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Beyond Boundaries - The Feasibility of Virtual Reality Technology for Design Exhibition Events

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ABSTRACT

The shift toward digitalisation accelerated the usage of online exhibitions; however, flat-screen platforms are still constrained in terms of spatial experience, interactivity, and social presence, all of which are required in industrial design education. This study addresses the lack of experiential quality in conventional online exhibitions and seeks to establish essential criteria for improving virtual exhibitions through virtual reality (VR), with a focus on realistic graphics, interactivity, and hardware accessibility. A qualitative case study was undertaken on a pilot virtual reality exhibition created by final-year industrial design students at a Malaysian university. Data were gathered through semi-structured interviews with ten participants, including designers and lecturers. The results show that realistic graphics promote design authenticity, interactivity improves engagement and assessment, and hardware dependency influences accessibility and user experience. These findings underscore the need of striking a balance between immersive design and technological inclusion. This study offers practical insights into creating effective and scalable VR display frameworks that support improved learning, evaluation, and remote collaboration in design education.

Keywords: Exhibition event, virtual reality exhibition, online exhibition, immersive experience, spatial experience

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INTRODUCTION

In these digital era, every sector or business has adapted their way of working with digitalisation take benefit from fast paced technological advancement. From emerging online business platform all the way to Artificial Intelligence (AI) applications which not limited to physical-only business models. The shift occurs eventually after the Covid-19 pandemic strikes which demands fast adaptation to accommodate current changes due to restriction and limitation.

To be specific, current exhibition scene also changed globally thanks to the increasing capabilities of personal computer hardware performance, alongside more advanced applications are now available for various purposes in general. Thus, the rise of online exhibitions emerges to solve the current flaws in existing physical exhibition which limits the visitors' experiences that requires them to visit the venue physically. However, the online exhibition which only depends on flatscreen restrict some core involvement by users which are, limited interactivity and social presence (Kayaalp, 2024).

However, online exhibition which relying on flatscreen interface such as 360 viewers, website and scrolling page often seem to be lack of spatial experiences. This desktop-based method only limits the user's control with mouse clicks, scrolling and arrow controls which user not physically move within the space and reducing the spatial perception and sense of presence.

Nevertheless, the recent improvement in virtual reality (VR) technology made the immersive experience even more possible. The popularity of VR devices is growing as devices become more realistic and less expensive. VR users can become fully immersed and engaged through multisensory experiences and reacting to user inputs, including spoken commands and hand gestures. This feature made the technology widely used in various areas, including therapy, model-making, and even video games (Wong et al., 2020). The known capabilities of VR such as immersive 3D object, interactive world, spatial navigation and multi-user interaction will enhance current use of flatscreen experiences limitation as stated before.

This research seeks to identify the crucial criteria required for conducting VR exhibitions to improve flat-screen experience with limited spatial interaction and engagement. While such platforms allow works to be displayed digitally, they often fail to replicate the experiential and spatial qualities that are important in design exhibitions. In fields such as industrial design, where the understanding of form, scale, and user interaction is essential, these limitations can reduce the effectiveness of the exhibition as a medium for communication, learning, and evaluation.

This study employs a qualitative case study approach to investigate the implementation of virtual reality (VR) in design exhibition and assessment within a real educational context (Yin, 2018). The study gathers useful insights about user interaction, evaluation procedures, and the effectiveness of immersive features by looking at a VR display created by final-year industrial design students. By going beyond theoretical or prototype-based investigations, this practical application demonstrates the uniqueness of the study and makes it possible to apply and assess the VRDEX framework

LITERATURE REVIEW

Transformation of Exhibition Practices Post-Pandemic

Conventional exhibition procedures were severely disturbed by the COVID-19 epidemic, which forced organizations, educational institutions, and the design sector to quickly switch from physical to digital media. This change was structural as well as technological, altering the way exhibitions are chosen, viewed, and assessed. Digital platforms proved significant limits in reproducing the spatial and experience aspects of physical displays, even while they allowed continuity during times of limited mobility.

According to recent studies, immersive engagement, spatial awareness, and interactive depth are necessary attribute for user experience and evaluation processes, clearly absent from online exhibitions, which are mainly presented through flat-screen interfaces (Radianti et al.,2020). These restrictions are more noticeable in design-related fields, especially industrial design, where precise perception of form, scale, materials, and ergonomics is crucial to the evaluation of products.

