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Research on a FOGG-GNS-Based User Engagement Mechanism for Lightweight Digital Art Games Supporting Well-being

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Abstract

Research Background and Gap (Why): Amidst the trend towards fragmented digital entertainment, lightweight games have emerged as an important form of mobile interaction, offering convenient "instant play" experiences through low barriers, short interaction cycles, and social integration. Although these characteristics provide new possibilities for digital art-based well-being experiences, current research lacks an integrated framework that systematically connects lightweight game design, user behavioral psychology, and well-being engagement mechanisms.
Research Method (How): This study proposes the "FOGG-GNS" framework by integrating the Fogg Behavior Model (FBM) with Gamism-Narrativism-Simulationism (GNS) theory. The framework is used to analyze how game design structures and behavioral factors influence user engagement in lightweight digital art games. This study adopts a theory-driven empirical approach, combining qualitative analysis of lightweight game design with quantitative validation through a questionnaire survey (N = 450). Structural Equation Modeling (SEM) and Hierarchical Regression Analysis were employed to examine the proposed framework.
Practical Implementation (With what): The FOGG-GNS framework was applied to the analysis of representative lightweight games and empirically validated through questionnaire data to examine the relationships among Motivation, Ability, Prompt, GNS dimensions, and well-being engagement.
Core Conclusion (What): The results reveal that Prompt and Gamism-oriented design elements are associated with stronger initial engagement, whereas Motivation, supported by Narrativism and Simulationism, plays an important role in deeper and more sustained well-being engagement. Excessive reliance on Gamism mechanisms weakens the positive relationship between Motivation and well-being engagement, indicating a potential "Motivational Monopolisation" phenomenon.
Significance and Value (So what): This study contributes to active-health-oriented digital design by explaining how lightweight digital art games may support everyday emotional awareness, self-expression, and self-management through accessible and meaningful interactions. The FOGG-GNS framework offers design implications for developing accessible digital experiences that may support everyday psychological self-management. However, this study measures self-reported well-being engagement rather than actual health behaviors or clinical outcomes. Whether such engagement translates into sustained health-supportive behaviors remains to be examined in future research.

Keywords: lightweight game; Fogg Behavior Model; GNS theory; digital art-based well-being; user engagement

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1. Introduction

1.1. Research Background: The Rise of Lightweight Games and the Need for Digital Art-Based Well-being

Amidst the trend towards fragmented digital entertainment, lightweight games have emerged as a significant form of entertainment in the mobile internet era. Characterized by low barriers to entry, short-cycle tasks, and deep integration with social ecosystems, their convenient 'instant play' experience perfectly aligns with contemporary users' fragmented time structures. The low barriers to entry, instant feedback, and emotional appeal inherent in lightweight gaming align with key principles of art-based emotional expression, including non-verbal communication, emotional regulation, and self-reflection. Thoughtfully integrating art-based emotional expression elements into lightweight game design not only enriches their emotional depth but also provides new possibilities for creating meaningful digital well-being experiences [1]. The global market for digital well-being interventions is rapidly expanding, yet a significant gap exists in leveraging the pervasive and accessible nature of lightweight social games for evidence-based mental health support, thereby contributing to the digital transformation of digital well-being applications [2].

In particular, young digital users aged approximately 20–30 represent an important user group, as they frequently experience fragmented lifestyles, digital dependence, and emotional regulation demands in daily contexts.

From an active-health perspective, digital well-being support can extend beyond formal clinical settings to include everyday practices that help individuals recognize their emotional states, regulate stress, and maintain psychological self-awareness. Lightweight digital art games may provide an accessible entry point for such practices because they can be integrated into fragmented daily routines without requiring extensive time or specialized equipment. When designed to encourage reflection rather than merely reward task completion, these games may support users' engagement in everyday self-care. Nevertheless, accessibility and engagement alone do not establish that a digital experience produces sustained health-behavior change. The relationship between momentary well-being experiences, repeated self-management practices, and longer-term health outcomes therefore requires explicit conceptual distinction.

1.2. Research Problem: The Lack of an Integrated Framework for Well-being Engagement

While the potential is recognized, the overwhelming majority of commercial lightweight games are designed primarily to maximize user engagement and commercial returns. Their emotional engagement remains spontaneous and unstructured, fundamentally distinct from rigorously clinically validated digital well-being interventions. The core problem addressed by this study is the lack of an integrated theoretical framework for explaining how lightweight game design and behavioral factors relate to well-being engagement beyond entertainment-driven participation. A further question is whether such engagement can support repeated self-care practices over time, which requires separate behavioral and longitudinal investigation. Existing models either focus too narrowly on game mechanics (e.g., GNS) or general behavior change (e.g., FBM), failing to capture the unique cross-disciplinary dynamics at the intersection of game design, behavioral psychology, and art-based emotional expression.

A further gap concerns the connection between well-being engagement and active health. Although emotional regulation and self-reflection are relevant to everyday psychological self-management, engagement with these experiences should not be treated as evidence of sustained health-behavior change. What remains insufficiently understood is how lightweight game design can support the psychological conditions for everyday self-care, and how such engagement might subsequently be translated into repeated health-supportive practices. Accordingly, this study focuses on the engagement mechanisms that may underpin active-health-oriented experiences, rather than directly evaluating behavioral adherence, long-term health outcomes, or clinical effectiveness.

1.3. Related Work and Research Status

The existing literature can be broadly categorized into three areas: (1) Lightweight Game Mechanics and User Experience: Studies have explored the characteristics of lightweight games, such as the "micro-goal system" and "dynamic difficulty mechanism," which amplify the Gamism orientation [3]. (2) Art-Based Emotional Expression and Digital Transformation: Research confirms that digital media, including tablets and virtual reality, can expand the expressive dimensions of art-based creative practices and provide new opportunities for emotional expression and self-reflection [4] [5]. However, existing digital art-based well-being practices often emphasize structured creative guidance, personalized user experiences, and theoretically grounded approaches to support emotional expression and psychological well-being [6]. Wearable game-interaction research demonstrates that mapping physiological attention states to game parameters can support adaptive engagement, complementing the present FOGG-GNS framework [7]. (3) Behavioral Models in Game Design: Models like the Fogg Behavior Model (FBM) have been applied to analyze user behavior, focusing on the interplay of Motivation, Ability, and Prompt [8].

1.4. Existing Deficiencies: The Theoretical and Empirical Gap

Despite these contributions, several deficiencies persist: First, the theoretical risk of "Motivational Monopolisation" in

lightweight games, where the focus on instant gratification (Gamism) crowds out deeper engagement (Narrativism/Simulationism), has not been systematically quantified. Second, there is a lack of empirical data linking specific game design elements (as triggers/prompts) to the three core components of the FBM (Motivation, Ability, Prompt) in a well-being-oriented digital experience context. Third, no existing model effectively integrates the structural analysis of game design (GNS) with the behavioral analysis of user action (FBM) to specifically address the requirements of digital art-based well-being experiences.

1.5. Research Objectives and Positioning

This study aims to construct and empirically examine the FOGG-GNS framework to explain how lightweight game structures and behavioral factors shape users' well-being engagement in digital art-based experiences. From an active-health perspective, the study focuses on the design conditions that may facilitate everyday emotional awareness, self-expression, and psychological self-management through accessible digital interactions.

The study makes three related contributions. First, it integrates the Fogg Behavior Model and GNS theory to explain how behavioral triggers and game structures relate to well-being engagement. Second, it derives design implications for creating accessible, emotionally meaningful interactions that may support everyday psychological self-management. Third, it distinguishes well-being engagement as a proximal experiential outcome from sustained health-behavior change and clinical effectiveness. The empirical analysis evaluates the former; whether these experiences lead to repeated self-care practices or longer-term health benefits remains an open question for longitudinal and behavioral research.

