Strengthening visitor engagement at innovation and technology exhibitions through VR-Ethnosport

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ABSTRACT: Innovation and technology exhibitions represent a method to disseminate scientific research findings to society. This research explores the application of a virtual reality program, VR-Ethnosport, designed to enhance the attractiveness and drawing power of exhibitions. The application has been developed by sophomore students of the State University of Surabaya (UNESA), Indonesia, under the guidance of their teachers, to provide the students with a project-based learning experience culminating in a tangible product. The application integrates virtual reality with traditional sports, specifically bull racing, which is known as an interactive experience for visitors in the context of Indonesian culture. To evaluate the effectiveness of the application, the researchers collected feedback through questionnaires and brief interviews with attendees. The findings indicate that this application successfully stimulates enthusiasm and engagement among visitors, rendering the exhibition more impactful. Furthermore, the application effectively captures attention and enhances public understanding of a virtual environment's cultural and sporting aspects.

INTRODUCTION

Integrating innovation and technology in exhibitions is an exemplary method for disseminating scientific findings to society [1]. This current article is based on the innovation product exhibition with the theme *Innovating today, building tomorrow, creativity, and entrepreneurship for a suitable future* held in Surabaya, Indonesia [2][3]. The exhibition attracted participants as part of Konaspi XI (*Konvensi Nasional Pendidikan Indonesia*), a prestigious annual national education convention hosted by the State University of Surabaya (Universitas Negeri Surabaya), Surabaya, Indonesia (UNESA) [2]. In this article, the authors report on visitor participation at an exhibition focused on virtual reality (VR) applications in educational technology and sports training, known as the VR-Ethnosport project [4].

The project involved a collaboration between lecturers and students at UNESA. It aimed to achieve two primary objectives. Firstly, it provided a hands-on, project-based learning opportunity for sophomore students. By working on a real-world application, they could apply their theoretical knowledge to a tangible product, enhancing their practical skills and understanding. Secondly, for the exhibition visitors, the VR application served as a novel medium to explore and engage with the rich cultural heritage of bull racing. Through immersive virtual reality experiences, visitors had the chance to delve deeper into this traditional sport and gain a new perspective on its significance.

The VR application provides visitors with a live virtual experience. By merging virtual reality elements with traditional sports, this application creates an engaging and interactive environment that enhances visitors' understanding of the content. Users can explore and interact with the sport while practicing cultural elements, creating a dynamic and informative experience. These activities allow visitors to participate in a way that allows them to enhance their skills and cultural appreciation through the integration of the culture of the sport, which is not always offered by exhibitions. This exhibition became more educational and memorable event that increased the appreciation of global traditions [5][6]. Using technology is exciting for regular visitors as it offers digital interaction, bridging the difference between passive learning and participatory activity. With this different approach which enables visitors to interact with cultural content through the VR application - Ethnosport has the potential to make the exhibition more meaningful, build enthusiasm and arouse interest in the subject, which was previously not noticed.

LITERATURE REVIEW

Essential Tools and Requirements for VR Game Development

Virtual reality is an increasingly advanced technology in high demand within the gaming industry [6]. The appropriate tools are essential to producing high-quality VR games. Blender, Unity3D and Oculus are among the best choices for VR game development [7]. Blender is utilised to create high-quality 3D models and animations, and it can produce VR

interactions. Unity3D is a widely recognised and trusted platform for VR game development, offering a variety of features that facilitate the manufacturing process. Oculus is optimised for the best VR headsets available on the market, enhancing the VR game experience. It is noted that several requirements must be fulfilled for the application to function successfully, such as the necessary hardware that includes a personal computer equipped with a discrete graphics card, a minimum of 8GB of RAM, and either an 8th-generation Intel processor or a newer model or an AMD Ryzen processor. Additionally, the operating system must also be Microsoft Windows 8 or a later version [7][8].

Users must install several applications, including Blender, a highly versatile 3D modelling and animation tool, and Unity3D, essential for developing interactive games and applications. To enhance the immersive experience, users should also have access to Google Cardboard and Oculus Quest, enabling them to engage actively in virtual reality environments [7][9].

