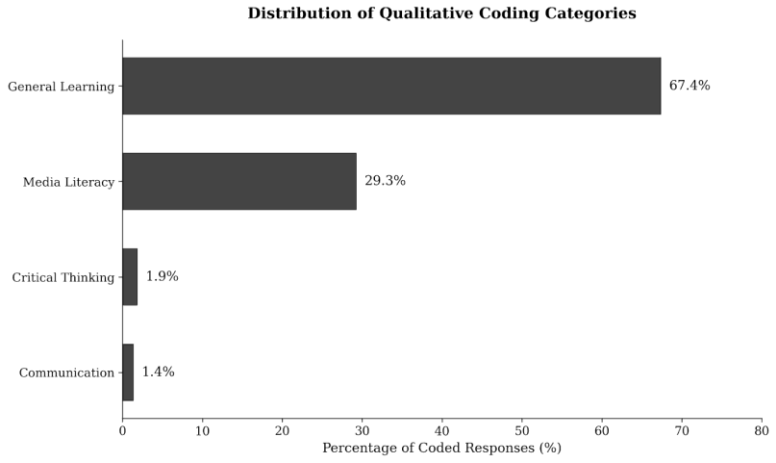


Figure 1. Distribution of the qualitative coding categories (percentage of coded responses) (Source: authors' own data).

Inter-Rater Reliability

Two independent coders analyzed 20% of randomly selected responses ($n \approx 220$) to establish coding reliability. Initial inter-rater agreement was 82%. Discrepancies were resolved through consensus discussion, and a refined codebook was applied to the full dataset. Cohen's kappa was calculated at $\kappa = .78$, indicating substantial agreement and acceptable coding reliability.

Quantitative Analysis

Descriptive statistics (means, standard deviations, frequencies, percentages) characterized engagement patterns and satisfaction across demographic groups. Inferential statistical tests examined whether observed demographic differences were statistically significant:

a. One-way ANOVA: tested differences in satisfaction ratings across age groups and regions
b. Independent samples t-tests: compared gender differences in engagement metrics
c. Chi-square tests: analyzed categorical variables (completion rates, theme preferences) across demographic groups
d. Multiple regression: examined simultaneous effects of age, gender, and region on satisfaction outcomes

The significance threshold was set at $p < .05$. Effect sizes (Cohen's d for t-tests, η^2 for ANOVA) were calculated to assess practical significance beyond statistical significance.

Qualitative Analysis

Thematic analysis followed an iterative process:

1. Preliminary review of 10% sample to identify emergent patterns
2. Development of initial coding framework aligned with digital literacy competency models
3. Independent coding by two researchers on 20% sample
4. Consensus discussions to refine coding definitions and resolve discrepancies
5. Application of refined codebook to full dataset
6. Quantification of theme prevalence across demographic subgroups
7. Selection of representative quotes illustrating each thematic category

Mixed-Methods Integration

Quantitative and qualitative findings were integrated through convergent triangulation, where numerical engagement patterns were interpreted alongside qualitative learning articulations to develop a comprehensive understanding of intervention effectiveness across contexts.

RESULTS

Overall Engagement and Satisfaction Metrics

Participant ratings on four key dimensions of engagement revealed moderate-to-positive reception, as shown in Table 2.

Table 2. Overall Engagement Metrics across Key Dimensions

Dimension	Mean Rating	*SD*	95% CI	Scale	*n*	*t*-value*	*p*-value
Gameplay Satisfaction	3.79	1.12	[3.73, 3.85]	1–4	1,100	52.97	< .001
Conceptual Understanding	3.82	1.09	[3.76, 3.88]	1–4	1,100	55.32	< .001
Theme Relatability	3.75	1.14	[3.68, 3.82]	1–4	1,100	50.88	< .001
Gameplay Interest	3.74	1.11	[3.68, 3.80]	1–4	1,100	51.97	< .001

*Note: 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree). *One-sample t-tests comparing mean to scale midpoint (2.0). All dimensions significantly above midpoint (all $p < .001$, all $d > 1.50$).*

Mean ratings between 3.74 and 3.82 indicate generally positive reception, significantly above the scale midpoint (all one-sample t-tests: $p < .001$). Standard deviations of approximately 1.1 across all measures indicate substantial individual variability in user experiences. The consistency

of means and standard deviations across dimensions (range of means = 0.08 points) suggests balanced reception without systematic preference for specific aspects of the intervention. Figure 2 presents these mean ratings with their standard deviations.

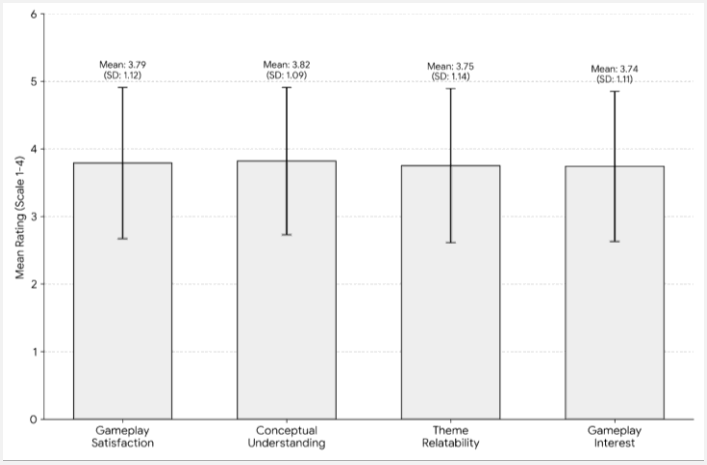


Figure 2. Mean ratings (±*SD*) on the four engagement dimensions (4-point scale) (Source: authors' own data).

