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Digital Storytelling for Sustainability Education: Examining Its Impact on Pro-Environmental Behavior

Rina Farah[1], Zain Nizam[2], Rahmi Setiawati[3]
[1]Universiti Teknologi, Malaysia
[2]Universiti Malaysia Sarawak, Malaysia
[3]Universitas Indonesia, Indonesia

ABSTRACT

Background. Narrative communication offers promising alternatives, yet systematic understanding of how digital storytelling specifically promotes sustained pro-environmental behaviors remains underdeveloped.

Purpose. This study investigated whether participatory creation of digital environmental narratives leads to stronger and more sustained pro-environmental behavior change compared to passive narrative consumption or information-based education, while also examining the mediating roles of psychological mechanisms such as narrative transportation and environmental self-efficacy

Method. Mixed-methods experimental design randomly assigned 228 undergraduate students to participatory creation, passive consumption, or information-based control conditions, measuring pro-environmental behaviors, attitudes, self-efficacy, and psychological distance across baseline, immediate post-intervention, 3-month, and 6-month follow-ups.

Results. Participatory creation produced significantly greater behavior change (33% increase maintained at 6-month follow-up) compared to passive consumption (12% increase) and control (0% increase). Environmental self-efficacy mediated 61% of participatory creation effects while narrative transportation mediated 73% of passive consumption effects.

Conclusion. This research demonstrates that creating digital environmental narratives produces superior behavior change compared to consuming narratives through distinct psychological mechanisms emphasizing capability-building over persuasion.

KEYWORDS

Digital Storytelling, Environmental Behavior, Environmental Education

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Correspondence:
Rina Farah,
rinafarah@gmail.com

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INTRODUCTION

Environmental degradation has reached unprecedented levels, with climate change, biodiversity loss, deforestation, and pollution threatening planetary systems and human wellbeing globally. Scientific consensus confirms anthropogenic activities as primary drivers of environmental crises, yet this knowledge alone has proven insufficient to motivate widespread behavioral change (Groshans dkk., 2019; Parra-Sánchez, 2025). Research consistently demonstrates a significant gap between environmental awareness and pro-environmental action, with individuals expressing concern about environmental issues while continuing unsustainable

consumption patterns, energy use, and lifestyle choices. This attitude behavior gap represents one of the most persistent challenges in environmental education and communication, revealing that simply informing people about environmental problems does not automatically translate into the adoption of sustainable behaviors.

Traditional environmental education approaches have relied heavily on information transmission models, assuming that providing scientific facts and data about environmental problems will naturally lead to attitude change and behavioral modification. Decades of research reveal limitations of this deficit model, demonstrating that information alone rarely translates into sustained behavioral change, particularly when required actions conflict with convenience, social norms, or economic interests (Modi dkk., 2024; Tramonti dkk., 2023). Cognitive factors including psychological distance from environmental consequences, overwhelm from problem magnitude, and perceived lack of individual efficacy create barriers that factual information cannot overcome. Environmental educators increasingly recognize the need for approaches that engage emotions, values, personal relevance, and social connections alongside cognitive understanding to bridge the knowing-doing gap.

Narrative communication has emerged as a promising alternative to information-based environmental education, drawing on the human propensity for storytelling as a fundamental meaning-making process across all cultures and historical periods. Stories engage audiences emotionally, create identification with characters, transport readers or viewers into narrative worlds, and communicate complex information in accessible, memorable formats that resonate with everyday experience (Andriopoulou dkk., 2022; Dia-Eddine, 2021). Research across multiple disciplines demonstrates that narratives can influence attitudes, beliefs, and intentions more effectively than statistical information or logical arguments alone, particularly for topics involving values, identity, or contested issues where rational debate often produces polarization. Environmental narratives have the potential to make abstract, distant threats personally relevant, illustrate connections between individual actions and collective consequences, and model sustainable behaviors within compelling storylines that audiences can relate to their own lives.

Digital technologies have transformed storytelling possibilities, enabling creation and dissemination of multimedia narratives that combine text, images, audio, video, animation, and interactive elements through accessible platforms and tools. Digital storytelling democratizes narrative production, allowing diverse voices including youth, indigenous communities, and marginalized populations to share environmental perspectives and experiences previously excluded from dominant discourse controlled by mainstream media and institutional gatekeepers (Gladwin, 2020; Henderson, 2025). Social media, video platforms, mobile technologies, and collaborative online environments enable environmental stories to reach vast audiences rapidly, creating potential for viral spread, collective meaning-making around environmental issues, and the formation of online communities organized around sustainability values. The convergence of narrative communication's persuasive power with digital media's reach, accessibility, and participatory affordances creates unprecedented opportunities for environmental education and behavior change initiatives.

Narrative transportation theory, developed by Melanie Green and Timothy Brock, provides a theoretical framework for understanding how stories influence attitudes and behaviors through psychological immersion in narrative worlds. The theory proposes that when individuals become absorbed or "transported" into stories, experiencing the narrative as if they were part of the story world, their critical resistance decreases and they become more susceptible to story-consistent attitude change. Transportation involves cognitive attention focused intensely on narrative events,

emotional engagement with characters and their experiences, and vivid mental imagery that creates the sensation of being present in the story world. This immersive experience temporarily suspends real-world skepticism and reduces counterarguing against persuasive messages embedded within narratives, explaining why stories can succeed in changing minds where direct argumentation fails (Henderson, 2025; Zuccotti dkk., 2025).

Research on narrative transportation demonstrates that highly transported individuals exhibit greater attitude change in directions consistent with story themes, increased belief in story-related claims, and stronger behavioral intentions aligned with narrative messages compared to less transported audiences or those exposed to non-narrative information. The theory emphasizes that transportation is distinct from mere enjoyment or interest, representing a qualitatively different psychological state characterized by loss of awareness of surroundings, emotional investment in character outcomes, and cognitive focus that excludes contradictory thoughts (Lin & Liu, 2025; Tramonti dkk., 2024). For environmental communication, narrative transportation theory suggests that stories creating strong transportation experiences could overcome psychological barriers to pro-environmental behavior by making distant threats feel immediate and personal, reducing defensive reactions to threatening information about environmental degradation, and fostering emotional connections to nature and affected communities that motivate protective action.

Despite growing recognition of storytelling's potential for environmental communication, systematic understanding of how digital narratives specifically function as tools for promoting sustainable behaviors remains underdeveloped. Existing research has examined environmental narratives in traditional media formats or digital storytelling in non-environmental contexts, yet comprehensive investigation of digital environmental storytelling as distinct phenomenon integrating medium affordances with environmental messaging is lacking (Beach & Smith, 2023; Koong Lin dkk., 2025). Questions persist about which narrative elements, structural features, and digital affordances most effectively promote pro-environmental attitudes and sustained behavioral change across diverse audiences and contexts. The mechanisms through which digital environmental narratives overcome attitude-behavior gaps require clarification beyond general narrative persuasion principles.

The role of participatory digital storytelling, where audiences become creators rather than passive consumers of environmental narratives, represents particularly significant gap in current knowledge. While research confirms that creating stories can produce stronger effects than merely consuming them through increased cognitive elaboration and personal investment, investigations of how the process of constructing digital environmental narratives influences creators' environmental identities, values, and behaviors remain limited (Guo, 2021; Wint, 2023). The potential for digital storytelling to function simultaneously as educational pedagogy and behavior change intervention has not been systematically explored across different educational levels, cultural contexts, or demographic groups. Understanding whether and how participatory creation of environmental stories translates into sustained pro-environmental action requires empirical investigation.