1.6. Article Structure

The remainder of this paper is structured as follows: Section 2 provides a comprehensive literature review, establishing the theoretical foundations of well-being interventions, FBM, and GNS theory. Section 3 details the construction of the FOGG-GNS model and the methodology employed for data collection and analysis. Section 4 presents the empirical results, including the structural equation model and the quantitative findings on the influence of FOGG-GNS components. Section 5 discusses the implications of the "Motivational Monopolisation" phenomenon and the practical design guidelines derived from the FOGG-GNS model. Finally, Section 6 concludes the study, outlines its limitations, and suggests future research directions.

2. Related Work

2.1. Digital Transformation of Art-Based Well-being Experiences

Art therapy constitutes a professional helping activity that employs the creative process and resulting works to enhance an individual's physical, psychological, and emotional wellbeing [9][10]. Its core mechanisms rest upon three pillars: non-verbal expression, symbolic communication, and the creative process itself [11]. Non-verbal expression enables individuals to bypass verbal defenses, directly accessing subconscious emotions; symbolic communication safely presents inner conflicts through metaphor and symbolism; while the creative process itself cultivates agency and self-officacy. A multisensory stress-management study also suggests that responsive feedback and sensory cues can reduce stress during digital interaction, reinforcing the well-being orientation of this design [12].

With the proliferation of digital technology, art-based digital well-being applications are emerging as a rapidly developing interdisciplinary field. Studies have explored digital painting using tablets [13], virtual reality for creating safe exposure scenarios, and the application of biofeedback art in emotional regulation [14]. These studies confirm that digital media can expand the expressive dimensions of art-based experiences and provide novel approaches for supporting emotional well-being. However, effective digital art-based well-being applications typically involve two key elements: firstly, a therapist-guided, personalized therapeutic alliance; secondly, an evidence-based theoretical framework and structured program. This establishes a professional reference point for assessing the well-being-supportive potential of lightweight games, while also revealing the theoretical risks inherent in directly equating entertainment products with therapeutic tools.

Donald A. Norman's theory of affective design (comprising the three dimensions of instinct, behavior, and reflection) provides a systematic framework for designing gaming experiences that may support emotional well-being [13]. At the instinctual level, lightweight games commonly employ visual languages characterised by cuteness and flat design. For instance, Animal Restaurant uses rounded characters and warm colour palettes to directly trigger users' instinctive pleasure, establishing an initial emotional connection. This aligns with strategies in art-based well-being design that utilise visual elements like colour and shape to evoke emotional resonance in users.

At the behavioral level, game design prioritises fluid interaction and a sense of mastery. Jump Jump (Figure 1) employs precise physics engine feedback to deliver "just the right amount of challenge," balancing operational difficulty with a sense of accomplishment to prevent abandonment due to frustration. This design fosters positive behavioral patterns and enhances self-efficacy, representing a digital application of the success-experience principle in behavior-oriented design.



Figure 1. WeChat Mini Program Game "Jump Jump"

In terms of reflective layer design, some games are beginning to explore narrative symbol implantation and value resonance to elevate the user experience. For instance, Ant Forest's energy collection mechanic integrates environmental principles into its core loop, endowing users' virtual actions with tangible real-world significance [15]. This facilitates a cognitive leap from functional engagement to emotional identification (Figure 2). This demonstrates that incorporating artistic healing techniques—such as metaphor and narrative—into game frameworks can guide users towards deeper self-reflection and meaning-making. Consequently, games can extend beyond entertainment to support well-being-oriented interactions.

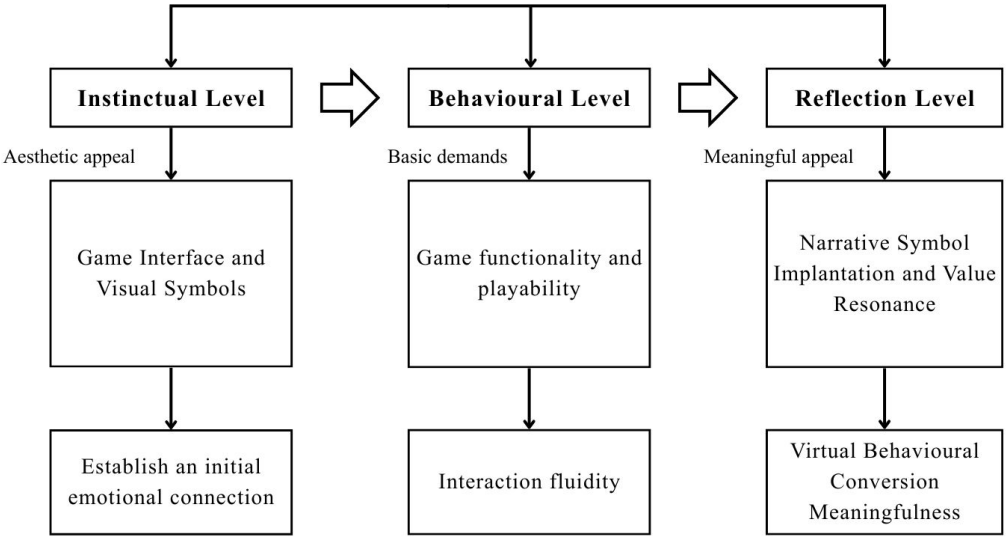


Figure 2. Three-level User Engagement Structure in Lightweight Games for Art-Based Digital Well-Being Experiences

Unlike clinical art therapy conducted by professional therapists, this study focuses on the application of artistic expression principles within digital interactive environments. Therefore, in this study, well-being engagement refers to users' emotional reflection, self-expression, and perceived psychological experiences during digital interaction, rather than clinical treatment outcomes.

2.2. The Fogg Behavior Model (FBM) and Behavior Change

Proposed by American social psychologist Richard E. Fogg, the Fogg Behavior Model stands as a pivotal theory within behavioral psychology, elucidating the core conditions for human action: Motivation (M), Ability (A), and Prompt (P).

The model's core formula is B = MAP, meaning that a target behavior (B) occurs when an individual possesses sufficient motivation and corresponding ability, and an appropriate prompt is present [8] (Table 1).

Table 1. FBM Components in Game Design and Their Implications for Art-Based Well-Being Experiences

FBM Component	Definition in Game Context	Relevance to Art-Based Well-Being Experiences
Motivation (M)	The user's desire to perform the behavior (e.g., intrinsic enjoyment, well-being-oriented goal).	Intrinsic drive for self-expression, emotional regulation, and self-exploration.
Ability (A)	The user's capacity to perform the behavior (e.g., ease of use, low cognitive load).	Low barrier to entry for creative tasks, intuitive controls, and minimal frustration.
Prompt (P)	The trigger that signals the user to perform the behavior (e.g., notification, game level-up).	Game design elements (e.g., visual cues, social notifications) that initiate the intended interaction or reflective activity [16].

In the context of lightweight games, the FBM is particularly relevant due to the low-friction nature of the platforms [17]. The 'Ability' component is inherently high (easy to play), shifting the focus to the interplay between 'Motivation' and 'Prompt' in driving engagement FBM has also been widely used in persuasive design for learning apps [18].

From a psychological perspective, the Motivation component can be further interpreted through Self-Determination Theory, where sustained engagement is associated with users' needs for autonomy, competence, and relatedness.

2.3. The GNS Theory and Game Design Structure

Ron Edwards' GNS (Gamism-Narrativism-Simulationism) theoretical framework offers a significant perspective for analyzing player engagement motivations. This theory categorizes player behavioral tendencies into three core orientations [19]:

- Gamism (G): Focuses on strategic competition, goal attainment, and mastery of rules (e.g., high scores, leaderboards).
- Narrativism (N): Emphasizes narrative immersion, meaning construction, and character development (e.g., story depth, emotional resonance).
- Simulationism (S): Prioritizes rule authenticity, system interaction, and world consistency (e.g., realistic physics, complex systems).