As a result, in addition to accelerate the adoption of alternative display technologies, the pandemic-driven digital transformation has exposed a crucial gap: traditional digital platforms' incompetence to offer the sensory and perceptual quality needed for design evaluation. As a result, there is growing interest in immersive technologies, especially virtual reality (VR), as a possible way to close this gap.

Digital and Virtual Exhibition Paradigms

Digitalisation and Online Exhibition Platforms

The digitization of exhibition techniques has resulted in increased accessibility, active involvement, and cost savings. Online platforms are especially appealing in educational and institutional contexts because they enable exhibitions to reach audiences worldwide without being limited by physical location. These platforms, however, are primarily screen-based, which makes for a passive viewing experience with little opportunity for user participation.

From a pedagogical standpoint, these settings limit embodied active participation. Immersion learning research indicates that when users can interact spatially and contextually with content instead of just watching it, meaningful knowledge creation takes place (Torrence, 2024). In the context of design exhibitions, this constraint impairs the evaluator's ability to effectively interpret product attributes, reducing the dependability of assessment results.

Figure 1. The interface of MIFF Furniverse website

Distinction Between Online and Virtual Exhibitions

The term “online exhibition” covers numerous simple web-based showcases that lack the structured interactivity of virtual exhibitions; yet virtual exhibitions may appear on the web but go beyond static online displays (Bilushchak et al., 2024). For example, Bonis et al. describe virtual exhibitions as dynamic environments where visitors navigate, observe exhibits, and in many cases interact with content, enabling richer engagement compared to simple online displays (Sylaiou et al., 2024).

All virtual exhibitions are considered online exhibitions, but not all online exhibitions are considered virtual exhibitions, as they offer a real-like simulation of the virtual world by using virtual reality devices (Pinandita & Nabila Shabiriani, 2021).

Accordingly, current literature highlights the need to identify the specific technological criteria, interaction features, and experiential attributes that enable virtual exhibitions to effectively simulate spatial presence and visitor engagement. These insights form the basis for examining VR technology features suitable for application in exhibition environments, as addressed in the first objective of this study. Despite advancements in digital exhibition platforms, limitations in spatial perception and interactivity highlight the need for immersive technologies such as virtual reality, particularly in design evaluation contexts

Theoretical Foundations of Virtual Reality in Design Evaluation

Realistic Visuals and Perceptual Fidelity

a. Visual Intensity versus Functional Realism

Although visual quality is frequently linked to VR environments' effectiveness, theoretical frameworks make a distinction between functional realism (perceptual usefulness) and visual intensity (sensory richness). According to Bowman and McMahan (2007), technological characteristics that affect sensory intensity include display resolution, tracking precision, and system responsiveness. However, a more meaningful user experience is not always connected with more visual detail.

Slater's theory of place illusion and plausibility offers a more sophisticated interpretation of virtual reality realism (Slater, 2009). According to this concept, the system's capacity to generate plausible interactions and logical spatial cues is more important for realistic behaviour in virtual worlds than graphical quality. This implies that functional realism which the way users perceive and react to their surroundings is more important than simply visual improvements.

This distinction is further supported by recent empirical research, which shows that while better texture resolution enhances perceived realism, geometric complexity does not always have a substantial impact on user perception, suggesting that realism is selectively created based on perceptual relevance.

b. Material, Texture, and Scale Perception in Design Evaluation

Perceptual consistency in evaluation contexts encompasses accurate representation of material attributes, surface textures, and size in addition to visual clarity. These components are necessary for consumers to properly evaluate the ergonomics, usability, and quality of products.

According to recent VR studies, perceived realism greatly affects user motivation, engagement, and cognitive processing while also lowering unnecessary cognitive load (Larmuseau, 2025). It also suggests that more effective understanding of design elements is made possible by precise visual depiction. However, improper texturing may influence perceived material quality, and inappropriate scale may mislead ergonomic judgment. Therefore, realistic visuals are essential elements that directly affect the validity of outcomes of evaluation in digital contexts, rather than only being cosmetic upgrades for industrial design displays.