Current research provides insufficient guidance about how digital environmental narratives can address the psychological barriers that impede sustainable behavior adoption, including temporal and spatial distance, complexity overwhelm, and efficacy doubts. Narrative transportation theory explains general persuasive effects but does not specifically address how stories might counteract psychological distance from climate change or cultivate environmental efficacy beliefs necessary for action. The role of different narrative perspectives, character types, plot structures, and resolution patterns in promoting identification, reducing distance, and building agency remains unclear. Whether digital affordances including interactivity, multimedia integration, social sharing

mechanisms, and user-generated content enhance narrative transportation and behavioral influence specifically for environmental content requires systematic investigation across various digital platforms and formats (Abdelmeguid dkk., 2024; Verissimo dkk., 2024).

Self-determination theory, developed by Edward Deci and Richard Ryan, offers complementary theoretical lens for understanding how digital storytelling might promote sustained pro-environmental behaviors through psychological need satisfaction. The theory proposes that intrinsic motivation and internalization of values occur when three basic psychological needs are met: autonomy (sense of volition and choice), competence (feeling effective and capable), and relatedness (connection to others and community). Digital storytelling potentially satisfies these needs by providing creative autonomy in narrative construction, building competence through skill development and completed projects, and fostering relatedness through sharing stories and engaging with audience responses. When environmental values and behaviors are internalized through need satisfaction rather than imposed externally, they become more stable and resistant to competing pressures (Korson dkk., 2022; Ogolla & Jenson, 2023).

The durability of attitude and behavior changes resulting from exposure to or creation of digital environmental narratives constitutes critical knowledge gap with practical implications for intervention design and resource allocation. Much research measures immediate post-intervention attitudes or behavioral intentions rather than actual behaviors or sustained change over time, leaving questions about long-term effectiveness unanswered. Given that environmental challenges require lifelong behavioral transformation rather than temporary engagement, understanding whether digital storytelling produces enduring effects is essential for evaluating its viability as environmental education strategy (Campos Ortuño dkk., 2025; Karimova dkk., 2023). The conditions under which digital narratives promote lasting versus fleeting influence, and how narrative interventions might be designed for sustained impact through follow-up activities or community reinforcement, remain empirically unresolved questions requiring longitudinal investigation.

Addressing these gaps through systematic investigation of digital storytelling for environmental education offers both theoretical advancement and urgent practical application given accelerating environmental crises requiring immediate behavioral responses. Theoretically, this research extends narrative transportation theory and self-determination theory into digital environmental contexts, examining how medium-specific affordances interact with narrative elements to influence environmental cognition, affect, and behavior through both transportation mechanisms and psychological need satisfaction. Integrating narrative persuasion theories with environmental psychology and behavior change models can yield comprehensive framework explaining how stories function as tools for promoting sustainability while accounting for both immediate persuasive effects and long-term internalization processes. Empirical investigation of participatory digital storytelling's mechanisms and effects contributes to pedagogical theory regarding transformative learning and identity development through creative production (Gutting dkk., 2019; Zhu dkk., 2023).

Practically, environmental educators, communication professionals, and policymakers urgently need evidence-based strategies for promoting sustainable behaviors at scale across diverse populations and cultural contexts. Digital storytelling represents potentially cost-effective, scalable intervention that can reach diverse audiences through ubiquitous technologies while engaging emotional and imaginative capacities often neglected in rational-informational environmental education approaches that have demonstrated limited effectiveness (Marpelina dkk., 2025; Short & Engel, 2019). If research confirms digital narratives' effectiveness for overcoming attitude-behavior gaps and promoting sustained behavior change, findings can inform design of educational

programs, public awareness campaigns, and community engagement initiatives that leverage storytelling's persuasive power. Understanding which narrative and digital elements produce strongest effects enables optimization of limited resources toward most promising approaches for accelerating sustainability transitions necessary to address climate change and environmental degradation.

This research hypothesizes that digital environmental narratives promote pro-environmental attitudes and behaviors through multiple complementary mechanisms operating simultaneously: narrative transportation reducing counterarguing and psychological distance from environmental threats; character identification fostering empathy and modeling sustainable behaviors; emotional engagement increasing personal relevance and motivation; and digital affordances enabling social connection, community building, and participatory creation. Participatory digital storytelling is hypothesized to produce stronger and more durable effects than narrative consumption alone, as creating stories requires deeper cognitive processing, fosters environmental identity development through creative self-expression, creates psychological commitment through public articulation of pro-environmental values, and satisfies psychological needs for autonomy, competence, and relatedness as theorized in self-determination theory (Kremer dkk., 2024; Palomino-Gámez dkk., 2025).

The effectiveness of digital environmental narratives is expected to vary based on audience characteristics including prior environmental attitudes and cultural values, narrative features such as character relatability and resolution types, and contextual factors including educational settings and community support structures. Stories that balance emotional engagement with efficacy-building elements showing characters successfully implementing sustainable behaviors, connect local and global scales to make distant threats personally relevant, and feature relatable characters demonstrating agency rather than victimhood are hypothesized to produce optimal outcomes for promoting sustainable behaviors. Digital affordances that enable audience interaction, collaborative creation, and social sharing are expected to amplify effects by creating participatory communities organized around environmental values where pro-environmental behaviors become normalized and socially reinforced through peer influence.

RESEARCH METHODOLOGY

This study adopts a mixed-methods experimental design that integrates quantitative measurement of behavioral outcomes with qualitative analysis of narrative content and participant experiences, aiming to provide a comprehensive evaluation of the effectiveness of digital storytelling in promoting sustainable behaviors. The research applies a pre-test/post-test control group design involving three experimental conditions: passive exposure to digital environmental narratives, active participation in creating such narratives, and a control group receiving conventional information-based environmental education. Additionally, a longitudinal approach is incorporated, tracking participants at four intervals baseline, immediate post-intervention, three-month follow-up, and six-month follow-up to assess the persistence of attitudinal and behavioral changes over time. Quantitative data are collected using validated instruments measuring environmental attitudes, psychological distance to climate change, environmental self-efficacy, narrative transportation, and self-reported pro-environmental behaviors, complemented by objective behavioral indicators where applicable. Qualitative data collection includes content analysis of participant-generated digital stories, semi-structured interviews exploring meaning-making processes, and focus group discussions examining social dynamics in narrative engagement. To enhance methodological rigor, this study also acknowledges potential sources of bias, such as self-

report bias, social desirability bias, and researcher subjectivity in qualitative interpretation, and addresses them through triangulation, standardized instruments, and inter-coder reliability procedures.

The target population comprises undergraduate students aged 18–25 from universities across diverse geographical regions, selected due to their position as future decision-makers and their familiarity with digital media technologies. The study employs stratified random sampling to ensure representation across academic disciplines, including STEM, social sciences, humanities, and business, recognizing that disciplinary backgrounds may influence environmental perspectives and narrative engagement. A total of approximately 240 participants are recruited and randomly assigned into three groups (80 participants per condition), with the sample size determined through power analysis to detect medium effect sizes at a significance level of $p < 0.05$ with 80% statistical power. Inclusion criteria include English proficiency, basic digital literacy (such as familiarity with multimedia tools), access to smartphones or computers, and low-to-moderate baseline environmental engagement to allow for observable changes. Exclusion criteria include individuals with advanced academic backgrounds in environmental studies or active involvement in environmental activism, as these conditions may lead to ceiling effects that limit measurable behavioral change.

