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Article

Integrating emotional marketing with digital twin technology in communication: Advancing sustainable competitive advantage in higher education

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Abstract: Enhancing student experience and increasing student satisfaction with Higher Education Institutions (HEIs) services is a critical factor in achieving a competitive advantage for HEIs. This study explores the concepts of affective digital twin and emotional marketing as innovative strategies to enhance student engagement, improve student satisfaction, and enhance their attachment to HEIs. This study aims to clarify the implications of integrating affective digital twin with emotional marketing to foster sustainable relationships between students and HEIs while enhancing the competitive advantage of HEIs. A qualitative descriptive research approach, including a review of previous literature, was used to analyze the impact of these strategies on student experience and satisfactions. The results indicate that affective digital twin contributes to personalized learning experiences by tracking and analyzing student emotions and providing dynamic responses, while emotional marketing enhances student loyalty through effective communication strategies rooted in personal values and experiences. The integration of both strategies improves student satisfaction, increases enrollment and retention rates, and enhances the competitive position of institutions. The study recommends that HEIs adopt an integrated approach combining affective digital twin and emotional marketing to ensure an interactive, student-centred learning experience, leading to a sustainable competitive advantage.

Keywords: emotional marketing; digital twin; higher education; student experience; sustainability

1. Introduction

Digital transformation has recently turned into an integral part of the strategy and activity of HEIs in the early 20s. In many ways, this process can be seen as natural because the wish to lead change and stay ahead of time in any sphere is an inherent trait of leading organizations. Digital transformation somehow touches different sides of the institution's work, teaching, infrastructure development, updates to curricula, optimization of administrative procedures, research, business practices, human resources governance, social activities, digital governance, information management, and marketing. The successful rollout of digital transformation needs a kind of rethinking, restructuring, and basically re-inventing a lot of processes. If we look at the multidimensional nature of digital transformation with its different aims, fields, participants, and process levels, it should be viewed as a process that works through cooperation of people, and it's aimed at strengthening their contribution to institutional growth as well as to overall societal development. In short, digital transformation means a serious paradigm shift, it shows up in a new organizational culture, management system, pedagogical practice, and evaluation methods. It influences all

areas of the academic world and should be handled holistically, and integrally, not just as a simple upgrade of the available technology [1].

The quick evolution of digital technologies, especially artificial intelligence, has ended up shifting several sectors, like industry, medical care, farming, and learning. In the middle of these new tools, digital twin tech has become kind of a strong way to do modeling, run simulations, and support data-led choices. This is mostly made possible by progress in IoT, AI, data analytics, and cloud computing, so digital twins help organizations try different scenarios, foresee what might happen, and limit hazards before changes get applied in real spaces. You can see use cases everywhere—factories, hospitals, transit, power systems, and smart cities, and that is why adoption keeps growing. Even higher education is now looking at the potential too, by folding digital twins into teaching activities, research work, and how institutions manage daily operations. As the underlying tools keep improving, digital twins are expected to reshape learning, research, and decision-making practices across academia even more in the future [2].

With intensifying competition in the higher education sector, institutions must adopt effective marketing strategies that extend beyond conventional promotion to include market segmentation and strategic positioning [3]. Emotional marketing plays a crucial role in this context. Sharma et al, describes it as "the language of hearts," emphasizing its significance in fostering emotional connections between institutions and their target audiences to cultivate long-term relationships [4]. Jiang et al, describe emotional marketing as a strategic approach that fosters emotional bonds with individuals, strengthens trust and brand identification, and ultimately enhances long-term loyalty [5]. Similarly, Pereira et al, highlight emotional marketing as a contemporary strategic approach that focuses on building emotional connections between organizations and their audiences, thereby enhancing engagement and relationship quality [6]. This perspective suggests that purchasing decisions are increasingly shaped by non-rational factors, with emotional elements, such as brand symbolism and institutional identity, playing a decisive role in consumer behavior and long-term brand affiliation.

On the other hand, Digital twins improve operational efficiency by reducing errors and lowering ,mostly by relying on artificial intelligence and machine learning. In the business sector, this type of technology has shown it works well for start-ups, and it can reinforce their sustainability strategies especially when the economy gets shaky. Some research points out that if you blend digital twin tools with emotional intelligence, Such as emotional awareness and enhanced clarity, which has a positive effecton the long-term sustainability of those start-ups. Overall the findings suggest that organizations should start weaving these approaches into their strategic frameworks in order to strengthen resilience and boost adaptability in a world that is becoming more and more dynamic [7].