Hardware Dependence and Experiential Inequality

Hardware accessibility has a big impact on VR's effectiveness because high-quality experiences need advanced gadgets like powerful computers and head-mounted displays. This leads to differences in the user experience, with those who own more expensive equipment experiencing greater clarity and immersion. According to research on VR inclusion, users are frequently excluded from these systems because of financial and technological limitations, which reflects larger problems of digital inequality (Radianti et al., 2020; van Deursen & van Dijk, 2019). These disparities raise questions regarding equality in educational settings since users' capacity to interact with and evaluate virtual environments effectively.

Next, VR integration in education must prioritize inclusivity and scalability to ensure equal accessibility for a wide range of users. While VR has been found to improve engagement and learning, its effectiveness is dependent on alignment with educational goals rather than technological complexity (Radianti et al., 2020). Hardware variations, ranging from mobile-based VR to high-end systems, result in changes in immersion and engagement, which may have an impact on learning outcomes. This emphasizes the necessity for adaptive, cross-platform solutions that can perform in a variety of technical environments (Parmaxi, 2020; van Deursen & van Dijk, 2019). Ensuring accessibility while maintaining functional quality is therefore essential to prevent widening existing inequalities in educational contexts.

Virtual Reality in Exhibition

The presence of a VR exhibition can unlatch new avenues for exploring new realities beyond the confines of space and time. VR exhibition has become a digital era identifier capable of adapting to the advanced technology. The broad reach of space and time eventually makes virtual exhibitions more engaging and fascinating for designers and viewers (Alhalabi, 2016). The visual and auditory created by the VR HMD produced an immersive user experience that mimics the real world

Furthermore, immersion in VR refers to the sensation of being physically present in an artificial environment, which absorbs the user via visuals, sound, and other stimuli. The elements that increase the rate of immersiveness include seamless surroundings, visual convincing, freedom of movement, physical interaction, physical feedback, narrative engagement, and 3D audio (Wigmore, 2016).

However, there is still a lack of an integrated framework that connects VR technological features with immersive exhibition experience, usability, and feasibility. Hence, this study further seeks to develop an immersive virtual design exhibition framework informed by literature and contextual case findings.

VRDEX – Industrial Design Assessment and Exhibition

The Virtual Reality Design Exhibition and Assessment (VRDEX) framework was created to improve the established distance learning mode specifically for industrial design courses that lack some attributes to make it more intriguing or engaging in delivering the output to the student (CODES Stream, 2021). Meanwhile online virtual platforms (OVP) such as Google Meet and Zoom which improving flat-screen learning experience is more suitable for theory-based learning compared to practical-based courses which demands a different approach as it comprises different program structures which need a comprehensive observation for the identified challenges (Cao et al., 2023).

Lack of real-time communication, passive proposal defence, and no immersive product pitching, make the method less practical for exhibition and assessment purposes. Thus, the framework is designed to leverage the current education approach with the capabilities of VR technology, benefiting from its immersive and interactivity attributes (Cao et al., 2023).

Specifically, VRDEX aims to:

i. Enhance visual realism to support accurate perception of design attributes

ii. Incorporate interactive elements to facilitate engagement and exploration

iii. Address hardware variability to ensure accessibility and fairness

Figure 2 explains the flow of a virtual exhibition module, starting from the preparation, management, assessment, and dissemination.