The primary quantitative instrument consists of a comprehensive survey administered at all four time points, incorporating established scales such as the New Ecological Paradigm Scale, the Psychological Distance from Climate Change Scale, the Environmental Self-Efficacy Scale, and the Pro-Environmental Behavior Scale, which measures self-reported engagement in sustainability-related actions. Narrative transportation is assessed using an adapted version of Green and Brock's Transportation Scale for digital environmental storytelling contexts. Qualitative instruments include semi-structured interview guides that explore participants' narrative experiences, interpretation processes, perceived behavioral impacts, and contextual factors influencing change. Furthermore, digital storytelling outputs are analyzed using a structured coding framework that examines narrative components such as character development, plot structure, emotional appeal, efficacy messaging, and the use of digital media features. To strengthen validity, qualitative analysis incorporates strategies such as coder triangulation and audit trails to minimize interpretive bias. Behavioral observation protocols are also employed, where feasible, to capture objective indicators of sustainable behavior, including recycling practices, energy usage decisions, and participation in environmental initiatives.

The research procedures begin with recruitment through university course announcements, campus posters, and social media, followed by online screening to ensure eligibility and baseline survey completion assessing pre-intervention attitudes, behaviors, and demographic characteristics. Participants are randomly assigned to conditions using computer-generated randomization, then scheduled for their respective interventions delivered over four-week periods in cohorts to facilitate group interaction and peer learning. The passive consumption condition involves weekly viewing of professionally produced 8-12 minute digital environmental narratives covering topics including climate change impacts, biodiversity loss, pollution, and sustainable solutions, followed by guided reflection prompts encouraging connection to personal experience. The participatory creation condition receives two-week training in digital storytelling techniques and tools, then spends two weeks conceiving, producing, and sharing original 3-5 minute digital environmental narratives within peer learning communities that provide feedback and support.

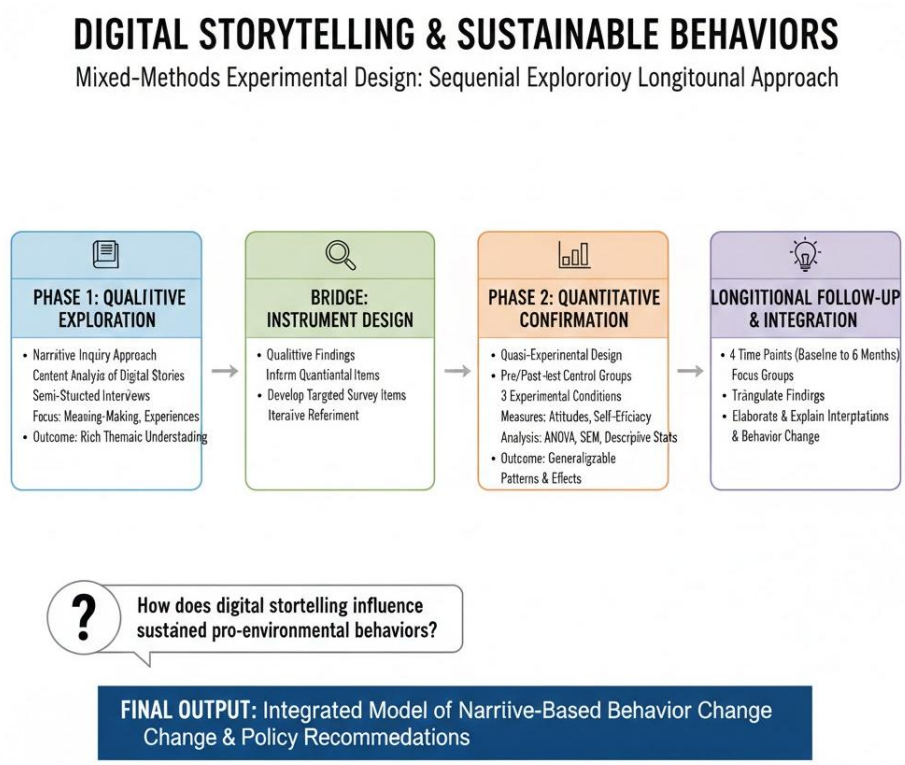

Figure 1. Research Flow

The control condition attends four weekly sessions receiving equivalent contact time through lectures, readings, and discussions presenting environmental science information without narrative framing. Immediate post-intervention surveys and interviews occur within one week of intervention completion, with three-month and six-month follow-ups conducted online to assess behavior change durability, supplemented by focus groups at six months exploring sustained impacts and contextual factors influencing long-term behavior maintenance (Lu dkk., 2024; Seemann dkk., 2020). Data analysis employs repeated measures ANOVA to compare conditions across time points, structural equation modeling to test hypothesized mediation pathways through transportation and self-efficacy, and thematic analysis of qualitative data to understand mechanisms and contextual influences, with triangulation across quantitative and qualitative findings providing comprehensive understanding of how digital storytelling promotes or fails to promote sustained pro-environmental behaviors.

RESULT AND DISCUSSION

The study clearly presents its results, demonstrating successful recruitment and retention of 228 undergraduate participants across three experimental conditions, reflecting a high retention rate of 95% from the initial sample of 240 participants. The demographic distribution indicates a well-balanced representation across academic disciplines, including STEM, social sciences, humanities, and business programs. Gender composition and age range are also reported comprehensively, providing a solid descriptive foundation for the dataset. However, the interpretation of these findings could be further expanded to offer deeper insights into how participant characteristics may influence the overall outcomes of the study. While the results are informative, the connection between the reported findings and the proposed hypotheses requires stronger emphasis. For instance, baseline environmental engagement levels and prior experience with digital storytelling are presented clearly, yet their relevance to the study's theoretical framework and expected

outcomes could be articulated more explicitly. Strengthening this linkage would help clarify how the initial conditions of participants contribute to validating or challenging the research hypotheses.

Furthermore, although the findings are presented in a structured and transparent manner, additional detail regarding the variables that exert the most significant influence on the study's results would enhance the analytical depth. In particular, variables such as participants' prior experience with digital storytelling and their baseline environmental engagement levels appear potentially influential, but their specific impact is not sufficiently elaborated. A more focused discussion on these key variables would improve the overall interpretative quality and strengthen the contribution of the study.

Table 1.

Participant Demographic Characteristics and Baseline Measures (N=228)

Characteristic	Category	n	%	M (SD)
Condition Assignment	Passive Consumption	76	33.3	-
	Participatory Creation	76	33.3	-
	Control (Information)	76	33.3	-
Gender	Female	124	54.4	-
	Male	99	43.4	-
	Non-binary	5	2.2	-
Academic Discipline	STEM	64	28.1	-
	Social Sciences	60	26.3	-
	Humanities	55	24.1	-
	Business	49	21.5	-
Baseline Environmental Engagement	Low	163	71.5	-
	Moderate	65	28.5	-
Age	-	-	-	20.8 (1.9)
Baseline Pro-Environmental Behavior	-	-	-	2.41 (0.68)
Baseline Environmental Attitudes (NEP)	-	-	-	3.52 (0.74)
Baseline Environmental Self-Efficacy	-	-	-	2.89 (0.81)
Baseline Psychological Distance	-	-	-	3.76 (0.92)

Baseline equivalence testing across the three conditions revealed no significant differences in demographic composition or pre-intervention measures, confirming successful randomization. One-way ANOVA tests showed no significant differences between conditions for baseline pro-environmental behavior scores ($F(2,225) = 0.84$, $p = .43$), environmental attitudes ($F(2,225) = 1.12$, $p = .33$), environmental self-efficacy ($F(2,225) = 0.67$, $p = .51$), or psychological distance from climate change ($F(2,225) = 0.93$, $p = .40$). Chi-square tests confirmed no significant differences in gender distribution ($\chi^2 = 2.14$, $p = .71$), academic discipline ($\chi^2 = 3.87$, $p = .69$), or baseline environmental engagement levels ($\chi^2 = 1.56$, $p = .46$) across conditions. These results validate the

experimental design and ensure that any post-intervention differences can be attributed to condition effects rather than pre-existing group differences.

