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"Warning in Spaces: Blending Heritage, Nature and Design"

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"Harmony in Spaces : Blending Heritage, Nature and Design"

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05-3742716
uitmperakpress@gmail.com

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”Cultivating Immersive Experience : Integrating Visual Reality (VR) Application In Enriching Visitors’ Engagement In Taman Botani Negara Shah Alam”

Noor Syazwani¹, Shaibatul 'Islamiah Che Man^{2*}, Asilah Abdul Mutalib³, Zalina Ismail⁴

^{1,2} Studies of Landscape Architecture, School of Town Planning and Landscape Architecture, Faculty of Built Environment, UiTM, Puncak Alam Selangor

^{3,4} Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, Malaysia

Abstract

This study examines the incorporation of immersive Virtual Reality (VR) to augment visitor interaction at Taman Botani Negara Shah Alam (TBNASA), Malaysia. This research examines the potential of virtual reality to offer interactive, instructive, and emotionally engaging experiences in a botanical garden, acknowledging the shortcomings of conventional interpretative methods in appealing to digital-native audiences. A quasi-experimental approach was utilized, comprising two groups: one engaging with the garden via a 360-degree VR film, and the other through traditional in-person visits. Data were gathered through structured questionnaires and evaluated utilizing an independent samples t-test. Results demonstrate that VR markedly improved participants' emotional and immersive engagement in one assessed area, but other dimensions exhibited no statistically significant variation. The findings endorse the implementation of virtual reality as a strategic instrument to enhance environmental education and tourist happiness in nature-based tourism contexts.

Keyword : Virtual Reality (VR), Visitor Engagement, Environmental Education, Botanical Garden, Immersive Experience

INTRODUCTION

A pertinent challenge faced by nature-based destinations such as Taman Botani Negara Shah Alam (TNBSA) in recent years has been the limited visitor engagement resulting from conventional interpretive methods, including static signage and passive educational tools. Conventional methods frequently fail to engage contemporary audiences, especially digital-native generations who choose dynamic and engaging experiences (Aziz, Salleh, & Yusof, 2020). The global implementation of immersive technologies, such as Virtual Reality (VR), in tourism and environmental education has shown considerable promise in augmenting user engagement via multimodal and experiential learning settings (Wojciechowski & Cellary, 2013). It is because, Virtual Reality (VR) can replicate real-world surroundings, promote exploration, and enhance the retention of instructional material, therefore cultivating a stronger bond with nature (Falk & Dierking, 2016). However, the application of immersive technology in Malaysian ecotourism and public parks is limited, underscoring a digital gap that hampers the efficacy of environmental education and tourist retention (Ahmad & Ariffin, 2021).

The Taman Botani Negara Shah Alam (TBNSA) has historically functioned as a significant venue for environmental education, conservation, and public enjoyment. TBNSA is acknowledged for its abundant

biodiversity and cultural landscapes, providing significant ecological and educational advantages. Yet, the park's visitor engagement is frequently constrained by the reliance on traditional interpretive tools, such as static signboards and printed materials, which fail to captivate and sustain the interest of contemporary visitors, particularly younger, digitally savvy demographics (Aziz, Salleh, & Yusof, 2020; Norazah, Abdullah, & Ibrahim, 2022).

Considering evolving visitor expectations and technological progress, Virtual Reality (VR) has emerged as a significant global tool, facilitating immersive, interactive experiences that enhance environmental comprehension through experiential learning (Wojciechowski & Cellary, 2013; Falk & Dierking, 2016). Besides, VR has also demonstrated enhancements in cognitive engagement, emotional connection, and knowledge retention, rendering it a significant medium for environmental interpretation. Notwithstanding its international success, the incorporation of VR in ecotourism and public parks in Malaysia is constrained, highlighting a disparity between global trends and local implementation (Ahmad & Ariffin, 2021).