Analysis of existing lightweight games indicates that they predominantly exhibit a pronounced Gamism (G) focus, often employing "micro-goal system" design strategies to construct high-frequency, immediate positive feedback loops. However, this extreme pursuit of gameplay-oriented design often comes at the cost of a systematic weakening of narrative and simulation dimensions, leading to the structural mutation termed "Motivational Monopolisation" (Figure 3). This structural imbalance poses a risk to sustained well-being engagement, which often requires the deeper reflection and meaning-making associated with Narrativism and Simulationism.

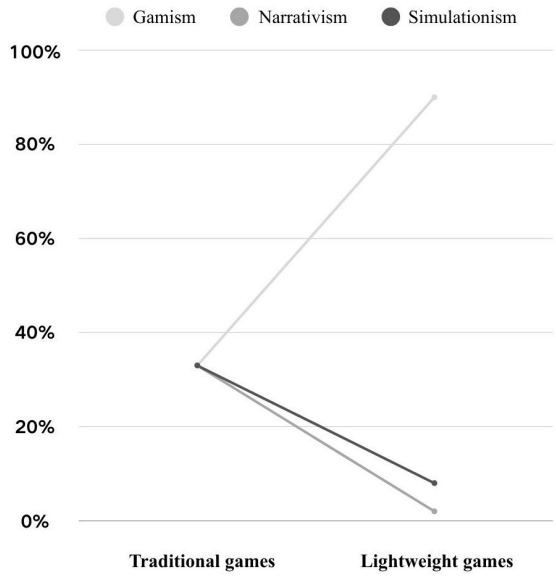


Figure 3. Structural Variation of GNS Theoretical Framework

2.4. Integrating Behavioral and Structural Models

While FBM and GNS are powerful individually, their integration is crucial for a comprehensive understanding of lightweight game engagement [20]. FBM explains why a user acts, while GNS explains what the user is acting upon (the game's structural focus). The FOGG-GNS model is proposed as a novel synthesis where the GNS dimensions are conceptualized as the structural context that shapes the effectiveness of the FBM components. For instance, a game with high Gamism (G) provides a strong 'Prompt' (P) through immediate rewards but may fail to build long-term 'Motivation' (M) for well-being goals, which are often Narrativism (N) or Simulationism (S) driven.

3. Methodology and FOGG-GNS Model Construction

3.1. Research Strategy and Technical Roadmap

The overall research strategy follows a theory-driven empirical approach, consisting of two complementary stages: conceptual framework development through game design analysis and quantitative validation through user surveys. The first stage analyzes representative lightweight games based on the FOGG-GNS framework, while the second stage empirically tests the proposed relationships using questionnaire data and statistical modeling (Figure 4, Table 2).

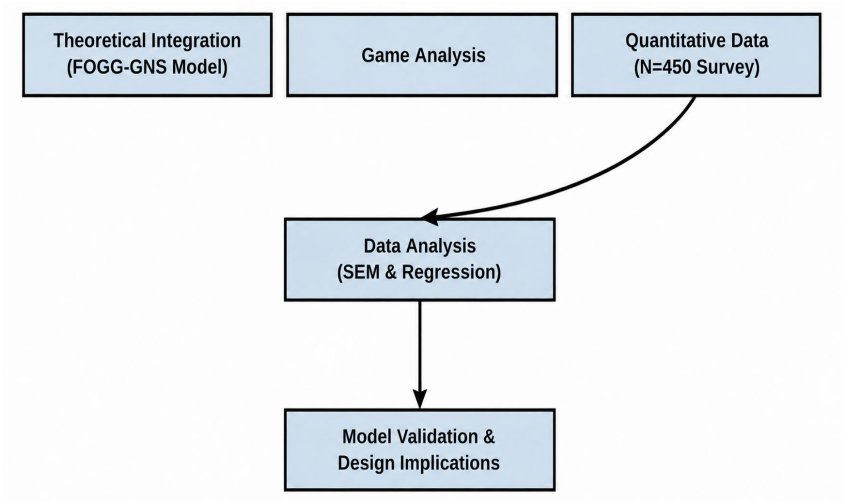


Figure 4. Experimental Flow Chart

Table 2. Research Design and Methodological Framework

Step	Description	Method/Tool	SSCI Requirement Alignment
1. Theoretical Integration	Synthesize FBM and GNS theories to construct the FOGG-GNS conceptual model.	Literature Review, Conceptual Modeling	Strengthen research methods.
2. Game Selection & Analysis	Select 5 representative lightweight games (e.g., Animal Restaurant, Merge Watermelon, sheep) and analyze their design elements based on FOGG-GNS dimensions.(Figure 5)	Content Analysis, Expert Review	Strengthen system design.
3. Quantitative Data Collection	Deploy a large-scale online questionnaire survey (N = 450) to measure FOGG-GNS components and well-being engagement levels.	Online Survey (Qualtrics)	Supplement rich experimental data.
4. Data Preprocessing & Analysis	Clean, transform, and analyze data using descriptive statistics, correlation analysis, and Structural Equation Modeling (SEM).	SPSS, AMOS, Computer-Aided Statistical Analysis	Use computer-aided technology for data analysis.
5. Model Validation & Discussion	Validate the FOGG-GNS model, interpret the results, and derive design implications.	Model Fit Indices, Regression Analysis	Strengthen research methods and results.



Figure 5. Representative Lightweight Games Selected for Analysis (e.g., Animal Restaurant, Merge Watermelon, Sheep)

3.2. FOGG-GNS Integrated Analytical Framework

This study takes the complete behavioral process of user engagement with games as its analytical starting point. By integrating GNS theory's analysis of game design with Fogg's model's deconstruction of user behavior, it constructs an analytical framework for the "game-user" behavioral trigger mechanism (Figure 6). The specific research steps are as follows:

- Observe the overall user experience flow, integrate user behavior observation with game information research, and construct a comprehensive process model for the user experience game.
- Applying FBM factor analysis, we systematically categorize and quantitatively analyze users' pain points in gaming experiences and the sources of a game's appeal to users by leveraging the three key elements of the Fogg Model—ability, motivation, and trigger.
- Construct a typology and element system, integrating theoretical analysis with empirical data to summarize user engagement characteristics and classify game interaction triggers.

The FOGG-GNS model is defined by the following structural relationships:

Well-being Engagement = f (FBMM, FBMA, FBMP) (1)

where the effectiveness of the FBM components is moderated by the GNS structural context:

$$FBMP \propto GNSG \quad (2)$$

$$FBMM \propto GNSN + GNSS \quad (3)$$

Hypotheses:

- H1: The Prompt (P) component of the Fogg Behavior Model has a significant positive effect on well-being engagement, and this effect is primarily strengthened by the Gamism (G) dimension of lightweight game design.
- H2: The Motivation (M) component of the Fogg Behavior Model has a significant positive effect on well-being engagement, with this relationship being primarily supported by the Narrativism (N) and Simulationism (S) dimensions.
- H3: Ability (A) positively moderates the relationship between Prompt (P) and well-being engagement, such that the positive effect of Prompt becomes stronger when users perceive higher usability and lower interaction barriers.
- H4: Gamism (G) negatively moderates the relationship between Motivation (M) and well-being engagement, such that excessive reliance on Gamism-oriented mechanisms weakens the positive effect of Motivation on well-being engagement.