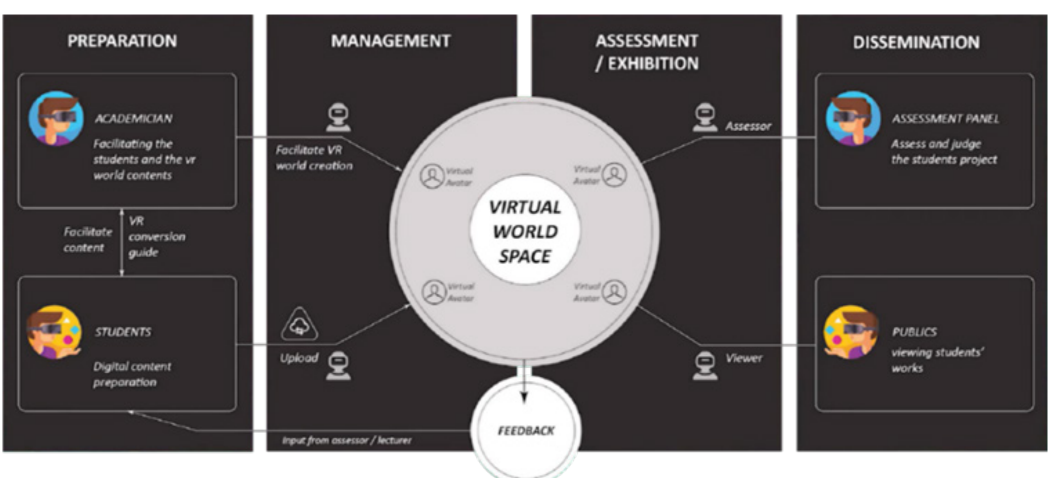

Figure 2. VRDEX Framework for virtual exhibition uses

METHODOLOGY

This study used a qualitative case study approach to investigate the design traits, experiential aspects, and implementation considerations of a virtual reality (VR) exhibition in an industrial design school setting. A qualitative approach was chosen because it provides for an in-depth study of participants' views, interpretations, and professional judgments on immersive exhibition spaces, particularly in relation to learning, assessment, and design communication (Creswell & Creswell, 2017).

The case study focused on a pilot VR exhibition created and implemented by a group of final-year industrial design students at a Malaysian university during a period of limited physical learning opportunities. The exhibition served as both a presenting platform and a test bed for the proposed VRDEX. By treating the VR display as a limited instance, the study was able to investigate how VR was designed, experienced, and evaluated inside a real educational setting, as opposed to a hypothetical or simulated implementation.

Data Collection Procedure

Data were collected through semi-structured interviews with key stakeholders who possessed relevant expertise in industrial design, digital exhibition practice, and design pedagogy. Semi-structured interviewing was chosen as it provides a balance between flexible dialogue and consistent thematic coverage across participants, allowing insights to emerge naturally while still addressing the core research objectives.

A total of ten participants were recruited using purposive sampling: five industry design practitioners and five industrial design lecturers from both public and private universities. These groups were selected because they are directly involved in design evaluation, project supervision, and exhibition-based presentation processes, making them well positioned to provide informed and experience-based perspectives. The sample size was considered appropriate for qualitative thematic research, where depth of insight is prioritised over numerical representation.

Figure 3. Participant experiencing VR exhibition during the interview session

Each interview session takes roughly 45 minutes. This duration was optimized to capture rich, qualitative insights without imposing undue burden on participants during the physical exhibition. All participants provided written informed permission prior to the session in accordance with institute's ethical committee protocol. Interviews were audio-recorded with the participants' permission to ensure an accurate record of the conversation. Figure 3 shows the data collection session with participants.

The interviews explored topics such as:

i. Impact of the COVID-19 Pandemic on Design

ii. Role of Exhibitions in Design Practice

iii. Current Adaptation of Technology in Exhibitions

iv. Experience with Virtual and Immersive Exhibitions

v. Key Design and Technical Elements of an Effective VR Exhibition

vi. Challenges and Limitations of Implementing VR Exhibitions

vii. Elements that enhance or weaken the exhibition experience

viii. Future Directions of Design Exhibitions

Interview data were analysed using thematic analysis in accordance with Braun and Clarke's six-phase process, which included data familiarization, generation of initial codes, organization of codes into potential themes, theme review and refinement, thematic category definition, and final synthesis of findings.

Coding and data organisation were supported using ATLAS.ti software, which enabled systematic grouping of statements, quotations, and emerging categories derived from; (i) interview transcripts, (ii) observations from the VR exhibition implementation and (iii) feedback during prototype engagement.

To improve the reliability and consistency of interpretation, triangulation was used to look for recurring patterns across many datasets. Throughout the study, both convergent and divergent perspectives were investigated, allowing the data to reflect agreement as well as tensions and uncertainty in participant responses.

VRDEX Framework Implementation

The pilot VR exhibition served not only as a test environment for exploring user experience, but also as a mechanism to evaluate the practicality of the VRDEX framework in a real instructional and assessment setting. Insights generated from participant reflections and observational feedback were subsequently used to refine the framework and identify key design criteria relevant to immersive virtual exhibition development. Figure 4 shows the step taken in developing the virtual exhibition.

