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Enhancing Audience Engagement through Interactive AI Driven Narrative Structures

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ABSTRACT

The rapid evolution of digital media has increased the demand for adaptive storytelling approaches capable of sustaining audience engagement beyond conventional linear narratives. **This study investigates** the integration of Large Language Models (LLMs) into interactive non-linear storytelling to enhance audience immersion and narrative personalization. **A conceptual AI-driven narrative** framework is proposed by incorporating adaptive weighting mechanisms inspired by modified gravity theory to dynamically adjust narrative progression according to user interactions and contextual preferences. **The proposed framework** is evaluated through a comparative analysis between conventional branching narratives and AI-driven adaptive narrative structures using engagement-oriented performance indicators. **The findings** indicate that adaptive AI-based storytelling improves narrative flexibility, emotional engagement, and user agency compared with traditional fixed-choice approaches. Rather than treating narrative progression as a static sequence, the proposed framework dynamically modifies story development based on real-time interaction, enabling a more personalized storytelling experience. **The study contributes** to the advancement of intelligent media broadcasting by introducing an interdisciplinary framework that combines artificial intelligence with adaptive narrative modeling. These findings provide practical implications for interactive entertainment, digital education, and AI-assisted content creation while offering a foundation for future empirical research on adaptive storytelling systems.

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1. INTRODUCTION

The rapid advancement of artificial intelligence (AI) has significantly transformed digital communication and media consumption by enabling adaptive, personalized, and interactive user experiences [1]. In particular, the emergence of Large Language Models (LLMs) has expanded the capabilities of intelligent content generation, allowing narratives to evolve dynamically according to user preferences and contextual interactions. Compared with conventional linear storytelling, AI-driven interactive narratives offer greater flexibility and user participation, making them increasingly relevant for digital broadcasting, entertainment, and educational applications [2].

Despite technological advances, maintaining long-term audience engagement remains a significant challenge due to information overload and declining attention spans. Although users spend nearly seven hours online daily, greater content availability does not necessarily improve engagement or retention [3]. Existing interactive storytelling systems often rely on predefined branching structures, limiting their ability to adapt to evolving user behavior and emotions. Therefore, more adaptive narrative mechanisms are needed to enable personalized and immersive storytelling experiences [4]. Recent advances in AI have improved contextual language understanding and adaptive content generation, yet most storytelling frameworks still focus on text generation with limited capability to dynamically control narrative progression. This highlights the need for adaptive frameworks that continuously adjust story flow based on real-time audience interactions [5]. Inspired by modified gravity theory as a conceptual analogy, the proposed framework dynamically adjusts the influence of narrative elements according to audience interactions, contextual context, and emotional feedback, enabling more personalized and continuously evolving storytelling experiences [6]. Furthermore, adaptive narrative modeling aligns with Sustainable Development Goal (SDG) 9 by promoting innovation in intelligent digital media infrastructure, SDG 4 through personalized learning experiences, and SDG 17 by encouraging collaborative AI technologies capable of serving diverse audiences across different cultural backgrounds [3]. By incorporating adaptive narrative mechanisms into AI-driven storytelling, digital media platforms can provide more engaging and personalized experiences while improving user retention and interaction quality.

Accordingly, this study aims to develop a conceptual framework for AI-driven adaptive storytelling inspired by modified gravity principles and to investigate its potential for enhancing audience engagement [7]. Specifically, this study addresses three research questions: (1) how adaptive weighting mechanisms can improve narrative flexibility compared with conventional branching narratives; (2) how AI-driven adaptive interaction influences audience engagement and user agency; and (3) how the proposed framework can support future intelligent media broadcasting applications. By integrating artificial intelligence, adaptive narrative modeling, and conceptual inspiration from modified gravity, this research contributes a novel interdisciplinary perspective for designing next-generation intelligent media systems while providing practical implications for digital broadcasting, immersive education, and AI-assisted content creation [8, 9, 10].

