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GENERATIVE ARTIFICIAL INTELLIGENCE FOR DESIGNING NON-FUNGIBLE TOKENS (NFTS) BASED ON BRAND IDENTITY FOR DIGITAL ASSETS IN HIGHER EDUCATION

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ABSTRACT

The rapid advancement of generative artificial intelligence (AI) and blockchain technologies has transformed digital content creation and value generation in the contemporary digital economy. In higher education, these technologies create new opportunities to enhance student competencies through experiential learning and digital asset development. This study aimed to synthesize theoretical concepts and related research, develop a conceptual framework, and evaluate the suitability of a generative AI–based framework for designing non-fungible tokens (NFTs) grounded in brand identity for digital assets in higher education. The research was conducted in three phases: (1) synthesis of literature and theoretical foundations related to generative AI, brand identity, NFTs, and student competencies; (2) development of a conceptual framework integrating technological processes, creative design, and branding strategies; and (3) evaluation of the framework's suitability by seven experts in artificial intelligence, computer art, and branding using purposive sampling. The proposed framework comprises five interrelated components: brand identity input, generative AI processes, AI-generated outputs and student competencies, evaluation mechanisms, and NFT marketplace application with feedback loops. The findings indicate that the framework provides a systematic guideline for integrating generative AI and NFT design into higher education, supporting digital creativity, AI literacy, strategic branding, and digital value creation.

Keywords: *Generative artificial intelligence, Non-fungible tokens (NFTs), Brand identity, Student competencies, Higher education*

1. INTRODUCTION

The rapid advancement of digital technologies and artificial intelligence (AI) has reshaped value creation in the digital economy, shifting the emphasis toward creativity, innovation, and symbolic meaning. As a result, higher education institutions face increasing challenges in developing students' competencies in applying AI to design, create, and extend the value of digital outputs [1].

Non-fungible tokens (NFTs), enabled by blockchain technology, verify the ownership and authenticity of unique digital works and have evolved beyond financial speculation into strategic tools for communicating brand identity and creative value in digital environments [2], [3]. In higher education, NFTs can support experiential learning by allowing students to transform academic or creative outputs into verifiable digital assets, enabling the demonstration of competencies, achievements, and professional identity [4], [5].

Despite the growing interest in digital assets, previous studies have predominantly focused on the technical infrastructure of blockchain or the commercial/financial speculation of NFTs. A critical literature gap remains regarding how

Generative AI can be systematically integrated with structured Brand Identity models within higher education to foster tangible student competencies. Most existing educational frameworks treat AI merely as an automated content-generation tool rather than a pedagogy-driven mechanism for strategic branding, digital entrepreneurship, and identity-driven value creation. Consequently, educators lack a standardized, empirically validated framework that bridges AI prompting, visual branding, ethical governance, and real-world Web3 market integration.

Prior frameworks addressing NFTs in branding, such as NFTByBrands and Crypto-marketing focus on market positioning and consumer value rather than on the generative design process itself or on educational competency outcomes. Conversely, studies on generative AI in design emphasize technical mechanisms (e.g., diffusion models, GANs) without embedding these processes within a brand-identity structure or a pedagogical model. Educational NFT studies establish the pedagogical value of NFTs as verifiable digital credentials but do not specify how generative AI should be used to produce brand-identity-consistent outputs. The present study differs from this prior work in both motivation and findings: it is motivated by the need for a systematic, teachable process — rather than a market-facing or purely technical model — and its principal finding is a five-component, expert-validated framework (Brand Identity, Generative AI Process, Output, Evaluation, NFT Marketplace/Feedback) that operationalizes brand identity as an input dataset for generative AI-driven, competency-building NFT creation.

Generative AI further enhances this process by supporting creative production through data-driven design generation, increasing creative flexibility and opportunities for digital value creation [6], [7]. Accordingly, AI competency development extends beyond technical skills toward innovation, value creation, and digital entrepreneurship aligned with the evolving role of higher education [1], [8].

Based on this context, this study proposes a conceptual framework titled “Generative Artificial Intelligence for Designing Non-fungible Tokens (NFTs) Based on Brand Identity for Digital Assets in Higher Education”, which is intended as a guideline for integrating generative AI and NFTs into teaching and learning processes to support identity-driven digital creation and sustainable application in the contemporary digital economy. To address this gap, the study is guided by the following research questions;

RQ1: What theoretical foundations and related studies concerning generative artificial intelligence, brand identity, and non-fungible tokens (NFTs) can be synthesized to support the design of digital assets in higher education?

RQ2: How can the synthesized theoretical concepts and empirical evidence be integrated into a conceptual framework for designing non-fungible tokens (NFTs) based on brand identity using generative artificial intelligence in higher education?

RQ3: To what extent is the proposed conceptual framework for designing non-fungible tokens (NFTs) based on brand identity using generative artificial intelligence considered suitable and applicable for implementation in higher education?

2. RESEARCH OBJECTIVES

2.1 To synthesize theoretical concepts and related studies concerning the application of generative artificial intelligence in designing non-fungible tokens (NFTs) based on brand identity for digital assets in higher education.