While digital transformation impacts numerous aspects of the HEIs, teaching, administration, marketing, digital governance, the synergy between digital twin and emotional marketing as a tool to enhance student experience and competitive advantage in HEI context has yet to be adequately investigated. Digital twin offers virtual replications of educational and administrative processes which facilitate decision-making and risks management. Emotional marketing builds affective

relationship with the students, which ultimately helps strengthen student loyalty. However, the relationship between digital twin as a sophisticated technology and emotional marketing as a strategy in HEIs context is still lacking in the study.

Investigating how these two concepts can be integrated may provide valuable insights into innovative strategies that enhance student experience, foster emotional engagement with academic institutions, and bolster university attractiveness in an increasingly competitive landscape. Accordingly, this study seeks to address the following key questions:

Q1- What defines Digital Twin and its key characteristics?

Q2- How can digital twin transform student experience and service quality in higher education?

Q3- How does emotional marketing strengthen student-institution bonds and boost satisfaction and loyalty?

Q4- How can digital twin and emotional marketing boost university reputation and student retention?

Q5- What key challenges do higher education institutions face in implementing digital twin?

The acceleration of digitalization and fierce competition in higher education have brought an urgent need to apply an integration strategy that leads to enhanced student experience and superior institutional performance. This article emphasizes the critical role of digital twinning and emotional marketing integration as strategic actions in advancing student engagement, reinforcing institutional loyalty, and establishing a sustainable competitive edge. By integrating emotions and digital capabilities at high level, higher education can achieve differentiation in providing learning experience and meeting student expectations. Applied research on specific implementation mechanisms and results is further encouraged for integration of the two concepts, and consequently on student experience and future higher education.

2. Materials and methods

This study employed a qualitative descriptive research approach to explore the integration of digital twin and emotional marketing as a strategic framework for enhancing student experience and strengthening competitive advantage in higher education. According to Neuman, descriptive research is characterized by its ability to "depict the specific details of a situation, social setting, or relationship" and "commences with a clearly defined issue or question, aiming to describe it with precision," focusing primarily on 'how' and 'who' inquiries [8]. Lambert and Lambert, emphasize that qualitative research methodologies, including phenomenology and grounded theory, serve both descriptive and explanatory functions [9]. They advocate for the use of the term "qualitative descriptive research" to accurately define studies that do not strictly align with other qualitative approaches, such as ethnography or phenomenology. Moreover, qualitative descriptive research is rooted in naturalistic inquiry, which seeks to examine phenomena as they exist within their natural context [9]. Given the nature of this study, which aims to identify key characteristics associated with integrating digital twin and emotional marketing as a strategic framework, it aligns with the qualitative descriptive research paradigm. Furthermore,

to achieve the study's objectives, a comprehensive content analysis of digital and printed resources pertinent to the subject matter was conducted [10]. In addition, Bowen, outlines three key phases of content analysis: skimming, thorough reading, and interpretation [10]. Content analysis allows for the systematic breakdown of reading and writing into smaller, manageable components, facilitating the identification of key themes and patterns within the materials [11]. The primary objective of this analytical approach is to extract fundamental insights by recognizing recurring themes and trends in the available literature and data [12].

The methodology of this study was divided into four stages. Firstly, we conducted a thorough search on major academic databases Scopus and Web of Science with the keywords such as "Emotional Marketing", "Digital Twin", "Higher Education", "Student Experience". Peer-reviewed articles, institution reports, and empirical research published in English in the past 5 years have been identified. Core readings were included to construct a theoretical basis. In the second stage, we clearly defined criteria for inclusion and exclusion. Papers directly relating to emotional marketing, application of digital twin or students' satisfaction at higher educational institution (HEI) have been included. Articles with inappropriate context such as not relating to higher education or application of digital twin or emotional marketing, lacking clarity on methodological procedures and empirical evidence have been excluded. In the third stage, we extract data and analyze on what were the goals, major findings, how digital twin and emotional marketing applied to HEIs and recommendations and challenges of implementing this strategy in HEIs were based on analyzed data. Based on the extracted findings, we identified main advantages and how integrating digital twin and emotional marketing together can be seen as an innovative way for increasing student satisfaction and connection with institution. In the fourth stage, we performed detailed analysis of extracted findings to explore how the integration of digital twin technology and emotional marketing could be effectively used for increasing students' experiences and institution connection and what further opportunities could exist with this integrated approach for building a competitive advantage sustainably. Through the four stages, a thorough and integrated study was conducted to evaluate the effectiveness of digital twin and emotional marketing integration at improving the institution's excellence and competitiveness in higher education, enriching students' experiences and increasing institution attachment as well as a large student enrollment and retention to gain and retain a sustainable competitive advantage.