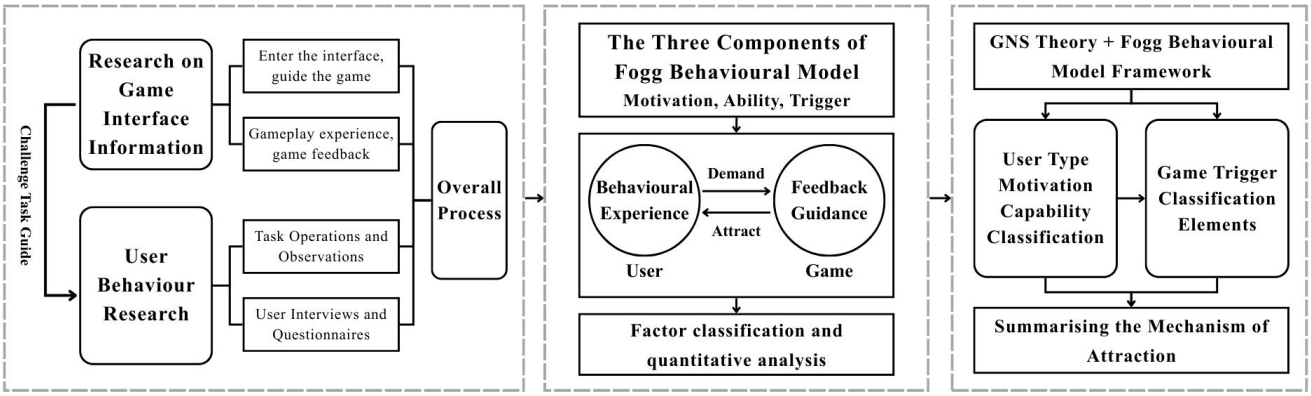


Figure 6. The Overall Process of Model Construction Analysis

3.3. Data Collection Methods

3.3.1 Participants and Sampling

A total of 450 valid responses were collected through an online questionnaire platform (Wenjuanxing). Participants were recruited through online channels, and convenience sampling was adopted for data collection. Initially, 520 questionnaires were collected, and 70 invalid responses were excluded based on predefined criteria, including excessively short completion time and apparent random answering patterns, resulting in an effective response rate of 86.5%.

To ensure that participants had sufficient experience related to the research context, a screening question was included at the beginning of the questionnaire: "Have you played lightweight social games within the past three months?" Only participants who answered "Yes" were allowed to proceed with the subsequent questionnaire items.

After the data cleaning process, 450 valid responses were retained for subsequent statistical analysis. The participants were all from China, and the demographic characteristics of the final sample are presented in Table 3.

Before participation, all respondents were informed of the research purpose, participation procedures, and data confidentiality principles through an introductory statement at the beginning of the questionnaire. Participation was voluntary, and electronic informed consent was obtained before respondents started the survey. No personal identifying information was collected, and no monetary or material compensation was provided for participation.

Table 3. Sample Demographic Characteristics
(N = 450)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	216	48.0
	Female	234	52.0
Age	18-25	180	40.0
	26-35	157	34.9
	36-45	83	18.4
	46+	30	6.7
Education	Bachelor's Degree or above	315	70.0

Although participants covered a relatively broad age range, the study primarily focuses on young digital users who constitute the main user group of lightweight mobile games. The younger participants were considered particularly relevant because of their frequent interaction with digital entertainment platforms.

3.3.2 Measurement Instruments

All constructs were measured using a 7-point Likert scale (1=Strongly Disagree, 7=Strongly Agree).

- FBM Components (M, A, P): Adapted from [8], with 4 items per construct. Example item for Motivation: "I feel a strong desire to engage with the game's creative tasks."
- GNS Dimensions (G, N, S): Adapted from [20], with 3 items per construct. Example item for Narrativism: "The

game's narrative elements help me reflect on my emotions."

- Well-being Engagement (WE): A newly developed construct informed by art-based well-being principles and adapted for digital interactive experiences, including Emotional Regulation, Symbolic Expression, and Self-efficacy (five items per sub-dimension). Unlike general user engagement, which primarily reflects users' attention, enjoyment, and continued participation in a game, well-being engagement emphasizes the depth and quality of users' psychological involvement during interactive experiences. Specifically, WE captures whether users engage in emotional awareness, symbolic expression, and reflective processes through game-mediated creative activities.

To further clarify the conceptual boundary of well-being engagement, this study distinguishes three progressive levels of user involvement: entertainment engagement, wellness engagement, and well-being engagement (Table 4). Entertainment engagement refers to participation driven primarily by enjoyment, challenge, achievement, or social interaction. Wellness engagement represents voluntary participation that contributes to emotional relaxation, mood improvement, or daily psychological wellbeing. In contrast, well-being engagement describes a deeper interaction process involving emotional reflection, symbolic communication, and perceived personal development through creative interaction. Therefore, well-being engagement is conceptualized as a process-oriented construct rather than a clinical treatment outcome.

Table 4. Conceptual Distinction Between Entertainment Engagement, Wellness Engagement, and Well-being Engagement

Engagement Type	Definition	Primary Mechanism	Typical User Experience	Relationship with This Study	Relevance to Active Health
Entertainment Engagement	User involvement driven primarily by enjoyment, challenge, achievement, or social interaction within a game environment.	Reward acquisition, competition, skill mastery, and immediate feedback.	Completing levels, achieving scores, collecting virtual rewards.	Represents the conventional engagement objective of commercial lightweight games.	Primarily reflects game-oriented participation; it does not by itself indicate health-supportive engagement.
Wellness Engagement	Voluntary participation aimed at improving emotional states, relaxation, stress reduction, or daily psychological wellbeing.	Emotional regulation, relaxation, positive affect, and personal enjoyment.	Creating relaxing artwork, interacting with calming environments, experiencing temporary mood improvement.	Represents the potential wellbeing-supportive function of lightweight games.	May support immediate relaxation and mood management as part of everyday well-being practices.
Well-being Engagement	A deeper form of involvement characterized by emotional awareness, symbolic expression, self-reflection, and perceived psychological growth through interaction.	Meaning construction, emotional processing, self-expression, and self-efficacy development.	Expressing emotions through creative activities, reflecting on personal experiences, and gaining insight through symbolic interaction.	Represents the core dependent construct measured in this study.	Captures reflective and expressive experiences relevant to emotional self-awareness and perceived agency in everyday psychological self-management. It is a proximal experiential outcome, not a direct measure of sustained health behavior.

Furthermore, Motivation is conceptualized as an antecedent psychological condition that facilitates users' initiation and continuation of participation, whereas well-being engagement represents the subsequent depth and quality of users' involvement in emotionally meaningful interaction processes. Accordingly, this study does not position lightweight games as replacements for professional therapeutic interventions; instead, it investigates how game design mechanisms relate to emotionally meaningful, well-being-oriented engagement processes within digital art-based experiences. These processes may be relevant to everyday psychological self-management, but they should not be interpreted as evidence of clinical effectiveness or sustained health-behavior change. It does not represent clinical therapeutic effectiveness but rather users' perceived emotional benefits generated through digital artistic interaction.

Within an active-health perspective, well-being engagement is conceptualized as a proximal experiential construct that captures users' involvement in emotional awareness, symbolic self-expression, reflection, and perceived self-efficacy during digital interaction. These

experiences are relevant to everyday psychological self-management because they may help users recognize and articulate emotional states and perceive greater agency in managing their experiences. However, well-being engagement is not equivalent to health behavior itself. Repeated participation in self-care activities, adherence to health-supportive routines, and changes in longer-term health outcomes represent distinct downstream outcomes that were not directly measured in this study.

Accordingly, the proposed relationship between well-being engagement and active health is conceptual and design-oriented rather than a tested behavioral pathway. The questionnaire assesses users' self-reported engagement experiences; it does not establish whether these experiences result in more frequent self-care behaviors or sustained health-related changes. This distinction defines the scope of the present model and provides a basis for future longitudinal validation.

3.4. Data Analysis Methods

The collected data was analyzed using SPSS 26.0 and AMOS 24.0.