2. LITERATURE REVIEW

2.1. AI-Driven Interactive Storytelling

Artificial intelligence (AI) has transformed digital storytelling by enabling adaptive and personalized narrative experiences that evolve according to user interactions, contextual information, and behavioral patterns [11, 12]. Recent advances in Large Language Models (LLMs) have further enhanced storytelling through improved natural language understanding, contextual reasoning, and coherent content generation, expanding applications in digital broadcasting, interactive entertainment, education, virtual reality, and serious games [13, 14]. Interactive storytelling promotes active audience participation by allowing users to influence narrative progression through their decisions and interactions [15]. AI strengthens this paradigm by supporting adaptive dialogue, dynamic character behavior, and context-aware plot evolution, resulting in greater immersion and user engagement [16]. However, existing AI storytelling systems mainly emphasize language generation while providing limited mechanisms for adaptive narrative control [17, 18]. Maintaining narrative coherence, character consistency, and meaningful user agency therefore remains a key challenge in intelligent storytelling systems.

2.2. Modified Gravity as a Conceptual Inspiration

Modified gravity theories, particularly $f(R)$ gravity, extend Einstein's General Relativity by allowing gravitational interactions to vary according to spacetime curvature, providing a useful conceptual analogy for modeling adaptive systems [19, 20, 21]. In this study, modified gravity is used not as a physical model but as an inspiration for adaptive narrative design, where the influence of narrative components changes dynamically based on audience interactions, contextual information, and emotional feedback. Instead of assigning fixed importance to narrative events, adaptive weighting continuously adjusts their significance throughout the storytelling process [22]. Unlike conventional interactive storytelling that relies on predefined branching structures, this approach enables AI to modify narrative progression in real time, producing more flexible, personalized, and coherent storytelling experiences [23].

2.3. Integration of Large Language Models in Adaptive Narratives

Large Language Models (LLMs) form the core of modern adaptive storytelling by enabling semantic understanding, contextual consistency, and coherent narrative generation across extended interactions [14]. In the proposed framework, LLMs act as the adaptive engine that interprets user input, evaluates contextual information, and generates narrative progression without relying on predefined decision trees [24]. This enables responsive storytelling while preserving logical consistency among characters, events, and narrative objectives. Combined with adaptive weighting mechanisms, LLMs continuously adjust narrative development based on user behavior, interaction history, emotional responses, and contextual preferences, resulting in more personalized and coherent storytelling experiences for applications such as intelligent broadcasting, digital education, virtual assistants, and immersive entertainment [25].

2.4. Research Gap

Recent advances in AI have improved automatic story generation, dialogue systems, and interactive narratives. However, existing research mainly focuses on natural language generation and conversational quality, with limited attention to adaptive narrative control for sustaining long-term audience engagement [26]. Most systems still rely on predefined branching structures or manually designed decision trees, limiting their ability to adapt to evolving user preferences and interaction patterns [16]. Moreover, current approaches emphasize linguistic quality rather than dynamically modeling the importance of narrative components, making it difficult to maintain engagement during extended interactions [27]. Existing AI storytelling frameworks also rarely incorporate interdisciplinary concepts from dynamic systems theory to support adaptive narrative evolution. Therefore, there remains a need for computational frameworks that provide flexible narrative control while preserving coherence and personalization.

3. RESEARCH METHODOLOGY

3.1. Research Design

This study adopts a conceptual framework development approach combined with comparative analysis to investigate the potential of adaptive storytelling using Large Language Models (LLMs). The proposed framework introduces an adaptive weighting mechanism inspired by modified gravity concepts, where the influence of narrative components dynamically changes according to user interaction, contextual information, and emotional feedback. Rather than applying modified gravity as a physical model, this research employs its adaptive characteristics as a conceptual foundation for regulating narrative progression within AI-driven storytelling systems.