The average session time per narrative segment was 63 seconds (*SD* = 28 seconds, *Mdn* = 58 seconds, Range = 15–180 seconds), suggesting substantive engagement beyond superficial clicking. This duration provided adequate time for reading narrative text (approximately 120–150 words per segment) and considering decision options.

Engagement was not evenly distributed across narrative themes (Table 3). Of the 690 responses that could be categorised by theme, most concerned general or unclassified content (450 responses, 65.2%), followed by media literacy themes (230, 33.3%). Social awareness (50, 7.2%), critical thinking (40, 5.8%), digital skills (30, 4.3%) and engagement features (20, 2.9%) attracted considerably less interaction; percentages exceed 100% because participants could engage with more than one theme. Mean time per theme followed the same ordering, from 68 seconds (*SD* = 31) for general content down to 45 seconds (*SD* = 20) for engagement features, and these differences were statistically significant, $F(5, 684) = 3.82$, $p = .002$, $\square^2 = .027$. The effect size indicates that theme accounted for approximately 2.7% of the variance in time spent, so although participants lingered measurably longer on general narrative content than on skills-focused material, the practical magnitude of that difference was small. This ordering mirrors the distribution of learning outcomes in Table 4, where general learning dominated (67.4%) while critical thinking appeared in only 1.9% of codeable responses: the themes most directly targeting digital literacy competencies drew both the least interaction and the shortest engagement.

Table 3. Thematic Engagement Patterns

Theme Category	Interactions (*n*)	% of Total	Engagement Depth	Mean Time per Theme (sec)	*SD*
Other/General	450	65.2%	High	68	31
Media Literacy	230	33.3%	Moderate	62	28
Social Awareness	50	7.2%	Low	54	26
Critical Thinking	40	5.8%	Low	51	24
Digital Skills	30	4.3%	Very Low	48	22
Engagement Feature	20	2.9%	Very Low	45	20

Note: Total n = 690 (participants who engaged with thematic content categorization). Percentages do not sum to 100% as participants could engage with multiple themes. Engagement Depth = qualitative assessment

based on decision complexity and completion rates. One-way ANOVA for time differences across themes: $F(5, 684) = 3.82$, $p = .002$, $\eta^2 = .027$.

Table 4. Distribution of Learning Outcomes by Category

Learning Outcome Category	Instances	% of Codeable Responses	95% CI	*n* (codeable)	Example Indicators
General Learning	465	67.4%	[63.9%, 70.8%]	690	"Educational," "Informative," "Learned something new"
Media Literacy	202	29.3%	[26.0%, 32.7%]	690	"Check sources," "Verify information," "Recognize fake news"
Critical Thinking	13	1.9%	[1.0%, 3.2%]	690	"Analyze claims," "Question motives," "Evaluate evidence"
Communication	10	1.4%	[0.7%, 2.6%]	690	"Careful sharing," "Consider consequences," "Responsible communication"
Comprehension Issues	~410	37.3%*	[34.2%, 40.5%]	1,100	Blank responses, "No idea," irrelevant symbols, confused statements

*Note: Percentages for learning categories calculated from codeable responses only (n = 690). *Comprehension Issues calculated from full sample (N = 1,100), representing proportion unable to articulate any clear learning. Chi-square test: $\eta^2(3) = 582.4$, $p < .001$ (distribution differs significantly from uniform). Age × Learning Type interaction: $\eta^2(12) = 31.8$, $p = .001$, Cramér's V = .156.*

Patterns of Satisfaction by Age

Analysis of satisfaction ratings across age groups revealed significant and systematic variation (Table 5). Figure 3 displays the same ratings with their standard deviations.

Table 5. Mean Satisfaction Ratings by Age Group

Age Group	Mean Rating	*SD*	95% CI	% Satisfied (≥3.0)	*n*	Cohen's *d* vs. 40+*
Under-20	3.73	1.08	[3.58, 3.88]	93.3%	200	0.29
20–24 years	3.80	1.10	[3.67, 3.93]	95.0%	290	0.37**
25–29 years	3.95	1.06	[3.82, 4.08]	98.8%	250	0.50***
30–39 years	3.67	1.15	[3.52, 3.82]	91.8%	240	0.24*
40+ years	3.40	1.18	[3.19, 3.61]	85.0%	120	

*Note: Satisfaction composite = average of four engagement dimensions. One-way ANOVA: $F(4, 1095) = 12.43$, $p < .001$, $\eta^2 = .043$. Post-hoc Tukey HSD: 25–29 > all others except 20–24 ($p < .05$); 40+ < all others ($p < .01$). *Effect sizes compared to 40+ group: *small (d = 0.20–0.49), **medium (d = 0.50–0.79), ***large (d ≥ 0.80).*

Statistical Analysis

One-way ANOVA confirmed that age group differences were statistically significant, $F(4, 1095) = 12.43$, $p < .001$, with a small-to-medium effect size ($\eta^2 = .043$, indicating age group accounts for approximately 4.3% of the satisfaction variance).

Post-hoc Tukey HSD tests revealed:

a. 25–29 age group scored significantly higher than all other groups except 20–24 (all $p < .05$)
b. 40+ group scored significantly lower than all younger groups (all $p < .01$)

Under-20 and 20–24 groups did not differ significantly ($p = .67$).