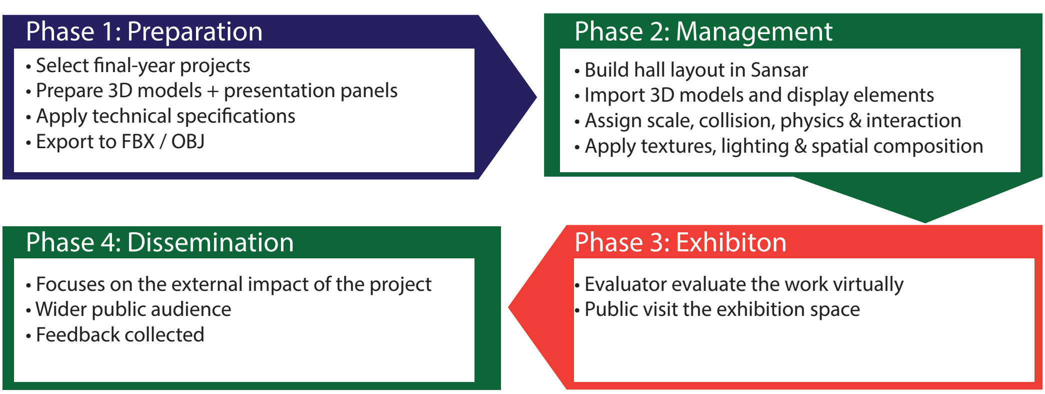

Figure 4. VRDEX-guided virtual exhibition development workflow

DISCUSSION

Criteria of Effective Immersive Virtual Reality Exhibition

The analysis highlighted three major elements that influenced participants' experiences at the VR exhibition: (i) Realistic Visuals, (ii) Interactivity, and (iii) Hardware Dependence. These themes were created through iterative coding of interview transcripts and then supplemented with observational notes and prototype interaction feedback.

Table 1 shows sample code and quote which contribute to the development of final themes.

Table 1
Sample codes and illustrative quotations supporting the identified themes

Theme	Codes	Quote
Realistic Visuals	Material & Texture Realism, Immersive Experience	"Realistic visual is crucial to convince people with what they see"
Interactivity	Object Inspection, Material Switching	"Options to change material in real-time with button clicks"
Hardware Dependence	Accessibility Option, Experience Variability	"Need to use optimum computer power to run smoothly"

Realistic Visuals

Participants consistently associated high-fidelity visual rendering and accurate material representation in the virtual exhibition. This aligns with VR studies that position visual realism as a key contributor to immersion and perceptual authenticity in three-dimensional environments. However, the findings extend this discussion by revealing that, for design experts in particular, realism was not merely an aesthetic feature but a professional authentication: accurate textures, scale, and detailing were act as indicators of design quality and reliable representation of student work.

> *"Experts can distinguish between wood textures, so the exact replication of the real wood used on the real object adds another level of immersion to the user in the digital space."* *(I2, T2)*

At the same time, this emphasis on visual fidelity introduces a potential trade-off. While realistic models enhanced interpretive clarity and material awareness, they also increased dependency on computational rendering capability and platform stability. This conflict is consistent with earlier criticisms that caution against associating immersion only with visual intensity because doing so could disadvantage those with limited access to high-end equipment while favouring technologically advanced users. Thus, realism highlighted issues of inclusivity, accessibility, and scalability in exhibition contexts while also enhancing experiential credibility.

These results imply that "visual realism" should be viewed as both a technical goal and an educational obligation, in which accuracy in form and content promotes design communication while still demanding practical compromise with platform and resource limitations.

Interactivity

The findings also highlight interactivity, particularly the ability to manipulate, inspect, and socially discuss artefact, as a central driver of perceived immersion. Participants reported emotional and cognitive engagement when interaction provided a sense of autonomy, confirming the idea that VR settings are most effective when users are active participants rather than passive observers. This reflects broader literature that associates interactivity with experiential depth, learning engagement, and affective presence in VR-based environments.

> *"I loved how we can touch the product in the virtual world. The interaction added really make me feel presence in that digital space. It is like I am in the game. Is it possible to at least feeling the object we touched in future?" (I4, T3)*

However, the data suggest a multifaceted understanding of interactivity. On the one hand, object interaction allowed consumers to evaluate products in a more dynamic manner than in traditional web shows, improving functional knowledge and design critique. Participants, on the other hand, expressed interest in future features such as haptic feedback, implying that VR embodiment continues to be limited when tactile sensation is simulated rather than experienced.

