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DESIGNING IMMERSIVE PEDAGOGIES: VIRTUAL REALITY AS A CATALYST FOR STUDENT-CENTRED AND CO-CREATIVE LEARNING IN HERITAGE EDUCATION

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Abstract:

This study explores the use of Virtual Reality (VR) in enhancing heritage education by shifting the focus from conventional content delivery to immersive, student-centred learning experiences. While VR has become increasingly popular in education, its integration within heritage studies, particularly in Southeast Asia, remains limited. Guided by Kolb's Experiential Learning Theory, a seven-week classroom intervention was conducted with 30 undergraduate students enrolled in the Cultural Heritage Conservation course at Universiti Malaysia Kelantan. The study employed a mixed-methods approach that combined survey responses, reflections, and interviews to examine how VR shapes students' spatial understanding, emotional engagement, and interpretive skills in heritage learning. Findings indicate a strong level of agreement among participants (mean: 4.35–4.43) that VR enhances their ability to visualise spatial arrangements, appreciate cultural significance, and experience deeper emotional connection with heritage sites. Qualitative feedback further confirms VR's potential to position students as active interpreters rather than passive recipients of information. This study highlights the transformative potential of VR as a pedagogical tool in heritage education, offering a scalable, cost-effective, and inclusive model that bridges theoretical instruction with experiential engagement.

Keywords:

Cultural Heritage Interpretation, Experiential Learning, Heritage Education, Immersive Learning, Student-Centred Pedagogy, Virtual Reality (VR)

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Introduction

In recent years, virtual reality (VR) has emerged as a powerful educational medium, offering immersive and interactive experiences that surpass the limitations of traditional classroom methods. However, its application in heritage, particularly within structured and formal learning environments, remains underdeveloped in Southeast Asia. Heritage studies continue to face persistent challenges in communicating the spatial complexity, cultural depth, and emotional resonance of historical sites, which are often lost in text-heavy content or static 2D visuals (Monaro et al., 2024; Rusnak, 2022). These pedagogical limitations are further compounded by access barriers due to geography, conservation policies, and financial constraints (Aziz & Siang, 2014), thereby restricting opportunities for experiential and interpretive learning.

In response to these gaps, this study integrates VR into heritage interpretation activities within a Malaysian university setting. Conducted with undergraduate students enrolled in the SCY3053 "Cultural Heritage Conservation" course at Universiti Malaysia Kelantan (UMK), the project enabled students to virtually explore the United Nations Educational, Scientific and Cultural Organisation, UNESCO World Heritage Sites through 360-degree panoramic environments using VR headsets. The main aim of this study is to examine how VR can enhance students' comprehension and interpretation of cultural heritage while encouraging a shift from theoretical, content-driven instruction to immersive and student-centred learning experiences.

Literature Review

Design education today has undergone a rapid transformation, with technology becoming an integral part of the teaching and learning approach. At the same time, technology has also created and re-created related knowledge in various ways. Although conventional teaching methods are still widely used, they are now increasingly replaced by technology-based approaches. Most of the time, traditional practices in teaching and learning are heavily reliant on teacher-centred methods, where educators deliver information through lectures. In this approach, students passively receive materials by listening and taking notes with minimal interaction (Dwiniasih & Khumaeroh, 2021). This conventional approach model remains common in many educational settings that focus primarily on curriculum content delivery (Chebii et al., 2018).

However, such traditional methods face several challenges. Students tend to be passive in the classroom, which ultimately results in lower levels of engagement and limited development of critical thinking skills. Fang et al. (2023) found that students exposed to lecture-based methods are less likely to participate or ask questions during lessons. This passiveness inhibits cognitive development and analytical reasoning (Kiat et al., 2020). Furthermore, compared to students who have been exposed to problem-solving or active learning methodologies, those relying on conventional teaching demonstrate lower levels of understanding and knowledge retention (Nurdin, 2021). Therefore, findings suggest that traditional teaching methods fail to stimulate the higher-order thinking skills required in today's rapidly changing academic and professional landscapes (Kiat et al., 2020)

To meet the demands of the 21st century, student-centred, experiential and co-creative learning approaches have become increasingly important, especially in design education. Through these methods, students are encouraged to explore knowledge independently, supported by

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technology that enables learning without boundaries and beyond the learning syllabus. In this context, students are motivated to be more active and to take responsibility for their own learning rather than relying on teacher-driven delivery.