2.2 To develop a conceptual framework for the application of generative artificial intelligence in the design of non-fungible tokens (NFTs) grounded in brand identity for digital assets in higher education.

2.3 To evaluate the suitability and applicability of the proposed generative artificial intelligence–based framework for designing non-fungible tokens (NFTs) based on brand identity for digital assets in higher education.

3. LITERATURE REVIEW

3.1 Brand identity

Brand identity plays a critical role in defining and establishing the unique characteristics of an organization or product. A clearly articulated brand identity serves as a fundamental element in brand development by communicating differentiation and distinctiveness, which can contribute to sustainable competitive advantage [9], [10]. Consumers who demonstrate higher aesthetic awareness tend to be more sensitive to brand image and visual presentation compared to those with lower aesthetic expectations. The analysis and development of brand identity can be understood through six key dimensions. First, physique refers to the tangible and visual characteristics of a brand, including the technical attributes and digital graphic elements that represent its external appearance. Second, personality reflects the distinctive traits

and symbolic characteristics that shape digital brand recognition and differentiation [11]. Third, culture represents the values and digital cultural context embedded within the brand, which communicate its underlying identity and meaning. Fourth, relationship describes the interactions and connections established between the brand and its audience, influencing engagement and long-term loyalty [12]. Fifth, reflection refers to the perceptions, experiences, and interpretations formed through brand exposure, contributing to emotional responses and strengthening consumer relationships. Finally, self-image represents the internalized perception and aspirational identity that consumers associate with the brand, shaped through consistent communication of ideas, emotions, and symbolic meanings [13].

Together, these dimensions provide a comprehensive framework for understanding how brand identity can be designed and communicated stratigically, particularly within digital environments where visual, symbolic, and experiential elements play a central role.

3.2 Non-fungible tokens (NFTs)for digital assets

Non-fungible tokens (NFTs) are digital assets characterized by their non-interchangeability and uniqueness, as each token possesses distinct attributes that prevent direct substitution or exchange [14], [15]. The acquisition of NFTs typically requires a foundational level of financial literacy, particularly in relation to cryptocurrency systems and digital asset valuation. Buyers must be able to understand and evaluate the perceived value of NFTs in order to make informed purchasing decisions and achieve satisfaction with ownership. Furthermore, blockchain technology enables transparent verification of ownership, reinforcing authenticity and provenance. The uniqueness and scarcity inherent in NFTs serve as key drivers of value creation, as limited supply enhances the perceived exclusivity and emotional attachment experienced by owners of rare digital assets [2], [16], [17]. In the marketing context, NFTs have increasingly been utilized as strategic tools to support branding and promotional objectives, contributing to consumer engagement and value communication [18] . Consumer attitudes and purchase intentions toward NFTs are influenced by multiple underlying factors, including personality traits, cultural values, social context, media exposure, and information environments [15].

3.3 Generative artificial intelligence

Generative artificial intelligence (AI) refers to a subset of artificial intelligence techniques that utilize advanced learning algorithms to generate new content based on patterns identified from existing data. These systems are capable of producing original outputs that can support creative processes and decision-making activities (Peres et al., 2023). Generative AI can create a wide range of creative products, including textual content, visual images, music, narratives, and virtual environments, thereby expanding the scope of digital content production [20]. By analyzing large-scale datasets, generative AI models learn underlying structures and patterns, enabling the creation of new content that reflects similar characteristics or formats while maintaining novelty. This capability allows for the rapid and efficient generation of large volumes of content, significantly enhancing productivity and creative flexibility [21]. As a result, generative AI has emerged as a powerful tool for digital asset design, facilitating the development of distinctive and personalized outputs. Such capabilities contribute to improved user and customer experiences and play an increasingly important role in supporting organizations wishing to enhance their value creation and engagement within digital environments.

3.4 Student Competencies in the Context of Generative AI and NFT Design in Higher Education

In the context of the digital economy, student competencies are required to extend beyond basic technological proficiency toward the capacity to create and communicate digital value [1]. Generative artificial intelligence plays a significant role in enhancing learners' AI literacy, creative thinking, and complex problem-solving abilities, which are essential competencies for contemporary education and employment contexts [22]. Non-fungible tokens (NFTs) can function as both educational tools and digital assets that represent the uniqueness, authenticity, and value of student-generated work [3]. Rather than serving solely as instruments for financial speculation, NFTs provide a mechanism for constructing and communicating brand identity through authentic creative outputs [2]. The process of NFT design further supports the development of value communication skills, brand strategy formulation, and project management competencies [16]. Moreover, the integration of generative AI with NFTs enhances digital creativity

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and fosters an entrepreneurial mindset among learners [1].

Therefore, the integration of generative AI and NFTs within higher education represents a significant pedagogical approach for developing student competencies aligned with the demands of the contemporary digital workforce and innovation-driven economy [8].

4. RESEARCH METHODOLOGY

This study was conducted in three phases in accordance with the research objectives.