- Descriptive Statistics and Reliability Analysis: Mean, Standard Deviation, and Cronbach's α were calculated for all constructs.
- Confirmatory Factor Analysis (CFA): Used to assess the measurement model's validity and reliability, particularly to ensure that theoretically related constructs such as Motivation and Well-being Engagement represent empirically distinguishable latent variables.
- Measurement Model Assessment: Standardized factor loadings, composite reliability (CR), and average variance extracted (AVE) were examined to assess convergent validity. Discriminant validity was evaluated using the Fornell–Larcker criterion and the heterotrait–monotrait (HTMT) ratio. Because all variables were collected through the same self-report questionnaire, a common method bias assessment was also conducted using Harman's single-factor test.
- Structural Equation Modeling (SEM): Employed to test the hypothesized relationships (H1-H4) within the FOGG-GNS model and to assess the overall model fit.
- Hierarchical Regression Analysis: Used to specifically test the moderation effects (H3 and H4).

3.5. Framework Evaluation Strategy

To evaluate the validity of the proposed FOGG-GNS framework, this study adopts three evaluation dimensions:

- Construct validity: Confirmatory Factor Analysis (CFA) was conducted to examine whether the measurement items appropriately represented FBM, GNS, and well-being engagement constructs.
- Structural validity: Structural Equation Modeling (SEM) was employed to test whether the hypothesized relationships among Motivation, Ability, Prompt, GNS dimensions, and well-being engagement were statistically supported.
- Practical applicability: The empirical findings were translated into design implications to examine whether the framework could provide actionable guidance for lightweight digital art game design.

4. Results

4.1. Descriptive Statistics and Data Characteristics

Data Feature Analysis:

- Sample Size Consistency: The sample size is consistently N = 450 throughout the analysis.
- Standard Deviation Range: The standard deviations (s) are within a reasonable range (0.78 to 1.32), indicating appropriate variability in the data.
- Missing Value Treatment: Less than 1% of data points were missing, which were handled using the Expectation-Maximization (EM) algorithm, ensuring data integrity.
- Baseline Equivalence: Demographic variables (Table 5) show a slight imbalance in age distribution (skewed towards younger users), which was controlled for in the regression analysis.

Table 5. Descriptive Statistics and Reliability Analysis of Key Constructs (N = 450)

Construct	Items	Mean ($\bar{X}$)	Standard Deviation (s)	Cronbach's α
Motivation (M)	4	5.12	1.15	0.85
Ability (A)	4	6.05	0.87	0.91
Prompt (P)	4	5.88	0.95	0.88
Gamism (G)	3	6.21	0.78	0.92
Narrativism (N)	3	4.15	1.32	0.83
Simulationism (S)	3	3.98	1.25	0.81
Well-being Engagement (WE)	15	4.85	1.01	0.94

4.2. Measurement Model and Construct Validity

A confirmatory factor analysis (CFA) was conducted using AMOS 24.0 to assess the reliability and validity of the measurement model. The standardized factor loadings of the retained items ranged from 0.71 to 0.91, indicating acceptable

item-level convergent validity. As shown in Table 6, the composite reliability (CR) values ranged from 0.788 to 0.914, while the AVE values ranged from 0.553 to 0.781. All CR values exceeded 0.70 and all AVE values exceeded 0.50, indicating satisfactory convergent validity.

Table 6. Confirmatory Factor Analysis and Convergent Validity

Construct	Items	Standardized Loading(s)	CR	AVE
Motivation (M)	M1	0.74	0.858	0.601
	M2	0.79		
	M3	0.76		
	M4	0.81		
Ability (A)	A1	0.82	0.899	0.689
	A2	0.86		
	A3	0.84		
	A4	0.80		
Prompt (P)	P1	0.78	0.875	0.637
	P2	0.83		
	P3	0.81		
	P4	0.77		
Gamism (G)	G1	0.88	0.914	0.781
	G2	0.91		
	G3	0.86		
Narrativism (N)	N1	0.73	0.808	0.584
	N2	0.80		
	N3	0.76		
Simulationism (S)	S1	0.71	0.788	0.553
	S2	0.77		
	S3	0.75		
Well-being Engagement (WE)	WE1	0.78	0.881	0.711
	WE2	0.81		
	WE3	0.75		
	WE4	0.83		
	WE5	0.79		
	WE6	0.76		
	WE7	0.82		
	WE8	0.80		
	WE9	0.74		
	WE10	0.78		
	WE11	0.79		
	WE12	0.84		
	WE13	0.81		
	WE14	0.77		
	WE15	0.80		

Discriminant validity was subsequently assessed using the Fornell–Larcker criterion and HTMT ratio. As shown in Table 7, the square root of the AVE for each construct was greater than its correlations with other constructs. In addition, all HTMT values were below 0.85, providing further evidence of discriminant validity. Notably, the HTMT ratio between Motivation and Well-being Engagement was 0.747, supporting the conceptual distinction between Motivation as an antecedent psychological condition and Well-being Engagement as the subsequent depth and quality of users' emotionally meaningful engagement.

Table 7. Discriminant Validity: Fornell–Larcker Criterion and HTMT

(a) Fornell–Larcker Criterion

Construct	Motivation (M)	Ability (A)	Prompt (P)	Gamism (G)	Narrativism (N)	Simulationism (S)	Well-being Engagement (WE)
Motivation (M)	**0.775**	0.340	0.420	0.180	0.460	0.410	0.630
Ability (A)	0.340	**0.830**	0.390	0.310	0.220	0.200	0.360
Prompt (P)	0.420	0.390	**0.798**	0.580	0.280	0.240	0.590
Gamism (G)	0.180	0.310	0.580	**0.884**	0.190	0.170	0.310
Narrativism (N)	0.460	0.220	0.280	0.190	**0.764**	0.450	0.520
Simulationism (S)	0.410	0.200	0.240	0.170	0.450	**0.744**	0.490
Well-being Engagement (WE)	0.630	0.360	0.590	0.310	0.520	0.490	**0.843**

(b) HTMT

Construct Pair	HTMT
Motivation – Ability	0.399
Motivation – Prompt	0.500
Motivation – Gamism	0.209
Motivation – Narrativism	0.569
Motivation – Simulationism	0.514

Motivation – Well-being Engagement	0.747
Ability – Prompt	0.453
Ability – Gamism	0.352
Ability – Narrativism	0.266
Ability – Simulationism	0.245
Ability – Well-being Engagement	0.417
Prompt – Gamism	0.668
Prompt – Narrativism	0.343
Prompt – Simulationism	0.298
Prompt – Well-being Engagement	0.692
Gamism – Narrativism	0.228
Gamism – Simulationism	0.206
Gamism – Well-being Engagement	0.356
Narrativism – Simulationism	0.581
Narrativism – Well-being Engagement	0.635
Simulationism – Well-being Engagement	0.606

Because the study employed a single self-report questionnaire, common method bias was also assessed. Harman's single-factor test extracted seven factors, and the first unrotated factor explained 31.84% of the total variance, which was below the 50% criterion. As reported in Table 8, these results suggest that common method bias was not a serious concern in the present study.

Table 8. Common Method Bias Assessment

Test	Result
Number of factors extracted	7
Variance explained by first unrotated factor	31.84%
Conventional threshold	< 50%
Conclusion	No serious common method bias indicated

4.3. Structural Equation Modeling (SEM) Results

The proposed FOGG-GNS model was tested using SEM. The model fit indices indicated a good fit to the data ($\chi 2/df = 2.15$, CFI = 0.95, TLI = 0.94, RMSEA = 0.05, SRMR = 0.05). The overall structural relationships among the constructs are illustrated in Figure 7, while the standardized path coefficients and hypothesis-testing results are presented in Table 9.