Social interactivity emerged as an important aspect of the exhibition experience, enabling instance debate and collaborative discovery. However, research also revealed conflicts between entertaining gamified interaction and professional exhibition etiquette, implying that curatorial and pedagogical framing are still necessary to prevent minimise formal assessment environments.

For VRDEX, these insights imply that interactivity should be treated as an intentional experiential strategy rather than a technological add-on. Interaction design must balance engagement, functional clarity, and academic formality, ensuring that immersive novelty enhances rather than distracts from learning and evaluation purposes.

Hardware Dependence

While realism and interactivity enhanced immersion, participants also acknowledged that these qualities were highly contingent on hardware capability. Users with VR-ready systems and high-performance head-mounted displays reported smoother rendering and stronger spatial presence, whereas others anticipated variability in experience due to differing device specifications.

This emphasizes the idea that immersion is not only a design outcome but a technologically mediated condition, shaped by processing power, graphics performance, and platform compatibility. The finding aligns with previous studies that caution against assuming uniform user experience in VR environments, particularly in educational or public exhibition settings where equipment access may vary widely.

> *"I think to achieve the exact same realistic visual really depends on the hardware. The VR HMD and VR-ready computer can render the graphics effectively. The visual experience might differ from one user to another due to the different hardware used." (I3, T4)*

Critically, this dependence on hardware introduces structural inequities: richer immersive engagement becomes available primarily to those with resource advantages. For a design education context, this raises ethical questions about fairness in assessment, participation, and exposure, especially when VR exhibitions function as platforms for academic evaluation and professional visibility.

Within the VRDEX framework, hardware specification should therefore be reframed as a design and policy consideration, not merely a technical necessity. Rather than assuming ideal technological conditions, future implementations could incorporate multi-tier access strategies (e.g., VR mode and desktop mode), helping mitigate experiential disparities while retaining immersive potential where available.

CONCLUSION

This study investigated the possibility of virtual reality (VR) technology as a platform for design exhibitions, with a focus on its experiential value, practical limits, and relevance to industrial design education. The findings demonstrate that VR displays can work as an immersive evaluation environment, with visual fidelity, interactivity, and spatial presence supporting deeper engagement with design outputs. Participants emphasized the relevance of material and texture realism, proper scale perception, and the capacity to modify items in the virtual realm, all of which contributed to a better sense of authenticity while examining student work.

At the same time, the study demonstrates that the practicality of VR implementation is influenced by technological accessibility and performance limits. Differences in hardware capabilities, rendering quality, and user readiness may have an impact on the consistency of the exhibition experience, especially in assessment contexts. These findings indicate that, while VR provides significant opportunity to expand design communication and critique, its use must be accompanied by careful consideration of accessibility, device compatibility, and institutional support.

Overall, the study shows that VR-based exhibitions are more than just a temporary replacement for real events, but also a possible complementing method that might expand chances for distant participation and collaborative interaction. The findings of this study contribute to existing conversations about immersive technology in education by offering empirically grounded information on how VR might improve exhibition-based learning and assessment in industrial design programs.

Future study could expand on this work by assessing user experience across bigger and more varied participant groups, comparing other VR display platforms, or combining quantitative performance indicators with qualitative evaluation. Longitudinal studies may also help to better understand how familiarity, technical knowledge, and infrastructural preparation influence long-term adoption. Such findings would help to develop VR exhibition frameworks and inform more inclusive and scalable implementation tactics in educational and professional design environments.

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REFERENCES

Alhalabi, W. S. (2016). *Virtual reality systems enhance students' achievements in engineering education*. *Behaviour & Information Technology, 35*(11), 919–925. https://doi.org/10.1080/0144929X.2016.1212931

Bilushchak, T., Vintoniv, K., & Malyk, H. (2024). *Showcasing Identity: Virtual Exhibitions of the Ukrainian Diaspora in Canada under Creative Commons License Attribution 4.0 International (CC BY 4.0)*.

Bowman, D. A., & McMahan, R. P. (2007). *Virtual reality: How much immersion is enough? Computer, 40*(7), 36–43. https://doi.org/10.1109/MC.2007.257

Cao, Y., Ng, G. W., & Ye, S. S. (2023). *Design and evaluation for immersive virtual reality learning environment: A systematic literature review*. *Sustainability, 15*(3), Article 1964. https://doi.org/10.3390/su15031964

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE.