Existing Research on VR Applications in Traditional Sports

The main goal of the World Ethnosport Confederation (WEC) is to promote and endorse ethnosports [10]. The WEC is *an international organization dedicated to advancing and recognizing traditional sports and games globally* [10]. Several previous studies have explored the use of VR in cultural and sport events. For example, a study compared traditional and immersive video formats for assessing cricket with the conclusion that immersive videos significantly improved prediction accuracy, while the delivery style influenced the confidence levels [11]. Furthermore, VR can foster empathy and cross-cultural understanding by immersing users in virtual reconstructions of historical sites or cultural rituals [12]. Additionally, another study investigated the potential of VR in promoting traditional sports and games, and found that VR-based simulations could provide an accessible way for people to learn and participate in traditional sports [13].

DEVELOPMENT OF THE VR-ETHNOSPORT PROJECT

The VR-Ethnosport application presents an innovative virtual reality experience related to bull racing, known in Indonesia as *Kerrabhân Sapè* or *Karapan Sapi*. This application was developed as part of the Ethnophysics VR project (Figure 1). Traditional sports originating from Madura Indonesia are renowned for their rich cultural significance and the exciting competition between pairs of bulls racing in the field [14]. This virtual experience allows users to witness the speed, skill and teamwork demonstrated in the races, while providing educational information about the history and traditions of the sport. This application serves to preserve the cultural heritage. Its format makes it accessible to a global audience, offering an engaging way to appreciate and understand the unique aspects of this specific Indonesian culture.

Figure 1: Trademarks associated with VR-Ethnosport and VR-Ethnophysics projects.

In the middle of 2024, a collaborative effort between lecturers and students at UNESA led to the developing of a virtual reality (VR) application focused on *Karapan Sapi*, a traditional bull racing sport. This project served as a valuable learning experience for the students, allowing them to apply their knowledge to a real-world problem and create a tangible product. For visitors to the exhibition, the VR application offered an innovative way to explore and engage with *Karapan Sapi*'s cultural heritage, providing a unique and immersive experience. Students of UNESA developed the assets of VR-Ethnosport in May-July 2024 in the form of their final project assignment. Students played a role as asset creators. Under the guidance of lecturers, students were assigned a task to design and develop specific assets for the application as part of their final project assignment. The lecturers provided direction by defining the assets needed. In August, the lecturers, with assistance from senior students, finalised the application and code. Thus, the goals of the project were:

1. For students, the project aimed to provide sophomores with a project-based learning experience, enabling them to work on a real-world application that culminated in a tangible product.
2. For exhibition visitors, the application served as a new form of media, offering visitors an engaging experience to learn about and interact with the cultural heritage of bull racing through VR technology.

The study was focused on two questions and was conducted for direct examination of the following topics:

RQ1: How does the virtual reality - Ethnosport affect visitor engagement in exhibitions designed to promote the understanding and appreciation of traditional sports, specifically bull racing?
RQ2: What are visitors' perceptions and experiences regarding the virtual reality - Ethnosport during the exhibition event?

RESEARCH METHODS

This study employed a mixed methods approach, integrating both quantitative and qualitative techniques for data collection [15]. A structured questionnaire was administered to exhibition visitors to gather quantitative data regarding their level of engagement with the VR-Ethnosport application. Additionally, in-depth interviews were conducted with a selected cohort of participants to investigate their perceptions and experiences related to the VR application. By synthesising these two forms of data, this research aimed to provide a comprehensive analysis of the application's effectiveness in enhancing visitor engagement.

The exhibition ran for three days, from 8 to 10 October 2024. During this period, the VR application was showcased to a diverse audience primarily composed of lecturers and educators from various institutions across Indonesia (Figure 2).