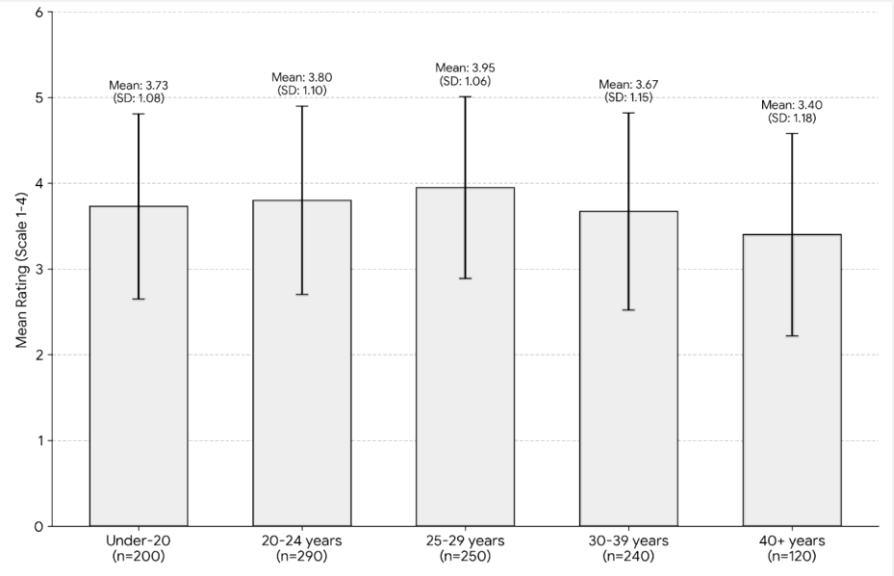


Figure 3. Mean satisfaction ratings (±*SD*) by age group (Source: authors' own data).

Key Patterns

1. *Optimal Performance (25–29 cohort)*: This age group achieved highest satisfaction (M = 3.95, 95% CI [3.82, 4.08]), significantly exceeding all groups except 20–24 years.
2. *Systematic Age-Related Decline:* Satisfaction declined 0.55 points (16.2%) from peak (25–29) to lowest (40+), representing a large practical difference despite moderate statistical effect size.
3. *"Digital Native" Paradox:* The under-20 group showed lower satisfaction than young adult groups (20–29), contradicting assumptions about inherent technological advantage (p = .03 vs. 25–29 group).

Gender Participation Patterns

Gender distribution showed significant female overrepresentation overall (60% female, 40% male; χ^2 goodness-of-fit vs. 50:50 = 44.0, $p < .001$), with age-specific variation (Table 6).

Table 6. Gender Participation Rates by Age Group

Age Group	Female % (*n*)	Male % (*n*)	Total *n*	χ^2 test vs. 50:50	*p*-value	Cramér's *V*
Under-20	50% (100)	50% (100)	200	0.00	1.00	.00
20–24 years	58% (168)	42% (122)	290	7.30	.007	.16**
25–29 years	61% (152)	39% (98)	250	11.66	< .001	.22***
30–39 years	57% (137)	43% (103)	240	4.82	.028	.14*
40+ years	50% (60)	50% (60)	120	0.00	1.00	.00
Overall	60% (660)	40% (440)	1,100	44.00	< .001	.20*

*Note: Chi-square tests compare observed gender distribution to expected 50:50 ratio. Effect size interpretation: *small (V = .10–.29), **medium (V = .30–.49), ***large (V ≥ .50). Independent samples t-test for gender difference in overall satisfaction: t(1098) = 0.54, p = .59, Cohen's d = 0.03 (no significant difference).*

Female participation peaked significantly in working-age demographics (20–39 years), with maximum representation in the 25–29 cohort (61%, significantly different from parity: χ^2 = 11.66, $p < .001$). Both the youngest (under-20) and the oldest (40+) cohorts showed gender parity.

Satisfaction by Gender

An independent-samples t test revealed no significant gender difference in overall satisfaction (Females: $M = 3.80$, $SD = 1.10$; Males: $M = 3.77$, $SD = 1.12$; $t(1098) = 0.54$, $p = .59$, $d = 0.03$), indicating that while women participated at higher rates, their experience did not differ systematically from that of men.

Geographic Variations in Platform Effectiveness

Regional analysis revealed substantial geographic disparities with significant implications for digital equity (Table 7). Figure 4 shows the mean rating for each region on each of the four engagement dimensions.

Table 7. Regional Performance Across Assessment Dimensions

Region	Gameplay	Conceptual	Relatability	Interest	Overall Mean	*SD*	95% CI	*n*
Kurunegala	4.20	4.18	4.15	4.19	4.18***	0.62	[4.05, 4.31]	110
Gampaha	3.85	3.82	3.80	3.83	3.83	0.88	[3.72, 3.94]	140
Matara	3.78	3.75	3.73	3.76	3.76	0.91	[3.62, 3.90]	95
Kandy	3.72	3.70	3.68	3.71	3.70	0.95	[3.58, 3.82]	125
Colombo	3.68	3.65	3.63	3.66	3.66	0.98	[3.57, 3.75]	285
Kalutara	3.60	3.58	3.56	3.59	3.58	1.02	[3.46, 3.70]	130
Hambantota	3.45	3.42	3.40	3.43	3.43	1.08	[3.27, 3.59]	85
Ratnapura***	2.93	2.85	3.00	3.01	2.95	1.15	[2.79, 3.11]	130

*Note: Overall Mean = average of four engagement dimensions. One-way ANOVA: $F(7, 1092) = 18.67$, $p < .001$, $\eta^2 = .107$. Post-hoc Tukey HSD: ***Kurunegala significantly higher than all others (all $p < .001$); ***Ratnapura significantly lower than all others (all $p < .001$). Performance gap between highest and lowest regions = 1.23 points (41.7% of scale range).*