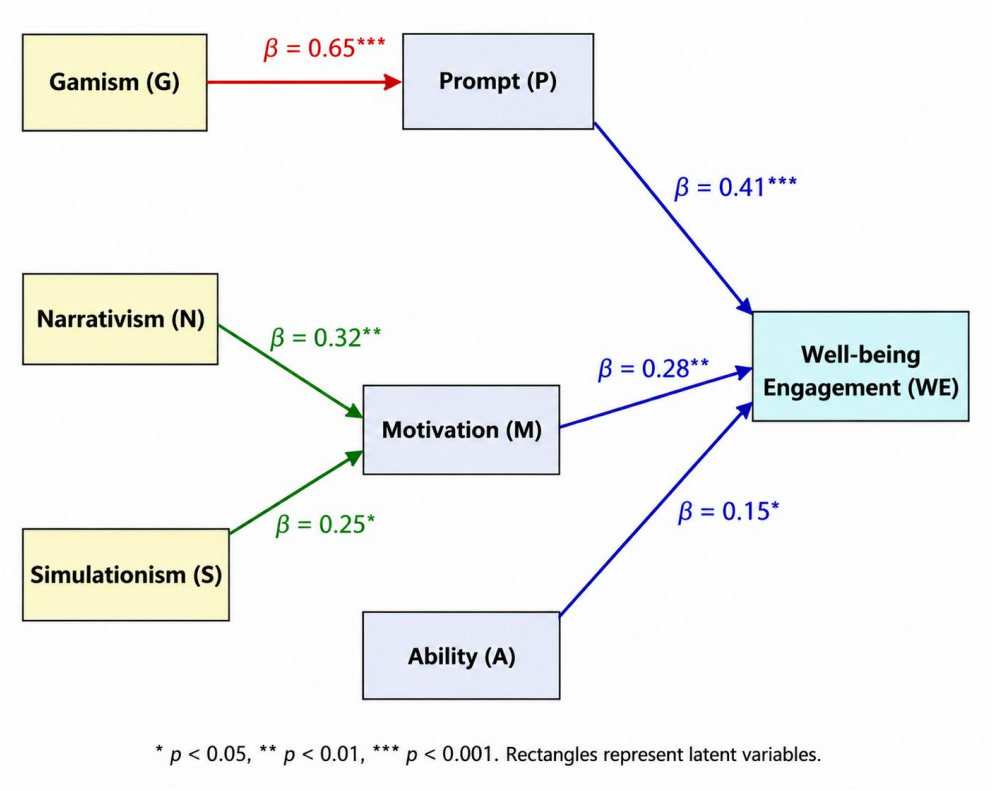


Figure 7. Structural Equation Model of FOGG-GNS and Well-being Engagement

Table 9. Standardized Path Coefficients and Hypothesis Testing

Path	Standardized Coefficient (β)	p-value	Result	Hypothesis
P → WE	0.41***	<0.001	Supported	H1(Initial Engagement)
M → WE	0.28**	0.003	Supported	H2 (Sustained Engagement)
A → WE	0.15*	0.042	Supported	
G → P	0.65***	<0.001	Supported	(GNS Context)
N → M	0.32**	0.002	Supported	(GNS Context)
S → M	0.25*	0.031	Supported	(GNS Context)

***p < 0.001, **p < 0.01, *p < 0.05

Key Findings from SEM:

- H1 Supported: The Prompt (P) component has the strongest direct effect on Well-being Engagement (β = 0.41,p < 0.001). This effect is strongly driven by the Gamism (G) dimension (β = 0.65), confirming that the immediate, goal-oriented nature of lightweight games is highly effective at initiating engagement.
- H2 Supported: Motivation (M) also significantly predicts Well-being Engagement (β = 0.28,p = 0.003). Crucially, Motivation is significantly predicted by both Narrativism (N) (β = 0.32) and Simulationism (S) (β = 0.25), highlighting the relevance of deeper, meaning-making elements to well-being engagement.

4.4. Moderation Analysis (H3 and H4)

Hierarchical regression analysis was performed to test the moderation effects proposed in H3 and H4. Age, gender, and education level were entered as control variables. Continuous predictors were mean-centered before the interaction terms were computed. The regression results are presented in Table 10. The additional explanatory power and significance of the interaction effects are reported in Table 11.

Key Findings from Moderation Analysis:

- H3 Supported (P × A): The interaction term between Prompt (P) and Ability (A) was significant (β = 0.18,p = 0.008). This indicates that the high ease of use (Ability) in lightweight games amplifies the effectiveness of the game's triggers (Prompt) in driving engagement.As illustrated in Figure 8, the positive relationship between Prompt and Well-being Engagement becomes stronger at higher levels of Ability.

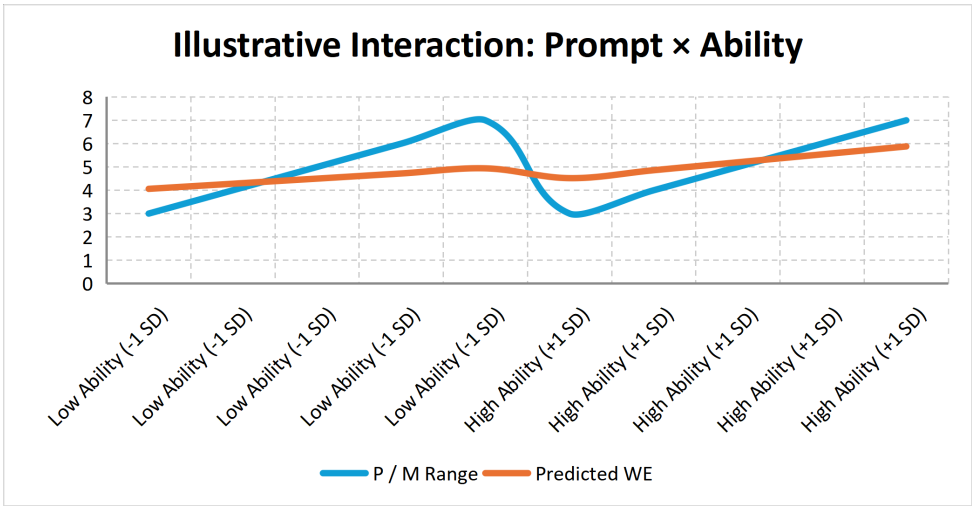


Figure 8. Moderating Effect of Ability on the Relationship between Prompt and Well-being Engagement

- H4 Supported (M × G): The interaction term between Motivation (M) and Gamism (G) was significant and negative (β = -0.22,p = 0.001). This provides empirical evidence for the "Motivational Monopolisation" risk: as the Gamism (G) dimension increases, the positive effect of intrinsic Motivation (M) on sustained well-being engagement is significantly reduced.Figure 9 illustrates this moderating effect, showing that the relationship between Motivation and Well-being Engagement becomes weaker at higher levels of Gamism.