4.1 Phase 1

Synthesis of generative artificial intelligence applications for the design of non-fungible tokens (NFTs) based on brand identity for digital assets in higher education. This phase involved a comprehensive analysis and synthesis of relevant documents, research studies, and conceptual frameworks obtained from both national and international academic databases. The literature synthesis was guided by explicit screening criteria to ensure methodological transparency. Sources were retrieved from SCOPUS-indexed and other peer-reviewed databases using combinations of the keywords 'generative artificial intelligence', 'non-fungible token', 'NFT', 'brand identity', and 'higher education competencies'. Studies were included if they were published in peer-reviewed journals, conference proceedings, or recognized institutional reports; directly addressed at least one of the three core constructs - brand identity, generative AI design processes, or NFT applications; and were published within the last five years to capture the rapid evolution of generative AI and Web3 technologies, with seminal theoretical works on brand identity retained irrespective of publication date. Studies limited to purely financial or speculative analyses of cryptocurrency markets, without reference to design, branding, or educational applications, were excluded. The findings were used to establish the foundational knowledge base for identifying key components and determining the role of generative AI in NFT design within a brand identity framework, with the aim of supporting experiential learning in higher education.

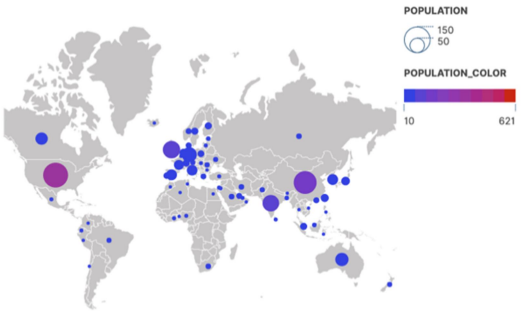

Figure 1: Countries that have adopted generative artificial intelligence technology include the United States. (created by the authors)

The global research landscape related to generative artificial intelligence was analyzed to identify research trends and technological adoption patterns, as illustrated in Figure 1, which presents countries actively contributing to generative AI research based on SCOPUS-indexed publications.

Based on the systematic review and synthesis of relevant theoretical concepts and empirical studies, key components related to brand identity, generative artificial intelligence processes, AI-generated artworks, evaluation indicators, and student competencies were identified. The synthesized findings were organized into thematic categories to establish foundational elements supporting the development of the proposed conceptual framework. The detailed synthesis results are presented in Tables 1–5.

The synthesis of brand identity dimensions relevant to non-fungible tokens (NFTs), including uniqueness, purpose and values, physique, storytelling, relationship, and ethical responsibility, is summarized in Table 1.

Table 1: The synthesis of brand identity of non-fungible tokens (NFTs)

Topic	Description	References
Unique (Uniqueness/Scarcity)	Distinctive characteristics that express brand personality through stance and style, innovative elements, target audience understanding, emotional appeal, design language, and verifiable ownership.	[2], [6], [15], [16], [17], [23]
	Digital scarcity and authenticity in NFTs are established through blockchain verification, enabling cryptographic proof of uniqueness and ownership. Token standards (ERC-721, ERC-1155), smart contracts, and immutable ledgers prevent replication and ensure verifiable ownership history. Perceived uniqueness drives consumer purchase intention, emotional attachment, and willingness to pay premium prices.	[24], [25], [26], [27]
Purpose and Values (Brand Purpose)	Purpose and values that underpin the brand's unique attributes.	[2], [9], [10], [18], [28]

Topic	Description	References
	Authentic brand mission requires clear purpose and value alignment with Web3 communities and digital-native consumers, emphasizing transparency, sustainability, and ethical practices. Blockchain transparency supports trust building through verifiable claims. Co-creation and community-driven NFT development reflect shared value creation, while exclusivity, aesthetics, and novelty communicate strategic brand positioning and identity in digital marketplaces.	[25], [29], [30], [31]
Physique (Visual Identity)	Key brand elements include patterns and shapes, visual arrangement and composition, proportion and scale, texture and material, color and contrast, and the positioning of design elements.	[9], [28]
	Visual consistency in AI-generated NFT assets requires coherent brand identity across color, typography, form, and composition. Design aesthetics and technical quality influence brand attachment and perceived value. Digital representation of materials and textures supports brand translation into virtual environments, while generative coherence ensures recognition across variations. Adaptive identity enables creative variation while maintaining brand consistency.	[25], [32], [33], [34], [35], [36]
Storytelling (Narrative)	Create compelling stories and storytelling. Communicate Inspiration Processes, Values and Cultural Principles.	[6], [37], [38]
	Interactive narratives use gamification and storytelling in metaverse environments to create engaging NFT experiences. Narrative-driven NFTs strengthen emotional connection, while blockchain enables transparent provenance and collaboration stories. Community co-creation enhances authenticity and engagement, and NFTs function as transmedia entry points across physical and digital touchpoints. Cultural relevance and localized storytelling increase market appeal.	[25], [36], [39], [40]
Relationship (Consumer Engagement)	Relationships between brand owners and buyers through digital media, and the interconnection of design elements that shape overall design relationships and outcomes.	[9]
	Virtual brand experience in immersive metaverse environments drives interest, immersion, and recommendation intention. NFT ownership fosters community belonging, psychological ownership, and emotional attachment. Co-creation dynamics on Web3 platforms enable participatory value creation, while customer engagement mediates loyalty outcomes. Platform interoperability extends NFT utility and strengthens ongoing brand relationships beyond single transactions.	[25], [41], [42], [43], [44], [45], [46], [47]
Ethical (Responsibility)	Data Ethics and AI Practices in the Copyright of the Sources Referenced in Use.	[48], [49]
	Environmental sustainability concerns focus on blockchain energy consumption, with post-Merge Ethereum and Layer 2 solutions reducing carbon impact. AI ethics address bias, fairness, transparency, and intellectual property in generative content. Authenticity verification prevents counterfeit NFTs and deepfakes, while smart contracts support digital rights, ownership transfer, and royalties. Privacy protection emphasizes self-sovereign identity and data security. Market integrity requires managing speculation and financial risks, alongside cultural sensitivity in the responsible use of cultural assets.	[50]