3. Results and discussion

3.1. The concept of digital twin and its characteristics

Industry 4.0 has significantly reshaped global economic growth, driving transformations across various sectors. Emerging technologies now define companies' competitiveness in the market. The transition from physical to digital goods, such as books, music, and games, has been accelerated by innovations in digital creation and distribution. Technologies like augmented reality and virtual reality further expand the potential for digitizing goods and services. A key breakthrough in this shift is the digital twin concept, which enables the synchronization of physical and digital entities, profoundly impacting multiple industries and fostering growth and efficiency [13,14].

The digital twin concept was first introduced in 2003 within the aerospace sector and was later structured into three core components: (1) a physical entity within a real-world space, (2) a corresponding virtual representation in a digital environment, and (3) a bidirectional data exchange mechanism that enables synchronization and interaction between both entities. While a universally accepted definition of digital twin has yet to be established, it is broadly understood as a digital counterpart of a physical entity. Functioning as a dynamic virtual model, digital twin facilitates real-time integration between physical and digital systems, leveraging advanced technologies to achieve specific objectives [15].

The term of digital twin encompasses a range of technologies that involve creating digital replicas of physical objects, locations, individuals, and environments to facilitate virtual simulations. In the manufacturing sector, digital twin has been employed to assess supply chains and optimize factory operations. Looking ahead, their impact is expected to extend beyond manufacturing, influencing various industries through broad technological applications. Expanding the definition of digital twin is essential, as they enable seamless data exchange between the physical and digital worlds, allowing both living and nonliving entities to be monitored, analyzed, and optimized [16].

Digital twin is increasingly conceptualized as digital representations of both living and non-living entities, enabling seamless data exchange between the physical and virtual realms while enhancing manufacturing processes. Their ability to monitor, analyze, and optimize physical functions provides continuous feedback that contributes to improving human well-being and overall quality of life. Furthermore, the adoption of digital twin is expanding across various sectors, with growing discussions surrounding their potential applications in educational contexts [16].

Human digital twin can be leveraged to collect and analyze physical, physiological, and contextual data, offering deeper insights into the human body and overall well-being. These digital replicas have the potential to enhance quality of life and promote well-being [17]. Additionally, contextual data, such as environmental factors, age, emotional state, and personal preferences, can be integrated with demographic information to provide a comprehensive understanding of an individual's status [16].

3.2. Leveraging digital twin to enhance student experience and service quality in higher education

HEIs play a critical role in shaping student experiences and fostering academic and administrative excellence. Among the key factors influencing student engagement and institutional reputation are academic quality, faculty with student relationships, and effective service delivery. Research indicates that reputation and academic aspects, particularly teaching quality and faculty, student interactions, significantly contribute to students' emotional brand attachment. This, in turn, enhances their willingness to participate in voluntary and extra-role behaviors. Mediation analysis has revealed that non-academic aspects, such as efficient complaint resolution, Information technology support, and administrative assistance, serve as full mediators, whereas institutional access and reputation act as partial mediators in shaping students' citizenship

behaviors. However, for students to actively contribute to value creation, the services provided by HEIs must align with their functional and emotional needs [18]. Therefore, assessing service quality from the student's perspective is essential to accurately capture their needs and expectations, as student satisfaction is strongly influenced by perceived service quality in higher education institutions [19].

Digital twin is an innovative technology that facilitates real-time monitoring, analysis, and feedback to enhance overall quality of life and well-being. The concept of an emotional digital twin represents a groundbreaking approach to improving mood and emotional well-being. This system fosters self-awareness through real-time biofeedback based on physiological signals, empowering individuals to manage stress, develop self-regulation skills, and enhance motivation and social competencies. Additionally, by recognizing and interpreting emotions, digital twin contributes to improved empathy and strengthened social relationships. From an institutional perspective, analyzing collective emotional patterns enables HEIs to address individual student needs effectively, fostering trust and reinforcing their ability to influence student experiences. Studies suggest that distinguishing physiological patterns significantly improves with ensemble methodologies, optimizing parameter selection for physiological signals and ensuring the extraction of the most relevant information [20]. Implementing digital twin within HEIs can therefore enhance student experiences, satisfaction, and engagement by promoting self-awareness, emotional regulation, and social skill development. Moreover, real-time emotional analysis can help universities provide personalized support, creating a more interactive and student-centered academic environment while strengthening institutional competitiveness.