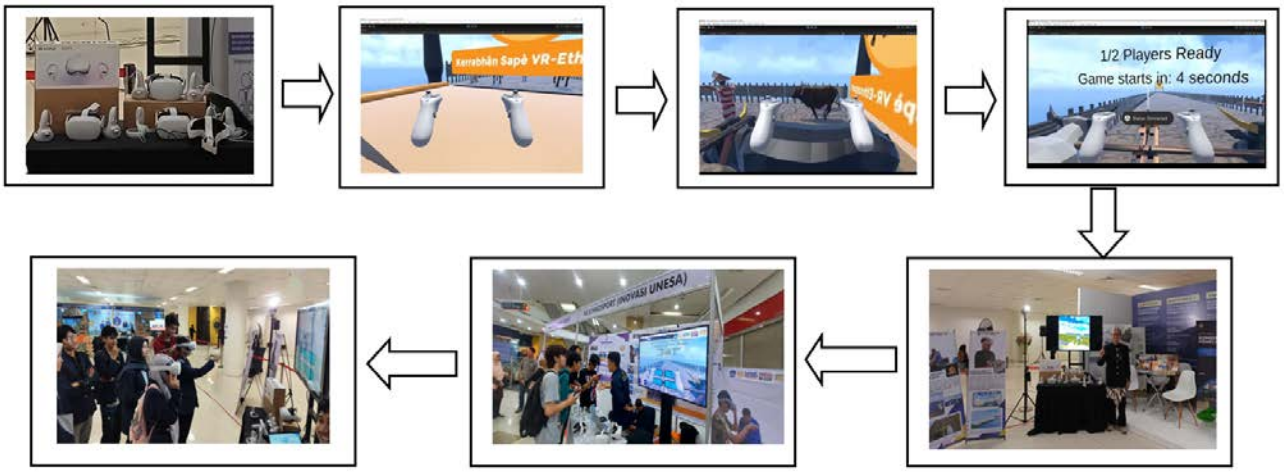

Figure 2: Illustration of the use of VR-Ethnosport and its application during the exhibition.

The exhibition attracted participants as part of Konaspi XI (*Konvensi Nasional Pendidikan Indonesia*), a prestigious annual national education convention hosted by UNESA. The event, inaugurated by the Indonesian President, drew significant attention from academics, educators, policymakers and cultural enthusiasts nationwide. This high-profile setting created an ideal platform to showcase the exhibition, leveraging the event's prominence to engage attendees interested in education, culture and technology.

Although an exact count of visitors specifically to the VR application's booth was not done, the overall Konaspi XI UNESA event attracted a substantial audience. According to the article published on the UNESA Web site [2], the total number of participants reached 4,450 from UNESA and 2,559 from outside UNESA, amounting to 7,009 attendees. One hundred twenty of them filled out a questionnaire, and ten were chosen for interviews. These ten participants were randomly selected and given codes like Participant 1, Participant 2, and so on. The analysis of the quantitative data concentrated on the mean and standard deviation derived from a Likert scale ranging from 1 to 5.

The VR-Ethnosport application uses the concept of uniform and non-uniform linear motion (Figure 3). Players are expected to answer questions to control the movement of the bull [16]. It should be noted that correct answers are given a certain score, such as +1 or +2, causing the bull to move forward. Meanwhile, no answer results in a score of zero, causing the bull to remain still. Conversely, incorrect answers receive a negative score, such as -1 or -2, causing the bull to move backward.

Figure 3: VR view - Ethnosport.

RESULTS AND DISCUSSION

Impact of the VR-Ethnosport Application on Visitor Engagement at Exhibitions

The value of Kaiser-Meyer-Olkin's (KMO) of the questionnaire item is 0.876 and the Bartlett test indicated significant findings for further analysis. The variance explanation of the scale is 65.57% and the overall Cronbach alpha for the reliability of the instrument is 0.924, indicating high reliability. The findings of this study indicate that using the VR-Ethnosport application significantly increased visitor engagement with the traditional sport of bull racing, with an overall mean of 4.48 (SD = 0.24) ranging from 4.12 to 4.74 on a ten-item scale.

Many participants noted that the immersive nature of the VR experience deepened their understanding of the cultural and historical background of the sport. Those who were not familiar with bull racing appreciated how the virtual environment brought the dynamics of the race to life, allowing them to understand better the skills and teamwork required by the bull and jockey. As a result, visitors felt a greater appreciation for the sport, with some expressing admiration for the community's efforts to preserve the tradition. Table 1 includes the ten items used for visitor testing.

Table 1: Visitor engagement - questionnaire items.