Key elements of generative artificial intelligence applied to NFT design processes, including pattern recognition, prompt-to-image generation, contextual projection, iterative refinement, and perception-to-generation, are synthesized in Table 2.

Table 2: The synthesis of Generative AI for NFT Design.

Element of Generative AI	Description	References
1. Pattern Recognition	AI systems analyze large datasets of brand assets, visual identities, and NFT market trends to identify patterns that resonate with target audiences. Using machine learning models such as CNNs and GANs, they extract visual features, including styles, color schemes, and compositional elements, to support distinctive brand identity and enhance NFT market value.	[51], [52], [53], [54]
2. Prompt-to-Image Generation	Text-to-image diffusion models, such as Stable Diffusion and Midjourney, convert textual brand descriptions into visual NFT assets. By using natural language prompts based on brand narratives, values, and aesthetic guidelines, they enable rapid prototyping of diverse brand identities aligned with strategic positioning and market differentiation.	[13], [33]
3. Contextual Projection	Advanced generative models adapt brand identity elements to specific contexts by considering market positioning, cultural factors, and audience characteristics. They generate NFT collections that maintain brand consistency while optimizing for different digital platforms, environments, and user experiences.	[55], [56]
4. Iterative Refinement	AI-powered design systems continuously optimize NFT	[57], [58], [59]

Element of Generative AI	Description	References
	brand assets using feedback, user engagement, market metrics, and brand perception data. Generative models iteratively refine visual elements and brand-story alignment while preserving core brand identity and equity.	
5. Perception-to-Generation	Neuroaesthetic and psychographic data guide generative models to create NFT brand identities with strong emotional and cognitive appeal. By applying perceptual psychology and emotional response prediction, these models generate memorable brand assets that strengthen audience engagement and brand recognition in digital marketplaces.	[60], [61]

Characteristics and value-enhancing attributes of AI-generated artworks used in NFT environments are presented in Table 3.

Table 3: The synthesis of AI Artworks.

Element of AI Artworks	Description	References
1. Visual Complexity & Density	Description: The level of detail, texture, and compositional richness generated by algorithms. Impact: High visual complexity signals effort, quality, and luxury, enhancing aesthetic appeal and reducing skepticism toward AI-generated content.	[33], [47], [62], [63]
2. Dynamic Interactivity (Living Assets)	Description: The ability of digital artworks to evolve through data inputs or user interaction. Impact: Increases engagement and emotional attachment by transforming ownership into ongoing co-creation, supporting long-term loyalty.	[16], [64], [65]
3. Archival Reinterpretation (Heritage Augmentation)	Description: AI-generated reinterpretations based on brand archives or historical assets. Impact: Strengthens brand authenticity by connecting innovation with heritage, reinforcing identity while appealing to contemporary audiences.	[66]
4. Algorithmic Uniqueness (Digital Scarcity)	Description: Generative mechanisms ensuring each output is unique while maintaining thematic coherence. Impact: Creates verifiable scarcity, enhancing desirability, purchase intention, and status signaling in digital and luxury markets.	[67]
5. Human-AI Collaboration (The "Human Premium")	Description: The integration of human curation or conceptual input alongside AI generation. Impact: Preserves perceptions of craftsmanship, reduces resistance to automation, and supports higher perceived value.	[68]
6. Personalization Capability	Description: AI-enabled customization allowing users to co-create outputs within brand-defined boundaries. Impact: Enhances self-expression and emotional connection, strengthening brand attachment and perceived value.	[69], [70], [71]

Evaluation indicators used to assess AI-generated NFTs across physiological, psychological,

and behavioral dimensions are summarized in Table 4.

Table 4: The synthesis of Evaluation Indicators for AI-Generated NFTs and Brand Identity.