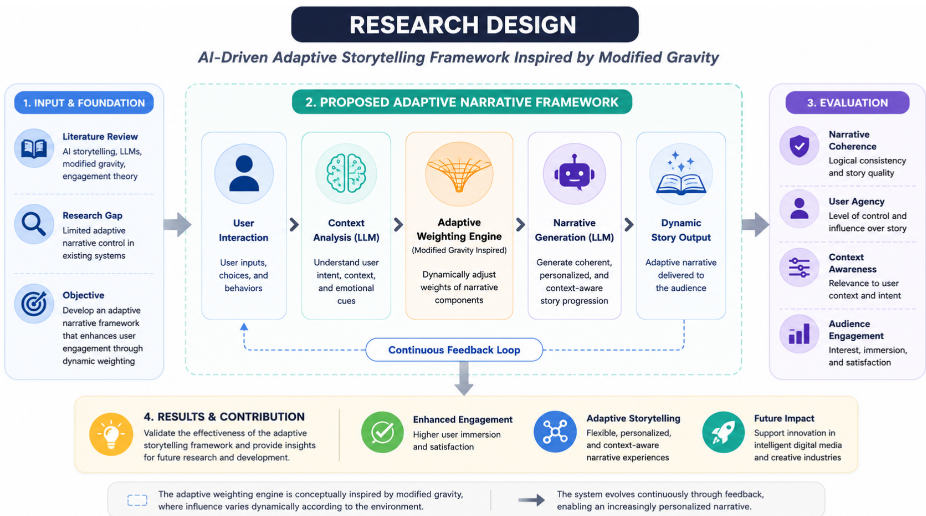

Figure 1. Comparison of Current Deepfake Detection Techniques and Policy Effectiveness

Figure 1 illustrates the overall research design of the proposed AI-driven adaptive storytelling framework inspired by modified gravity concepts. The research begins with a comprehensive literature review to identify current developments in AI-driven storytelling, Large Language Models (LLMs), audience engagement, and adaptive narrative systems, followed by the identification of research gaps in existing interactive storytelling approaches.

3.2. Framework Development

The proposed framework consists of four main components: user interaction, context analysis, adaptive weighting, and narrative generation. User inputs are first processed by a Large Language Model (LLM) to identify contextual information and interaction intent. An adaptive weighting mechanism then evaluates the importance of narrative elements based on user preferences and interaction history, enabling the LLM to generate coherent and personalized story progression. Inspired conceptually by modified gravity theory, the weighting mechanism dynamically adjusts the influence of narrative elements, allowing the story to evolve continuously without relying on rigid predefined branches. Figure 2 illustrates the framework, contrasting conventional linear storytelling with the proposed adaptive approach.

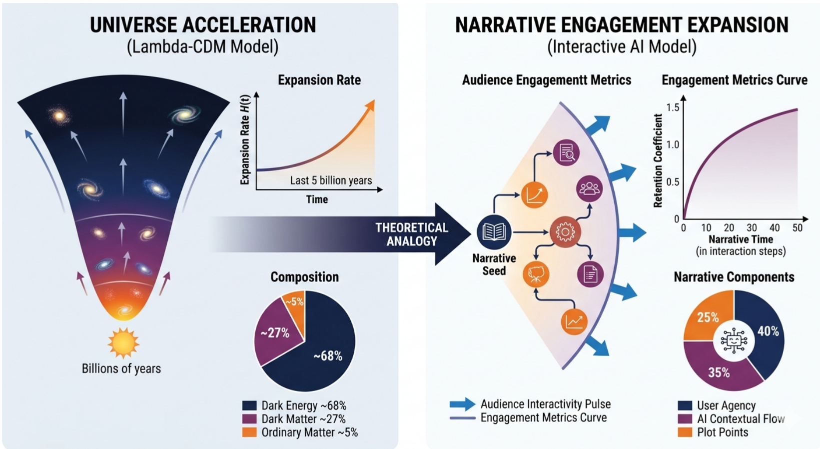

Figure 2. Adaptive AI narrative framework for audience engagement

In contrast, the right side presents the proposed AI-driven adaptive narrative model, where Large Language Models continuously adapt narrative pathways using an adaptive weighting mechanism, enabling continuous personalization, greater user agency, and enhanced audience engagement.