Digital twin is already transforming distance education by enabling immersive and interactive learning experiences across various disciplines. In tourism and hospitality education, virtual tours allow students to explore digital replicas of historical and culturally significant sites, exemplified by My Hometown Project [21]. In STEM fields, digital twin simulates complex engineering and biological systems, fostering a deeper understanding of intricate concepts [22]. As the adoption of digital twin expands, their accuracy and sophistication continue to evolve, bridging the gap between digital and physical realities while raising important ethical and existential considerations [23]. Their integration into education offers numerous advantages, including personalized learning experiences through adaptive analysis of student strengths, weaknesses, and learning styles, as well as immersive virtual reality simulations that replicate real-world environments. Additionally, digital twin facilitates real-time assessments, allowing educators to track student progress and provide targeted interventions. They also enhance collaborative learning by fostering teamwork in virtual environments and improving accessibility, particularly for students with disabilities who may face barriers in traditional classroom settings.

The integration of digital twin in education challenges conventional lecture-based teaching, often regarded as an outdated, teacher-centered approach. As these intelligent systems gain prevalence, student engagement is expected to increase through interactive learning methods such as discussion, investigation, practice, and content creation. The rise of augmented and virtual reality further suggests a future in which educational content and teaching methodologies are preserved with

unprecedented precision, redefining knowledge dissemination [24]. As the education sector undergoes a significant transformation following the pandemic, both educators and students have increasingly embraced digital learning methods. In this evolving landscape, digital twin is gaining traction, though research and application remain in their early stages. Studies emphasize the student-centric benefits of digital twin in creating immersive, simulated learning environments that replicate real-world classrooms, enabling personalized learning experiences, continuous assessment, and progress tracking. Additionally, they support professional teacher development by offering real-time feedback, identifying areas for improvement, and providing access to dynamic learning resources. Digital twin also enhances collaborative learning by connecting students in virtual spaces, enabling adaptive instruction, and facilitating virtual laboratories and scientific simulations [22].

From an instructional standpoint, digital twin is being explored as tools for refining teaching methodologies, tailoring educational experiences, and supporting continuous professional development for educators. Research highlights the potential of digital twin in creating virtual laboratories that simulate real-world lab environments, enabling students to conduct experiments, make observations, and analyze data in controlled digital settings [25,26]. These simulations are particularly beneficial when access to physical laboratories is limited. Furthermore, digital twin facilitates the modeling of complex scientific phenomena across disciplines such as engineering, physics, chemistry, and biology, allowing students and researchers to explore diverse scenarios and analyze data effectively [27].

By leveraging digital twin to develop individualized student models, institutions can design highly personalized learning experiences. This involves tracking academic progress, identifying strengths and weaknesses, and dynamically adapting educational content to meet students' specific needs. Research indicates that such an approach enhances student engagement and learning outcomes [28,29]. Additionally, digital twin enables virtual field trips, allowing students to explore historical sites, cultural landmarks, and natural environments that may be inaccessible in person [30].

To enrich the professional development of educators, digital twin can simulate classroom scenarios, enabling teachers to refine instructional techniques, practice classroom management strategies, and engage in realistic student interactions within a controlled virtual environment. This hands-on training enhances pedagogical skills and improves the overall quality of instruction [31]. Beyond academia, digital twin plays a pivotal role in advancing research by providing virtual representations of research objects or concepts, facilitating experiments, data collection, and scenario simulations. This improves research efficiency while reducing reliance on physical resources, making scientific inquiry more cost-effective [32]. Moreover, digital twin can optimize administrative operations by digitizing institutional expertise. Universities can use these models to simulate campus infrastructure, optimize resource allocation, improve space management, and enhance energy efficiency. Additionally, digital twin support data-driven decision-making by offering predictive insights into organizational and executive functions, thereby streamlining administrative processes and improving institutional effectiveness [33].