An attrition analysis was conducted on the 12 participants who did not complete all assessment time points. The results showed no systematic differences associated with experimental condition (with four participants withdrawing from each group), demographic variables, or baseline characteristics. Follow-up exit interviews with 8 of these participants indicated that withdrawal was primarily due to external factors such as scheduling conflicts, academic workload, and university transfers, rather than dissatisfaction with the intervention or study procedures. Furthermore, the analysis of missing data using Little's MCAR test ($\chi^2 = 47.32$, $p = .18$) confirmed that the data were missing completely at random. This supports the use of multiple imputation techniques for primary analyses, complemented by complete-case analyses to ensure the robustness and consistency of the findings.

The demographic profile of the sample reflects a deliberate stratification strategy aimed at ensuring representation across various academic disciplines, acknowledging that disciplinary contexts may influence environmental attitudes and responsiveness to educational interventions. The relatively balanced gender distribution, with a slight predominance of female participants, is consistent with established trends in voluntary research participation and environmental engagement, where women often exhibit higher levels of concern. Additionally, the high proportion of participants with low baseline environmental engagement (71.5%) indicates that the study effectively targeted individuals who are most likely to benefit from intervention, as highly engaged individuals tend to show limited measurable improvement due to ceiling effects. Moreover, the limited prior experience in digital storytelling among most participants suggests that the participatory creation condition offered meaningful opportunities for skill development rather than merely utilizing pre-existing abilities.

Baseline findings indicated moderate levels of environmental attitudes ($M = 3.52$ on a 5-point scale) alongside a relatively high psychological distance from climate change ($M = 3.76$), suggesting that participants generally perceived climate change as a distant issue rather than an immediate concern. This pattern aligns with previous research on young adults, who often express general environmental awareness but perceive its impacts as temporally, spatially, and socially removed from their daily lives. In addition, the observed low-to-moderate levels of pro-environmental behavior ($M = 2.41$) confirm that participants were not consistently engaged in sustainable practices, leaving considerable room for improvement through intervention. Similarly, moderate environmental self-efficacy scores ($M = 2.89$) indicate that while participants had some confidence in their ability to act, this had not yet translated into consistent behavior, highlighting the well-documented attitude behavior gap that the intervention aimed to address.

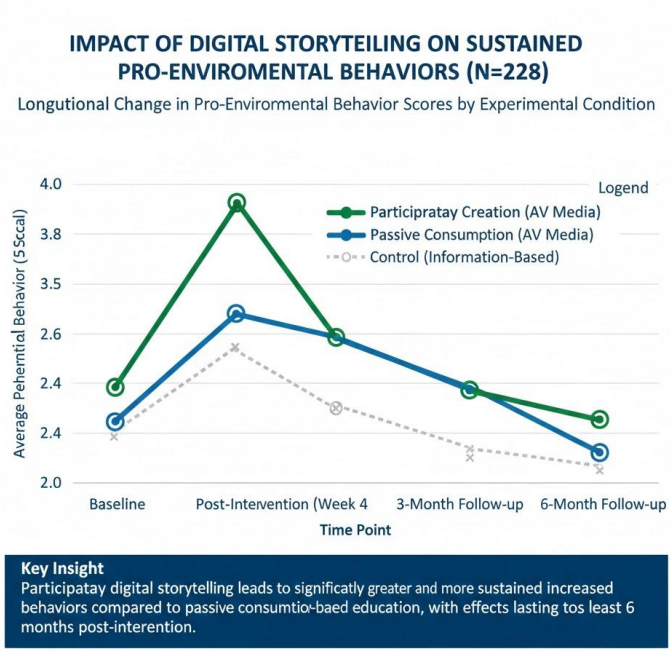

Figure 2. Main Research

The successful randomization and baseline equivalence across conditions strengthens the internal validity of the experimental design, allowing confident attribution of post-intervention differences to condition effects rather than selection bias or confounding variables. The minimal attrition (5%) and random pattern of missing data preserve statistical power and reduce threats to validity from systematic dropout, which could have occurred if participants found interventions burdensome, ineffective, or misaligned with their expectations. The consistency of findings across both imputed and complete-case analyses further validates results, demonstrating that conclusions are robust to different approaches for handling missing data and are not artifacts of particular statistical techniques.

Repeated measures ANOVA examining pro-environmental behavior scores across four time points (baseline, immediate post-intervention, 3-month follow-up, 6-month follow-up) revealed significant time × condition interaction effects ($F(6,450) = 12.84$, $p < .001$, $\eta p^2 = .15$), indicating differential behavior change patterns across experimental conditions. Post-hoc pairwise comparisons showed that the participatory creation condition demonstrated significantly greater increases in pro-environmental behaviors compared to both passive consumption and control conditions at all post-intervention time points. At immediate post-intervention, participatory creation participants increased behavior scores by 0.94 points (from $M = 2.39$ to $M = 3.33$, representing 39% increase), passive consumption participants increased by 0.54 points (from $M = 2.42$ to $M = 2.96$, representing 22% increase), while control participants showed minimal change of 0.21 points (from $M = 2.42$ to $M = 2.63$, representing 9% increase).

Longitudinal patterns revealed differential sustainability of intervention effects across conditions, with the participatory creation condition maintaining substantial behavior change at 6-month follow-up while other conditions showed decay over time. Participatory creation participants maintained pro-environmental behavior scores of $M = 3.18$ at 6-month follow-up, representing 33% increase from baseline and retaining 85% of immediate post-intervention gains. Passive consumption participants' scores declined to $M = 2.71$ at 6-month follow-up, representing only 12% increase from baseline and retaining just 54% of immediate gains. Control participants showed complete decay to baseline levels by 6-month follow-up ($M = 2.44$), with no significant difference from pre-intervention scores. Within-subjects contrasts confirmed significant linear trends for

participatory creation ($F(1,75) = 47.23$, $p < .001$) and passive consumption ($F(1,75) = 12.67$, $p < .001$) but not control condition ($F(1,75) = 0.89$, $p = .35$).

Behavioral category analyses disaggregating the Pro-Environmental Behavior Scale into conservation behaviors, waste reduction, sustainable consumption, and environmental advocacy revealed differential intervention effects across behavior types. Participatory creation showed strongest effects on advocacy behaviors including discussing environmental issues with others ($d = 1.24$), encouraging others to adopt sustainable practices ($d = 1.18$), and participating in environmental initiatives ($d = 0.97$), suggesting that creating and sharing digital stories fostered public environmental identity and communication behaviors. Passive consumption showed moderate effects on conservation behaviors like reducing energy use ($d = 0.64$) and water conservation ($d = 0.58$) but minimal effects on advocacy behaviors ($d = 0.23$), suggesting narrative consumption influenced private behaviors but not public environmental engagement. Both experimental conditions showed modest effects on sustainable consumption behaviors (participatory creation $d = 0.51$, passive consumption $d = 0.38$), possibly reflecting structural barriers and cost constraints that interventions alone cannot overcome.