However, despite its growing adoption, research on the application of VR in enriching visitors' engagement at botanical gardens remains limited, particularly in Malaysia. This study explores the role of VR in tourism, its potential benefits in botanical gardens, relevant theories supporting immersive technology, and past studies on VR's effectiveness in enhancing visitor experiences.

Therefore, there are two (2) objectives of this study which are (i) to develop an immersive Virtual Reality (VR) experience as a tool for enhancing visitor engagement at Taman Botani Negara Shah Alam (ii) To evaluate the efficiency of immersive Virtual Reality (VR) applications in promoting enhanced engagement among visitors.

LITERATURE REVIEW

Virtual Reality and Visitor Engagement

Visitor interaction is an essential component of interpretive tactics in environmental education. Conventional interpretative methods, like signage and guided tours, frequently constrain interaction and individualized experiences. Conversely, VR facilitates active participation and investigation at an individual's own speed, hence enhancing cognitive and emotional engagement (Parmaxi, 2020). Research indicates that immersive environments enhance cognitive retention and foster stronger emotional ties to the provided content (Baceviciute et al., 2022).

In botanical contexts, where biodiversity, spatial arrangement, and seasonal variations can be intricate to represent, virtual reality efficiently simulates these processes. This improves comprehension, particularly among younger demographics and individuals unacquainted with botany (Suh & Prophet, 2018). A VR simulation of an ecosystem can illustrate ecological interactions in real time, rendering abstract concepts more concrete and relevant.

Virtual Reality as an Educational and Interpretative Tool

The educational potential of virtual reality has been examined across various fields, including heritage tourism, museum studies, and environmental education. In botanical gardens, virtual reality can depict uncommon or seasonal flora and facilitate virtual guided tours of otherwise inaccessible areas (Makransky

et al., 2020). A study by Marques and Pombo (2021) shown that VR-based learning modules in natural sciences enhanced student motivation and information retention relative to traditional techniques. Moreover, immersive VR facilitates co-presence and social learning when utilized collectively. Visitors in public gardens can partake in communal experiences, so augmenting the social dimension of learning (Wang et al., 2023). This is especially pertinent for informal learning settings like Taman Botani Negara Shah Alam, where virtual reality may enhance the actual experience and accommodate various learning styles.

Evaluating VR Efficiency in Visitor Experience

Assessing the efficacy of VR in augmenting visitor engagement can be accomplished using quantitative methodologies that yield measurable results. Standard measures encompass attention span, duration of engagement with the VR content, interaction frequency, and post-experience knowledge evaluations (Jensen & Konradsen, 2018). These data points enable researchers to quantitatively examine user responses to VR environments relative to conventional interpretation methods.

Alhalabi et al. (2021) performed a quantitative study within a botanical framework, including structured questionnaires to assess learning results and user engagement. The results indicated a notable enhancement in visitors' cognitive engagement, demonstrated by elevated information retention scores following the VR encounter.

Furthermore, quantitative analysis can evaluate usability metrics including task completion rates, reaction times, and interaction frequencies. These measurements assist in assessing if the VR design promotes or obstructs user involvement. High disengagement or diminished interaction metrics may signify problems with interface design or information clarity (Radianti et al., 2020).

RESEARCH METHODOLOGY

Research Design

This study employed a quantitative research methodology to investigate the impact of immersive Virtual Reality (VR) experiences on visitor engagement in a botanical garden context. This method facilitates an objective and quantifiable evaluation of visitor reactions, providing significant insights into the application of developing technology to improve public engagement in natural and educational settings. It also offers dependable data that can guide the future development of digital technologies in environmental education and tourism experiences.

Taman Botani Negara Shah Alam, situated in Selangor, was chosen as the research location because of its abundant biodiversity and its function as an educational and recreational area. As one of Malaysia's largest botanical gardens, it encompasses many themed landscapes, extensive plant collections, and interpretive paths, rendering it exceptionally conducive for immersive virtual representation. The study examines the impact of immersive virtual reality on visitor engagement, in contrast to conventional garden visiting methods, focusing on factors such as attention, curiosity, enjoyment, and perceived learning.