By integrating digital twin across multiple educational domains, institutions can significantly enhance student learning experiences, provide adaptive and dynamic

educational services, and ultimately increase student satisfaction with the quality and accessibility of academic and administrative support [2]. In addition, students play a crucial role in shaping their institution's reputation through advocacy and feedback, both online and offline. Their shared experiences, whether academic or extracurricular, can influence an institution's competitive standing [34]. Given the constant interaction between students, faculty, and administrators, collective efforts contribute to mutually beneficial outcomes [35,36].

Furthermore, research highlights the strong relationship between emotional brand attachment to higher education institutions and students' citizenship behavior, reflected in their willingness to provide feedback, participate in university events, and promote their institution on social media [37]. This emotional connection, reinforced by institutional reputation and high-quality services, fosters loyalty and positive student engagement [38]. Institutions must recognize that student-centered learning environments play a critical role in enhancing reputation and emotional bonds, ultimately leading to long-term engagement and advocacy [39]. Additionally, students with strong emotional ties to their university are more likely to pursue further studies or professional development within the same institution, perceiving it as a long-term educational partner [37]. Institutions that cultivate emotional connections with students can foster positive word-of-mouth, increase student satisfaction, and enhance their overall market position [40].

3.3. The power of emotional marketing in strengthening student loyalty and satisfaction

Emotional marketing plays a crucial role in establishing a strong connection between students and academic institutions, directly influencing their satisfaction and loyalty. Sharma et al., defines emotional marketing as a strategy based on emotions, describing it as the "language of hearts [4]." He emphasizes that emotional marketing involves companies creating an emotional bond with customers, fostering deep relationships as they acquire products and services. Similarly, Robinette et al, explains that emotional marketing refers to a company-wide effort to develop a meaningful connection with consumers, making them feel valued and cared for, which in turn encourages loyalty [5]. Furthermore, Rytel, describes emotional marketing as a modern approach in which managing emotional connections between a company and its customers becomes a key factor in stimulating exchanges [6]. Moreover, He highlights that purchasing decisions are increasingly influenced by emotional aspects, including brand symbols and other elements with symbolic attributes that shape consumer behavior and the duration of their relationship with a brand [6].

All these perspectives share a common theme: emotional marketing is centered on establishing a strong bond between service providers and their users. While emotional marketing was first developed within a business and consumer background, when applied in the higher education context, it needs to be viewed from a wider perspective. Universities are not traditional service providers and students are not traditional consumers but rather these students are active partners to a long term relationship with an educational institution. Emotional marketing in this context, therefore, can be defined as creating trust, senses of belonging, identity and emotional

attachment with an educational institution. This can be achieved through the communication of an institution's message which enhances a students' experience.

Researchers argue that in today's competitive marketing environment, emotional marketing is no longer optional but essential for businesses and institutions to remain relevant. The emphasis on relationship-building is a critical aspect of effective marketing strategies [41]. Moreover, HEIs should prioritize managing students' emotions as a core component of emotional marketing. Additionally, consumer purchasing decisions are influenced by two primary factors: functional needs, which are satisfied through the features and benefits of products and services, and emotional needs, which arise from the psychological satisfaction of ownership [42]. Universities can leverage emotional marketing as a strategic tool to differentiate themselves in a highly competitive landscape. As a contemporary service marketing strategy, emotional marketing is vital for university positioning, ensuring competitiveness in a market where differentiation is key [41].

Goleman, defines emotional intelligence as the ability to manage relationships and build networks, enabling individuals to achieve their personal goals while fostering meaningful connections [43]. Universities can enhance emotional intelligence by integrating digital twin, technological representations of real-world entities, into their strategies. This approach allows institutions to better understand and respond to student needs, strengthening relationships and increasing satisfaction. In higher education, where frequent interactions between students and institutions are fundamental, relationship-building is crucial for universities to maintain their appeal. According to Serrat, developing emotional intelligence enhances productivity and success while also helping others achieve their potential [44]. Emotional intelligence also plays a significant role in reducing stress, managing conflict, and promoting stability and harmony within institutions. Moreover, emotional management leads to effective leadership, improved communication, reduced workplace conflicts, better problem-solving skills, and increased career advancement opportunities [45]. In addition, understanding and appreciating human emotions fosters social bonds and enhances empathy in institutional relationships [42].