CODES Stream. (2021). *VRDEX: Industrial design students project assessment and exhibition module using VR technology* [Video]. YouTube. https://youtu.be/CXatVds2CSE

van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2019). *The first-level digital divide shifts from inequalities in physical access to inequalities in material access*. *New Media & Society, 21*(2), 354–375. https://doi.org/10.1177/1461444818797082

Esam, A., Wan Ab. Rahman, W. N., Kamarudin, N., Mad Halid, N., Yusof, Y., & Tugiran, Y. (2025). Utilisation of Virtual Tradeshows in the Malaysian MICE Industry: Post-Pandemic Impact. *International Journal of Business and Technopreneurship (IJBT)*, *15*(1), 69–80. https://doi.org/10.58915/ijbt.v15i1.909

Furniture News. (2020, July 6). *MIFF Furniverse – Malaysia's online exhibition*. https://www.furniturenews.net/events/articles/2020/08/26/44037152-miff-furniverse-%E2%80%93-malaysias-online-exhibition

Greengard, S. (2019). *Virtual reality*. MIT Press.

Jimeno-Morenilla, A., Sánchez-Romero, J. L., Mora-Mora, H., & Coll-Miralles, R. (2016). *Using virtual reality for industrial design learning: A methodological proposal*. *Behaviour & Information Technology, 35*(11), 897–906. https://doi.org/10.1080/0144929X.2016.1215525

Kayaalp, F., Başcı Namlı, Z., & Meral, E. (2024). *My museum: A study of pre-service social studies teachers' experience in designing virtual museums*. *Education and Information Technologies*. Advance online publication. https://doi.org/10.1007/s10639-024-12742-8

Kraftangan Malaysia. (2021). *Virtual Craft Event*. https://www.mycraftevent.com/

Larmuseau, C., De Leersnijder, L., Rotsaert, T., Boel, C., Demanet, J., & Schellens, T. (2025). *Beyond realism: Rethinking VR design for optimal learning in technical and vocational secondary education*. *Computers & Education: X Reality, 6*, Article 100098. https://doi.org/10.1016/j.cexr.2025.100098

MIFF Furniverse. (2021). *Post Show Report*. https://2023.miff.com.my/highlights/miff-furniverse/

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*, Article 103778. https://doi.org/10.1016/j.compedu.2019.103778

Slater, M. (2009). Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1535), 3549–3557. https://doi.org/10.1098/rstb.2009.0138

Parmaxi, A. (2020). *Virtual reality in language learning: A systematic review and implications for research and practice*. *Interactive Learning Environments, 31*(1), 172–184. https://doi.org/10.1080/10494820.2020.1765392

Pinandita, A., & Nabila Shabiriani, U. (2021). Virtual Exhibition Room in the Pandemic Era. *Article in Budapest International Research and Critics Institute (BIRCI-Journal) Humanities and Social Sciences*. https://doi.org/10.33258/birci.v4i3.2323

Sjukriana, J., Hanafiah, M. H., Asyraff, M. A., & Kusumah, G. (2025). Unveiling the landscape of event technology adoption in hospitality and tourism industry: insights from a systematic literature review. *International Journal of Event and Festival Management*, *16*(2), 207–228. https://doi.org/10.1108/IJEFM-06-2024-0077

Sylaiou, S., Dafiotis, P., Koukopoulos, D., Koukoulis, K., Vital, R., Antoniou, A., & Fidas, C. (2024). *From physical to virtual art exhibitions and beyond: Survey and some issues for consideration for the metaverse*. *Journal of Cultural Heritage, 66*, 86–98. https://doi.org/10.1016/j.culher.2023.11.002

Torrence, K. (2024). *Advancing authentic immersive learning*. *The Journal of Applied Instructional Design, 13*(4). https://doi.org/10.59668/2033.18644

Viralingam, N., & Ramaiah, C. K. (2008). *Comparative study of HTML and animated user interfaces of an online exhibition*. *DESIDOC Journal of Library & Information Technology, 28*(4), 42–49.

Wigmore, I. (2016). *Immersive virtual reality*. TechTarget. https://www.techtarget.com/whatis/definition/immersive-virtual-reality-immersive-VR/

Wong, Y. Y. R., Wong, P. L., Wong, P. W., & Goh, C. P. (2020). *The Implementation of Virtual Reality (VR) in Tertiary Education in Malaysia*.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE.