Metaverse and regenerative tourism: the role of avatars in promoting sustainable practices

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Acknowledgment: This research received support through several grants: (1) The Research Grants Council of the Hong Kong Special Administrative Region, China, provided funding (Project No. 25504823; PolyU/RGC Project No: P0047204) for the project titled "Co-creating value with virtual humans: The effects of non-verbal communication during face-to-face service encounters." (2) The Innovation and Technology Commission of the Hong Kong Special Administrative Region, China, awarded a grant (Project No. ITS/028/22FP; PolyU/RGC Project No: P0043294) for the project "An Interaction Framework of Hospitality Virtual Human Persona and Brand Personality Consistency." (3) PolyU (UGC) funded the project "Multi-Modal Multi-Label Tourism Statistics Inferring from Publicly Available Geo-Social Footprint Data" under VP(RI)'s Special Allocation (Project P0045695). (4) The University Grants Committee supported the project "Avatar in Green Training: Perceived Authenticity, Virtual Rapport, Green Engagement, and Green Creativity" under the Mr and Mrs Chan Chak Fu Research Assistantship (Project P0045911). (5) Project P0043864, "Data Science and AI for Hospitality," by Accel Innovations Limited. (6) Project P0045486, "Metaverse in Hospitality and Tourism," by the University Grants Committee under the Research Matching Grant Scheme (RMGS).

To cite this article: Liu, S. & Hao, F. (2024). Metaverse and regenerative tourism: the role of avatars in promoting sustainable practices. *Asia Pacific Journal of Tourism Research, 29*(7), 869-884. DOI: 10.1080/10941665.2024.2350401

To link to this article: https://doi.org/10.1080/10941665.2024.2350401

Published online: **13 May 2024**

Metaverse and Regenerative Tourism: The Role of Avatars in Promoting Sustainable Practices

Abstract: This study explores the role of avatars in enhancing awareness and learning outcomes in virtual regenerative tourism. Data from 483 participants engaging in online virtual tourism experiences were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that extrinsic motivations like authenticity, immersion, perceived social distance, and textual credibility positively influence attitudes towards avatars, which in turn significantly impact learning outcomes. These outcomes are moderated by intrinsic motivations such as prosocial identity. Enhanced learning notably shapes regenerative practices, including conservation efforts support for local community. Contributing to Self-Determination Theory, this research highlights the interplay between virtual environments and self-identity in ethical behavior. It offers key insights for destination marketers and tourism operators in leveraging virtual technologies for sustainable tourism development.

Keywords: Regenerative tourism, metaverse, attitude, avatar, motivations, self-determination theory, sustainability, virtual travel, authenticity, user engagement

Introduction

Despite the adoption of the 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs) in 2015, the implementation of these goals has encountered numerous challenges. The World Travel & Tourism Council (WTTC, 2021) in its net zero roadmap for travel and tourism, acknowledges climate change as an increasingly critical issue, with the tourism industry contributing significantly to global greenhouse gas emissions—accounting for an estimated 8% to 11%. The World Tourism Organization (2023) projects a 25% increase in these emissions by 2030 compared to 2016 levels. Additionally, tensions between local residents and tourists have escalated, exacerbated by natural disasters like wildfires (BBC, 2023b) and the phenomenon of retaliatory tourism in the post-pandemic era (BBC, 2023a). These growing challenges necessitate a reevaluation of the tourism industry's sustainability efforts and the adoption of transformative strategies.

Regenerative tourism represents a paradigm shift within the industry, transcending conventional sustainable tourism approaches (Becken & Kaur, 2021). It advocates for the seamless integration of tourism activities with local communities and natural processes, aiming to enhance the well-being of both human and environmental systems (Bellato & Pollock, 2023). Farrell and Twining-Ward (2004) were pioneers in integrating regenerative principles into the tourism sector. Following

this, 'conscious travel' was formulated by Pollock (2012), positioning regenerative tourism at the forefront and integrating an ecological perspective into the domain of tourism. The foundational tenets are characterized by a commitment to sustainability (Hussain & Haley, 2022), the restoration of ecosystems and cultural heritage (Cheer, 2020; Duxbury et al., 2020), the co-creation of value between stakeholders and indigenous populations (Bellato & Pollock, 2023; Zaman et al., 2023), and the enablement of local populations in tourism activities (Becken & Kaur, 2021), all pursued under the premise of economic feasibility. Therefore, this study delineates regenerative tourism as an advanced paradigm that elevates destinations through environmental rejuvenation, cultural amplification, and community fortification, significantly surpassing the scope of traditional sustainability efforts. Despite its potential, there remains a significant knowledge gap regarding the principles and practices of regenerative tourism among the general populace. Addressing this gap through improved awareness and education is essential for fostering wider acceptance of regenerative tourism, potentially guiding the industry towards a more integrative and sustainable future (Ajoon & Rao, 2020).

The integration of the metaverse into regenerative tourism heralds a transformative approach by extending beyond geographical confines to engage a wider audience through immersive experiences that replicate the real world (Zhang et al., 2022). Avatars, serving as digital stand-ins and cultural mediators within this virtual milieu, are pivotal in acquainting users with local communities and disseminating knowledge on regenerative tourism's tenets and practices. The role of avatars transcends mere representation, evolving into a dynamic educational tool that fosters a deep understanding and appreciation of regenerative tourism (Yang & Wang, 2023). The metaverse's unique ability to mimic authentic environments and interactions marks it as a groundbreaking platform for advocating and furthering regenerative tourism's objectives. However, an evident gap persists in our comprehension of how intrinsic and extrinsic motivations, particularly within the metaverse context, orchestrate to influence learning outcomes and engagement in regenerative tourism.

Self-Determination Theory (SDT) posits that intrinsic motivation, fueled by an individual’s interest and quest for knowledge, engages learners more deeply in the learning process (Deci & Ryan, 2012). Conversely, extrinsic motivations, manifested through engagement with avatars—acting as conduits of knowledge within the metaverse—, the perceived authenticity and credibility of avatars, social connectivity, and immersive experiences, play a critical role in shaping attitudes towards learning and the effectiveness of educational experiences (Mazlan & Burd, 2012). Despite

these insights, current literature lacks a detailed examination of how avatar characteristics and metaverse learning environments contribute to these educational dynamics.