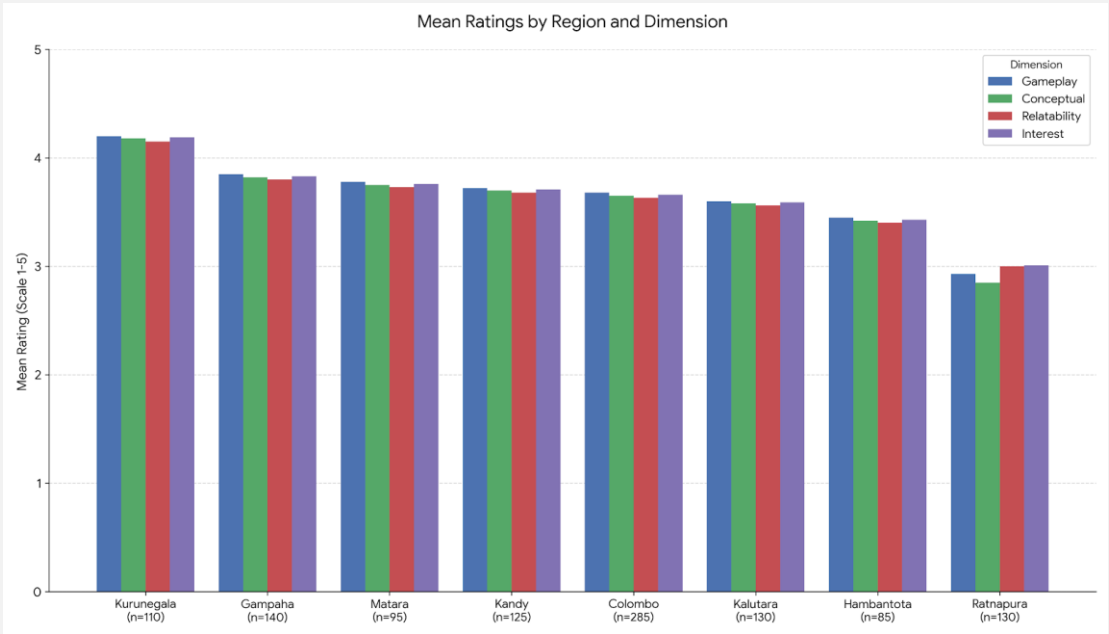


Figure 4. Mean ratings by region and engagement dimension (Source: authors' own data).

Statistical Analysis

One-way ANOVA confirmed highly significant regional differences, $F(7, 1092) = 18.67$, $p < .001$, with a medium effect size ($\eta^2 = .107$, indicating region accounts for 10.7% of satisfaction variance—larger than age effects).

The 1.23-point difference between highest-performing (Kurunegala, $M = 4.18$) and lowest-performing (Ratnapura, $M = 2.95$) regions represents a 41.7% performance gap on the 4-point scale. Post-hoc tests confirmed both extremes differed significantly from all other regions (all $p < .001$).

Multiple Regression Analysis

To examine simultaneous effects of demographic factors, multiple regression was conducted with overall satisfaction as the dependent variable and age group, gender, and region as predictors: The full model is reported in Table 8.

Table 8. Multiple Regression Analysis - Predictors of Overall Satisfaction

Predictor Variable	□ (standardized)	SE	*t*-value	*p*-value	95% CI for □
(Constant)		0.12	30.45	< .001	[3.41, 3.89]
Region (continuous)	−.31	0.03	−10.23	< .001	[−.37, −.25]
Age Group	−.15	0.02	−6.82	< .001	[−.19, −.11]
Gender (Female = 1)	.02	0.06	0.64	.522	[−.06, .10]

Note: N = 1,100. Overall model: F(10, 1089) = 14.23, p < .001, R^2 = .116, Adjusted R^2 = .108. Dependent variable = Overall Satisfaction (composite of four engagement dimensions). Region coded as 8-level categorical predictor (reference = Ratnapura, lowest performing). Age coded as 5-level ordinal predictor. Model explains 11.6% of satisfaction variance, with region as strongest unique predictor.

The results indicate that region was the strongest predictor of satisfaction, accounting for unique variance beyond age and gender effects. Gender showed no independent effect when controlling for other factors. Figure 5 summarises these results: panel (a) gives the standardised regression coefficients and panel (b) contrasts mean satisfaction in the highest- and lowest-performing regions.

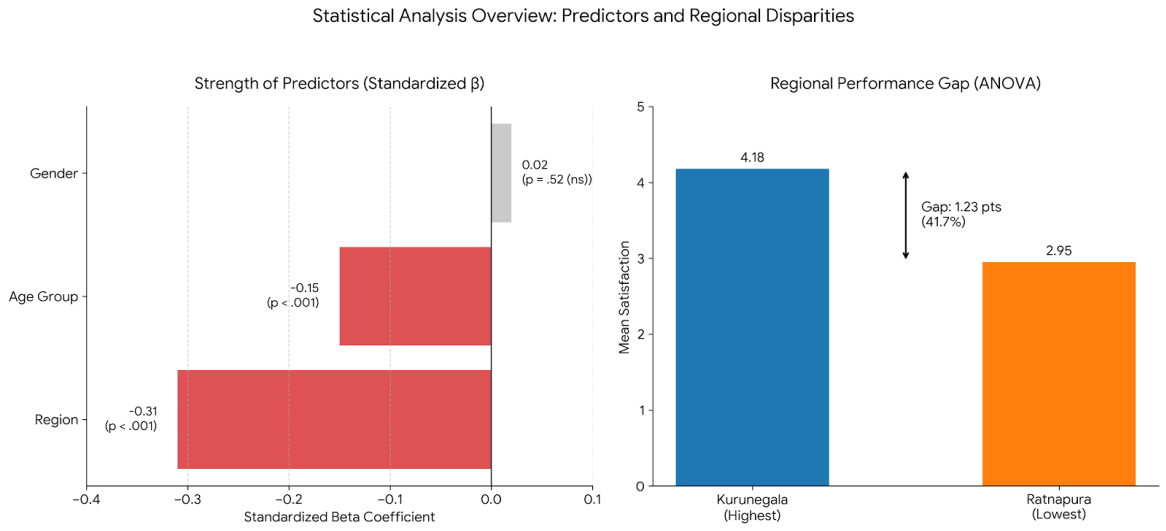


Figure 5. Statistical analysis overview: (a) standardized regression coefficients for age group, gender and region; (b) mean satisfaction in the highest- and lowest-rated regions (Source: authors' own data).