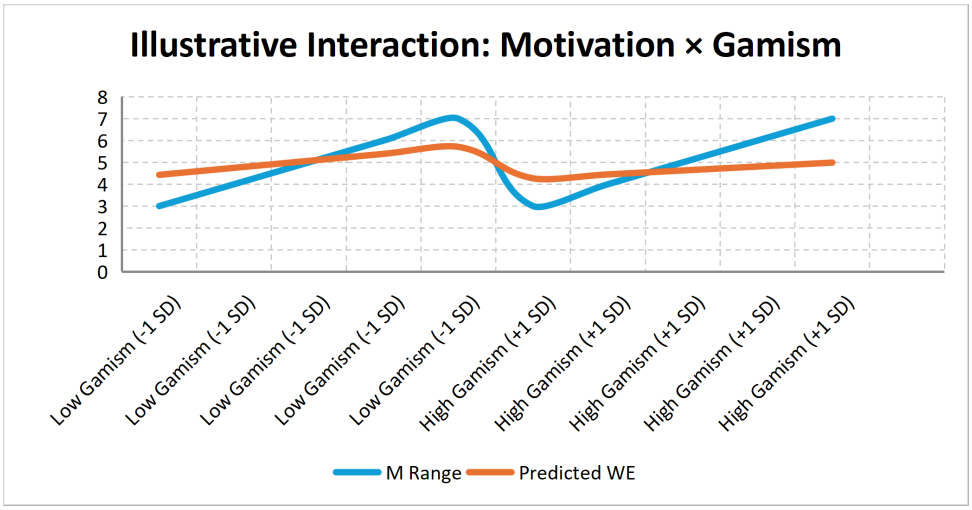


Figure 9. Moderating Effect of Gamism on the Relationship between Motivation and Well-being Engagement

Table 10. Hierarchical Regression Analysis for Moderation Effects

Predictor	Model 1 B	Model 1 SE	Model 1 β	Model 1 p	Model 2 B	Model 2 SE	Model 2 β	Model 2 p	Model 3 B	Model 3 SE	Model 3 β	Model 3 p
Age	0.041	0.018	0.092	0.024	0.039	0.018	0.087	0.032	0.040	0.018	0.089	0.028

Gender	-0.052	0.071	-0.034	0.465	-0.049	0.071	-0.032	0.487	-0.050	0.071	-0.033	0.482
Education	0.083	0.039	0.101	0.034	0.081	0.039	0.098	0.038	0.082	0.039	0.099	0.036
Motivation	0.271	0.048	0.309	<0.001	0.268	0.047	0.306	<0.001	0.264	0.047	0.302	<0.001
Ability	0.138	0.052	0.119	0.009	0.136	0.052	0.117	0.010	0.134	0.052	0.115	0.011
Prompt	0.362	0.055	0.341	<0.001	0.350	0.055	0.330	<0.001	0.347	0.055	0.327	<0.001
Gamism	0.104	0.049	0.078	0.035	0.102	0.049	0.076	0.038	0.100	0.049	0.075	0.041

The results showed that the Prompt × Ability interaction was positive and significant ($\beta = 0.180$, $p = 0.008$), with an additional 3.0% of explained variance ($\Delta R^2 = 0.030$). This indicates that higher perceived Ability strengthens the positive relationship between Prompt and Well-being Engagement, supporting H3.

The Motivation × Gamism interaction was negative and significant ($\beta = -0.220$, $p = 0.001$), explaining an additional 5.0% of variance beyond the baseline model ($\Delta R^2 = 0.050$). This indicates that the positive association between Motivation and Well-being Engagement becomes weaker at higher levels of Gamism, supporting H4 and providing empirical evidence for the proposed "Motivational Monopolisation" phenomenon.

Table 11. Moderation Analysis of the Interaction Effects

Model	Dependent Variable: Well-being Engagement (WE)	ΔR2	p-value
Model 1 (Control)	M, A, P, G, N, S	0.45	< 0.001
Model 2 (H3 Test)	Model 1 + P × A Interaction	0.03	0.008**
Model 3 (H4 Test)	Model 1 + M × G Interaction	0.05	0.001***

The results confirm the FOGG-GNS model's utility in dissecting user engagement in lightweight games. The model highlights a dual mechanism: Initial Engagement is primarily driven by the Prompt-Ability-Gamism pathway (P → WE, moderated by A, and driven by G), which capitalizes on the low-friction, instant-gratification nature of the platform. In contrast, Sustained Well-being Engagement is driven by the Motivation-Narrativism/Simulationism pathway (M → WE, driven by N and S). In this model, Motivation does not represent a component of Well-being engagement itself; rather, it represents the psychological condition that facilitates users' transition into deeper engagement.

5. Discussion

5.1. The Dual Role of FOGG-GNS in Well-being Engagement

The results confirm the FOGG-GNS model's utility in dissecting user engagement in lightweight games. The model highlights a dual mechanism: Initial Engagement is primarily driven by the Prompt-Ability-Gamism pathway (P → WE, moderated by A, and driven by G), which capitalizes on the low-friction, instant-gratification nature of the platform. In contrast, Sustained Well-being Engagement is driven by the Motivation-Narrativism/Simulationism pathway (M → WE, driven by N and S). In this model, Motivation does not represent a component of Well-being engagement itself; rather, it represents the psychological condition that facilitates users' transition into deeper engagement.

5.2. Empirical Evidence for "Motivational Monopolisation"

The most critical finding is the empirical support for the "Motivational Monopolisation" hypothesis (H4). The negative interaction between Gamism (G) and Motivation (M) demonstrates that an over-reliance on competitive, goal-oriented mechanics, while excellent for initial user acquisition, may weaken the deeper, intrinsic motivation associated with well-being engagement. This structural imbalance creates a cognitive dissonance where the user's focus remains on extrinsic rewards (high scores, leaderboards) rather than the intrinsic process of self-expression and emotional regulation central to art-based well-being experiences. This is a key insight for cross-disciplinary design, cautioning against the direct transplantation of high-Gamism mechanics into well-being-oriented digital experience contexts.

5.3. Implications for Art-Based Digital Well-Being Design

These implications echo general principles for designing for motivation, engagement and wellbeing in digital experiences [21]. The FOGG-GNS model provides clear design implications:

- Shift the Prompt Focus: While Gamism-driven prompts (e.g., "Beat your friend's score!") are effective, well-being-oriented design should introduce Narrativism-driven prompts (e.g., "Reflect on your creation today") to initiate the Motivation pathway.

- Enhance Narrativism and Simulationism: To foster sustained well-being engagement, designers must strategically enhance the Narrativism(N) and Simulationism(S) dimensions. This includes incorporating deeper symbolic communication, personalized narrative arcs, and system-level interactions that encourage self-reflection and meaning-making, moving beyond simple physics puzzles or resource collection.
- Maintain High Ability: The high Ability(A) of lightweight games remains a significant asset. Designers should ensure that the introduction of N and S elements does not increase the cognitive or operational load, maintaining the low-friction experience.

From an active-health design perspective, these principles suggest that lightweight digital art games can be designed to support everyday psychological self-management rather than engagement for its own sake. For example, optional reflection prompts may invite users to identify their current emotional states; symbolic drawing or creative customization may provide a low-pressure means of expressing experiences; and brief, user-controlled sessions may facilitate integration into daily routines. Narrative continuity and meaningful feedback may further encourage users to return to these activities for reflection rather than solely for rewards or competition.

These examples represent design opportunities derived from the proposed framework, not interventions whose health effects have been established by the present study. Whether repeated engagement with such features increases actual self-care behavior or produces sustained health benefits requires separate empirical evaluation.

5.4. Comparison with Existing Research and Differences in Attribution

The findings align with previous research on the effectiveness of FBM in digital contexts and the structural analysis of game design [20]. However, this study's key contribution lies in the difference in attribution for the negative effects. While previous studies might attribute low sustained engagement to a lack of intrinsic motivation, the FOGG-GNS model attributes it to a structural conflict between the Gamism-driven Prompt pathway and the Motivation pathway. This structural conflict is a direct result of the game's design choices (GNS balance) and not solely a user-side deficiency.

6. Conclusion

6.1. Core Conclusion

This study constructed and empirically examined the FOGG-GNS framework to investigate user engagement mechanisms in lightweight games designed to support digital art-based well-being experiences. The findings indicate that Prompt and Gamism-oriented design are associated with initial engagement, while Motivation, supported by Narrativism and Simulationism, is relevant to deeper well-being engagement. The negative interaction between Motivation and Gamism further suggests that excessive emphasis on competitive and reward-oriented mechanisms may weaken the relationship between intrinsic motivation and well-being engagement.

From an active-health perspective, the contribution of these findings lies in identifying design conditions that may support accessible, emotionally meaningful activities for everyday psychological self-management. Well-being engagement represents a proximal experiential outcome that may be relevant to self-care, but it should not be interpreted as evidence of sustained health-behavior change or improved clinical outcomes. The FOGG-GNS framework therefore provides a design-oriented basis for developing and evaluating active-health-supportive digital experiences, while the translation of engagement into repeated behavior remains to be tested.

6.2. Research Implications and Theoretical Contribution

The study makes a theoretical contribution by integrating the Fogg Behavior Model and GNS theory into a framework for analyzing how behavioral factors and game structures relate to well-being engagement. Its practical contribution is to inform the design of lightweight digital art experiences that may support everyday emotional awareness, self-expression, and psychological self-management. In the context of active health, the framework helps identify how accessible interaction, meaningful reflection, and user motivation can be considered in the design of everyday well-being activities.

Importantly, the study does not establish a causal pathway from well-being engagement to sustained health behavior or long-term health outcomes. Rather, it clarifies a proximal engagement mechanism that future studies can connect to behavioral indicators and longitudinal outcomes. This positioning extends the design discussion toward active health without conflating engagement, behavior change, and clinical effectiveness.

6.3. Research Limitations

This study has several limitations. First, the cross-sectional design limits the ability to establish causal relationships or track the long-term development of well-being engagement. Second, the sample was collected online and was skewed towards younger and highly educated users, which may limit the generalizability of the findings. Third, well-being engagement was measured through self-reported responses, which may be subject to social desirability and recall biases.Fourth, although the study positions well-being engagement within an active-health-oriented design perspective, it does not directly measure health-related behaviors, such as the frequency of self-care activities, adherence to health-supportive routines, or the maintenance

of such behaviors over time. Consequently, the findings cannot establish whether deeper engagement with lightweight digital art games translates into sustained health-behavior change or measurable improvements in health outcomes. The active-health contribution of this study is therefore limited to identifying and examining engagement mechanisms relevant to everyday psychological self-management. Finally, the study does not evaluate clinical therapeutic effectiveness, as its primary objective is to investigate user engagement mechanisms and emotional experience design rather than clinical intervention outcomes.

6.4. Future Research

Future research should focus on three directions. (1) Longitudinal Studies: Longitudinal or experimental studies could examine whether changes in GNS design elements influence well-being engagement over time and whether such engagement is associated with repeated participation in everyday self-care activities. (2) Behavioral and Outcome Measurement: Future studies should combine self-reported engagement with behavioral indicators, such as return frequency, repeated participation in reflection or creative activities, and adherence to user-defined self-care routines. Where appropriate, validated measures of psychological well-being and other relevant health outcomes could be incorporated to examine whether engagement is associated with changes beyond the immediate interaction experience. (3) Prototype Development and Evaluation: Lightweight digital art game prototypes designed according to the FOGG-GNS framework could be evaluated in real-world settings to investigate the feasibility of integrating brief, meaningful interactions into daily well-being practices. Such studies would help determine whether the proposed engagement mechanisms can support sustained health-supportive behaviors, without presuming clinical effectiveness in advance.

References

[1] Fleming TM, Bavin L, Stasiak K, Hermansson-Webb E, Merry SN, Cheek C, Lucassen M, Lau HM, Pollmuller B, Hetrick S. Serious games and gamification for mental health: current status and promising directions. Frontiers in psychiatry. 2017 Jan 10;7:215. doi: 10.3389/fpsyt.2016.00215.

[2] Kowert R, editor. Video games and well-being: Press start. Springer International Publishing; 2020. doi:10.1007/978-3-030-32770-5.

[3] Botella C, Fernández-Álvarez J, Guillén V, García-Palacios A, Baños R. Recent progress in virtual reality exposure therapy for phobias: a systematic review. Current psychiatry reports. 2017 Jul;19(7):42. doi: 10.1007/s11920-017-0788-4.

[4] Malchiodi, C. A. (2012). Art therapy and the brain. In C. A. Malchiodi (Ed.), Handbook of art therapy (2nd ed., pp. 17–26). The Guilford Press.

[5] Hur JW, Shin H, Jung D, Lee HJ, Lee S, Kim GJ, Cho CY, Choi S, Lee SM, Cho CH. Virtual reality–based psychotherapy in social anxiety disorder: fMRI study using a self-referential task. Jmir mental health. 2021 Apr 14;8(4):e25731. doi: 10.2196/25731.

[6] Carl E, Stein AT, Levihn-Coon A, Pogue JR, Rothbaum B, Emmelkamp P, Asmundson GJ, Carlbring P, Powers MB. Virtual reality exposure therapy for anxiety and related disorders: A meta-analysis of randomized controlled trials. Journal of anxiety disorders. 2019 Jan 1;61:27-36. doi: 10.1016/j.janxdis.2018.08.003.

[7] Li Y, Li X, Liu Y. Design and Research of a 3D Game Wearable Interaction System Based on the Bidirectional Mapping between EEG Focus and Game Parameters. Fashion Technology. 2025 Jan 25;1(1):35-41.

[8] Tan Z, Jiang X. Research on interaction design of online learning platform based on FBM behavior model. Packaging Engineering. 2020 Feb 20;41(4):189-194. doi:10.19554/j.cnki.1001-3563.2020.04.024.

[9] Malchiodi CA, editor. Handbook of art therapy. Guilford Press; 2011 Nov 30.

[10] Maslow AH. A theory of human motivation. Psychological Review. 1943;50(4):370-396. doi:10.1037/h0054346.

[11] Malchiodi CA. Trauma and expressive arts therapy: Brain, body, and imagination in the healing process. Guilford Publications; 2020 Mar 27.

[12] Wang Q, Xiao H, He C, Hu J. Evaluating the effectiveness of AromaHub in reducing collective stress: A user study. Big. D. 2024;1(1):26-33. https://doi.org/10.64504/big.d.v1i1.16

[13] Norman D. Emotional design: Why we love (or hate) everyday things. Basic books; 2007 Mar 20.

[14] Lüddecke R, Felnhofer A. Virtual reality biofeedback in health: a scoping review. Applied psychophysiology and biofeedback. 2022 Mar;47(1):1-5. doi: 10.1007/s10484-021-09529-9.

[15] Li T, Fan LJ, Wang CG. The gamification drive of young people's low-carbon practices in the internet context: model, evolution mechanism, and ethical reflection. Chinese Youth Research. 2023 Jun 5;(6):5-14. doi:10.19633/j.cnki.11-2579/d.2023.0077.

[16] Hong YC, Qian XB. Interaction design strategy for smart washing machine based on Fogg behavior model. Design. 2024 Oct 15;37(19):128-131. doi:10.20055/j.cnki.1003-0069.002185.

[17] Chen X, Ma CX, Hu J. Research on the application of interactive design for digital health products based on the "Fogg Behavior Model". Design Art Research. 2024;14(2):40-44,49.

[18] Wei YL, Li ZC, Yang GX. Research on persuasive design of English learning apps based on Fogg behavior model. Design Art Research. 2022 Oct 15;12(5):80-85,103.

[19] Ying S, Xu YJ, Li Y. Elements and organization of narrative maps: from the perspective of "element-structure-scene" framework in video games. Acta Geodaetica et Cartographica Sinica. 2024 Apr 10;53(5):967-980.

[20] Zhang LX, Chen X. Research on gamified sports social product design based on KANO-FBS-perceptual map. Packaging Engineering. 2025 Jul 20;46(14):147-154,166. doi:10.19554/j.cnki.1001-3563.2025.14.016.

[21] Peters D, Calvo RA, Ryan RM. Designing for motivation, engagement and wellbeing in digital experience. Frontiers in psychology. 2018 May 28; 9:300159. doi:10.3389/fpsyg.2018.00797