Emotional marketing has become a fundamental strategic tool in modern business and higher education, allowing institutions to establish strong emotional connections with students, thereby enhancing loyalty and ensuring long-term success. Integrating emotional intelligence into marketing strategies offers significant benefits, improving interactions between individuals and institutions and fostering stability and mutual understanding in both business and academic settings.

As competition in higher education intensifies, institutions must adopt strategic marketing approaches beyond traditional promotional efforts. Effective marketing strategies should not only attract students but also address their diverse needs while strengthening the institution's competitive position [3]. Given the evolving expectations and varied backgrounds of students, higher education administrators must develop a deeper understanding of this diversity to better serve both prospective and current students [46].

Several key factors influence students' university selection, including academic excellence and employment opportunities [47,48], education quality [49], tuition fees and overall costs [50], and institutional reputation [51]. While these rational

considerations are significant, emotional factors also play a crucial role in students' decision-making processes, yet they remain underexplored in existing research [52]. High school students, in particular, place substantial importance on emotional factors. These emotional and rational attributes serve as valuable insights for university administrators in crafting strategies to engage students on an emotional level [53].

In this regard, emotional marketing is a human aspect of sustainable educational change. Technical systems may optimize efficiency and personalization but sustainable universities necessarily sustain their emotional connection to their students and stakeholders. Emotional marketing thus governs that technological evolution is balanced with students' comfort of mind, feeling of belonging, and university's integrity. Additionally, integrating digital twin with emotional marketing strategies can provide higher education institutions with a distinct competitive advantage. This approach enhances student attraction during the selection process while ensuring continuous engagement and responsiveness to students' academic needs. By improving student satisfaction with university services, institutions can transform students into brand ambassadors who contribute to attracting and retaining future students. Ultimately, this strategy strengthens the university's academic reputation and positively impacts its rankings.

3.4. Integrating digital twin and emotional marketing to enhance university reputation and student attraction

The integration of digital twin in education represents a transformative shift, enabling real-time data synchronization for instant monitoring and advanced modeling that ensures accurate representation of physical systems. With enhanced interconnectivity, digital twin interacts seamlessly with other systems, facilitating comprehensive analysis, while predictive analytics allow institutions to anticipate student behaviors and academic trends. Additionally, remote monitoring and control provide faster responses and operational improvements, supported by continuous dynamic updates that ensure data accuracy. As 3D modeling and data visualization technologies evolve, the predictive capabilities of digital twin continue to expand, further enhancing their value across various fields [16]. Moreover, integrating digital twin with emotional marketing strategies in higher education institutions can significantly enhance student engagement by leveraging data-driven insights and smart technologies. Additionally, the integration between Digital Twin and Emotional Marketing can be considered as a technology-human relationship model for sustainable educational transformation. Digital Twin offers the analytical intelligence necessary to collect, analyze, understand and predict students' learning behaviors, learning modes, and emotional states; then Emotional Marketing provides the relation mechanism through which universities interact, serve and connect with students more meaningfully. Consequently, Digital Twin deals with the "what" students need and "when" they need the right thing, while Emotional Marketing helps to respond in a more inspiring and close-to-human way. The integration of the two will result in a resilient, synergy, feedback loop, through which data-driven insights improve emotional engagement, which in turn adds new knowledge for further improvements. Below are key approaches to achieving this integration:

3.4.1. Predictive analytics and emotional understanding of students

The digital twin helps universities understand students' emotional and academic requirements by analyzing learning behaviors and data utilizing artificial intelligence techniques. In addition, by implementing AI-based predictive learning, universities can gauge students' emotions through interactions on digital learning environments, social media platforms, and even based on engagement with various elements of the digital learning platform. These insights can be used to tailor support, predict challenges and implement effective strategies to both boost students' performance and well-being. Also real-time feedback and student evaluation are key in student learning success. The digital twin system can provide students with targeted responses by analyzing their reactions and identify misconceptions and learning difficulties and providing prompt responses.Gamified virtual learning environments and simulated learning spaces can contribute to improving student learning with high level of motivation and efficiency. The digital twin backed virtual learning can also promote students' collaboration through an improved shared online learning environment and communication by linking students separated by distances and facilitating their interaction with other peers.