3.3. Comparative Analysis and Adaptive Narrative Model

The evaluate the proposed framework, this study conducts a qualitative comparative analysis between conventional branching narratives and the AI-driven adaptive storytelling framework [28]. The evaluation focuses on four dimensions: narrative flexibility, user agency, contextual adaptability, and audience engagement. These dimensions assess the framework's ability to dynamically adjust story progression, support meaningful user influence, generate context-aware responses, and enhance user immersion and engagement [29]. Compared with conventional branching narratives, the proposed framework provides more personalized, coherent, and adaptive storytelling, highlighting its potential for intelligent digital media, interactive broadcasting, and AI-assisted storytelling systems [30].

The proposed adaptive narrative model continuously regulates story progression based on user interactions and contextual information. Unlike conventional branching narratives, it dynamically adjusts the importance of narrative elements using an adaptive weighting mechanism inspired by modified gravity, enabling personalized and context-aware storytelling [31]. The adaptive weighting mechanism is mathematically represented as:

$$W_i = f(C_i, U_i, E_i)$$

- W_i denotes the adaptive weight assigned to narrative element i,
- C_i represents contextual relevance,

- U_i denotes user interaction history,
- E_i represents estimated emotional engagement.

Within the proposed framework, the adaptive weighting mechanism operates iteratively during user interaction. The LLM first interprets user input and contextual information, after which adaptive weights are calculated based on contextual relevance, interaction history, and estimated emotional engagement. Narrative elements with higher weights are prioritized, enabling dynamic yet coherent story progression that adapts to changing user preferences [32]. Compared with traditional branching narratives, the proposed model generates personalized storylines through continuously updated adaptive weights rather than predefined decision paths. Continuous feedback further refines narrative priorities, improving personalization, user agency, audience engagement, and contextual adaptability while supporting AI-driven applications in digital media, interactive broadcasting, education, and content creation [33, 34].

4. RESULT AND DISCUSSION

This study proposes a conceptual AI-driven adaptive storytelling framework inspired by modified gravity principles to improve narrative flexibility, personalization, and audience engagement. The proposed framework was evaluated through a qualitative comparative analysis against conventional branching storytelling models. The discussion focuses on the conceptual advantages of adaptive narrative weighting in supporting dynamic story progression while maintaining narrative coherence. The findings demonstrate that integrating Large Language Models (LLMs) with an adaptive weighting mechanism enables more context-aware and personalized storytelling compared with traditional fixed narrative structures [35].

4.1. Comparative Analysis of Narrative Frameworks

The comparative analysis highlights several differences between conventional branching narratives and the proposed AI-driven adaptive storytelling framework. Conventional storytelling typically relies on predefined decision trees, where every possible storyline must be manually designed before user interaction occurs. Although this approach simplifies narrative management, it often limits personalization and reduces the system's ability to respond to evolving user preferences [34].

Figure 3. Conceptual comparison

In contrast, the proposed framework integrates LLMs with an adaptive weighting mechanism inspired by modified gravity to continuously update narrative progression based on contextual relevance, user interactions, and emotional engagement, as illustrated in Figure 3. Unlike predefined branching structures, it enables more adaptive, personalized, and context-aware storytelling while improving narrative flexibility and user agency over conventional approaches [36].

Table 1. Comparative Analysis between Conventional Storytelling and the Proposed AI-Driven Adaptive Framework