This study endeavors to investigate the influence of tourists' extrinsic and intrinsic motivations on the learning outcomes of regenerative tourism and their subsequent effect on regenerative practices. Extrinsic motivators examined include the avatar authenticity and textual credibility, perceived social distance with avatar, and the level of immersion experienced by individuals. Meanwhile, intrinsic motivators include interest in sustainable practices and knowledge pertaining to regenerative tourism. Grounded in the framework of SDT (Deci, 1971), the research seeks to address the following questions: 1) How do extrinsic motivations impact the attitude towards avatars? 2) How do intrinsic motivations influence the attitude towards avatars? 3) What is the effect of avatar attitudes on the learning outcomes in regenerative tourism? 4) How do learning outcomes influence regenerative practices? Theoretically, this study broadens the application of the Self-Determination Theory to the context of regenerative tourism, underscoring the importance of both intrinsic and extrinsic motivations in shaping individuals' behavioral intentions. Practically, this research offers valuable insights for destination marketers, tourism operators, and service providers, highlighting the potential of avatars as an educational tool to encourage tourists to engage with and respect the people, places, and cultures of local communities.

Metaverse and Attitude towards Avatars

The metaverse, as a virtual platform, expands the scope of regenerative tourism, facilitating wider participation and fostering sustainable practices. It provides immersive and interactive experiences that enhance visitor engagement with regenerative tourism principles (Xu et al., 2023), and its integration with regenerative tourism aids in the widespread promotion of sustainable practices (de Brito Silva et al., 2022). Central to the metaverse are avatars, serving as influential educational tools in virtual learning (Mazlan & Burd, 2012). They significantly affect students' attitudes, learning outcomes, and behavioral intentions. Mazlan and Burd's (2012) research on avatar-associated learning motivations found that avatars positively influence attitudes towards learning by providing a sense of identity. They also shape behavioral intentions, such as willingness to participate and collaborate. Tran (2024) underscore the benefits of avatars in enhancing online learning platform usability and effectiveness in metaverse-driven sustainable tourism context.

Self-Determination Theory (SDT)

Self-Determination Theory (SDT) is a theory grounded in empirical evidence, providing a comprehensive framework for exploring human motivation and personality within societal settings (Gilbert, Fiske, & Lindzey, 1998). During the initial stages of SDT development, three fundamental psychological needs—autonomy, competence, and relatedness—were identified as critical components that drive the formation of intrinsic motivation (Gilbert et al. 1998). Subsequently, SDT emerged from investigations into how extrinsic rewards influence intrinsic motivation (Deci & Ryan, 2012). If external events, such as positive feedback (Deci, 1971) or competition (Deci & Ryan, 2012), were expected to fulfill these essential needs, they would bolster intrinsic motivation. Hence, when exploring human motivations and behaviors, incorporating an understanding of both intrinsic and extrinsic factors is crucial (Deci, 1971).

SDT's applicability extends beyond individual motivation, addressing the dynamics in various domains. For example, Hsu, Wang, and Levesque-Bristol (2019) have extended the validation of SDT to online settings, demonstrating that the satisfaction of basic psychological needs through online courses enhances self-regulated learning and improves perceived knowledge transfer and academic achievement. Nonetheless, the impact of avatars and virtual environment characteristics on learning regenerative practices within metaverse-based regenerative tourism remains ambiguous. This study seeks to unravel how immersion, authenticity, textual credibility, and perceived social distance influence attitudes towards avatars, subsequently fostering extrinsic motivations that affect learning outcomes. Additionally, the significance of intrinsic motivations such as interest and knowledge basis in fostering regenerative behaviors within virtual contexts is still insufficiently explored (Gilal et al., 2020). Hence, this study aims to investigate the impacts of intrinsic and extrinsic motivations on individuals' learning outcome in the context of virtual regenerative tourism.

Extrinsic Motivations

Immersion

Immersion, as defined in various research contexts, is a state of deep psychological engagement experienced by users within a virtual environment (Witmer & Singer, 1998; Hooi & Cho, 2012). In this study, immersion is conceptualized as a state of deep involvement in the virtual environment, particularly significant in virtual tourism within the metaverse. The immersive nature of the metaverse enhances the tourism experience, allowing for more interactive and captivating engagement with destinations (Yang & Wang, 2023). Previous studies have explored factors like avatar

personalization (Waltemate et al., 2018) and avatar similarity (Hooi & Cho, 2012) in relation to immersion, but there is limited research on how an immersive environment influences attitudes towards avatars. Virtual engagement with tourism destinations enriches real-life experiences by providing immersive and authentic interactions within the metaverse (Buhalis et al., 2023). This enriched virtual experience catalyzes the development of positive attitudes towards avatars, as individuals are more likely to identify and empathize with these virtual representations that mirrors real-world interactions and environments. This leads to the following hypothesis.

H1: Immersion has a positive impact on attitude towards avatars.

Authenticity

Authenticity significantly influences user engagement within virtual environments by shaping social reactions and narratives. This is underscored by Mura et al. (2017), who emphasize the critical role of realism and immersion in fostering authentic virtual experiences. Roth et al. (2019) further refine this understanding by defining authenticity as the perception of genuineness and reality in avatars, which are key to enabling empathetic and meaningful communication. Such authentic representations are shown to improve interaction outcomes, as individuals tend to exhibit higher empathy levels and pro-social behaviors towards avatars that they perceive as genuine (Du et al., 2023; Roth et al., 2019). Building on the principles of SDT, it is posited that authentic avatars engender positive attitudes among users, serving as a pivotal motivator for deeper and more voluntary engagement with the learning content, particularly within the realm of regenerative tourism education (Mura et al., 2017; de Brito Silva et al., 2022; Jones et al., 2022). This synthesis of research findings leads to the articulation of the following hypothesis:

H2: Authenticity has a positive impact on attitude towards avatars.

Textual Credibility

Textual credibility in this study refers to the perceived trustworthiness and reliability of content conveyed by avatars about regenerative tourism (Kim et al., 2022). This aspect is vital as it shapes how information is processed, remembered, and utilized in

communication. Research has shown that avatars can enhance the perceived credibility of information. Liew, Tan, and Ismail (2017) noted that a non-interactive avatar positively influenced website trust and patronage intentions. Furthermore, Alves and Soares (2013) found that an avatar with a pre-recorded human voice increased credibility compared to no avatar presence. The perception of credibility significantly affects attitudes towards avatars, with individuals more inclined to trust and accept information deemed reliable and valuable (Jin & Sung, 2010). Nowak and McGloin (2014) observed that higher textual credibility correlates with increased trust and influences purchase intentions in online contexts. However, Nowak, Hamilton, and Hammond (2009) suggested that the attitude toward the source may not always mediate the trust's effect on avatar choice. In this study, it is posited that credible messages from avatars lead to positive attitudes towards them, thereby fostering engagement. This forms the basis of the following hypothesis.

H3: Textual credibility has a positive impact on attitude towards avatars.