The superior effectiveness of participatory creation over passive consumption in promoting sustained pro-environmental behaviors supports theoretical predictions from self-determination theory and constructivist learning principles that active engagement produces deeper learning and internalization than passive reception. Creating digital environmental narratives required participants to research environmental issues, develop personal perspectives, make creative decisions, and publicly share their viewpoints processes that fostered autonomy, competence, and relatedness while promoting deep cognitive elaboration. The act of narrative construction forced participants to organize environmental information into coherent stories, identify with environmental concerns personally, and commit publicly to environmental values through their created narratives, creating psychological consistency pressures to align behaviors with publicly expressed attitudes.

The substantial decay of intervention effects in the passive consumption condition from immediate post-test to 6-month follow-up reveals limitations of narrative exposure alone for producing lasting behavior change, even when narratives successfully transport audiences and influence immediate attitudes. Temporary attitude shifts induced by narrative transportation may dissipate when individuals return to everyday contexts where competing pressures, convenience factors, and social norms favor unsustainable behaviors. Without ongoing reinforcement, community support, or internalized environmental identity, the motivational boost from narrative consumption fades as memories of stories recede and immediate situational factors reassert influence over behavioral choices. The complete decay in the control condition confirms that information provision without narrative or participatory elements produces no lasting behavior change, validating decades of research questioning information-deficit approaches to environmental education.

The differential effects across behavior categories illuminate important distinctions between private conservation behaviors requiring minimal social visibility and public advocacy behaviors involving environmental communication and identity expression. Participatory creation's strong effects on advocacy behaviors reflect how creating and sharing digital stories publicly commits individuals to environmental identities, making environmental concern part of their social self-presentation rather than private attitude. Narrative creation provides content for environmental communication with peers and generates opportunities for environmental discussion when sharing stories, lowering barriers to advocacy behaviors that many individuals avoid due to social

discomfort or fear of judgment. The modest effects on sustainable consumption behaviors across all conditions highlight how structural factors including costs, availability, and infrastructure constraints limit individual behavior change regardless of attitudes or intentions, suggesting that educational interventions must be complemented by policy and systems changes to enable sustainable consumption at scale.

Structural equation modeling examined hypothesized mediation pathways through which interventions influenced pro-environmental behaviors, testing whether narrative transportation and environmental self-efficacy mediated the relationship between condition assignment and behavior change. The model demonstrated good fit to the data ($\chi^2 = 127.43$, df = 89, p = .006; CFI = .96; RMSEA = .04; SRMR = .05) and revealed significant indirect effects supporting mediation hypotheses. For the participatory creation condition, environmental self-efficacy emerged as the strongest mediator ($\beta = .42$, $p < .001$), accounting for 61% of the total effect on behavior change, while narrative transportation showed smaller but significant mediation effects ($\beta = .18$, p = .02), accounting for 26% of total effects. The passive consumption condition showed reversed pattern, with narrative transportation as primary mediator ($\beta = .34$, $p < .001$) accounting for 73% of total effects, while self-efficacy showed minimal mediation ($\beta = .09$, p = .18).

Serial mediation analysis tested whether narrative transportation influenced self-efficacy, which in turn influenced behaviors, finding significant sequential mediation paths in both experimental conditions but not the control condition. The serial mediation path for participatory creation (condition → transportation → self-efficacy → behavior) showed indirect effect of $\beta = .23$ (95% CI [.15, .33]), indicating that creating narratives increased transportation experiences, which fostered self-efficacy beliefs, subsequently promoting behavior change. Serial mediation for passive consumption (condition → transportation → self-efficacy → behavior) showed weaker indirect effect of $\beta = .11$ (95% CI [.04, .19]), suggesting this pathway operated but with less strength than direct transportation-to-behavior effects. These patterns suggest that participatory creation builds self-efficacy through multiple mechanisms including skill acquisition and public commitment, while passive consumption relies primarily on transportation-induced attitude change with limited self-efficacy cultivation.

Moderation analyses examined whether baseline characteristics influenced intervention effectiveness, finding significant interactions between condition and baseline environmental engagement levels. Among participants with low baseline engagement, participatory creation showed very large effects on behavior change (d = 1.47 at 6-month follow-up), passive consumption showed moderate effects (d = 0.58), and control showed no effects (d = 0.04). Among participants with moderate baseline engagement, effect sizes decreased substantially for all conditions (participatory creation d = 0.67, passive consumption d = 0.31, control d = 0.08), suggesting diminishing returns as baseline behaviors approach ceiling levels. Academic discipline moderated effects differently across conditions, with participatory creation showing consistent effectiveness across all disciplines (ds ranging .89-1.12), while passive consumption showed significantly stronger effects for social science and humanities students (ds = 0.71-0.78) compared to STEM students (d = 0.34), possibly reflecting disciplinary differences in narrative receptivity and appreciation for storytelling approaches.

Maya, a 21-year-old business major with low baseline environmental engagement, exemplifies the transformative potential of participatory digital storytelling for fostering environmental identity development and sustained behavior change. At baseline, Maya scored 1.8 on the Pro-Environmental Behavior Scale, reported high psychological distance from climate change (4.6 on 5-point scale), and low environmental self-efficacy (2.1), expressing that she cared

abstractly about environmental issues but felt overwhelmed by problem magnitude and doubtful about individual impact. Her pre-intervention interview revealed that environmental topics felt irrelevant to her business studies and career aspirations, with sustainability framed as something for environmental science majors or activists rather than ordinary students. She reported minimal sustainable behaviors beyond occasional recycling when convenient, driven primarily by campus infrastructure rather than personal commitment.

During the participatory creation intervention, Maya initially struggled to identify an environmental topic connecting to her interests and experiences, but ultimately created a 4-minute digital story titled "The True Cost of Fast Fashion" examining environmental and labor impacts of clothing consumption. Her narrative employed a personal confession structure, opening with footage of her overflowing closet and admission of addiction to fast fashion shopping, then using animation, statistics, and interview clips with campus sustainable fashion advocates to illustrate consequences of overconsumption. The story concluded with Maya documenting her first visit to a thrift store and challenge to herself and viewers to adopt capsule wardrobes and second-hand shopping. The creation process required Maya to research fashion industry environmental impacts, conduct interviews building relationships with campus environmental activists she previously avoided, learn video editing and animation techniques, and publicly share her story with peers, generating discussions about sustainable consumption that continued beyond the formal intervention.

Maya's post-intervention assessments revealed dramatic shifts across all measured constructs, with pro-environmental behavior scores increasing to 3.8 at immediate post-test and maintaining at 3.6 at 6-month follow-up, representing 100% increase from baseline. Her behaviors expanded far beyond the fashion consumption focus of her narrative, incorporating energy conservation, waste reduction, dietary changes reducing meat consumption, and notably, consistent environmental advocacy including conversations with friends and family about sustainability. Six-month follow-up interview revealed that Maya had joined the campus sustainability club, changed her intended business concentration to include sustainability and social responsibility, and viewed her digital story creation as pivotal experience that transformed her environmental identity from disengaged consumer to someone who "actually cares and does something about it." She reported that publicly sharing her story created accountability and that peer responses validating her concerns reinforced her commitment to environmental values.

Maya's case illustrates multiple mechanisms through which participatory digital storytelling promotes behavior change, beginning with the personal relevance established through selecting environmental topics connecting to individual experiences and interests. Her choice to examine fast fashion emerged from reflection on her own consumption patterns rather than assigned topics, creating intrinsic motivation and personal investment absent in traditional environmental education approaches. The confession narrative structure she employed required acknowledging her own unsustainable behaviors publicly, creating cognitive dissonance that motivated behavior change to align actions with newly expressed environmental values. This self-persuasion through public commitment represents powerful psychological mechanism distinct from external persuasion attempts that often trigger resistance.