Objective 1: Development of an Immersive Virtual Reality Experience

To accomplish the first purpose, an immersive Virtual Reality (VR) experience was created utilizing 360-degree video technology to replicate the distinctive environmental and educational attributes of Taman Botani Negara Shah Alam. The objective was to furnish visitors with an interactive, captivating, and educational digital experience of the garden's principal features, thereby augmenting their sense of presence

and connection through immersive technology.

Site Selection

The chosen sites showcased in the VR video are the Laman Rempah Ratus (Herbal and Spice Garden) and Taman Haiwan (Animal Park). These two regions were selected for their educational significance, biodiversity, and attractiveness to visitors. Laman Rempah Ratus exhibits a diverse assortment of indigenous herbs and spices frequently utilized in culinary, medicinal, and cultural applications in Malaysia. This region provides a profound sensory and cultural experience, rendering it suitable for virtual interpretation. The Zoo showcases small animals, including deer, birds, and domesticated species, facilitating environmental education and emotional connection, particularly for younger audiences.

Equipment and Filming Technique

A camera 360 was employed to acquire high-resolution panoramic imagery of these locations. The camera was affixed to a tripod to emulate a typical visitor viewpoint. The first-person perspective amplifies the immersive experience, enabling viewers to feel as though they are traversing the garden and seeing its aspects in real time (Radianti et al., 2020).

Video Editing and Post-Production

The captured footage was edited utilizing Insta360 Studio for stitching, color correction, stabilization, and scene transitions. Background audio from the garden, including avian vocalizations and ambient natural sounds, was retained to ensure environmental realism. Supplementary voice-over narration and subtle background music were incorporated to direct the viewer's focus and amplify emotional involvement.

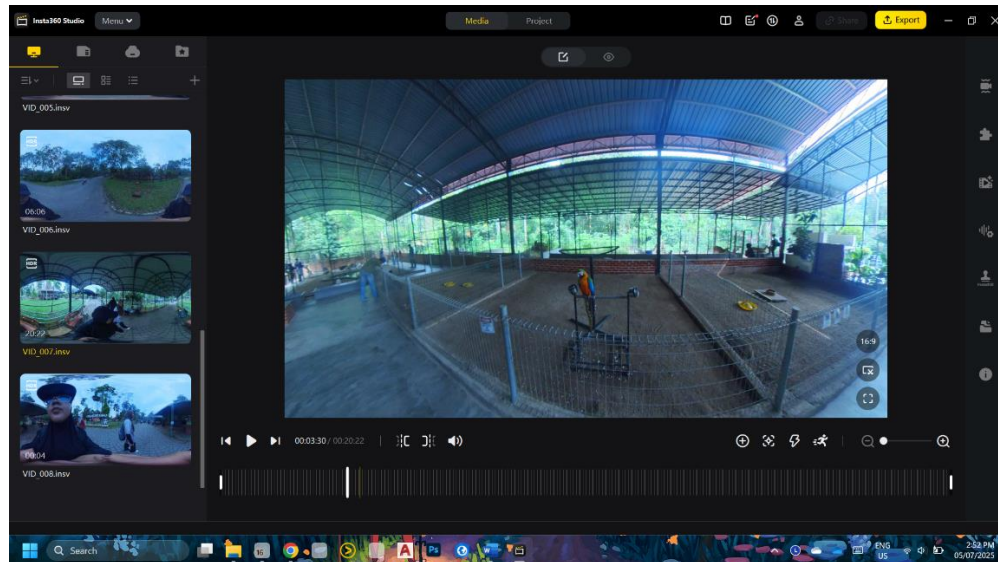


Figure 1 : Edit video in Insta360 Studio

Content Design and Educational Stratification

Narration and text overlays were incorporated into the VR content to provide information on plant species in Laman Rempah Ratus and animals in Taman Haiwan. These aspects emphasized their nomenclature, applications, ecological roles, and cultural importance. Subtitles and concise descriptions were delivered in an approachable and comprehensible manner to engage a general audience, fostering curiosity and

education (Markowitz et al., 2018). Efforts were made to guarantee that the content adheres to interpretative and environmental education standards.

Exportation and Virtual Reality Integration

The completed 360-degree film was exported in a format suitable for the VR headset. The VR content was downloaded onto the headset and evaluated for video fluidity, navigational ease, and user comfort. Participants received fundamental directions to guarantee the safe and successful use of the equipment.

The VR experience constituted the primary material for the experimental group in the quasi-experimental investigation. The study offers a significant and quantifiable framework for evaluating the impact of immersive technology on visitor engagement in nature-based settings by virtually showcasing specific sites such as Laman Rempah Ratus and Taman Haiwan.



Figure 2 : 360 Video in VR Headset

Objective 2: Evaluation of Visitor Engagement with Immersive VR

This study employed a quasi-experimental approach with an experimental group and a control group to assess the efficacy of the generated immersive Virtual Reality (VR) experience. The objective was to evaluate and contrast visitor engagement levels at Taman Botani Negara Shah Alam through various modalities—virtual reality versus conventional methods—utilizing a quantitative survey.

Participant Groups and Setting

The experimental group comprised visitors who underwent a 3-minute 360-degree immersive virtual reality tour of certain areas inside the garden, specifically Laman Rempah Ratus and Taman Haiwan, utilising the VR headset. This group engaged exclusively with the virtual environment and did not do a physical tour of the garden throughout the session.

Conversely, the control group engaged with the garden using conventional methods, including in-person walking tours, static imagery, and recorded recordings of identical spots. Both groups were provided with

equivalent content and information to guarantee uniform exposure, with the sole change being the method of delivery.



Figure 3 : Visitor Using The VR

Data Collection Procedure

Upon concluding their separate experiences, participants from both groups were instructed to fill out a structured questionnaire aimed at assessing involvement during the experiences and their application.

A 5-point Likert scale was employed for each topic (1 = Strongly Disagree, 5 = Strongly Agree). This instrument was modified from earlier VR engagement studies and tailored for applicability in environmental education contexts (Pimentel et al., 2020; Hartmann et al., 2021).

Visitor Experiences (Without Virtual Reality)

Section A : Demographic

This part gathered demographic information, encompassing age, gender, and prior trips to Taman Botani Negara Shah Alam. These details facilitated the identification of visitor patterns and bolstered the analysis of engagement levels among users using conventional approaches.

Section B : Visitor Experience

This section assessed visitor engagement during the traditional visit by focusing on the clarity and accessibility of information such as signboards and brochures. It also measured how well the garden's layout and signage supported navigation, learning, and appreciation of plant biodiversity and conservation. Overall satisfaction and intention to recommend the experience were included to evaluate the effectiveness of the garden's communication and design.

Visitor Experiences (With Virtual Reality)

Section A : Demographic

This section gathered demographic data including age, gender, and whether the participant had visited Taman Botani Negara Shah Alam before. It also asked if they had previous experience using Virtual Reality (VR). If yes, they were asked to specify the purpose—education, entertainment, or exploring natural environments.

Section B ; Visitor Experience

This section focused on evaluating user engagement with the VR experience. Items included perceptions of usability, clarity, immersion, and learning outcomes related to plant biodiversity and conservation. It also assessed whether the VR application enhanced exploration and if participants would recommend the experience to others.

Sampling Method

A purposive sampling strategy was employed to recruit participants, concentrating on persons willing to engage in a brief experimental session and complete the questionnaire. Fifteen respondents participated, evenly distributed between the two groups, consistent with previous research employing small, targeted samples to evaluate VR in real-world contexts (Saini et al., 2022; Mütterlein, 2018).

Data Analysis Using SPSS

The raw data obtained from the post-experience questionnaire were initially coded and structured in Microsoft Excel to enable precise data cleaning and processing. Each comment received a numerical designation aligned with the 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). This coding process facilitated the discovery of critical engagement characteristics, including perceived usability, involvement, emotional response, learning, spatial awareness, and intent to recommend the VR experience.

Upon verifying the dataset's completeness and absence of errors, it was subsequently imported into SPSS (Statistical Package for the Social Sciences) for statistical analysis. The objective was to assess if the immersive VR experience significantly influenced visitor engagement in comparison to conventional garden visits.

The study utilized an Independent Samples t-Test to compare the means of two independent groups.

- the experimental group (participants who engaged with the garden via immersive virtual reality utilizing the Pico 4 headset), and
- The control group consists of participants who interacted with the garden via physical visits and conventional media.

The Independent Samples t-Test facilitated the detection of statistically significant disparities in engagement scores between the two groups. The significance level was established at $p < 0.05$. This assessment elucidated the effects of immersive virtual reality on multiple dimensions of visitor engagement, including emotional involvement, cognitive acquisition, and overall satisfaction.

The quantitative comparison of these two groups provided a more profound insight into the impact of immersive technology on visitor experiences within environmental education settings. The results support evidence-based recommendations for the future incorporation of virtual reality in the understanding of botanical and natural heritage.

RESULT AND DISCUSSION

Demographics Information

Table 1 defines the demographic profile of respondents, providing a comprehensive picture of the

participants in the study about visitor experience without virtual reality at Taman Botani Negara Shah Alam. The gender makeup exhibits a rather balanced distribution, with 53.33% of participants identifying as female and 46.67% as male. This equitable representation ensures that the findings accurately reflect both male and female perspectives, devoid of substantial gender bias.

The data reveals that the predominant age group among respondents is rather youthful. The predominant age group is individuals aged 18 to 24 years, constituting 40% of the sample. Subsequently, 26.67% of participants belong to the 25 to 34 age demographics, indicating that two-thirds (66.67%) are under the age of 35. This indicates that younger individuals constitute the primary demographic of interest for the study, potentially reflecting the park's attraction to students and young adults, or it may be affected by the sampling methodology.

Additionally, Table 1 indicates that 53.33% of respondents have previously visited Taman Botani Negara Shah Alam, whilst 46.67% have not. The equilibrium between first-time and returning visitors is significant, as it offers a comprehensive understanding of visitor expectations and experiences. Previous visitors can provide insights derived from their experiences and comparisons, whereas non-visitors contribute novel perspectives based entirely on their pre-visit perceptions.

Table 1 : Demographics Information of Taman Botani Negara Shah Alam For Visitor Experience Without Virtual Reality

Variables	Items	Frequency	%
Gender	Male	7	46.67
	Female	8	53.33
Age	18 – 24	6	40
	25 – 34	4	26.67
	35 – 44	2	13.33
	45 – 54	2	13.33
	55 – 64	1	6.67
Visited	Yes	8	53.33
	No	7	46.67

Table 2 shows the demographic features of respondents who engaged with Taman Botani Negara Shah Alam through virtual reality. The gender distribution is relatively equitable, with 53.3% female and 46.7% male participants, indicating approximately equal participation of both sexes. The majority of respondents are aged 25–34 and 35–44, each comprising 33.3% of the sample, followed by 20% in the 18–24 category. This distribution suggests a transition towards a more elderly demographic relative to the non-VR group, implying that virtual reality may attract somewhat older patrons. Individuals aged 45–54 and 55–64 are underrepresented, each constituting 6.7% of the sample.