No	Items	Means	SD
1	I feel involved when using the VR-Ethnosport application.	4.45	0.24
2	VR experience makes learning about *bull racing* fun.	4.32	0.11
3	I understand the importance of the *bull racing culture* through this application.	4.12	0.34
4	This application helps me learn about the rules of *bull racing*.	4.55	0.18
5	I can remember important facts about *bull racing* after using the VR application.	4.34	0.27
6	The VR experience enhanced my appreciation for traditional sports like *bull racing*.	4.65	0.34
7	I feel more interested in learning about other traditional Indonesian sports.	4.74	0.27
8	The features of this application are easy to use and understand.	4.65	0.18
9	The visuals and interactivity of the VR application enhanced my learning experience.	4.45	0.23
10	I would recommend the VR-Ethnosport application to others to learn about *bull racing*.	4.51	0.22
	Overall	4.48	0.24

The following part presents a selection of visitor responses regarding the impact of the VR Ethnosport application during the exhibition, as gathered through qualitative interviews:

The VR application - Ethnosport helped me better understand traditional sports, such as bull racing, because it gives me a chance to directly experience racing, which increases the value of this culture. (Participant 1)

By interacting with the virtual reality version of bull racing, I better understand the skills involved in the race and feel more connected to the tradition. (Participant 3)

Through the VR experience, I can better appreciate the importance of bull racing in Madurese culture, especially the collaboration between the jockey and the bull. (Participant 7)

The VR simulation of bull racing gave me an engaging and informative way to learn about this tradition, making it accessible even to someone unfamiliar with the sport. (Participant 10)

Exhibition Visitors' Perceptions Regarding the VR-Ethnosport Application

The majority of the visitors found the VR-Ethnosport application to be very interactive and engaging. Many respondents highlighted that the opportunity to virtually *participate* in the bull racing sport helped them create a personal connection with the event, making it feel more like an experience than an exhibition. This interactive aspect was particularly appealing to younger visitors, who are more likely to engage with technology [17].

Some participants also suggested further enhancements by including more detailed commentary or additional interactive features. Nevertheless, the overall feedback was very positive, with visitors appreciating how the VR application not only engaged them, but also brought them closer to Madurese culture, offering a new way to experience and learn about this unique sport. The data showed that 65% of the visitors were using the VR application for the first time, while 35% had previous experience with VR technology.

The VR-Ethnosport application provides a unique interactive experience, allowing users to immerse themselves in bull racing through immersive and hands-on features. As mentioned, the feedback on the user experience was largely positive, with many users praising its intuitive design, smooth operation and overall user-friendliness. From an educational perspective, the application successfully provides insights into bull racing in an informative and engaging manner. Users confirmed that the VR-Ethnosport application was significantly more engaging and transformative than traditional exhibition formats, such as static displays or videos, thereby enhancing their understanding and engagement with this traditional sport. Figure 4 demonstrates the visitors' high appreciation of various aspects of the application.