Evaluation Indicators	Description	References
Physiological		
Gaze Duration & Sweep Route	Measures the time a consumer spends looking at an artwork and the trajectory of their eye movements. Longer gaze duration and complex sweep routes indicate higher visual engagement and are positively correlated with perceived artistic quality.	[63]
Visual Complexity Score	A quantitative metric assessing the density of detail, texture, and compositional variance in the generative output. High complexity serves as a heuristic for "production effort," helping to mitigate the stigma of "low-effort" automation associated with AI art.	[63]
Psychological		
Brand Allure Capital (BAC)	A composite psychological construct comprising four dimensions: Beauty (aesthetic appeal), Arousal (stimulation/excitement), Pleasure (hedonic satisfaction), and Desire (aspirational longing). It drives digital connection and loyalty.	[64]
Ideal Self-Image	The degree to which the AI-generated asset or avatar aligns with how the consumer	[65]

Evaluation Indicators	Description	References
Congruence	wishes to be perceived in the metaverse. High congruence increases the social value of the asset and drives purchase behavior.	
Perceived Authenticity & Effort	The consumer's assessment of the "human intent" or craftsmanship behind the work. Explicit AI labels can lower this metric ("Tainted by Technology" effect), reducing brand trust unless human curation is evident.	[68]
Behavioral		
Purchase Intention	The behavioral likelihood of a consumer purchasing the digital asset. This metric is significantly influenced by technical scarcity, gamification elements, and the perceived resale value of the NFT.	[65], [70]
Willingness to Pay (WTP) / Human Premium	The maximum price a consumer is willing to exchange for the asset. Research indicates a "Human Premium," where consumers pay 300–500% more for human-made works compared to purely AI-generated ones.	[67]
e-WOM Intention	The likelihood of the consumer sharing the asset or brand experience on social media (electronic Word-of-Mouth). This is driven largely by the "Novelty" and "Surprise" elements of the generative output.	[71]

The competencies developed through AI-assisted NFT design in higher education contexts are synthesized and presented in Table 5.

Table 5 The synthesis of student competencies.

Student competency (Marketing & Tech Skills)	Description	References
Strategic Brand Analysis	This competency refers to the ability to analyze how AI-designed NFTs and digital assets communicate brand identity, values, and positioning within digital and educational ecosystems. Students evaluate alignment between NFT initiatives and institutional branding strategies, including stakeholder perception and long-term digital brand equity.	[56], [61], [72]
AI Literacy & Prompt Engineering	This competency emphasizes foundational knowledge of generative AI and prompt engineering for creating branded digital assets. Students learn to translate brand identity elements into effective prompts and critically evaluate AI-generated outputs for originality, bias, and brand consistency.	[69], [73], [74], [75]
Digital Market Positioning	Digital Market Positioning This competency involves the ability to strategically position AI-designed NFTs and digital assets within digital markets and platform ecosystems. Students apply branding, market segmentation, and analytics to enhance differentiation, engagement, and competitiveness in Web3 and metaverse contexts.	[56], [61]
Digital Ethics & Citizenship	This competency reflects the ability to assess ethical, legal, and societal implications of AI-generated digital assets. Students develop awareness of intellectual property, data privacy, transparency, and sustainability to support responsible digital citizenship and ethical decision-making.	[61], [74], [76]
Creative Innovation & Value Creation	This competency refers to the ability to apply creative and design-oriented approaches to generate meaningful value through AI-designed NFTs and digital assets, integrating design thinking and co-creation to support learning recognition, community engagement, and suitable creation.	[61]

4.2 Phase 2

Development of the framework for Generative Artificial Intelligence–based design of non-fungible tokens (NFTs) grounded in brand identity for digital assets in higher education. This phase focused on the development and structuring of the conceptual framework derived from the synthesis results obtained in Phase 1, with the aim of establishing a systematic approach for integrating generative AI and NFT design within the context of higher education.

The proposed conceptual framework integrating brand identity, generative AI processes, outputs, evaluation mechanisms, and NFT marketplace applications is presented in Figure 2.

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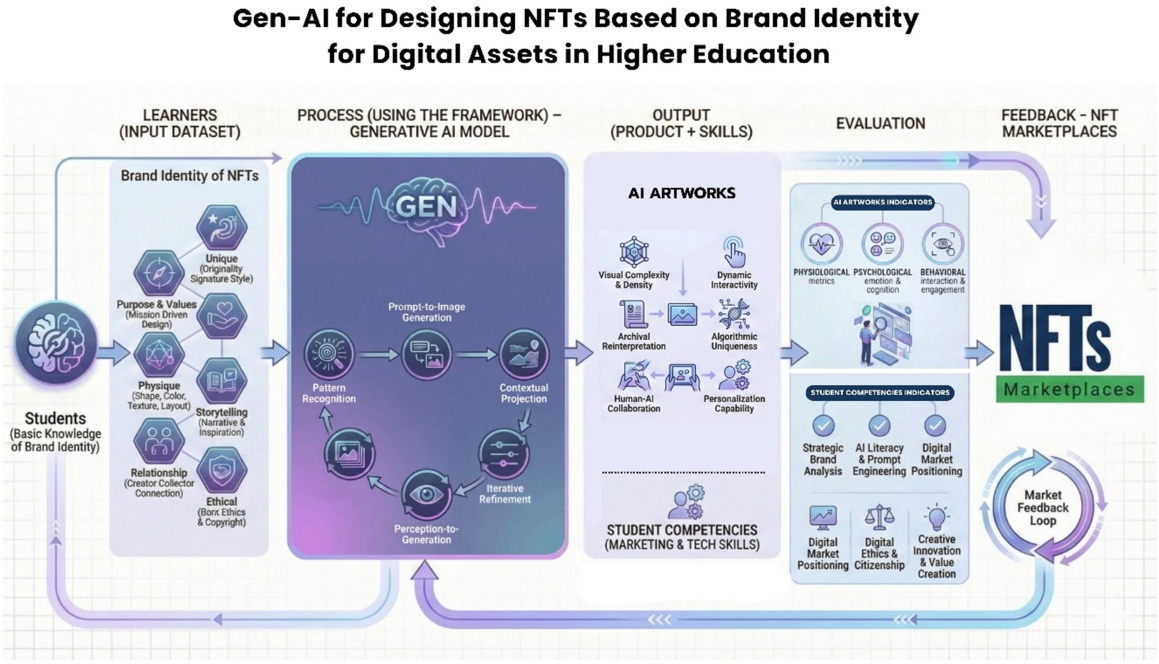