Perceived Social Distance

Perceived social distance is particularly important for social activities such as communication via mediation, which lack information processing through nonverbal and physical cues compared to social activities without mediation (Lim et al., 2012). Bogardus, a pioneer in the quantification of social distance with his scale introduced in 1924, defined social distance as the degree of empathetic understanding and closeness that exists not only between individuals but also within and across diverse groups. In a similar vein, the concept of perceived social distance, as delineated by Lim et al. (2012), emphasizes the significance attributed to relationships by individuals. This perception is influenced by a myriad of factors, such as gender, age, ethnicity, and cultural background, highlighting the multifaceted nature of social distance and its impact on interpersonal and intergroup dynamics. Existing research has discussed social distance regarding the interactions between human-to-human (Tawa et al., 2015), or human to robots (Halpern & Katz, 2013) in virtual environments. While not too much attention has been given to investigating the social distance between a human and an avatar. Kim et al. (2023) highlighted the significance of psychological distance in avatar-mediated experiences. Their study focused on investigating how user familiarity with avatars can facilitate efficient information acquisition, enhance user comfort, foster favorable attitudes, and increase the intention to use such experiences more frequently. Building on SDT, perceived

less distance formulates positive attitude towards avatars, which motivate individuals trusts and learn knowledge of regenerative tourism from avatar. Hence, the following hypothesis was framed.

H4: Perceived social distance has a positive impact on attitude towards avatars.

Learning Outcome

Learning outcome refers to a critical measure of the efficacy and results of the educational process (Chapman & Stone, 2010). Quantified through metrics such as achievement tests, learning outcome is pivotal for assessing learning effectiveness and teaching quality (Lin et al., 2017). It offers a gauge for the impact of learning on learners and is essential in evaluating the overall educational experience. Prior research has explored the impact of technology on learning outcomes. Nortvig, Petersen, and Balle (2018) analyzed the effects of different teaching formats, including e-learning, blended learning, and traditional face-to-face learning, on students' learning effectiveness, satisfaction, and engagement. They found that learning outcomes are influenced by factors like educator presence in online environments, student interest, and the quality of teaching and content. Reiners et al. (2014) highlighted the significance of realism and engagement in enhancing learning outcomes and emotional connections. Nortvig et al. (2018) suggested further investigation into various factors affecting teaching and learning across different formats and contexts. In the context of avatars disseminating knowledge of regenerative tourism in the metaverse, it is crucial to assess both avatar attributes and learning environment factors, such as immersion, to evaluate learning outcomes effectively. This leads to the formulation of the following hypothesis.

H5: Attitude towards avatars has a positive impact on learning outcome.

Intrinsic Motivations

Interest in Sustainable Practices

Personal interest, as extensively discussed in marketing and sociopsychological literature, plays a crucial role in shaping information processing, decision-making,

and consumer behaviors related to involvement (Gursoy & Gavcar, 2003). When it comes to sustainable practices, interest refers to an individual or collective inclination towards engaging in behaviors and initiatives that promote sustainability. Grounded in SDT, interest is identified as a key intrinsic motivator, compelling individuals towards activities aligned with their personal passions and curiosities (Deci & Ryan, 2012). Sie, Pegg, and Phelan (2021) further established that in the context of tourism, interest acts as a powerful intrinsic motivator positively impacting learning outcomes. Extending this logic, Islam, Zhang, and Hasan (2020) suggest that a deep-seated interest in sustainable practices spurs individuals to actively contribute towards a more sustainable and inclusive future. Such a commitment not only fosters a deeper comprehension of regenerative tourism principles and practices but also encourages the application of this knowledge and a lasting engagement in continuous learning. Additionally, Gilbert et al. (1998) highlights that strong intrinsic motivation can significantly alter outcomes initially driven by extrinsic motivators, emphasizing the importance of the interplay between intrinsic and extrinsic motivation in influencing learning outcomes. Consequently, this understanding leads to the formulation of the following hypothesis:

> **H6**: The relationship between attitude towards avatars and learning outcomes is positively moderated by an individual's interest in sustainable practices, such that greater interest in sustainable practices will enhance this relationship significantly.

Knowledge of Regenerative Tourism

Knowledge in the context of regenerative tourism refers to an understanding of regenerative practices and initiatives promoting environmental and socio-cultural sustainability. Previous research highlights the importance of knowledge in the tourism context. Tsaur, Yen, and Chen (2010) found that independent travelers, as opposed to group travelers, are more adept at acquiring new knowledge about destinations, including language, regulations, customs, geography, and culture. Rahman et al. (2020) noted that tourists' knowledge of tourism products and services significantly influences their travel behaviors, while Rahmafitria et al. (2021) emphasized that sufficient knowledge aids tourists in effectively assessing risks and adapting their travel plans. Drawing upon SDT, this research positions knowledge of regenerative tourism as a pivotal internal motivator that shapes tourists' perceptions, behaviors, and engagement levels (Deci & Ryan, 2012). In the context of regenerative

tourism within the metaverse, a foundational knowledge enhances tourists' capacity to comprehend and assimilate information presented via avatars, thereby augmenting learning achievements and fostering a deeper commitment to and interaction with sustainable practices. Accordingly, the study advances the following hypothesis:

H7: Knowledge of regenerative tourism positively moderates the relationship between attitudes towards avatars and learning outcomes, wherein more extensive knowledge engenders a significantly stronger correlation.

Regenerative Tourism Principles

Regenerative tourism, an emerging paradigm in the tourism industry, distinguishes itself from sustainable tourism, which primarily focuses on reducing environmental and cultural harm (Holden, 2008; Muhammad et al., 2023). Regenerative tourism, as defined by scholars, aims to actively enhance and revitalize environmental and cultural aspects of destinations (Becken & Kaur, 2021). It adopts a holistic approach, recognizing the interconnectedness of ecological, cultural, economic, and social elements (Duxbury et al., 2020), and emphasizes the overall well-being of destinations beyond financial aspects, including social, environmental, and cultural welfare (Duxbury et al., 2020). This concept fosters value co-creation with local communities, mutual education, and self-growth for tourists (Zaman et al., 2023), and offers transformative experiences that deepen connections with nature and local traditions (Bellato & Pollock, 2023). It also includes community involvement in tourism planning and management (Becken & Kaur, 2021).

Regenerative tourism is an innovative approach that extends beyond traditional sustainability, focusing on revitalizing destinations through a comprehensive, interconnected framework. This approach underlines restoration, cultural enrichment, holistic well-being, value co-creation, transformative experiences, and community empowerment. It has the potential to effect long-term behavioral changes in conservation, sustainability, and community development. This study identifies four key regenerative tourism practices: conservation efforts, carbon footprint offsetting, local community support, and choosing eco-certified accommodations, exploring how extrinsic and intrinsic motivations influence user behavior.