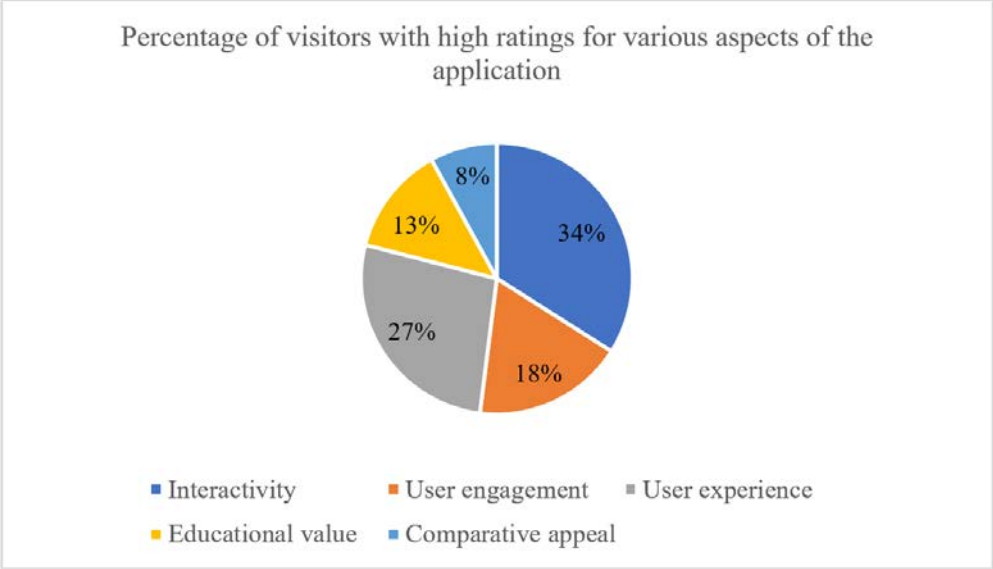

Figure 4: Visitors' perception - high ratings for various aspects of the application.

According to the visitors, the VR-Ethnosport application was most appreciated because of its interactive characteristics, with 34% of the respondents emphasising this aspect. It shows that the direct application plays a significant role in increasing user engagement. User experience also received substantial attention, with 27% of the visitors expressing satisfaction with the application's design, functionality and responsiveness. Engagement, accounting for 18% of the responses, reflects the level of immersion and sustained interest the application provides. In regard to learning, 13% of the visitors appreciated the educational aspect, noting the effectiveness of the application in conveying information about the bull racing. Finally, 8% of the responses pointed to comparative appeal, where the application was preferred over traditional exhibition formats, such as static displays or videos. These results indicate that while all aspects are appreciated, interactivity and user experience are the main drivers of the application's success in the exhibition. Below are included some comments from visitors to the exhibition regarding their experience with the VR-Ethnosport application:

I found the VR experience engaging and interactive, making the exhibition feel more dynamic and fun than traditional displays. (Participant 2)

The VR application, Ethnosport, enhances the interactivity of exhibitions by allowing users to engage with the experience directly. This engagement transforms the experience from a passive observation to an active contribution. (Participant 5)

A virtual reality (VR) headset enhances my connection with the content; this transformation shifts the exhibition from a passive activity to an engaging experience. (Participant 7)

The VR-Ethnosport application introduced an innovative dimension to the exhibition, transforming it into an experience that is not only educational but also engaging and memorable. (Participant 3)

The exhibition enhanced its vibrancy and engagement, fostering a sense of active participation rather than mere observation. (Participant 6)

VR-Ethnosport significantly enhances visitor engagement with traditional sports, mainly the frequently practiced sport of bull racing. This immersive experience deepens users' understanding and appreciation of the cultural and historical significance of the sport. Visitors, especially those unfamiliar with bull racing, note that the virtual environment vividly brings the race to life, allowing them to comprehend better the skills and efforts involved. Direct interaction fosters a closer relationship with the tradition, and many participants admire the public's efforts to maintain its sustainability. Furthermore, this application is highly valued for its interactive characteristics, transforming the exhibition from a passive experience into an engaging and participatory one [18].

Younger visitors find VR technology very appealing, and many recommend its use. Additionally, incorporating more detailed commentary could further enhance their experience. Overall, this application captures visitors' attention and provides a unique method for engaging with, and appreciating the heritage of, Madurese culture.

Although the VR application demonstrates positive results in increasing visitor engagement and understanding of bull racing, several vital limitations require attention. This research primarily focused on specific visitor groups, which may only represent a small segment of a broader audience. Furthermore, while suggestions for enhancements - such as adding comments - have been proposed, the impact of these improvements necessitates further exploration. Future research may include:

- a more diverse group of visitors to test the application;
- implementation of the recommended features (this is currently underway);
- assessment of these features' impact on user experience.

Further studies can also investigate the impact of long term involvement and explore how virtual reality can be integrated into the exhibition culture. This integration may facilitate the development of more profound and more sustainable relationships with cultural legacies.

CONCLUSIONS

The VR application effectively enhances visitors' interest and understanding of the bull racing through an interactive and immersive experience. This platform allows participants to connect with the race, thereby increasing their appreciation for its cultural significance and the associated effort. Many visitors find this technology engaging, transforming the exhibition into an enjoyable activity. While there are suggestions for improvements, such as incorporating a feedback mechanism, the overall response remains positive. It demonstrates that virtual reality technology can make cultural heritage more accessible and engaging for diverse audiences.

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