Chi-Square Analysis

The distribution of learning outcomes differed significantly from a uniform distribution, $\chi^2(3) = 582.4$, $p < .001$, indicating that responses were concentrated in the General Learning category rather than in specific competencies.

Age × Learning Outcome Interaction

Chi-square test of independence revealed a significant association between age group and learning outcome type, $\chi^2(12) = 31.8$, $p = .001$, Cramér's $V = .156$. Younger participants (under-24) showed higher rates of General Learning responses (73%), while 25–39 year-olds demonstrated higher Media Literacy articulation (35% vs. 27% overall).

The substantial proportion of Comprehension Issues (37% of all responses) indicates significant challenges in translating engagement into articulable learning for more than one-third of participants. This rate varied by age ($\chi^2(4) = 24.5$, $p < .001$), with the highest comprehension challenges in the 40+ group (48% unclear responses) and the under-20 group (42%). Figure 6 presents these results: panel (a) gives the share of responses coded as comprehension issues by age group and panel (b) compares learning-outcome categories for selected age groups.

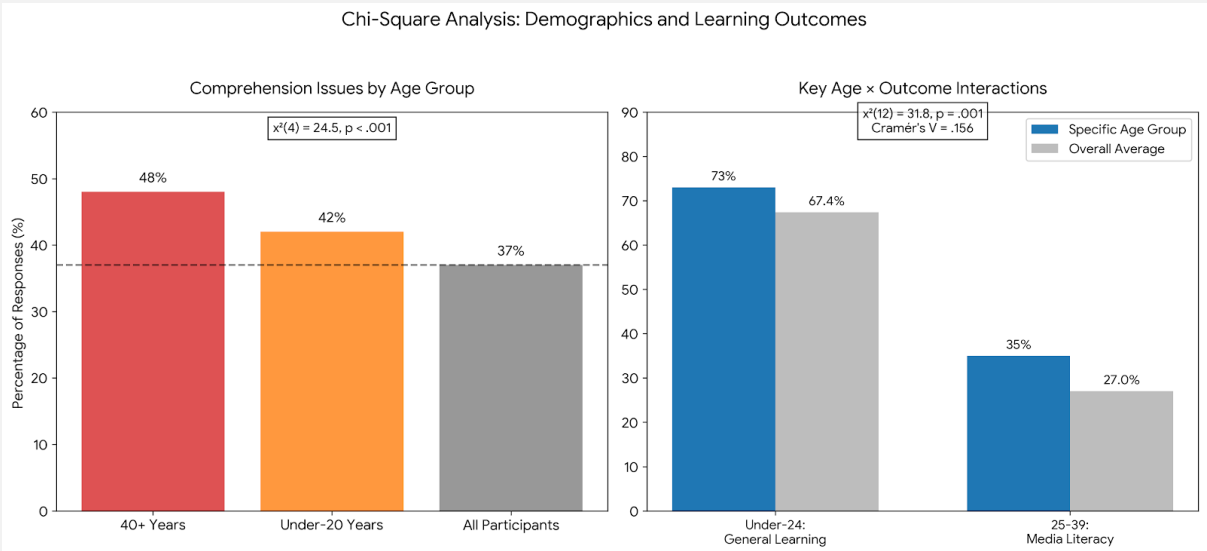


Figure 6. Chi-square results: (a) responses coded as comprehension issues by age group; (b) learning-outcome categories for selected age groups compared with the overall sample (Source: authors' own data).

DISCUSSION

The results describe a platform that engaged a large and demographically varied audience while producing learning outcomes that were predominantly general rather than specifically evaluative, and that were unevenly distributed across age groups and regions. These three features are interpreted in turn against the existing evidence on gamified prebunking and on digital inequality. Because the design was observational and the outcome measures were self-reported, the interpretation is restricted to patterns of engagement and articulated learning; it does not extend to claims about change in participants' ability to discriminate true from false content.

Engagement and the Depth of Learning Outcomes

The distribution of learning outcomes in Table 4 is the most consequential finding for intervention design. The session durations and satisfaction ratings in Table 2 indicate that the narrative held attention, which is consistent with meta-analytic evidence that game fiction is among the design features associated with larger effects on behavioural learning outcomes (Sailer & Homner, 2020). Yet the concentration of codeable responses in the general learning category, against a negligible share expressing analytic reasoning, indicates that attention did not convert into articulated evaluative competence for most users. This dissociation is not peculiar to the present platform. Meta-analytic estimates of gamified learning place cognitive effects in the small-to-moderate range and find motivational and behavioural effects both smaller and less stable (Sailer & Homner, 2020; Huang et al., 2020), and the reanalysis of the principal gamified inoculation trials concluded

that they moved response bias towards generalised scepticism rather than improving discrimination between true and false content (Modirrousta-Galian & Higham, 2023). A platform that leaves users with heightened awareness but no articulable procedure for verification produces precisely the outcome profile such a shift in bias would predict. The comparatively short engagement with the themes most directly targeting digital literacy competencies, relative to general narrative content in Table 3, reinforces this reading: the narrative was the attraction, and the instructional payload attached to it was the part users dwelt on least.