3.4.2. Immersive learning experiences through virtual and augmented reality

The inclusion of digital twins with the element of emotional marketing in VR and AR also increases student involvement by offering them the opportunity of immersive educational experiences that build emotional commitment to the university. Proactive students can tour the university campus, facilities, classrooms and laboratories and experience campus life along with current students and educators, which leads to establishing an emotional tie with the university prior to matriculation. In addition, through VR and AR technologies universities can also incorporate interactive lessons and labs that require simulations for subjects in such fields as medicine, science and engineering and offer dynamic learning that meets the students' individual cognitive and emotional requirements. The concept of intelligent educational robots as digital twins for teachers also plays a role by adapting educational style and content to the student's specific learning style.

3.4.3. Personalized interaction through AI-powered smart assistants

Using a combination of digital twin and smart assistant can redefine the student experience as instant and personalized assistance is delivered and it caters to student academic and emotional needs. Smart assistants can provide immediate responses to student queries, handle administrative tasks, overcome academic difficulties, and even guide students in personal matters which builds a rapport between the student and the institution and also a feeling of support and motivation among students. AI based emotional and academic analytics can also be utilized to offer a personalized learning journey, make proper recommendations and also anticipate potential problems before it may affect student learning. With digital twin based instructors the course content, lesson speeds, teaching styles and strategies are customized and optimized according to the learning behaviors of individual students and the outcome is increased learning efficiency.

3.4.4. Enhancing engagement through digital platforms

Use of digital twin technology into interactive educational settings also enhances student motivation and their feelings towards education. When institutional members implement gamification techniques into the learning process, an engaging set of academic challenges and practical learning scenarios can be developed and presented in order to raise the students' awareness of themselves and to enhance the students' level of motivation. The use of virtual student community, with the integration of digital twin technology, also helps students to experience emotional and social engagement in their learning and provides students a more integrated and connectedness experience. The members of this community would learn from one another, carry out joint learning activities and communicate with instructors; therefore students would feel a sense of belonging more strongly. They also experience sustained academic and social engagement in their university life. Digital twin can also be used to enhance the professional knowledge of instructors by offering constructive information to the instructors on their current instructing approach and suggesting some innovative instructing plans.

3.4.5. Improving student satisfaction and strengthening institutional loyalty

Universities can collect and analyze student data through digital twin technologies over time in order to measure their satisfaction with both the academic and administrative aspects of their university. By doing so, Universities can then provide specific measures to improve satisfaction. Integration of emotional marketing connects a student's academic life to positive emotions, further building their affiliation with the University. Also, with the aid of digital twin, intelligent virtual instructors can track students' behavior and academic progress in real-time. By tracking the students' levels of engagement, progress, and emotions, universities can easily pinpoint students in the brink of academic failure or emotional distress, providing appropriate measures to ensure they succeed. In addition, analysis of this information will contribute to learning strategies, optimization of resources, and enhancement of support mechanisms, leading to better student retention and a greater affinity for the institution.

The integration of digital twin and emotional marketing allows a university to create a highly sophisticated, responsive learning experience that is mindful of a student's academic and emotional requirements simultaneously. The utilization of digital twin ensures that continuous data collection and analysis of a student's well-being and academic needs leads to a higher level of personalized care, an increased sense of institutional loyalty, and better student satisfaction. Emotional marketing plays an instrumental role in amplifying this connection to ensure a profound student-university affiliation. This combination is the bedrock of the institution's future sustainability. By doing so, they increase student retention rates, attract prospective students to enroll, and cultivate their institutional reputation to be a preferred choice of learning for future generations of students. Additionally, by using smart data collection techniques and fully immersive technologies such as virtual reality or an intelligent AI chatbot to support learners, universities can increase their resource allocation efficiency, smooth out academic support services, and sustain adaptability to changes in learning landscapes.

In the context of the HEIs, sustainability takes into account of all spheres surrounding the higher education institutions in addition to the environment: the capability of delivering a sustainable educational value to its students, the durableness of its organization, its social responsiveness and the constant improvement and adaptation over time. The sustainable competitiveness of HEIs is therefore not simply achieved by technological modernization or by market positioning, but it entirely depends on the universities' endurance in coping up with the constantly changing user students' demands, the sustainable improvement of the service quality and the maintaining of sustainable relationships with all involved users. Therefore, the application of Digital Twin and Emotional Marketing contribute to the sustainable educational transformation in the sense that they support the development of adaptable, student-centered and resilient systems, which can contribute in the long-term performance of the institution.

3.5. Key challenges in implementing digital twin in higher education

Digital Twin technology primarily focuses on representing human-built systems rather than individuals. However, smart systems are designed to enhance human support, necessitating the modeling of human interactions and behaviors. A specialized category of digital twin, known as digital twin, virtually represents human entities[54]. Building a digital twin necessitate an integrated system where, for a system to work without fail, a structured data collection and analysis process is imperative. Data collection is the corner stone of any digital twin which requires gathering various data like medical records, genetic information, behavioral characteristics, and individual attributes. These data must be gathered in a stringent manner considering various inputs such as data from wearable devices and sensors, questionnaires, and clinical records etc based on the end use of the digital twin. It should provide information that best represents the characteristics and behavioral aspects of a human. However the modeling of human being with a digital twin has major challenges in itself due to required volume of high quality streaming data, privacy issues and difficulties in accurate human behavior modeling. As proposed by research, the inclusion of internal factors like personality, motivation, and emotions can lead to increased accuracy in behavior modeling [54]. Despite being a relatively recent innovation, digital twin is recognized as powerful tools for advancing personalized healthcare by enabling early disease detection, improving patient outcomes, and optimizing lifestyle choices. However, their development remains particularly challenging due to the intricate nature of human behavior modeling [15].

As a rapidly evolving and essential technology, digital twin plays a crucial role in digital transformation and intelligent system upgrades. These virtual representations of real-world objects or systems are continuously updated through real-time data acquired from internet of things devices. Driven by data and computational models, digital twin enables functions such as monitoring, simulation, prediction, optimization, and reasoning to support informed decision-making. The development and implementation of digital twin are complex; as Tao et al., highlighted, the digital twin model serves as a fundamental component, directly influencing the quality and reliability of associated services [55]. Despite its transformative potential, the

implementation of digital twin requires overcoming substantial technical and ethical challenges, particularly concerning data privacy, security, and the dynamic nature of human behavior [56].

As technology advances, novel and innovative applications are expected to emerge, reshaping various dimensions of teaching and learning within the academic landscape. While the concept of digital twin for educator's presents promising benefits, its practical implementation and integration into real-world educational environments remain in the developmental stages. To ensure their effective and equitable use in education, it is crucial to address ethical concerns such as data privacy, algorithmic bias, and the indispensable role of human educators in the teaching process [2].

Recent studies have emphasized the importance of advanced security architectures in Digital Twin ecosystems, particularly regarding authentication, privacy preservation, and secure data exchange. Emerging approaches based on blockchain technologies and post-quantum cryptographic mechanisms have demonstrated promising capabilities for enhancing trust, security, and resilience in Digital Twin environments. Such developments may provide valuable foundations for future Digital Twin applications in higher education, particularly when managing sensitive student behavioral and emotional data [57–59].

4. Conclusion

Digital Twin and Emotional Marketing-a paradigm shift in improving the student experience and a means of competitive advantage for HEIs. By exploiting Digital twin, HEIs will be able to formulate innovative models that encapsulate students' emotional, cognitive, and behavioral aspects, thus allowing for personalised learning, adaptive teaching and data-driven decision-making. There are, however, barriers to the deployment of Digital Twin in HEIs, ranging from data security issues, difficulty in modelling emotions, and implications of an AI-based approach on decision making. The accuracy of real-time emotional feedback will depend on high quality and real-time data feeds from wearables, surveys and analysis of academic performance metrics. When combining it with Emotional Marketing the Digital Twin can enhance student engagement by allowing for bespoke and personalised communications and building emotional bonds with HEIs. Ultimately, this will result in greater student satisfaction and retention. For the success of this, the adoption of an overall strategy framework at the HEIs will be necessary; one that will tackle technical, ethical, and educational aspects and ensure the role of the educator and not the automatism dominates. Given the increasing acceleration of the digital transformation in universities, this is an opportunity for HEIs to develop and enhance their academic offerings, build emotionally intelligent learning experiences and create a strong differentiator, all requiring further research into the improvement of AI driven EI, the challenge of algorithms bias, the development of sustainable and student-oriented applications.

In terms of sustainable development, this integrated approach helps HEIs sustain their long-term resilient development by applying technology innovation together with humanization of the educational practices. Digital Twin will help educational institutions adapt permanently through evidence and prediction-based decision making; while emotional marketing will assist HEIs keep the sustainable development

socially feasible by constantly safeguarding the trust, sense of belonging and the meaningful relationship with learners. In this way, sustainable educational transformation will be enabled through raising educational quality, institutional adaptability and sustainable value creation.

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