Willingness to Make Conservation Efforts

Various forms of tourism are linked to distinct conservation efforts by tourists. For instance, community-based tourism primarily focuses on biodiversity conservation and community livelihoods (Moswete & Thapa, 2009). Similarly, ecotourism attracts nature-conscious tourists who aim to safeguard natural resources and engage in environmental-friendly behaviors during their vacations (Dolnicar, 2006). Notably, the conservation efforts made by tourists emphasize voluntariness. Nelson, Partelow, and Schlüter (2019) found that tourists prefer voluntary contributions over government-imposed fees when it comes to coastal conservation. In the context of regenerative tourism and its core principles, tourists' willingness to engage in conservation efforts refers to their voluntary inclination and readiness to actively participate in practices that contribute to the preservation and improvement of local communities, natural environments, and biodiversity. According to SDT, there is a documented correlation between strong motivations and positive sustainable behaviors (Gilal et al., 2020). In the innovative context of virtual regenerative travel with avatar guides, this research posits that enhancing learning outcome in virtual interactions can catalyze regenerative practices. Hence, the following hypothesis was framed.

H8: Learning outcome has a positive impact on willingness to make conservation efforts.

Willingness to Offset Carbon Footprint

Willingness to offset carbon footprint involves a commitment to counterbalance carbon emissions through investments in carbon reduction projects or purchasing carbon offsets. It's a vital measure in assessing climate change impact (Juvan & Dolnicar, 2014) and critical for sustainable development and climate change mitigation. Existing research on carbon footprints primarily focuses on measurement methods and public attitudes towards emission reduction. Brouwer et al. (2008) observed a low participation rate in voluntary carbon offsetting among air travelers, while McKercher et al. (2010) studied residents' attitudes towards reducing tourism-related carbon footprints, finding that regular international tourists, despite being more aware of global climate change, were less willing to alter travel behaviors. These findings underscore the need for more research to understand what influences tourists' willingness to offset carbon footprints and to devise strategies that promote sustainable behaviors in tourism. Based on SDT, this study proposes that learning

outcomes can affect the willingness to offset carbon footprints in the context of metaverse regenerative tourism.

H9: Learning outcome has a positive impact on willingness to offset carbon footprint.

Willingness to Support for Local Communities

Supporting local communities in tourism, deeply rooted in the principles of community-based tourism, embodies a comprehensive commitment by tourists towards the well-being of local communities. This commitment goes beyond providing financial aid and encompasses active involvement in initiatives that promote economic growth, cultural preservation, social advancement, and environmental stewardship (Lee, Jan, & Yang, 2013). Tran (2024) emphasize that this concept entails not only adopting responsible tourism practices but also making purposeful contributions to the socio-economic empowerment of local communities. By engaging tourists with local enterprises and cultural traditions, a mutually beneficial relationship is fostered with host communities, redirecting tourism towards a more sustainable and inclusive trajectory, as suggested by Kim & Kang (2020). This approach aims to strike a balance between inclusivity and mitigating negative impacts such as environmental degradation, redefining tourism as a catalyst for positive transformation and emphasizing holistic development that benefits all stakeholders involved. Building on SDT, this study assumed that learning outcome can influence willingness to support for local communities. Hence, the following hypothesis was framed.

H10: Learning outcome has a positive impact on willingness to support for local communities.

Willingness to Choose Eco-Certified Accommodations

Eco-certification is awarded by an independent third party, specifically for goods and services that meet predetermined environmental criteria (Font, 2002). Certification plays a significant role in uniting local stakeholders towards the common objective of establishing standards to enhance the sustainable development contributions of

tourism (Constantin, Ispas, & Candrea, 2013). Additionally, tourists' preference for Eco-Certified Accommodations signifies their dedication to minimizing environmental impact while acknowledging and valuing the efforts made by these accommodations to safeguard and conserve the ecosystem. Despite the potentially higher costs associated with choosing an eco-certified hotel, there is a growing trend indicating that customers are willing to pay more for environmentally friendly products and services (Han, Hsu, & Lee, 2009). Building on SDT, this study assumed that learning outcome can influence willingness to choose eco-certified accommodations in the metaverse regenerative tourism context. Hence, the following hypothesis was framed and the theoretical framework is shown in Figure 1.

H11: Learning outcome has a positive impact on willingness to choose eco-certified accommodations.