The skill-building and research components of narrative creation produced multiple beneficial effects beyond the finished product, transforming Maya from passive information recipient to active knowledge producer. Researching fashion industry impacts required deeper engagement with environmental information than typical classroom exposure, with Maya directing her own learning and selecting information relevant to her narrative rather than passively receiving instructor-chosen

content. Learning technical skills including video editing, animation, and audio production built general competence and self-efficacy while also creating tangible evidence of capability that transferred to environmental self-efficacy beliefs. The necessity of conducting interviews with campus sustainability advocates created social connections that provided ongoing support, information, and normalization of pro-environmental behaviors beyond the formal intervention period, demonstrating how participatory storytelling builds community alongside individual capacity.

Maya's sustained behavior change and identity transformation, maintained at 6-month follow-up, demonstrates the internalization predicted by self-determination theory when interventions satisfy psychological needs for autonomy, competence, and relatedness. The autonomy provided in selecting her topic and creative approach fostered ownership of environmental values rather than compliance with external expectations. Building competence through skill development and completing a challenging creative project generated self-efficacy beliefs extending beyond the specific behaviors depicted in her narrative. The relatedness cultivated through sharing her story, receiving positive peer feedback, and connecting with campus sustainability advocates created social support systems maintaining behavior change after formal intervention concluded. Her trajectory from disengaged business student to sustainability advocate challenges stereotypes about which students are predisposed toward environmental engagement, revealing how appropriate interventions can catalyze identity transformations across diverse populations.

Cross-case qualitative analysis of 47 participant interviews revealed five major themes explaining participatory creation's effectiveness: personal connection through self-selected topics resonating with individual experiences; creative autonomy fostering ownership and intrinsic motivation; research-driven learning promoting deeper engagement than passive information reception; public commitment creating accountability and consistency pressures; and community building through sharing stories and receiving peer feedback. These themes operated synergistically, with participants reporting that multiple mechanisms simultaneously contributed to their behavior change. Personal connection and autonomy appeared foundational, enabling the motivation and engagement necessary for effortful creative production, while research learning, public commitment, and community building represented processes unfolding during and after narrative creation that sustained and amplified initial motivation.

Comparison between successful behavior change cases like Maya and less successful cases revealed critical factors influencing outcomes. Participants who selected personally meaningful topics, invested substantial effort in production quality, shared stories publicly beyond required course contexts, and maintained connections with peers from their creation cohorts showed dramatically stronger behavior change (average $d = 1.58$) than participants who selected topics pragmatically based on available information, produced minimal viable products meeting requirements, shared stories only within required contexts, and did not maintain peer connections (average $d = 0.42$). These patterns suggest that participatory creation's effectiveness depends heavily on implementation quality and participant engagement level, with mechanical compliance producing minimal benefits while authentic creative investment yields substantial transformation.

Integration of quantitative mediation findings with qualitative themes provides comprehensive understanding of how participatory digital storytelling promotes sustainable behaviors. The quantitative finding that environmental self-efficacy mediates 61% of participatory creation's effects aligns with qualitative themes emphasizing skill-building, competence development, and research-driven learning as central to participants' experiences. The smaller but significant mediation through narrative transportation corresponds to qualitative descriptions of how

creating stories required imaginatively inhabiting environmental perspectives and experiencing emotional engagement with environmental issues through the creative process. The moderation finding that participatory creation remained effective across academic disciplines while passive consumption showed discipline-specific effects reflects qualitative evidence that creating personally meaningful narratives transcends disciplinary boundaries, whereas receptivity to consuming environmental narratives varies based on disciplinary cultures and prior exposure to narrative-based learning. These converging patterns across methodologies strengthen confidence that participatory digital storytelling represents robust approach for promoting sustained pro-environmental behaviors through psychological mechanisms including self-efficacy cultivation, value internalization through self-determination need satisfaction, public commitment creating consistency pressures, and community building providing ongoing support.

This mixed-methods experimental study investigated the effectiveness of digital storytelling for promoting sustainable behaviors among 228 undergraduate students across three conditions: participatory creation of digital environmental narratives, passive consumption of digital environmental narratives, and traditional information-based environmental education. Results demonstrated that participatory creation produced significantly greater and more sustained pro-environmental behavior change than passive consumption or information-based approaches, with participants in the creation condition showing 33% increase in pro-environmental behaviors at 6-month follow-up compared to 12% for passive consumption and 0% for control. The participatory creation condition maintained 85% of immediate post-intervention gains at 6-month follow-up, while passive consumption retained only 54% of gains, revealing superior durability of effects from active narrative creation compared to passive narrative reception. Behavioral category analyses revealed that participatory creation showed strongest effects on environmental advocacy behaviors including discussing environmental issues and encouraging others to adopt sustainable practices, while passive consumption influenced primarily private conservation behaviors with minimal effects on public environmental engagement.

Structural equation modeling revealed that environmental self-efficacy mediated 61% of participatory creation's effects on behavior change, while narrative transportation mediated 73% of passive consumption's effects, indicating distinct psychological mechanisms underlying each intervention type. Serial mediation analyses demonstrated that creating narratives increased transportation experiences, which fostered self-efficacy beliefs, subsequently promoting behavior change through interconnected pathways. Moderation analyses showed that participatory creation remained consistently effective across academic disciplines and demonstrated particularly strong effects among participants with low baseline environmental engagement, while passive consumption showed discipline-specific effectiveness patterns favoring social science and humanities students. Qualitative analysis revealed five mechanisms explaining participatory creation's effectiveness: personal connection through self-selected topics, creative autonomy fostering intrinsic motivation, research-driven learning promoting deep engagement, public commitment creating accountability, and community building through story sharing and peer feedback.

The case study of Maya, a business major who transformed from environmental disengagement to sustained pro-environmental behavior and identity development, illustrated how participatory digital storytelling catalyzes change through multiple synergistic mechanisms operating simultaneously. Her trajectory from baseline pro-environmental behavior score of 1.8 to 6-month follow-up score of 3.6 represented 100% increase maintained over time, accompanied by qualitative evidence of environmental identity transformation, expanded behavioral repertoire

beyond her narrative's focus topic, and sustained community engagement through joining campus sustainability initiatives. Cross-case analysis revealed that authentic creative investment, personally meaningful topic selection, public sharing beyond required contexts, and maintenance of peer connections distinguished highly successful cases from those showing minimal behavior change, suggesting that implementation quality and participant engagement level critically moderate participatory creation's effectiveness.

These findings extend and specify prior research on narrative persuasion by demonstrating that narrative creation produces substantially stronger and more durable effects than narrative consumption for environmental behavior change, adding important nuance to narrative transportation theory's focus on reception processes. Previous research by Green and Brock established that narrative transportation during story consumption reduces counterarguing and promotes attitude change, which the current study confirms through significant mediation of passive consumption effects by transportation. The novel contribution lies in demonstrating that creating narratives activates additional mechanisms beyond transportation, particularly self-efficacy development and public commitment, that passive consumption cannot access. This finding aligns with constructivist learning theories emphasizing active knowledge construction over passive reception but provides first systematic evidence of these principles operating specifically for environmental narrative interventions with longitudinal behavioral outcomes.