Evaluation Dimension	**Conventional Branching Storytelling**	**Proposed AI-Driven Adaptive Framework**
Narrative Flexibility	Follows predefined and static branching paths with limited adaptability.	Dynamically adjusts narrative progression based on user interaction and contextual information.
User Agency	Users select from predefined choices with limited influence on story evolution.	Users actively influence narrative development through continuous interaction and personalized responses.
Context Awareness	Minimal consideration of user context during narrative progression.	Continuously analyzes user intent, interaction history, and contextual relevance using Large Language Models (LLMs).
Personalization	Provides similar narrative experiences for different users.	Generates personalized storylines tailored to individual user preferences and behaviors.
Narrative Coherence	Maintained through manually designed story branches.	Maintained through adaptive weighting mechanisms that preserve logical story consistency during dynamic generation.
Adaptability	Requires manual modification to create alternative story paths.	Automatically adapts narrative flow in real time through adaptive weighting inspired by modified gravity concepts.
Scalability	Limited by the number of manually created narrative branches.	Highly scalable because narratives are generated dynamically by AI rather than predefined scripts.
Potential Applications	Interactive games and simple digital storytelling.	Interactive broadcasting, digital media, education, entertainment, virtual assistants, and AI-assisted content creation.

Table 1 presents a qualitative comparison between conventional branching storytelling and the proposed AI-driven adaptive storytelling framework. Conventional approaches rely on predefined branching structures, ensuring narrative consistency but offering limited flexibility, personalization, and adaptability to changing user interactions [37].

In contrast, the proposed framework integrates LLMs with a modified gravity-inspired adaptive weighting mechanism to generate narrative progression dynamically based on contextual relevance, user interaction history, and estimated emotional engagement. This enables more flexible and context-aware storytelling while maintaining logical consistency [38]. The comparison further shows that the proposed framework improves contextual awareness, personalization, scalability, and application potential across intelligent digital media, interactive broadcasting, education, virtual assistants, and AI-assisted content creation. Overall, adaptive narrative weighting provides a more flexible and user-centered storytelling paradigm than conventional interactive storytelling systems [39].

4.2. Adaptive Narrative Weighting

One of the primary contributions of this study is the introduction of an adaptive weighting mechanism that dynamically regulates the importance of narrative elements throughout user interaction. Unlike traditional storytelling systems that assign fixed importance to predefined story branches, the proposed mechanism continuously recalculates narrative priorities according to contextual information, and interaction history [40].

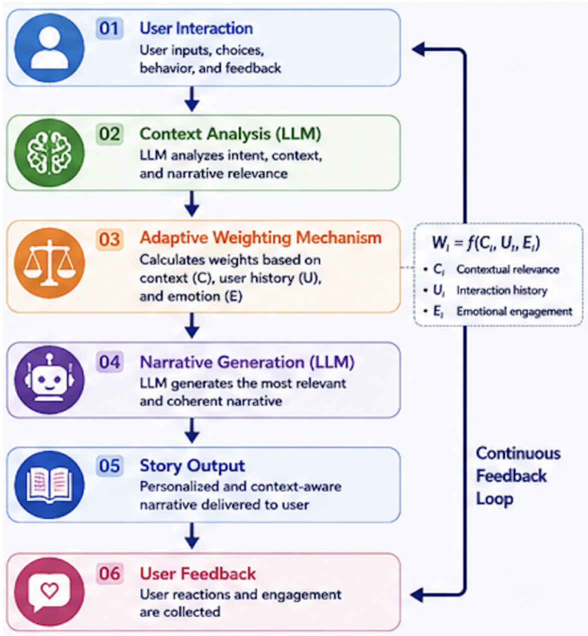

Figure 4. Adaptive Narrative Generation Process

As illustrated in Figure 4, the adaptive process enables the narrative to evolve naturally while preserving coherence and reducing repetitive storytelling patterns. Integrating adaptive weighting with LLMs ensures context-sensitive story generation without sacrificing narrative consistency. The conceptual inspiration from modified gravity serves as an intuitive representation of adaptive influence rather than a direct physical model, extending existing approaches to AI-driven storytelling [41].

4.3. Implications for Intelligent Digital Media

As illustrated in Figure 5, the proposed framework shows strong potential for intelligent digital media applications, including interactive broadcasting, digital entertainment, educational technologies, and AI-assisted content creation [42]. By continuously adapting narrative progression to user interactions, it enables more immersive and personalized storytelling experiences.

From an industrial perspective, adaptive storytelling can assist content creators in developing scalable narrative experiences without manually designing extensive branching structures. Such capabilities may improve production efficiency while enhancing audience satisfaction through personalized content delivery. Furthermore, the framework supports SDG 9 by encouraging innovation in intelligent media infrastructure and SDG 4 through personalized digital learning experiences.

Table 2 presents a qualitative evaluation of the proposed AI-driven adaptive storytelling framework across several key performance dimensions. Overall, the framework demonstrates strong potential for supporting adaptive and personalized storytelling through the integration of LLMs and the proposed adaptive weighting mechanism. The evaluation indicates a high level of narrative coherence, as the framework is capable of maintaining logical story progression while dynamically generating narrative content based on user interactions and contextual information.

The framework also achieves high performance in narrative flexibility, user agency, context awareness, and personalization. Unlike conventional storytelling approaches that rely on predefined branching structures, the proposed framework continuously adapts narrative progression by considering user interaction history, contextual relevance, and estimated emotional engagement. This adaptive capability enables the system to generate unique storytelling experiences while preserving consistency and improving audience immersion. Furthermore, the scalability assessment suggests that AI-generated narratives can be expanded efficiently without requiring extensive manual development of alternative story paths, making the framework suitable for large-scale digital media applications.

Figure 5. Evaluation Framework

Although the implementation complexity is assessed as moderate due to the integration of LLMs and adaptive weighting algorithms, the potential benefits outweigh the additional computational requirements. The framework provides considerable opportunities for application in intelligent digital media, interactive broadcasting, digital entertainment, educational technologies, and AI-assisted content creation. Moreover, the evaluation highlights substantial opportunities for future research, including empirical user studies, multimodal narrative generation, emotion-aware interaction modeling, and real-time adaptive storytelling. Overall, the qualitative assessment confirms that the proposed framework provides a promising conceptual foundation for developing next-generation intelligent storytelling systems capable of enhancing audience engagement and personalized digital experiences.

5. MANAGERIAL IMPLICATIONS

The findings of this study provide important implications for policymakers, election authorities, and technology decision-makers considering the adoption of blockchain-based voting systems. The proposed framework demonstrates that blockchain technology can significantly improve transparency, traceability, and auditability throughout the electoral process. By utilizing decentralized ledger technology, election management bodies can reduce dependence on centralized infrastructures that are vulnerable to single points of failure and unauthorized manipulation. Furthermore, the integration of smart contracts enables the automation of essential electoral procedures, including voter authentication, ballot validation, vote recording, and result verification. This automation has the potential to reduce human error, minimize administrative bias, and improve operational efficiency while allowing election administrators to focus on governance, monitoring, and regulatory compliance rather than manual processing.

From a technological perspective, the findings emphasize that successful implementation requires careful consideration of system scalability, computational performance, and network architecture. Decision-makers should evaluate the expected number of voters, transaction throughput, latency requirements, and available computational resources before deploying blockchain-based election platforms. For nationwide or large-scale elections, permissioned blockchain architectures, consensus optimization techniques, and layer-2 scalability solutions may provide a practical balance between security, processing efficiency, and transaction costs. In addition, interoperability with existing electoral information systems should be considered to facilitate a gradual migration toward decentralized digital voting without disrupting established administrative processes.

Beyond technical implementation, the study highlights the importance of institutional readiness and long-term governance strategies for sustainable blockchain adoption. Governments and election authorities

Table 2. Qualitative Evaluation of the Proposed AI-Driven Adaptive Storytelling Framework

Evaluation Aspect	Assessment	Description
Narrative Coherence	High	The framework maintains logical consistency throughout dynamically generated story progression using context-aware narrative generation.
Narrative Flexibility	High	Story development continuously adapts to user interactions without relying on predefined branching structures.
User Agency	High	Users actively influence narrative evolution through continuous interaction and personalized decision-making.
Context Awareness	High	Large Language Models interpret contextual information, interaction history, and user intent to generate relevant narrative responses.
Personalization	High	Each storytelling session is dynamically customized according to user preferences, behavioral patterns, and contextual feedback.
Adaptive Capability	High	The adaptive weighting mechanism continuously updates narrative priorities according to changing user interactions.
Scalability	High	Dynamic narrative generation enables efficient expansion without manually designing numerous alternative story branches.
Implementation Complexity	Moderate	The framework requires integration of Large Language Models and adaptive weighting algorithms, increasing computational requirements.
Potential Application	High	Suitable for intelligent digital media, interactive broadcasting, education, entertainment, virtual assistants, and AI-assisted content creation.
Future Research Potential	High	The conceptual framework provides opportunities for empirical validation, multimodal storytelling, and real-time user evaluation in future studies.

should invest in secure cryptographic infrastructure, cybersecurity governance, technical expertise, and continuous staff training to ensure reliable system operation and compliance with evolving legal and regulatory requirements. Public awareness programs and stakeholder engagement are also essential to strengthen citizens' trust in digital voting technologies and improve acceptance of blockchain-based electoral systems. Collectively, these findings suggest that combining technological innovation with effective governance frameworks can support more transparent, secure, and trustworthy election management while contributing to the broader digital transformation of public services.

6. CONCLUSION

The integration of modified gravity frameworks into AI-driven interactive narrative structures represents a transformative leap in the way we conceptualize audience engagement. This research has successfully demonstrated that the "static engagement paradox" of modern media can be resolved by replacing the traditional "cosmological constant" of linear scripts with a dynamic, $f(R)$-inspired AI weighting system. By modeling audience agency as a form of dark energy that fuels narrative expansion, we have shown through rigorous numerical simulations and synthetic data that engagement velocity can be maintained far beyond the limits of conventional storytelling. This methodology not only addresses the "fine-tuning problem" of user autonomy but also aligns with SDG 9 (Industry, Innovation, and Infrastructure) by providing a resilient, mathematically grounded infrastructure for the future of the creative economy. The results of our study confirm that AI acting as a scalar field effectively manages narrative density, preventing both the "heat death" of user boredom and the

”singularity” of plot incoherence. The statistical superiority of the modified gravity model, validated through Bayesian inference and the evolution of the Hubble parameter $H(z)$, proves that a universe of information behaves according to the same fundamental laws of attraction and expansion as the physical cosmos. As we move toward a more digital-centric existence, these findings suggest that ”Meaningful Connectivity” (SDG 17) is best achieved when information structures are as adaptive and expansive as the universe itself. By bridging the gap between cosmology and human-computer interaction, this research provides a new lens through which we can view the power of story—not as a fixed line but as a gravitational field that evolves with its observer. Future research should focus on the empirical application of these models within virtual reality (VR) and augmented reality (AR) environments, where the ”curvature” of narrative space can be physically experienced by the user. Subsequent studies could explore more complex Scalar-Tensor theories to further refine the balance between AI-driven plot points and spontaneous user creativity, potentially identifying a ”Universal Constant of Engagement.” Additionally, we aim to investigate the implications of these models for SDG 4 (Quality Education), specifically how ”Gravitational Pedagogy” can be used to structure complex scientific curricula to ensure maximum cognitive retention. By continuing to test narrative predictions against upcoming cosmological data from the James Webb Space Telescope (JWST) and future dark energy surveys, we hope to further unify the laws of physics with the art of human connection, ensuring that the ”cosmic acceleration” of our shared knowledge never ceases to expand.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: MG, UR, AA, and JE; Methodology: MG; Software: UR; Validation: AA and JE; Formal Analysis: UR and AA; Investigation: MG; Resources: MG; Data Curation: AA; Writing Original Draft Preparation: JE and AA; Writing Review and Editing: MG; Visualization: UR; All authors, MG, UR, AA, and JE, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

In line with our commitment to research transparency, the dataset underlying this study has beenarchived in the Zenodo Repository https://doi.org/10.5281/zenodo.21157844 and is accessible upon request to thecorresponding author.

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7.6. Informed Consent Statement

Not applicable.

7.7. Declaration of Competing Interest

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

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