A second consideration concerns measurement rather than the intervention. More than a third of all respondents left the open-ended learning question blank, answered with irrelevant characters, or stated that they did not understand it. Treating this group as having learned nothing would be an over-reading. A single open-ended prompt in a multilingual, voluntary, web-based setting places a substantial expressive burden on respondents, and failure to articulate learning is not equivalent to failure to learn. The reported distribution of learning outcomes should therefore be read as a lower bound on what users took away, and as an argument for assessment instruments that do not depend on unprompted written articulation.

Demographic Gradients in Satisfaction

Satisfaction peaked in the 25–29 cohort and declined in both directions, and the youngest group did not rate the experience most highly (Table 5). This pattern is inconsistent with the assumption that users who grew up with digital media are the most receptive to, or competent with, digital information tasks, an assumption for which the educational research literature finds no support (Kirschner & De Bruyckere, 2017). It is more consistent with an account in which familiarity with the narrative conventions and civic subject matter of the platform, rather than exposure to digital technology as such, drives receptiveness. The lowest satisfaction occurred in the oldest cohort, which also returned the highest proportion of uninterpretable open-ended responses; the two findings are plausibly related, and the satisfaction gap at the upper end of the age range may partly reflect the accessibility of the platform's interface and of its survey instrument rather than the appeal of the intervention itself. Distinguishing these explanations requires outcome measures administered independently of the platform, which the present design did not include.

The gender findings separate participation from experience. Women were substantially over-represented among participants, with the asymmetry concentrated in the working-age cohorts, yet gender showed no detectable association with satisfaction either in the bivariate comparison or once age and region were controlled (Table 6; Table 8). Differential uptake rather than differential experience therefore accounts for the composition of the sample. This distinction is worth stating precisely, because interventions elsewhere in South Asia have shown gendered effects on outcomes rather than on uptake: in urban Pakistan, negative effects on the identification of true news were driven by female respondents (Ali & Qazi, 2023). The present data speak only to who chose to participate and how they rated the experience, not to whether the platform worked equally well for women and men.

Regional Disparities and the Digital Divide

Region was the strongest demographic predictor of satisfaction, accounting for more unique variance than age and substantially more than gender, and the spread between the highest- and lowest-rated regions covered a large part of the usable scale range (Table 7). Read against the digital divide literature, this is an expected result rather than a surprising one: differences in internet skills, and in the outcomes people derive from internet use, are structured by education, socioeconomic position and geography independently of connectivity itself, and these second- and third-level divides are poorly captured by access statistics (Scheerder et al., 2017). The uneven South Asian results noted earlier follow the same logic, in that one instrument produced discernment gains in an educated urban Indian sample and none in a rural one (Guess et al., 2020), and a

general educational video in Pakistan became effective only when augmented with feedback tailored to the individual user (Ali & Qazi, 2023). Effectiveness in these settings is a function of fit between intervention and population, not a fixed property of the intervention.

This interpretation must nonetheless be held loosely. Participants were recruited through voluntary, multi-channel means, and the regional distribution of the sample was heavily weighted towards the Western Province. Region is consequently confounded with recruitment pathway, prior interest and baseline digital competence, and the observed regional gap cannot be attributed to the intervention's design in any one region. What the finding does establish is that an intervention distributed uniformly across a heterogeneous country did not produce uniform experience, a result with direct implications for equity claims made on behalf of scalable digital interventions, and one that the sampling limitations set out in the Limitations subsection constrain but do not remove.

Implications for Intervention Design

Three design implications follow. First, narrative engagement and skill acquisition require separate design attention. The present findings, together with the meta-analytic moderator evidence, suggest that narrative secures attention while explicit instructional scaffolding, in the form of structured reflection, decision feedback and opportunities to practise verification rather than observe it, is what converts attention into competence (Sailer & Homner, 2020; Nicholson, 2015). Second, single-exposure designs should not be expected to produce lasting change: inoculation effects decay within approximately two months without boosting and persist appreciably longer when learners are revisited at intervals (Maertens et al., 2021), which argues for distribution as a sequence of short contacts rather than as a one-off engagement. Third, equity should be designed and measured rather than assumed. Where an intervention is intended to reach a linguistically and geographically heterogeneous population, stratified recruitment, region-specific pilot testing and outcome measures that do not presuppose written fluency are necessary conditions for interpreting its reach, as the methodological literature on misinformation research in the Global South has argued (Badrinathan & Chauchard, 2024). More broadly, evidence synthesised across both hemispheres finds the most consistent support for inoculation or prebunking and for debunking among the available intervention types (Blair et al., 2024); the contribution that character-based platforms can make is likely to lie in extending the reach of these mechanisms to audiences that classroom-based and text-based approaches do not reach, provided the instructional component is strengthened.

Limitations

Participants were voluntary users who chose to engage with a digital literacy platform, representing a non-random convenience sample. This self-selection introduces systematic bias, as participants likely possessed: (a) higher baseline digital literacy than the general population, (b) pre-existing interest in media literacy topics, (c) greater motivation for self-directed learning, and (d) more favorable attitudes toward educational technology. Consequently, observed engagement rates and learning outcomes likely overestimate effectiveness for the broader Sri Lankan population, particularly individuals with limited digital skills, low educational attainment, or minimal interest in information verification.

The voluntary nature of participation also means that individuals most vulnerable to misinformation, including those with lowest digital literacy, limited critical thinking exposure, or highest susceptibility to manipulation tactics, are systematically underrepresented in the sample. This selection bias limits conclusions about the intervention's effectiveness for the populations most urgently requiring digital literacy support.