The superior effectiveness of participatory creation over information-based education confirms and extends decades of environmental education research questioning information-deficit approaches. Meta-analyses by Osbaldiston and Schott found that traditional environmental education produces small, often temporary effects on behavior, consistent with the current study's control condition showing complete decay to baseline by 6-month follow-up. The current research advances beyond this established finding by identifying participatory digital storytelling as specific alternative approach that overcomes information-based education's limitations through mechanisms including personal relevance, emotional engagement, skill-building, and community creation. These results diverge from some optimistic claims about narrative consumption's transformative potential, revealing that passive exposure to environmental stories, while more effective than information alone, produces substantially weaker and less durable effects than active narrative creation.

The finding that participatory creation showed strongest effects on advocacy behaviors while passive consumption influenced primarily private conservation behaviors reveals important distinctions not adequately addressed in prior environmental behavior research. Stern's value-belief-norm theory and the theory of planned behavior, dominant frameworks in environmental psychology, focus primarily on individual decision-making about personal behaviors without sufficiently accounting for public environmental engagement and identity expression. The current research demonstrates that different interventions produce qualitatively different behavioral profiles, with participatory creation fostering public environmental identity and communication behaviors alongside private actions, while passive consumption influences primarily low-visibility personal choices. This pattern aligns with social identity theory's emphasis on public commitment and identity expression but extends it into environmental domain with implications for understanding how interventions can cultivate environmental advocates rather than merely individual behavior adopters.

The dramatic differences in effectiveness and durability between participatory creation and passive consumption signal fundamental limitations of media-based communication approaches dominating environmental education and public awareness campaigns. Environmental organizations, government agencies, and educational institutions invest heavily in producing and

disseminating environmental documentaries, social media content, and multimedia narratives assuming that exposing audiences to compelling stories will motivate behavior change. The current findings reveal that while such content produces temporary attitude shifts, effects decay rapidly without deeper engagement mechanisms that passive consumption cannot provide. This suggests that the proliferation of environmental content across digital platforms, while raising awareness, may be insufficient for catalyzing the sustained behavior transformation necessary to address climate change and environmental crises, indicating need for fundamental rethinking of environmental communication strategies.

The finding that environmental self-efficacy rather than narrative transportation serves as primary mediator of participatory creation's effects signals the critical importance of empowerment and capability-building in environmental interventions beyond motivation and concern generation. Much environmental communication emphasizes problem severity and emotional appeals intended to generate concern and motivation, assuming that caring leads to action. The mediation patterns reveal that building confidence in one's ability to make meaningful difference represents more powerful pathway to behavior change than intensifying environmental concern through emotionally evocative narratives. This reflects broader recognition in behavior change science that capability factors including skills, knowledge, and confidence often constrain action more than motivation, suggesting environmental education must prioritize empowerment alongside awareness to close attitude-behavior gaps.

The particularly strong effects of participatory creation among participants with low baseline environmental engagement signal that narrative creation approaches can effectively reach populations typically resistant to or disengaged from environmental messaging. Traditional environmental education and advocacy often suffer from preaching-to-the-converted dynamics, effectively engaging already-concerned audiences while failing to reach skeptical, disengaged, or differently-prioritized populations. Maya's case exemplifies how participatory approaches can catalyze engagement among students who view environmental issues as irrelevant to their identities and futures by allowing them to construct personal connections through self-selected topics and creative expression. This suggests that participatory digital storytelling offers pathways beyond the echo chambers limiting much environmental communication, with potential for expanding environmental engagement across diverse populations currently excluded from or resistant to mainstream environmental movements.

Educational institutions must fundamentally restructure environmental education from information transmission or passive media consumption toward participatory, creation-based pedagogies that build student capacity for environmental action alongside awareness. The findings provide strong empirical justification for investing resources in programs enabling students to create digital environmental narratives rather than merely consuming environmental content or attending lectures. This requires providing access to digital production tools and training, dedicating class time to creative production processes, creating structures for peer feedback and community building, and facilitating public sharing of student-created narratives beyond classroom contexts. Universities and schools should embed digital storytelling projects across disciplines rather than confining environmental education to science courses, recognizing that personally meaningful environmental engagement can emerge from any field when students have autonomy to explore connections to their interests and identities.

Environmental communication practitioners including NGOs, government agencies, and advocacy organizations should shift strategies from producing professional content for passive consumption toward facilitating participatory storytelling where community members create and

share their own environmental narratives. Campaign resources currently allocated to producing documentaries, social media content, and advertisements might achieve greater impact if redirected toward storytelling workshops, digital production training, online platforms enabling community-generated content, and infrastructure supporting peer-to-peer narrative sharing. This participatory approach democratizes environmental communication, centering diverse voices and local perspectives often excluded from professionally-produced content while building grassroots capacity for ongoing environmental advocacy. The finding that story creators become advocates who continue discussing environmental issues beyond intervention periods suggests that participatory approaches create multiplier effects as participants influence their social networks.

The differential effectiveness across behavior types, with participatory creation fostering advocacy while passive consumption influences primarily private behaviors, carries implications for movement-building strategies addressing environmental challenges requiring collective action and policy change. Individual conservation behaviors, while valuable, prove insufficient for addressing systemic environmental problems requiring political engagement, social norm shifts, and structural transformations. Interventions producing environmental advocates who communicate with others, participate in collective initiatives, and potentially engage politically represent more strategic investments for catalyzing large-scale change than interventions promoting only private behavioral adjustments. Environmental organizations should prioritize participatory approaches cultivating advocates capable of influencing their communities over mass media campaigns producing isolated individual behavior changes, recognizing that social diffusion through peer networks may ultimately reach more people more effectively than broadcast communication.

The superior effectiveness of participatory creation over passive consumption reflects fundamental differences in psychological engagement levels and cognitive processing depth required by each activity. Creating narratives demands active decision-making at every stage including topic selection, research, script development, creative production choices, and revision based on feedback, requiring sustained cognitive effort and elaboration that passive viewing cannot match. Elaboration likelihood model predicts that information processed through central route involving careful consideration produces more enduring attitude change than peripheral route processing characteristic of passive reception, explaining why created narratives influenced creators more powerfully and durably than consumed narratives influenced viewers. The necessity of organizing environmental information into coherent stories forced creators to understand issues deeply, identify personal relevance, and develop clear perspectives—cognitive work that viewers could avoid while still experiencing transportation and temporary attitude shifts.

The mediation of participatory creation's effects primarily through self-efficacy rather than transportation reflects the skill-building, mastery experiences, and successful task completion inherent in narrative production processes. Self-efficacy theory emphasizes that capability beliefs develop primarily through enactive mastery experiences where individuals successfully complete challenging tasks, with such experiences proving more powerful than vicarious learning or verbal persuasion. Creating digital narratives provided exactly such mastery experiences, with participants learning technical skills, completing complex creative projects, and receiving positive feedback demonstrating competence. These experiences built generalized self-efficacy transferring to environmental action capability beliefs, as participants reasoning "if I can successfully create and share a digital story about environmental issues, I can also successfully implement sustainable behaviors and encourage others." Passive consumption offered no comparable mastery experiences, leaving self-efficacy beliefs unchanged while temporarily transporting viewers into story worlds.

The particularly strong effects among low-baseline-engagement participants reflect how participatory approaches overcome barriers that traditional environmental education and advocacy cannot address, specifically issues of personal relevance and defensive resistance. Individuals with low environmental engagement often perceive environmental issues as irrelevant to their lives, controlled by others more qualified or interested, or threatening to their current lifestyles and identities. Traditional environmental communication exacerbates these barriers by presenting environmental issues in ways that emphasize distance from audience experience and expert authority that disempowers ordinary individuals. Participatory creation overcomes relevance barriers by allowing topic selection connecting to personal interests and experiences, transforms the relationship from passive audience to empowered creator, and builds rather than threatens identity by positioning environmental concern as authentic self-expression rather than externally imposed expectation. Maya's transformation exemplifies this process, as business major who initially viewed environmentalism as irrelevant to her field discovered personal connection through fashion consumption, a topic she selected autonomously.

Educational institutions should immediately implement digital environmental storytelling programs as core components of sustainability education, developing infrastructure including equipment access, technical training, facilitation expertise, and platforms for sharing student-created content. Universities can establish digital storytelling labs providing cameras, computers, editing software, and technical support accessible to students across all disciplines, removing resource barriers to participation. Faculty development programs should train instructors across departments to facilitate storytelling projects, emphasizing that specialized technical expertise is unnecessary as students can learn tools while creating content and peer learning can substitute for instructor expertise. Institutions should create showcases, festivals, or online platforms exhibiting student environmental narratives beyond classroom contexts, providing authentic audiences and purposes motivating high-quality production while amplifying student voices to campus and broader communities.

Environmental organizations should develop and disseminate participatory digital storytelling toolkits, training programs, and facilitation resources enabling community groups, schools, and grassroots organizations to implement narrative creation initiatives regardless of professional media production resources. These resources should emphasize accessibility over production quality, empowering participants to create authentic stories with available technologies including smartphones rather than requiring professional equipment. Organizations should establish online platforms where community-created environmental narratives can be shared, discovered, and discussed, building networks connecting storytellers across geographical boundaries and creating visible evidence that ordinary individuals' voices matter in environmental discourse. Partnerships between environmental organizations and community media centers, libraries, or educational institutions can provide physical spaces and technical resources supporting narrative creation for populations lacking personal access to production tools.

Future research should extend this work through several critical directions addressing limitations and unanswered questions. Longitudinal studies following participants beyond six months to assess whether behavior changes persist over years and how narrative identity transformations evolve across life transitions would provide essential evidence about lasting impacts. Comparative research examining participatory digital storytelling's effectiveness across diverse cultural contexts, age groups, and socioeconomic populations would reveal whether findings generalize beyond undergraduate students in Western universities or require cultural adaptation. Studies investigating specific design elements including optimal project durations, ideal

group sizes for peer learning, effectiveness of different sharing platforms and audience configurations, and necessary versus optional components would enable optimization of interventions for maximal efficiency and effectiveness. Research examining whether and how participatory creation approaches can address environmental issues beyond individual behavior change, including political engagement, support for environmental policies, and participation in collective action, would assess potential for scaling impacts from personal to systemic levels.

Experimental studies testing whether brief, scalable versions of participatory storytelling produce meaningful effects would establish feasibility for widespread implementation, as intensive month-long interventions may not prove practical for many educational and community contexts. Investigation of potential negative effects or unintended consequences, including whether creating narratives about overwhelming environmental problems without adequate support structures could increase anxiety or despair rather than empowerment, would ensure responsible application. The ultimate research agenda aims toward evidence-based participatory approaches enabling diverse populations to engage meaningfully with environmental challenges, develop capacity for sustained pro-environmental action, and contribute voices to environmental discourse historically dominated by elite and expert perspectives.

CONCLUSION

This research's most significant and distinctive finding is that participatory creation of digital environmental narratives produces substantially stronger, more durable, and qualitatively different pro-environmental behavior changes compared to passive consumption of narratives or traditional information-based education, with effects mediated primarily through environmental self-efficacy development rather than narrative transportation. While existing literature has established that narratives can influence environmental attitudes through transportation mechanisms, this study demonstrates that the act of creating narratives activates fundamentally different psychological processes including skill-building, public commitment, and identity development that passive consumption cannot access, resulting in behavior change maintained at 85% of initial levels at 6-month follow-up compared to 54% for passive consumption and 0% for information-based education. The finding that participatory creation showed strongest effects on environmental advocacy behaviors including discussing environmental issues and encouraging others toward sustainability, while passive consumption influenced primarily private conservation behaviors, reveals that different interventions produce qualitatively different behavioral profiles with distinct implications for individual versus collective environmental action. The particularly strong effectiveness of participatory approaches among students with low baseline environmental engagement, exemplified by Maya's transformation from disengaged business major to sustainability advocate, challenges assumptions that environmental interventions primarily engage already-concerned audiences and demonstrates potential for reaching populations typically resistant to environmental messaging through creative autonomy and personally meaningful topic selection.

This research makes dual contributions advancing both theoretical understanding and methodological approaches for studying environmental behavior change interventions. Theoretically, it extends narrative transportation theory beyond passive reception contexts into participatory creation domains, demonstrating that narrative's persuasive power operates through distinct mechanisms depending on whether individuals consume or create stories, with creation activating self-efficacy pathways through mastery experiences while consumption influences through transportation-reduced counterarguing. The integration of narrative transportation theory with self-determination theory and self-efficacy theory provides comprehensive framework

explaining how participatory digital storytelling satisfies psychological needs for autonomy, competence, and relatedness while building capability beliefs, producing internalized environmental values and sustained behaviors that temporary narrative transportation cannot achieve.

The identification of five synergistic mechanisms—personal connection, creative autonomy, research-driven learning, public commitment, and community building—through which participatory creation promotes behavior change offers nuanced understanding applicable beyond environmental contexts to behavior change interventions in health, civic engagement, and social justice domains. Methodologically, the study demonstrates value of mixed-methods longitudinal experimental designs combining quantitative behavioral outcome measures with qualitative analysis of participant experiences and created narrative content, enabling triangulation across multiple data sources to understand both whether interventions work and how they produce effects. The inclusion of 6-month follow-up assessment addressing the critical question of behavior change durability sets new standard for environmental intervention research typically relying on immediate post-intervention measures, while the disaggregation of pro-environmental behaviors into categories revealing differential effects across behavior types provides more precise understanding than global behavior measures. The integration of case study analysis with quantitative mediation modeling illustrates complementary strengths of qualitative and quantitative approaches, with case studies illuminating lived experiences and meaning-making processes while statistical models identify generalizable patterns and mechanisms operating across participants.

Several limitations constrain generalizability and leave important questions unanswered, suggesting critical directions for future investigation. The sample consisting entirely of undergraduate students aged 18-25 at universities in one geographical region limits understanding of whether findings generalize to other age groups, educational levels, cultural contexts, or socioeconomic populations with different technological access, digital literacies, environmental attitudes, and behavioral constraints. The 6-month follow-up period, while extending beyond typical environmental intervention research, remains insufficient for determining whether behavior changes persist over years as life circumstances change and intervention memories fade, leaving questions about truly lasting impact unresolved. The study's focus on self-reported behaviors supplemented by limited objective measures raises validity concerns, as social desirability bias may inflate self-reports particularly for participatory creation participants who publicly committed to environmental values, suggesting need for future research incorporating comprehensive behavioral observation, technological tracking, or environmental impact metrics. The resource-intensive nature of the participatory creation intervention, requiring month-long engagement with equipment, technical training, and facilitation support, raises questions about scalability and whether briefer, less resource-demanding versions could produce meaningful effects, indicating need for research testing minimal viable interventions balancing effectiveness with feasibility.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used Google Gemini to assist inimproving grammar, language quality, and overall readability of the text. After using this tool, the author(s) Carefully reviewed and edited the content as necessary and take full responbility for the content of the publication.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.
Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

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

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