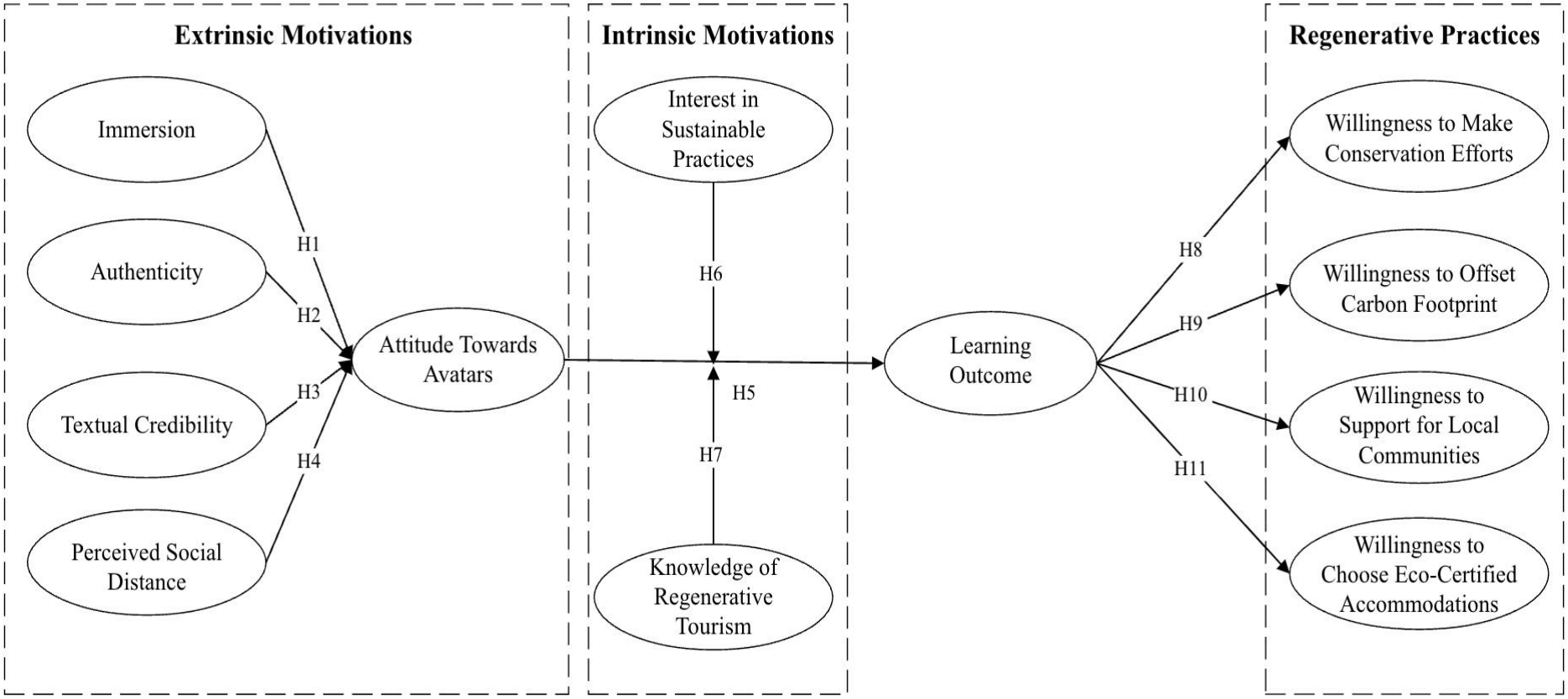

Figure 1: Conceptual Framework

Method

In recruiting participants for this study, we utilized Prolific, a platform celebrated for its significant contributions to data quality in social science research (Palan & Schitter, 2018). This allowed us to employ a convenience sampling strategy to compile a diverse and representative cohort of participants. The recruitment was governed by specific eligibility criteria: participants had to be a minimum of 18 years old, proficient in English, and possess an educational level of at least high school graduation or its equivalent. Out of the 675 participants who initially completed the survey, 483 were deemed valid for analysis after a meticulous screening process. A notable proportion of the ineligible participants (173 out of 183) were screened out based on their failure to meet the eligibility criteria as determined by their responses to preliminary screening questions. The remaining ineligibilities were attributed to incorrect answers to an attention check question, which was intricately designed around a specific video crafted for this study. This step was crucial to ensuring the data's reliability and the participants' attentiveness. Detailed demographic information of the valid participants is presented in Table 1. The entire research methodology, including participant recruitment and screening procedures, was executed in strict adherence to ethical guidelines, with all processes receiving approval from the Institutional Review Board.

Table 1: Demographic profile of participants

Variable	Category	Frequency (n=483)	Percentage (%)
Gender	Female	233	48.24%
	Male	250	51.76%
Age	18-34	347	71.84%
	35-54	113	23.40%
	>55	23	4.76%
Occupation	Employed full time	471	97.52%
	Employed part time	8	1.66%
	Unemployed looking for work	4	0.83%
Education	High school graduate	37	7.66%
	4-year degree	354	73.29%
	Some college	8	1.66%
	Professional degree	84	17.39%

Participants experienced a metaverse scenario simulating a regenerative tourism journey. To enhance immersion, a demonstration video featuring a virtual guide leading a rejuvenating expedition with local community engagement and nature exploration was developed. This design was intentionally broad to accommodate diverse demographics, including elderly individuals who might find complex virtual reality headsets challenging. Following Jones et al. (2022), which indicated women's tendency towards more convergent and accommodating communication styles, a female avatar guide was chosen for participant interactions. The video, not tied to any specific regenerative tourism destination, functioned as a universal educational tool to promote awareness of regenerative practices. This strategy ensured the video's accessibility and effectiveness in educating a broad audience. Visual details of the avatar guide and the complete video are available in the Online Appendix and Figure 2.

Figure 2: Avatar tour guide

This study's measurement items were adapted from validated scales, with modifications to suit its specific research context. Immersion was measured using three items from Fornerino et al. (2008), while avatar authenticity was assessed with four items from Chang et al. (2010). Textual credibility relied on Kim et al.'s (2022)

criteria for perceived word credibility. Perceived social distance was evaluated through Bogardus (1992), focusing on closeness perception with avatars. Attitude towards avatars was gauged using customized items from Cha (2020). Learning outcome was assessed with two items from Chapman and Stone (2010), examining learning effectiveness and engagement. Interest in sustainable practices was captured through four items from Gursoy and Gavcar (2003). Knowledge of regenerative tourism utilized three items from Rahmafitria et al. (2021). Willingness to engage in conservation efforts, support local communities, and choose eco-certified accommodations were each assessed using three items from Lange and Dewitte (2019) and Lee et al. (2013). Lastly, willingness to offset carbon footprint was measured with two items from Lu and Wang (2018). We designed the questionnaire utilizing 7-point Likert Scales.

Results

Data Analysis

The proposed measurement and structural model were evaluated using Partial Least Squares Structural Equation Modelling (PLS-SEM) through SmartPLS4. PLS-SEM was primarily selected as it is considered more appropriate for assessing intricate models in comparison to CB-SEM, as indicated by Hair et al. (2017). To examine the possibility of factor multicollinearity, a Variance Inflation Factor (VIF) analysis was conducted. The VIF values for our constructs varied between 1.1 and 3.6, all of which were beneath the suggested limit of 5.0, signifying that multicollinearity was not a major issue in our dataset (Hair et al., 2017).

Measurement Analysis

The assessment of the reflective measure constructs' reliability and validity was conducted and presented in Table 2. All outer loadings were found to be statistically significant and exceeded the minimum threshold of 0.6. Additionally, both Cronbach's α and composite reliability (CR) values surpassed the recommended threshold of 0.7, demonstrating satisfactory internal consistency reliability. Furthermore, the lowest average variance extracted (AVE) value exceeded the acceptable threshold of 0.5, confirming convergent validity (Hair et al., 2017). Therefore, the results provide support for the internal consistency reliability and convergent validity of the measures used in the study.