The substantial overrepresentation of Western Province participants (approximately 45% of sample) limits generalizability to rural and underserved populations. Western Province encompasses Colombo (commercial capital) and surrounding areas with superior infrastructure, higher

socioeconomic status, better educational resources, and greater digital access compared to rural provinces.

This geographic skew means the sample systematically underrepresents populations facing the greatest barriers to digital literacy: rural communities with limited internet connectivity, lower device ownership, fewer educational opportunities, and distinct cultural contexts. Regional performance differences observed in the study may reflect pre-existing infrastructure and education disparities rather than intervention design effectiveness per se. Caution is warranted in generalizing findings to populations outside well-connected urban and suburban areas.

The observational design lacks a control group or alternative intervention comparison, preventing causal attribution of observed outcomes specifically to the gamification approach versus other factors (e.g., general education effect, demand characteristics, temporal factors). Observed satisfaction and learning could reflect:

a. Hawthorne effects (participants responding positively due to research participation)
b. Novelty effects (initial enthusiasm that might diminish with repeated exposure)
c. Demand characteristics (participants inferring desired responses)
d. Secular trends (changes in media literacy awareness during study period)

Ethical Considerations of Gamification

While not a methodological limitation per se, it is important to acknowledge that gamification techniques, like any persuasive educational approach, carry potential for misuse. The same narrative transportation and emotional engagement mechanisms that can enhance learning could theoretically be exploited to reinforce misinformation or manipulate attitudes. Educational interventions must include explicit reflection on persuasion ethics and maintain transparency about pedagogical goals to avoid inadvertently teaching manipulation techniques that could be weaponized. Future research should examine potential unintended consequences of gamified interventions, including whether exposure to misinformation scenarios (even in refutational contexts) might paradoxically increase familiarity with false claims or normalize certain manipulation tactics.

CONCLUSION

This study examined engagement with a character-based gamified digital literacy platform among more than 1,100 voluntary users in Sri Lanka, and assessed how that engagement and its reported learning outcomes were distributed across age, gender and region. Against the first objective, engagement and satisfaction were moderately positive and consistent across all four measured dimensions, with session durations indicating substantive rather than cursory interaction. Against the second, satisfaction varied systematically by age and, more strongly, by region, while gender predicted participation but not experience. Against the third, the learning outcomes users articulated were predominantly general awareness rather than specific media literacy skills, and expressions of analytic reasoning were rare. Against the fourth, the combination of broad engagement with shallow and unevenly distributed learning indicates that reach and instructional effect should be evaluated as distinct criteria rather than treated as a single measure of success.

The contribution of the study is therefore twofold. It provides engagement evidence on a character-based gamified intervention from a South Asian context that is under-represented in the misinformation intervention literature, and it shows that aggregate engagement statistics can conceal demographic and geographic disparities large enough to matter for policy. Because the design was observational, lacked a control group and relied on self-reported outcomes, it establishes neither a causal effect of the gamification approach nor any change in users' ability to discriminate true from false content.

Future work should accordingly pair such platforms with controlled designs and behavioural outcome measures that separate discrimination from response bias; test whether sustained or repeated exposure, rather than a single session, yields durable gains; stratify recruitment so that

rural and low-connectivity populations are represented in proportion to their exposure to information disorder; and compare character-driven against technique-typology designs directly, so that the contribution of narrative to digital literacy learning can be estimated rather than inferred.

DECLARATIONS

Author Contributions. Conceptualization, F.A. and O.G.; methodology, F.A. and O.G.; investigation, F.A., O.G., N.d.M., and R.D.S.; formal analysis, F.A. and O.G.; data curation, N.d.M. and R.D.S.; visualization, O.G.; writing—original draft, F.A.; writing—review and editing, O.G., N.d.M., and R.D.S.; supervision, O.G.; project administration, F.A.

Funding. This research received no external funding.

Ethical Clearance and Informed Consent. The study was approved by the research ethics committee of the authors' university. Participation was voluntary and anonymous, and informed consent was obtained from all participants before they answered the questionnaire.

Conflict of Interest. The authors declare no conflict of interest.

Data Availability Statement. The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of AI Use. The authors used Claude AI (Anthropic) to assist in generating the diagram included in this manuscript. The tool was used solely for diagram generation and not for data collection, data analysis, interpretation of results, or manuscript writing. The authors reviewed and take full responsibility for the accuracy and content of the generated diagram and the entire manuscript.

REFERENCES

Ali, A., & Qazi, I. A. (2023). Countering misinformation on social media through educational interventions: Evidence from a randomized experiment in Pakistan. *Journal of Development Economics*, *163*, Article 103108. https://doi.org/10.1016/j.jdeveco.2023.103108

Badrinathan, S. (2021). Educative interventions to combat misinformation: Evidence from a field experiment in India. *American Political Science Review*, *115*(4), 1325–1341. https://doi.org/10.1017/S0003055421000459

Badrinathan, S., & Chauchard, S. (2024). Researching and countering misinformation in the Global South. *Current Opinion in Psychology*, *55*, Article 101733. https://doi.org/10.1016/j.copsyc.2023.101733

Basol, M., Roozenbeek, J., Berriche, M., Uenal, F., McClanahan, W. P., & van der Linden, S. (2021). Towards psychological herd immunity: Cross-cultural evidence for two prebunking interventions against COVID-19 misinformation. *Big Data & Society*, *8*(1), 1–18. https://doi.org/10.1177/20539517211013868

Basol, M., Roozenbeek, J., & van der Linden, S. (2020). Good news about bad news: Gamified inoculation boosts confidence and cognitive immunity against fake news. *Journal of Cognition*, *3*(1), Article 2. https://doi.org/10.5334/joc.91