Figure 2. Generative Artificial Intelligence Design NFTs by Brand Identity for Digital Assets in Higher Education framework. Source: Author's development.

This study proposes a conceptual framework for the process of applying generative artificial intelligence (AI) in the design of non-fungible tokens (NFTs) based on brand identity for digital assets in higher education. The framework systematically integrates creativity, technological processes, and marketing strategies within an experiential learning context. It provides students with opportunities to transform authentic creative work into digital assets that explicitly reflect their competencies and professional identity. The framework consists of five interrelated components: Brand Identity, Generative AI Process, Output, Evaluation, and NFT Marketplaces. Together, these elements illustrate the holistic structure and interconnections within the learning and value creation cycle. Students utilize brand identity datasets in conjunction with generative AI tools to design and develop NFTs as digital assets, thereby fostering experiential learning that integrates marketing knowledge, technological skills, and digital value creation.

1. Purpose and Concept: Brand Identity as an Input Dataset

The conceptual framework begins with the Purpose and Concept stage, in which brand identity functions as the input dataset defining the essence and characteristics of the digital work to be created. Brand identity is conceptualized through six key elements. First, Uniqueness emphasizes novelty, digital scarcity, authenticity, and verifiable ownership enabled through blockchain technology. Second, Purpose and Values reflect organizational mission, ethical considerations, transparency, and alignment with consumer values in the Web3 environment. Third, Physique refers to visual and physical characteristics, including form, color, texture, composition, and design consistency within NFT collections. Fourth, Storytelling incorporates cultural meanings, narratives, and historical context to foster emotional and symbolic engagement. Fifth, Relationship represents interactions between creators and collectors, including community engagement, co-creation, and long-term participation on digital platforms. Finally, Ethical Responsibility addresses issues related to AI ethics, copyright, data sources, sustainability, and responsible use of cultural and creative resources. Once brand identity is clearly defined, these conceptual elements are translated into visual outcomes through generative AI processes.

2. Process: Generative AI Model

The generative AI model functions as a mechanism for transforming abstract brand identity concepts into tangible digital artworks. The process

involves several interconnected stages. First, Pattern Recognition enables AI systems to analyze brand assets, visual characteristics, and NFT marketplace data to identify stylistic patterns and aesthetic attributes associated with brand recognition and marketing value. Second, Prompt-to-Image Generation translates narrative and conceptual inputs into visual NFT prototypes, enabling rapid exploration of diverse stylistic alternatives within the brand framework. Third, Contextual Projection situates brand identity elements within broader cultural contexts while maintaining identity consistency. Fourth, Iterative Refinement continuously improves AI-generated outputs based on user engagement data, market performance, and brand perception. Fifth, Perception-to-Generation integrates insights from consumer psychology and neuroaesthetic principles to enhance emotional impact, attention, and recognition. The outcome of this process includes not only digital artworks but also the development of creator competencies acquired through iterative practice.

3. Results: Artwork and Enhanced Competencies

The outputs of the framework consist of two primary components: AI-generated artworks and student competencies. AI artworks represent digital creative outputs characterized by visual complexity, dynamic interactivity, and algorithmic uniqueness while maintaining thematic consistency with brand identity. These outputs may include reinterpretations of brand heritage through AI, human–AI collaborative creation that preserves perceived craftsmanship, and personalization capabilities that strengthen emotional engagement.
Equally important are the learning outcomes reflected in student competencies. Through hands-on engagement in AI-assisted NFT creation, students develop integrated technological, creative, and marketing capabilities that are essential within the contemporary digital economy.

4. EVALUATION:

4.1 AI Artwork Evaluation

The impact of AI-generated artworks is evaluated across three dimensions. The physiological dimension assesses immediate visual responses and subconscious engagement, including indicators such as gaze duration, visual attention patterns, and visual complexity. The psychological dimension examines emotional and symbolic responses, including brand allure, ideal self-image congruence, and perceived authenticity and effort, particularly in relation to concerns regarding AI-generated content. The behavioral dimension evaluates potential audience actions, such as purchase intention, willingness to pay, and electronic word-of-mouth intentions, which reflect market engagement potential.

4.2 Student Competency Evaluation

Student learning outcomes are assessed through competency indicators including strategic brand positioning, AI literacy and prompt engineering skills, digital market positioning, creative marketing capability, and digital asset value creation. These competencies reflect the integration of technological knowledge with strategic and creative thinking.