Concerning attendance history, 66.7% of participants had previously frequented the park, whilst 33.3% had not, signifying a greater familiarity with the venue among this cohort. The research indicates that 53.3% of respondents have utilized virtual reality, whereas 46.7% have not, reflecting a modest degree of VR exposure. Upon analyzing the utilization of virtual reality, 60% indicated its application for gaming or entertainment, 40% for experiencing nature, and 33.3% for educational or learning objectives. These

findings indicate that although VR is mostly perceived as an entertainment medium, it also possesses significance for immersive, nature-oriented, and educational experiences. Table 2 indicates a sample that is comparatively diversified in age and usage habits, demonstrating a significant interest in the experiential and recreational capabilities of virtual reality technology.

Table 2 : Demographics Information of Taman Botani Negara Shah Alam For Visitor Experience With Virtual Reality

Variables	Items	Frequency	%
Gender	Male	7	46.7
	Female	8	53.3
Age	18 – 24	3	20
	25 – 34	5	33.3
	35 – 44	5	33.3
	45 – 54	1	6.7
	55 – 64	1	6.7
Visited	Yes	10	66.7
	No	5	33.3
Virtual Reality Used	Yes	8	53.3
	No	7	46.7
Purpose of Virtual reality	For education or learning	5	33.3
	For gaming or entertainment	9	60
	To experience natural	6	40

Descriptive and Inferential Analysis

The descriptive statistics reveal the general trends in how respondents rated their experiences across the two conditions. The results are summarized in the table below:

Table 3 : Group Statistic

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Q1	With VR	15	3.1333	1.30201	.33618
	Without VR	15	3.3333	1.34519	.34733
Q2	With VR	15	2.8667	1.59762	.41250
	Without VR	15	3.6667	1.23443	.31873
Q3	With VR	15	3.3333	1.44749	.37374
	Without VR	15	3.1333	1.40746	.36341
Q4	With VR	15	3.6667	1.11270	.28730
	Without VR	15	3.8000	1.08233	.27946
Q5	With VR	15	2.8667	1.64172	.42389
	Without VR	15	3.4667	1.12546	.29059
Q6	With VR	15	3.6667	1.23443	.31873
	Without VR	15	3.0000	1.41421	.36515
Q7	With VR	15	4.5333	.63994	.16523
	Without VR	15	3.6667	.89974	.23231

From the descriptive data, several key patterns emerge regarding the comparison between the two groups. For questions Q2, Q4, and Q5, the group that experienced the environment without Virtual Reality (VR) scored higher, suggesting that certain elements of the conventional experience may have been perceived more positively by participants. In contrast, the "With VR" group recorded higher mean scores for Q3, Q6, and most notably Q7. Among all the items, Q7 showed the largest difference in mean scores, with the "With VR" group scoring 4.53 compared to 3.67 in the "Without VR" group. This was also the highest individual score across all responses, indicating a particularly strong positive reaction to the VR experience for this item.

Inferential Statistics: Independent Samples T-Test

The results of the independent samples t-test are illustrated in the table that follows, which also includes the mean scores for each of the groups. The statistical significance criterion of $p < 0.05$ was employed to ascertain whether the differences observed between the two groups were deemed to be statistically significant

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						One-Sided p	Two-Sided p			Lower	Upper
Q1	Equal variances assumed	.020	.888	-.414	28	.341	.682	-.20000	.48337	-1.19015	.79015
	Equal variances not assumed			-.414	27.970	.341	.682	-.20000	.48337	-1.19019	.79019
Q2	Equal variances assumed	1.755	.196	-1.535	28	.068	.136	-.80000	.52129	-1.86782	.26782
	Equal variances not assumed			-1.535	26.324	.068	.137	-.80000	.52129	-1.87089	.27089
Q3	Equal variances assumed	.185	.671	.384	28	.352	.704	.20000	.52129	-.86782	1.26782
	Equal variances not assumed			.384	27.978	.352	.704	.20000	.52129	-.86786	1.26786
Q4	Equal variances assumed	.007	.934	-.333	28	.371	.742	-.13333	.40079	-.95432	.68765
	Equal variances not assumed			-.333	27.979	.371	.742	-.13333	.40079	-.95435	.68768
Q5	Equal variances assumed	6.487	.017	-1.167	28	.126	.253	-.60000	.51393	-1.65274	.45274
	Equal variances not assumed			-1.167	24.778	.127	.254	-.60000	.51393	-1.65894	.45894
Q6	Equal variances assumed	.350	.559	1.375	28	.090	.180	.66667	.48469	-.32617	1.65950
	Equal variances not assumed			1.375	27.498	.090	.180	.66667	.48469	-.32699	1.66032
Q7	Equal variances assumed	2.114	.157	3.040	28	.003	.005	.86667	.28508	.28271	1.45062
	Equal variances not assumed			3.040	25.278	.003	.005	.86667	.28508	.27986	1.45347

Table 4 : Independent Samples T-Test

Table 4 indicates that only Q7 exhibited a statistically significant difference between the two groups ($p = 0.005$), with the "With VR" group achieving substantially higher scores. This outcome indicates that the VR experience significantly influenced the perception or satisfaction assessed by Q7. For the remaining inquiries (Q1–Q6), the p-values exceeded 0.05, signifying no statistically significant difference between the groups for those items. Although certain mean differences were noted (e.g., Q2 and Q6), they lacked statistical significance.

Interpretation and Analysis

The study reveals a statistically significant result in Q7, indicating a substantial variation in visitor perception between the two groups. The "With VR" group achieved a mean score of 4.53, whereas the "Without VR" group scored 3.67, with a p-value of 0.005, indicating that the VR experience significantly enhanced participants' reactions to that item. The precise language of Q7 is unavailable; nonetheless, it can

be extrapolated that it pertains to an element of the experience significantly augmented by immersive technology, such as engagement, realism, comprehension, or emotional resonance. This result indicates that VR is particularly efficacious when utilized in areas that gain from visual or interactive simulation.

Conversely, the outcomes for Q1 to Q6 did not achieve statistical significance, but some still preferred the VR group. For instance, Q6 exhibited a comparatively elevated mean score in the VR group (3.67) against the non-VR group (3.00), suggesting a tendency of favorable reception that lacked statistical validation, potentially due to constraints in sample size. Conversely, in Q2 and Q5, the "Without VR" group had superior performance, indicating that traditional experiences may retain advantages in some settings, potentially linked to simplicity, familiarity, or clarity of information. Although not all facets of the experience were profoundly impacted by VR, the data reveals a distinct and quantifiable benefit in at least one critical domain, reinforcing the notion that VR may substantially enhance visitor engagement when conceived and executed with care.

Visual Insights: Bar Chart Summary



Figure 1 : Comparison of Mean Scores : With Virtual reality and Without Virtual Reality

The bar chart provides a visual summary that corroborates the numerical results from the descriptive and inferential analysis. It offers a distinct comparison of mean scores between the "With VR" and "Without VR" groups for all seven questions. The most visually notable observation is the considerable rise in the mean score for Q7 in the "With VR" group, which is markedly superior to that of the "Without VR" group. This stark difference visually reflects the statistical finding that identified Q7 as the sole statistically distinct item. In contrast, the bars for the other questions exhibit similar heights, suggesting only slight discrepancies in perception between the two groups for those items. In many instances, such as Q2 and Q5, the "Without VR" group achieved marginally higher scores; nonetheless, the discrepancies were tiny and visually negligible. The figure clearly demonstrates that, although most items had mild variations, the

influence of VR was particularly significant in Q7, corroborating the assertion that Virtual Reality had a distinct and quantifiable positive effect on that specific aspect of the tourist experience.

CONCLUSION

Ultimately, this study highlights the influence of Virtual Reality (VR) as a meaningful factor in enhancing visitor experience. While traditional landscape elements and exhibits still play a role, the statistical analysis revealed that VR technology significantly improved visitor perception, particularly in areas related to immersion and emotional engagement. The notable difference found in Q7 suggests that VR does more than simply replicate reality — it creates a deeper, more memorable experience. Although other aspects showed no significant differences, the overall trend leaned toward a more positive response with VR. These findings suggest that VR enhances not only visual engagement but also cognitive and emotional satisfaction. such,VR should be considered a strategic component in future visitor experience design, offering value that extends beyond physical exhibits.

REFERENCES

- Ahmad, A., & Ariffin, A. (2021). *Digital transformation in Malaysian ecotourism: Challenges and opportunities*. *Journal of Tourism and Environment*, 12(3), 45–58.
- Alhalabi, W., Alshammari, A., & Alharthi, R. (2021). Enhancing learning outcomes using VR-based environments in botanical settings. *International Journal of Emerging Technologies in Learning (iJET)*, 16(2), 112–120.
- Aziz, N. A., Salleh, N. H. M., & Yusof, N. A. (2020). Interpreting ecotourism for millennials: A study on signage and static communication tools. *Malaysian Journal of Sustainable Tourism*, 9(1), 22–30.
- Baceviciute, S., Maskeliunas, R., & Damaševičius, R. (2022). Immersion and emotional engagement in virtual environments: A cognitive perspective. *Computers in Human Behavior Reports*, 6, 100–112.
- Falk, J. H., & Dierking, L. D. (2016). *The museum experience revisited*. Routledge.
- Hartmann, T., Wirth, W., & Schramm, H. (2021). Testing engagement in immersive virtual environments: Development of a standardized instrument. *Media Psychology*, 24(1), 67–88.
- Jensen, L., & Konradsen, F. (2018). A review of the use of virtual reality head-mounted displays in education and training. *Education and Information Technologies*, 23(4), 1515–1529.
- Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2020). Adding immersive virtual reality to a science lab simulation causes more presence but less learning. *Learning and Instruction*, 60, 225–236.
- Marques, M., & Pombo, L. (2021). The impact of VR on learning natural sciences: Evidence from middle school students. *Education and Information Technologies*, 26(5), 5641–5661.

- Markowitz, D. M., Laha, R., Perone, B. P., Pea, R. D., & Bailenson, J. N. (2018). Immersive virtual reality field trips facilitate learning about climate change. *Frontiers in Psychology*, 9, 2364.
- Mütterlein, J. (2018). The three pillars of virtual reality? Investigating the roles of immersion, presence, and interactivity. *International Journal of Human–Computer Interaction*, 34(9), 908–918.
- Norazah, M. S., Abdullah, N., & Ibrahim, S. (2022). Visitor satisfaction in urban green parks: A study on Taman Botani Negara Shah Alam. *Journal of Urban Ecology*, 6(1), 1–10.
- Parmaxi, A. (2020). Virtual reality as a tool for environmental interpretation: A systematic review. *Journal of Environmental Education Research*, 26(4), 545–562.
- Pimentel, J., Ribeiro, A., & da Silva, F. (2020). User engagement and learning effectiveness of VR educational apps: A framework for evaluation. *Interactive Learning Environments*, 28(6), 734–749.
- Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778.
- Saini, R., Aggarwal, A., & Kapoor, A. (2022). Small-sample experimental studies in virtual environments: Design implications and challenges. *Virtual Reality & Intelligent Hardware*, 4(3), 245–258.
- Suh, A., & Prophet, J. (2018). The role of immersive media in enhancing visitor engagement: A study of virtual reality in botanical environments. *Tourism Management Perspectives*, 28, 133–144.
- Wang, Y., Li, M., & Huang, H. (2023). Co-presence and social learning in virtual natural environments: Impacts on knowledge sharing and engagement. *Virtual Reality*, 27(1), 85–102.
- Wojciechowski, R., & Cellary, W. (2013). Evaluation of learners' attitude toward learning in AR and VR environments. *Computers & Education*, 68, 570–585.