Blair, R. A., Gottlieb, J., Nyhan, B., Paler, L., Argote, P., & Stainfield, C. J. (2024). Interventions to counter misinformation: Lessons from the Global North and applications to the Global South. *Current Opinion in Psychology*, *55*, Article 101732. https://doi.org/10.1016/j.copsyc.2023.101732

Compton, J. (2013). Inoculation theory. In J. P. Dillard & L. Shen (Eds.), *The SAGE handbook of persuasion: Developments in theory and practice* (2nd ed., pp. 220–237). SAGE. https://doi.org/10.4135/9781452218410.n14

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology*, *79*(5), 701–721. https://doi.org/10.1037/0022-3514.79.5.701

Guess, A. M., Lerner, M., Lyons, B., Montgomery, J. M., Nyhan, B., Reifler, J., & Sircar, N. (2020). A digital media literacy intervention increases discernment between mainstream and false news in the United States and India. *Proceedings of the National Academy of Sciences*, *117*(27), 15536–15545. https://doi.org/10.1073/pnas.1920498117

Huang, R., Ritzhaupt, A. D., Sommer, M., Zhu, J., Stephen, A., Valle, N., Hampton, J., & Li, J. (2020). The impact of gamification in educational settings on student learning outcomes: A meta-analysis. *Educational Technology Research and Development*, *68*(4), 1875–1901. https://doi.org/10.1007/s11423-020-09807-z

Kiili, K., Siuko, J., & Ninaus, M. (2024). Tackling misinformation with games: A systematic literature review. *Interactive Learning Environments*, *32*(10), 7086–7101. https://doi.org/10.1080/10494820.2023.2299999

Kirschner, P. A., & De Bruyckere, P. (2017). The myths of the digital native and the multitasker. *Teaching and Teacher Education*, *67*, 135–142. https://doi.org/10.1016/j.tate.2017.06.001

Lewandowsky, S., & van der Linden, S. (2021). Countering misinformation and fake news through inoculation and prebunking. *European Review of Social Psychology*, *32*(2), 348–384. https://doi.org/10.1080/10463283.2021.1876983

Maertens, R., Roozenbeek, J., Basol, M., & van der Linden, S. (2021). Long-term effectiveness of inoculation against misinformation: Three longitudinal experiments. *Journal of Experimental Psychology: Applied*, *27*(1), 1–16. https://doi.org/10.1037/xap0000315

McGrew, S., Ortega, T., Breakstone, J., & Wineburg, S. (2017). The challenge that's bigger than fake news: Civic reasoning in a social media environment. *American Educator*, *41*(3), 4–9, 39.

Modirrousta-Galian, A., & Higham, P. A. (2023). Gamified inoculation interventions do not improve discrimination between true and fake news: Reanalyzing existing research with receiver operating characteristic analysis. *Journal of Experimental Psychology: General*, *152*(9), 2411–2437. https://doi.org/10.1037/xge0001395

Nicholson, S. (2015). A RECIPE for meaningful gamification. In T. Reiners & L. C. Wood (Eds.), *Gamification in education and business*. Springer. https://doi.org/10.1007/978-3-319-10208-5_1

Roozenbeek, J., Schneider, C. R., Dryhurst, S., Kerr, J., Freeman, A. L. J., Recchia, G., van der Bles, A. M., & van der Linden, S. (2020). Susceptibility to misinformation about COVID-19 around the world. *Royal Society Open Science*, *7*(10), Article 201199. https://doi.org/10.1098/rsos.201199

Roozenbeek, J., & van der Linden, S. (2019a). Fake news game confers psychological resistance against online misinformation. *Palgrave Communications*, *5*, Article 65. https://doi.org/10.1057/s41599-019-0279-9

Roozenbeek, J., & van der Linden, S. (2019b). The fake news game: Actively inoculating against the risk of misinformation. *Journal of Risk Research*, *22*(5), 570–580. https://doi.org/10.1080/13669877.2018.1443491

Roozenbeek, J., & van der Linden, S. (2020). Breaking Harmony Square: A game that "inoculates" against political misinformation. *Harvard Kennedy School Misinformation Review*, *1*(8). https://doi.org/10.37016/mr-2020-47

Roozenbeek, J., van der Linden, S., Goldberg, B., Rathje, S., & Lewandowsky, S. (2022). Psychological inoculation improves resilience against misinformation on social media. *Science Advances*, *8*(34), Article eabo6254. https://doi.org/10.1126/sciadv.abo6254

Ryan, R. M., & Deci, E. L. (2024). Self-determination theory. In F. Maggino (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 6229–6235). Springer. https://doi.org/10.1007/978-3-031-17299-1_2630

Sailer, M., & Homner, L. (2020). The gamification of learning: A meta-analysis. *Educational Psychology Review*, *32*(1), 77–112. https://doi.org/10.1007/s10648-019-09498-w

Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of Internet skills, uses and outcomes: A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, *34*(8), 1607–1624. https://doi.org/10.1016/j.tele.2017.07.007

Segers, M., & Van der Haar, S. (2012). The experiential learning theory: D. Kolb and D. Boud. In F. Dochy, D. Gijbels, M. Segers, & P. Van den Bossche (Eds.), *Theories of learning for the workplace: Building blocks for training and professional development programs* (pp. 52–65). Routledge.

Traberg, C. S., Roozenbeek, J., & van der Linden, S. (2022). Psychological inoculation against misinformation: Current evidence and future directions. *The ANNALS of the American Academy of Political and Social Science*, *700*(1), 136–151. https://doi.org/10.1177/00027162221087936