5. Real-World Application: NFT Marketplaces dnd Feedback Loop

NFT marketplaces function as real-world environments in which digital assets are distributed, evaluated, and exchanged. A central component of this stage is the market feedback loop, whereby market data—such as sales performance, user engagement, and audience feedback-are returned to creators. This feedback serves as an important source of learning, enabling refinement of brand identity, creative strategies, and design processes in subsequent iterations.

Overall, the proposed conceptual framework represents a comprehensive learning cycle for the digital era. Beginning with a strong conceptual foundation in brand identity, progressing through generative AI–enabled creation, producing measurable outputs, undergoing strategic evaluation, and incorporating real-world feedback, the framework transforms market data into strategic learning intelligence. This iterative cycle supports continuous creation, reflection, and development, enabling students to engage in sustained innovation and value creation within the digital economy.

4.2 Phase 3

Evaluation of the suitability of the generative artificial intelligence–based framework

for designing non-fungible tokens (NFTs) grounded in brand identity for digital assets in higher education. In this phase, the framework was evaluated by seven experts in artificial intelligence who were selected through purposive sampling. All experts possessed a minimum of five years of professional experience in related fields. The evaluation aimed to assess the appropriateness of the framework's components, operational processes, and feasibility for implementation within the higher education context. The research instrument employed was a System Architecture Suitability Assessment Form using a five-point rating scale. Data were analyzed using arithmetic mean and standard deviation. The suitability evaluation results of the proposed framework, assessed by expert reviewers, are presented in Table 6.

Table 6: Suitability of the generative artificial intelligence design of non-fungible tokens (NFTs) based on brand identity for digital assets in higher education.

Description	Result		Rate of Appropriateness
	Mean	S.D.	
1. Purpose and Concept: Brand Identity as an Imported Data Set			
1) Uniqueness	4.86	0.38	Most Appropriate
2) Purpose and Values	4.57	0.53	Most Appropriate
3) Physique	4.71	0.49	Most Appropriate
4) Storytelling	4.86	0.38	Most Appropriate
5) Relationship	4.57	0.53	Most Appropriate
6) Ethical	4.86	0.38	Most Appropriate
2. Process: Generative AI Model			
1) Pattern Recognition	4.86	0.38	Most Appropriate
2) Prompt-to-Image Generation	4.86	0.38	Most Appropriate
3) Contextual Projection	4.71	0.49	Most Appropriate
4) Iterative Refinement	4.86	0.38	Most Appropriate
5) Perception-to-Generation	4.71	0.49	Most Appropriate
3. The result: artwork and enhanced skills.			
3.1 Part 1: AI Artworks are digitally created works of art, comprising: 1) Visual Complexity and Density 2) Dynamic Interactivity 3) Archival Reinterpretation 4) Algorithmic Uniqueness 5) Human-AI Collaboration 6) Personalization	4.86	0.38	Most Appropriate
Capability			
3.2 Part 2: Student Competencies, represents the most important learning outcome.	4.86	0.38	Most Appropriate
4. Evaluation:			
4.1 AI Artworks Indicators			
4.1.1) Physiological			
1) Gaze Duration & Sweep Route	4.71	0.49	Most Appropriate
2) Visual Complexity Score	5.00	0.00	Most Appropriate
4.1.2) Psychological			
1) Brand Allure Capital: BAC			
- Beauty	4.86	0.38	Most Appropriate
- Arousal	4.68	0.38	Most Appropriate
- Pleasure	4.86	0.38	Most Appropriate
- Desire	4.86	0.38	Most Appropriate
2) Ideal Self-Image Congruence	4.57	0.53	Most Appropriate
3) Perceived Authenticity & Effort	4.71	0.49	Most Appropriate
4.1.3) Behavioral			
1) Purchase Intention	4.86	0.38	Most Appropriate
2) Willingness to Pay: WTP	4.71	0.49	Most Appropriate
3) e-WOM Intention	4.71	0.49	Most Appropriate
4.2 Student Competencies Indicators			
4.2.1) Strategic Brand Positioning	4.57	0.53	Most Appropriate
4.2.2) AI Literacy & Prompt Engineering	4.43	0.53	Most Appropriate
4.2.3) Digital Market Positioning	4.71	0.49	Most Appropriate
4.2.4) Creative Marketing	4.57	0.53	Most Appropriate
4.2.5) Digital Asset & Value Creation	4.71	0.49	Most Appropriate
5. Feedback			
The Real World: NFT Marketplaces & Feedback Loop			
NFT marketplaces function as real-world environments in which digital assets are distributed, evaluated, and exchanged	4.86	0.38	Most Appropriate

5. CONCLUSIONS

The research findings on the application of generative artificial intelligence in designing non-fungible tokens (NFTs) based on brand identity for

digital assets in higher education are presented in three parts corresponding to the research objectives.

Part 1: Synthesis of Concepts

The synthesis confirms that existing literature treats brand identity, generative AI, and NFTs largely as separate domains (Objective 2.1). While this integration was achieved at the conceptual level, the synthesis relied on secondary literature rather than primary empirical data, which may limit the granularity of certain constructs, particularly those relating to evolving generative AI capabilities.