Table 2: Constructs, items, and reliabilities

Items	Mean	SD	Kurtosis	Skewness	VIF	Loadings
Textual credibility (Kim et al., 2022) (Cronbach's α = 0.719, CR =0.732, AVE = 0.642)						
The words of the avatar are believable.	5.851	0.683	0.835	-0.624	1.702	0.869
The words of the avatar are honest.	5.983	0.708	0.064	-0.363	1.53	0.79
The words of the avatar leave me feeling accurately informed.	5.957	0.799	-0.698	-0.24	1.276	0.739
Perceived social distance (Bogardus, 1992) (Cronbach's α = 0.714, CR =0.839, AVE = 0.636)						
I would like to be a close friend with the avatar.	5.745	0.733	0.064	-0.383	1.303	0.778
I would like to be accompanied by the avatar.	5.913	0.812	-0.705	-0.212	1.44	0.787
I would like to have close contact with the avatar.	5.919	0.785	-0.704	-0.166	1.614	0.826
Authenticity (Chang et al., 2010) (Cronbach's α = 0.719, CR =0.822, AVE = 0.648)						
I would think of the avatar as a unique individual rather than as an anonymous person.	6.037	0.747	-0.598	-0.27	1.622	0.799
I could relate to the avatar in the experience.	6.054	0.709	0.017	-0.359	1.745	0.778
I was experiencing the same thoughts and feelings as the avatar.	6.046	0.695	-0.094	-0.36	1.822	0.815
I feel that the avatar is organic.	6.054	0.706	-0.456	-0.252	1.642	0.828
Immersion (Fornerino et al., 2008) (Cronbach's α = 0.783, CR =0.784, AVE = 0.698)						
I felt immersed in the virtual tour.	5.923	0.751	0.054	-0.433	1.894	0.862
I felt like I was part of the virtual tour.	5.979	0.803	-0.413	-0.395	1.826	0.855
I was able to forget about the outside world during the virtual tour.	5.975	0.772	-0.313	-0.364	1.422	0.787
Interest in sustainable practices (Gursoy & Gavcar, 2003) (Cronbach's α = 0.706, CR =0.734, AVE = 0.629)						
I am willing to pay extra for travel experiences that are environmentally friendly.	5.946	0.682	0.809	-0.561	1.543	0.819
I make an effort to minimize my ecological footprint while traveling.	6.06	0.749	-0.324	-0.395	1.487	0.852
I prefer travel experiences that align with my values of sustainability.	6.031	0.72	-0.278	-0.313	1.251	0.701
Knowledge of regenerative tourism (Rahmafitria et al., 2021) (Cronbach's α = 0.860, CR =0.867, AVE = 0.781)						
I understand regenerative tourism can contribute to the economic growth of local communities.	4.317	0.835	1.941	1.214	2.558	0.885
I understand that regenerative tourism values for local communities.	4.395	0.916	1.306	0.983	2.222	0.879
I understand that regenerative tourism can do further step towards sustainable	4.474	0.849	1.128	0.813	1.976	0.86

tourism, creating positive impacts and restoring ecosystems.						
Attitude towards avatar (Cha, 2020) (Cronbach's α = 0.741, CR =0.742, AVE = 0.660)						
I believe the avatar can be beneficial.	5.948	0.684	0.172	-0.324	1.707	0.853
I trust the avatar to perform tasks accurately.	6	0.739	-0.162	-0.37	1.54	0.808
I feel comfortable interacting with the avatar.	6.077	0.748	-0.65	-0.304	1.35	0.774
Learning outcome (Chapman & Stone, 2010) (Cronbach's α = 0.700, CR =0.701, AVE = 0.769)						
I've learned new information from the avatar.	6.06	0.652	0.129	-0.285	1.41	0.875
I can apply the knowledge I learned from the avatar.	6.145	0.653	-0.158	-0.291	1.41	0.88
Willingness to make conservation efforts (Lange & Dewitte, 2019) (Cronbach's α = 0.721, CR =0.738, AVE = 0.643)						
I would like to volunteer my time for conservation projects held by local communities.	5.886	0.703	0.375	-0.447	1.664	0.854
I would like to actively participate in campaigns focused on protecting wildlife and natural habitats.	5.948	0.756	-0.416	-0.261	1.544	0.837
I would like to advocate for conservation in the local community.	5.954	0.743	-0.143	-0.351	1.27	0.707
Willingness to support for local communities (Lee et al., 2013) (Cronbach's α = 0.709, CR =0.709, AVE = 0.632)						
I prefer to stay in locally owned accommodations.	5.954	0.774	-0.498	-0.271	1.586	0.819
I would like to support local artisans.	5.909	0.75	-0.113	-0.35	1.233	0.767
I would like to actively seek out opportunities to contribute to the local community projects during my travels.	5.998	0.743	-0.373	-0.3	1.555	0.797
Willingness to offset carbon footprint (Lu & Wang, 2018) (Cronbach's α = 0.715, CR =0.723, AVE = 0.778)						
I am aware of the carbon emissions generated by my travel activities.	5.822	0.765	0.038	-0.437	1.45	0.898
I would like to actively seek out carbon offset programs to neutralize the environmental impact of my travel.	5.899	0.793	-0.433	-0.291	1.45	0.866
Willingness to choose eco-certified accommodations (Lange & Dewitte, 2019) (Cronbach's α = 0.721, CR =0.730, AVE = 0.643)						
I would like to actively seek accommodations with eco-certifications and sustainability practices.	5.892	0.691	0.306	-0.384	1.594	0.844
I prefer accommodations that have received green certifications, such as LEED or Green Globe.	5.917	0.743	-0.219	-0.291	1.523	0.826
I will actively choose eco-certified accommodations to support sustainability.	5.934	0.767	-0.158	-0.385	1.283	0.732

Evaluation of the Structural Model

The coefficient of determination (R2) of the endogenous latent variables serves as a crucial criterion in assessing the structural model in PLS path models (Henseler et al., 2009). R^2 values of 0.19, 0.33, and 0.67 are interpreted as weak, moderate, and substantial, respectively (Chin, 1998, p.323). In this study, the R^2 (variance explained) shows attitude towards avatars (51.5%), learning outcome (31.2%), willingness to make conservation efforts (19.4%), willingness to support for local communities (16.7%), willingness to offset carbon footprint (20.4%), and willingness to choose eco-certified accommodations (15.8%). Table 3 displays the outcome of the structural model test.

Hypotheses Tests

The bootstrap analysis was conducted following the procedure suggested by Hair, Ringle, and Sarstedt (2011) and 5,000 subsamples were generated from the dataset comprising 483 cases. The significance level was set at 0.05, and a minimum t-value of 1.96 was considered necessary for statistical significance (Hair et al., 2017). Though hypothesis 1, which proposed a direct relationship between textual credibility and attitude towards avatars ($\beta = 0.249$, $t = 4.945$, $p < 0.01$) was significant. Hypothesis 2 assumed a direct positive relationship between perceived social distance and attitude towards avatars ($\beta = 0.325$, $t = 6.121$, $p < 0.01$). Hypothesis 3 predicted a positive relationship between authenticity and attitude towards avatars and the results showed a significant effect ($\beta = 0.2$, $t = 4.108$, $p < 0.01$). Hypothesis 4 predicted a positive relationship between immersion and attitude towards avatars and the results showed a significant effect ($\beta = 0.13$, $t = 2.959$, $p < 0.01$). Hypothesis 5 proposed a positive relationship between attitude towards avatars and learning outcome ($\beta = 0.398$, $t = 8.568$, $p < 0.01$). Hypothesis 8-11 predicted positive relationships between learning outcomes and regenerative practices which are willingness to make conservation efforts ($\beta = 0.441$, $t = 9.113$, $p < 0.01$), willingness to support for local communities ($\beta = 0.409$, $t = 9.767$, $p < 0.01$), willingness to offset carbon footprint ($\beta = 0.451$, $t = 10.226$, $p < 0.01$), and willingness to choose eco-certified accommodations ($\beta = 0.397$, $t = 8.176$, $p < 0.01$).

Table 3: Structural model assessment

	Hypotheses	Path coefficients	Standard deviation	T statistics
H1	Textual Credibility -> Attitude towards Avatars	0.249	0.05	4.945**
H2	Perceived Social Distance -> Attitude towards Avatars	0.325	0.053	6.121**
H3	Authenticity -> Attitude towards Avatars	0.2	0.049	4.108**
H4	Immersion -> Attitude towards Avatars	0.13	0.044	2.959**
H5	Attitude towards Avatars -> Learning Outcome	0.398	0.047	8.568**
H6	Interest in Sustainable Practice x Attitude towards Avatars-> Learning outcomes	-0.083	0.039	2.133*
H7	Knowledge of Regenerative Tourism x Attitude towards Avatars-> Learning outcomes	-0.039	-0.041	0.407^{N}
H8	Learning Outcome -> Willingness to Make Conservation Efforts	0.441	0.048	9.113**
H9	Learning Outcome -> Willingness to Support for Local Communities	0.409	0.042	9.767**
H10	Learning Outcome -> Willingness to Offset Carbon Footprint	0.451	0.044	10.226**
H11	Learning Outcome -> willingness Choose Eco-Certified Accommodations	0.397	0.049	8.176**

Note: **Statistical significance is below 1% level; ^{N} Statistical significance is large than 5% level.

The study further examined the moderation role of interest in sustainable practices and knowledge of regenerative tourism in the relationship between attitude towards avatars and learning outcome respectively. Hypothesis 6 predicted that interest in sustainable practice positively moderated the relationship between attitude towards avatars and learning outcome. However, the result showed that interest in sustainable practice (β = -0.083, t = 2.133, p <0.01) negatively moderated the relationship between them. To gain further insights into this moderation effect, slope analysis was conducted (Figure 3). The findings illustrate that tourists who have higher interest in sustainable practices are less influenced by avatars when learning regenerative tourism knowledge. While tourists who have lower interest in sustainable practices are more dependent on avatars expressing knowledge about regenerative tourism. Hypothesis 7 predicted that knowledge of regenerative tourism positively moderated the relationship between attitude towards avatars and learning outcome. However, the result showed that the moderation effect of knowledge of regenerative tourism β = -0.039, t = 0.407, p <0.01) was not significant. Regarding the path is not significant, we did not further discuss the moderation effect.

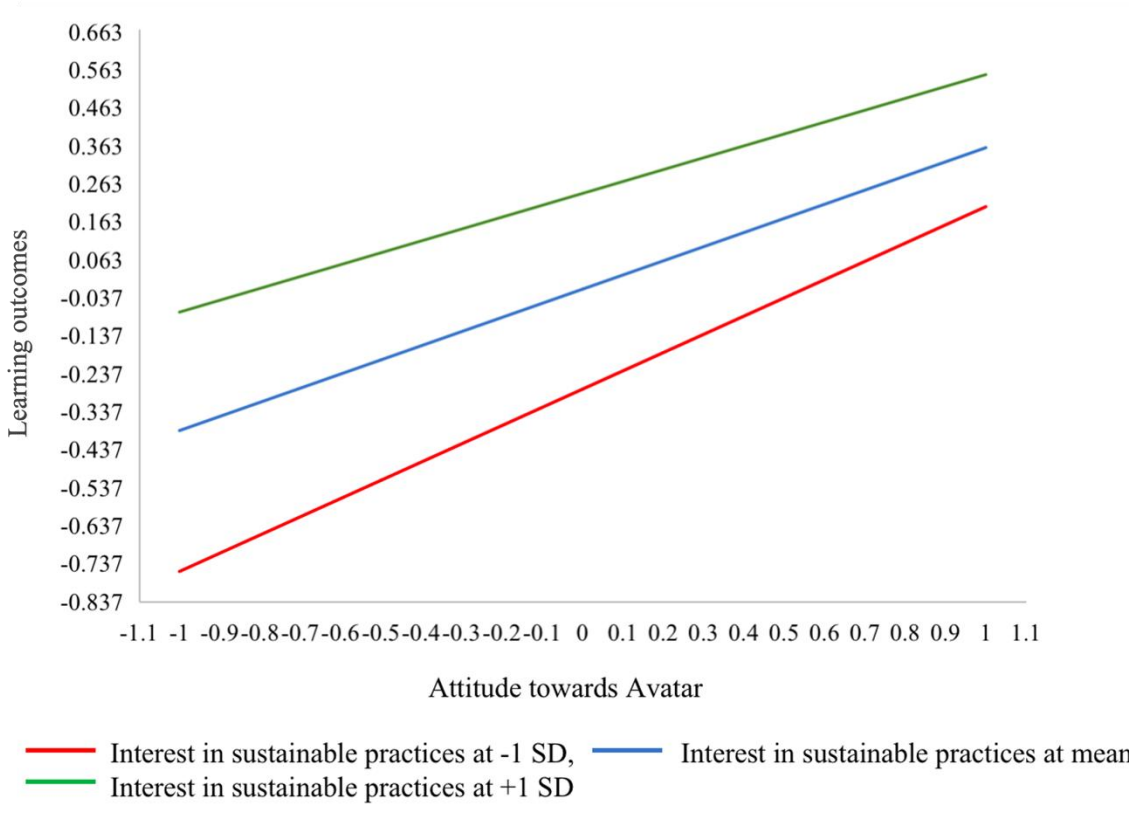

Figure 3

Discussion

This study delves into the influence of intrinsic motivations and extrinsic motivations on learning outcomes of regenerative tourism regarding its principles and practices and how learning outcome motivate individuals to adopt regenerative practices. Specifically, this study affirms the pivotal role of immersion, authenticity of avatars, perceived social distance with avatars, and textual credibility of avatars in shaping attitude towards avatars in metaverse regenerative tourism. This finding aligns with previous research regarding how different attributes can influence learning outcome in the e-learning contexts (Nortvig et al., 2018). Noticeably, the path coefficient of perceived social distance is the highest, which indicates that establishing a strong rapport has a positive impact on improving attitude towards avatars (Kim et al., 2023) and further formulate a strong motivation of learning knowledge relating to regenerative tourism.

Interest in sustainable practices negatively moderates the relationship between attitude towards avatar and learning outcome. When individuals have strong intrinsic motivations, individuals are less influenced by extrinsic motivation, which is supported by Sie et al. (2021). This insight underscores the intricate interplay between intrinsic and extrinsic motivations within educational contexts, emphasizing the nuanced role that

personal values and motivations play in learning efficacy. Moreover, there exists a not significant moderation effect of tourists' knowledge of regenerative on the relationship between attitude towards avatars and learning outcome, highlighting a deficiency in the general understanding and visibility of regenerative tourism (Ajoon & Rao, 2020).

In addition, it was discovered that positive learning outcome can lead to intentions of taking positive behaviors and propose four specific regenerative practices which are willingness to make conservation efforts, offset carbon footprint, support for local communities, and choose eco-certified accommodations. Significantly, educational achievements gained from participation in regenerative practices markedly shape the intention to mitigate carbon footprints. This finding aligns with the research conducted by Lu and Wang (2018), who determined that increasing travelers' awareness of the environmental effects of air travel and the advantages of carbon offset initiatives significantly influences their intentions. Discussions and implications follow.

Theoretical Implications

This study provides significant contributions to theories and literature. Firstly, by extending SDT framework to the emerging field of metaverse regenerative tourism, the study offers valuable insights into understanding and analyzing people' behavioral intentions in this unique context. This research underscores the pivotal role of intrinsic and extrinsic motivations in molding users' attitudes and behavioral intentions within regenerative tourism. Intrinsic motivations, such as personal interest in sustainable practices and knowledge about regenerative tourism, are internally driven forces that spur individuals towards engaging in behaviors that are inherently satisfying and aligned with their values and interests. On the other hand, extrinsic motivations are external incentives or pressures, including perceived authenticity and credibility of avatars, immersion, and social distance, which influence attitudes and behaviors through external rewards or recognition. By unraveling how these motivations interact to drive tourist behavior, this study enriches our comprehension of the foundational mechanisms that underpin engagement in regenerative tourism practices. This aligns with findings by Gilal et al. (2020), which suggest that the amalgamation of both intrinsic and extrinsic motivations is instrumental in fostering green purchasing behaviors among consumers.

Furthermore, aligned with the tenets of SDT (Deci, 1971; Gilbert et al., 1998), our investigation reveals that the fulfillment of basic psychological needs through extrinsic motivators can significantly bolster intrinsic motivation. By elucidating how extrinsically derived motivations, particularly those shaped by the metaverse experience such as immersion and avatar authenticity, interact with intrinsic motivations, this study offers a nuanced exploration of their collective impact on learning outcomes in regenerative tourism. This reciprocal influence not only deepens our understanding of how learning and behavioral intentions are shaped but also extends the theoretical breadth of SDT by

illustrating its applicability in the novel context of virtual tourism environments. This nuanced understanding emphasizes the synergy between intrinsic desires for personal fulfillment and external influences, illustrating a dynamic interplay that enriches educational achievements and the embracement of regenerative tourism practices.

Thirdly, the study makes a notable contribution to the field of SDT by investigating how avatars can accommodate users' preferences and cultural norms to facilitate effective communication and rapport building. This aligns with previous research by Nowak et al. (2009), which suggests that individuals tend to establish stronger connections with female avatars due to their perceived congeniality and accessibility. This theoretical contribution extends beyond the specific context of regenerative tourism and provides insights for avatar design and implementation in various communicative contexts where accommodation is crucial for establishing rapport and effective communication.

Fourthly, the study's exploration of moderation effects is another noteworthy contribution. By examining how intrinsic motivations related to interest in sustainable practices and knowledge of regenerative tourism moderate the relationship between attitude towards avatars and learning outcomes, the study highlights the importance of addressing the lack of general understanding and awareness of regenerative tourism. Avatars can serve as effective educational tools to disseminate knowledge about the principles and practices of regenerative tourism, bridging the gap and promoting greater visibility of this sustainable tourism approach.

Managerial Implications

This research yields pivotal managerial implications for stakeholders in the regenerative tourism and avatar-mediated communication sectors, offering insights that can guide the design and implementation of avatar-based metaverse experiences aligned with tourists' socially responsible travel preferences. Tourism operators and service providers can leverage these insights to enhance user satisfaction and encourage positive recommendations by ensuring experiences adhere to regenerative tourism principles. Leveraging avatars as an effective educational tool and incorporating immersive virtual experiences can facilitate the implementation of initiatives that promote sustainable practices and community engagement, such as virtual tours, interactive learning experiences, and educational campaigns.

Destination marketers can benefit from the findings of this study by effectively appealing to a broader audience and facilitating their engagement in regenerative tourism activities. By focusing on immersive virtual experiences and educational content, marketers can raise awareness about regenerative tourism and its positive impacts on the environment and local communities. This approach can help in promoting sustainable

practices and fostering a deeper understanding and appreciation of the principles of regenerative tourism among potential tourists.

For tourists, engaging with avatars and immersive virtual experiences can lead to firsthand knowledge about the importance of sustainable behaviors and their role in contributing to regenerative tourism. This increased awareness can inspire tourists to make more conscious choices during their travels, such as supporting local businesses, respecting cultural heritage, minimizing waste, and actively participating in community-based initiatives. Ultimately, tourists can become ambassadors for regenerative tourism, promoting its values and practices beyond their individual experiences and positively influencing others to embrace sustainable tourism behaviors.

The broader society also stands to benefit from the adoption of regenerative tourism practices. The shift towards sustainable travel behaviors, influenced by educational and immersive experiences, contributes to environmental conservation, cultural preservation, and community empowerment. This leads to a ripple effect on societal well-being, with local communities benefiting from increased cultural exchange, economic support, and environmental stewardship. Promoting regenerative tourism aligns with global efforts to address climate change and promote sustainable development, supporting broader societal goals for a healthier and more sustainable future.

Limitations

Despite the valuable findings and implications, this study has certain limitations that point to opportunities for future research. The primary limitation is that we mainly focus on four main regenerative practices. Future study should develop a comprehensive index of regenerative practices to guide stakeholders to act positively towards tourism destinations. Additionally, this study mainly explores users' intrinsic motivations from interest and knowledge two aspects. Future study should expand their scope to include diverse intrinsic motivations such as self-efficacy that is individual's belief in their capacity to master related knowledge and execute behaviors necessary to produce specific performance attainments. These future directions would enrich our knowledge of virtual regenerative tourism and its role in promoting sustainable behaviors.

Declaration of interest

There are no conflicts of interest to declare.

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