Part 2: Framework Development

The five-component framework substantially fulfills Objective 2.2 by translating abstract brand identity dimensions into an operational generative AI design and evaluation sequence. However, the framework remains conceptual: it has not yet been empirically piloted with student users, and its component boundaries (e.g., between Contextual Projection and Iterative Refinement) may require further operational specification for classroom implementation.

Part 3: Framework Evaluation

Expert evaluation (Objective 2.3) indicated high suitability across all components (M = 4.43–5.00). Nonetheless, the relatively lower rating for AI Literacy & Prompt Engineering (M = 4.43, SD = 0.53) — the lowest among all indicators — suggests that this competency area may require additional instructional scaffolding relative to others such as Visual Complexity Score (M = 5.00, SD = 0.00). This finding qualifies, rather than undermines, the overall suitability conclusion.

6. DISCUSSION

This study's primary contribution lies in the integration, rather than the invention, of its constituent constructs. Brand identity theory generative AI design mechanisms, and NFT-based educational applications are individually well established in the literature. The originality of this work is the systematic synthesis of these three strands into a single, empirically evaluated five-component framework - a combination not previously reported in the reviewed literature. In this sense, the contribution is best characterized as an applied integrative synthesis: it does not propose new generative AI algorithms or new brand identity theory, but it does offer a new applied structure - including a novel set of physiological, psychological, and behavioral evaluation indicators for AI-generated brand assets and a competency framework tailored to higher education - that did not previously exist in combined form. This distinction is important for situating the study's significance: its value lies less in theoretical novelty and more in providing higher education institutions with a practically actionable, expert-validated guideline for an emerging pedagogical practice.

The findings indicate that the development of a framework for applying Generative Artificial Intelligence (AI) in the design of non-fungible tokens (NFTs) based on brand identity can effectively support the creation of distinctive digital assets. The results are consistent with previous studies suggesting that generative AI functions as a significant tool for expanding creative potential and enhancing the diversity and efficiency of design processes, while maintaining the essential role of human creators in directing design decisions and creative judgment.

First, the findings demonstrate that the establishment of brand identity serves as a critical input within the generative AI process, ensuring that NFT outputs remain consistent with brand values and market positioning. This result aligns with [2], who argue that NFTs can function as mechanisms for communicating brand identity through symbolic and tangible digital assets, thereby strengthening relationships between users and brands. Furthermore, the integration of generative AI into the design process was found to increase the diversity of creative ideas and stylistic outcomes, supporting the argument of [7] that generative AI technologies play a vital role in fostering innovation and enhancing user experiences within digital environments.

Second, the development of the conceptual framework highlights the role of generative AI as an experiential learning tool that enhances learners' competencies in brand analysis, marketing communication, digital design, and digital asset creation. These findings are consistent with [16] , who suggests that digital asset design contributes to the development of value communication skills, brand strategy formulation, and entrepreneurial thinking within the digital economy. The results also align with contemporary educational trends emphasizing the integration of AI technologies to support the development of twenty-first-century skills. Reports by [8] and the [1] similarly emphasize that the integration of AI in learning environments promotes creativity, active engagement, and experiential learning.

Third, the expert evaluation results indicate that the integration of brand identity, generative AI, and NFTs is applicable within higher education contexts, particularly in promoting digital value creation and enhancing students' AI literacy and digital creativity skills. These findings correspond with the perspectives of [77] and [73], who note that while generative AI possesses substantial potential to support creative learning, its effective implementation requires ethical oversight, transparency, and human-centered evaluation to ensure responsible use in educational settings.

Finally, the discussion confirms that generative AI should not be viewed as a replacement for human designers, but rather as a creative support tool that augments human capabilities in digital asset creation. The framework demonstrates that generative AI can function as an effective learning mechanism that integrates technology, creativity, and digital value creation, thereby supporting higher education institutions in preparing learners for participation in the contemporary digital and creative economy.

7. LIMITATIONS

This study is subject to several limitations. First, framework validation relied on a purposive sample of seven experts using a single-round suitability assessment rather than an iterative Delphi process or empirical testing with students, limiting claims of pedagogical effectiveness. Second, the framework has not been tested across diverse institutional, disciplinary, or cultural contexts, limiting generalizability. Third, rapid changes in generative AI tools and blockchain regulation may affect the framework's long-term applicability.

8. IMPLICATIONS FOR IMPLEMENTATION

Higher education institutions are encouraged to apply the proposed conceptual framework within the design and management of teaching and learning activities related to digital creativity, digital media design, and digital marketing. The implementation of this framework can support experiential learning approaches by enabling students to develop authentic creative outputs while enhancing their competencies in digital value creation and innovation.

Furthermore, the application of generative AI in NFT design should be accompanied by human oversight in the processes of selection, evaluation, and decision-making. Particular attention should be given to ethical considerations, including copyright protection, data privacy, and transparency in AI-generated content. Ensuring responsible and ethical implementation is essential for supporting the sustainable development of digital assets and maintaining trust in AI-assisted creative practices within higher education contexts.

9. FUTURE RESEARCH

Future research should empirically validate the proposed framework in higher education settings, examine its applicability across different disciplines and institutions, and investigate the implications of emerging generative AI technologies and evolving blockchain ecosystems for digital asset design.

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CONFLICT OF INTEREST Authors state no conflict of interest.

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