Student-centred learning (SCL) is one of the most widely adopted approaches in modern education. This approach transforms the learning experience by placing students at the centre of the process, encouraging them to actively participate, collaborate, and be independent in their educational journey. Instead of relying on lecture-based instruction, students are prompted to explore, discuss, and interact with their peers to construct meaning together (Mohamad et al., 2020; Partarakis et al., 2021). Research has shown that SCL enhances academic performance, engagement and motivation, resulting in deeper understanding and improved outcomes (Benlahcene et al., 2020; Bhardwaj et al., 2025; Severiens et al., 2015). Besides that, other studies have also shown the improvement of other skills among students, especially in communication, teamwork and ability to adapt to their surroundings (Y.-D. Li & Ding, 2023; Oluwafunmilola, 2024)

Despite its advantages, SCL also presents challenges for both educators and students. For example, large and crowded class sizes may disrupt the active learning process, as teachers struggle to focus and engage with each learner effectively (Fufa et al., 2023). Educators also face heavy workloads and require additional preparation time before classes begin (Katawazai, 2021; Silva et al., 2021). There are also teachers who remain resistant to change and prefer familiar methods due to long-standing habits and comfort with traditional roles (Sadler, 2012; Silva et al., 2021). On the other hand, some students may find SCL demanding, specifically those who are less confident, passive or lack the necessary communication and digital skills (Matobobo & Risinamhodzi, 2022; Nerland, 2020). Consequently, such students may experience anxiety or hesitation to participate in the activities (Nerland, 2020).

Apart from SCL, experiential learning has become another essential approach that needs to be adopted in the learning process. Through experiential learning, students gain knowledge through direct experience and reflection, which allows them to develop a deeper understanding of the subjects taught. This approach is grounded in the learning theory developed by David Kolb, which describes learning as a cyclical process of four stages: concrete experiences, reflective observation, abstract conceptualisation, and active experimentation. First, learners engage in concrete experiences and actively experience the activities. Second, learners will reflect on these experiences, and third, form new ideas or modify existing concepts through reflection. Lastly, learners test the ideas obtained and apply them in new situations (Gordon, 2022; Moore et al., 2010).

In the context of heritage education, experiential learning is closely related to the practice of interpretation, where learners are not only exposed to heritage but also encouraged to reflect, construct meaning, and connect personally with cultural values. In addition, interpretation plays a crucial role in learning within heritage studies. This is because interpretation helps the public to critically analyse the facts provided in the context of heritage. Heritage interpretation enables visitors and communities to understand the deeper meaning, value, and significance of heritage sites and objects, while also fostering emotional and intellectual connections (Nowacki, 2021; Nyaupane, 2023). Interpretation can also enhance the sense of identity for a place among individuals and communities. It also ensures that diverse perspectives are

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represented simultaneously, making heritage more inclusive and relevant (Hutsal, 2024; Zhou et al., 2024).

Technology has greatly aided the delivery of lectures and the education system. Immersive uses of technology improve education in various ways. In this context, digital tools and online resources make educational materials more accessible and flexible, supporting both physical and remote learning (Ghory & Ghafory, 2021; Kalyani, 2024; Pinto & Leite, 2020). Interactive tools, platforms, games, and multimedia content can also engage students effectively, enhancing their motivation and participation (Shahid et al., 2019; Sudarsana et al., 2019). Moreover, technology helps students organise and personalise their learning according to different learning styles and needs (Kalyani, 2024; Sudarsana et al., 2019). Indirectly, the development of 21st-century skills can be achieved when students acquire digital literacy, enabling them to communicate effectively and master problem-solving skills that are highly valued in the workplace and beyond (Kalyani, 2024). Additionally, digital tools provide instant feedback and track progress, thereby improving learning outcomes (Ghory & Ghafory, 2021; Kalyani, 2024).

In this context, the use of VR has shown strong potential in transforming teaching and learning. VR acts as an innovative educational tool that supports immersive learning and experiential learning experiences. Students become more engaged and motivated to enjoy learning compared to traditional learning methods (Allcoat & von Mühlenen, 2018; Hui et al., 2022). Learning also becomes increasingly interactive and interesting. Studies have shown that VR can improve test scores and knowledge, especially in subjects that require spatial understanding or practical skills, such as anatomy, engineering, geography, and others (Ka et al., 2025; Lee & Hwang, 2022; Mallek et al., 2024). VR also enables students to practice complex or hazardous tasks in a safe environment, allowing for repeated experiences and bridging the gap between theory and real-life situations (Mallek et al., 2024). In addition, VR supports a wide range of subjects, including STEM, language, and the arts (Hui et al., 2022; Lee & Hwang, 2022). It also offers personalised learning preferences, adaptive experiences and access to an environment for students who are unable to be physically present at real sites (Mallek et al., 2024; Wang, 2025).

In heritage and cultural studies, VR applications have become increasingly relevant. A study conducted by Vola et al. (2025) reported that integrating 360-degree and VR technologies enhances student engagement and improves academic performance. Similarly, studies have demonstrated that VR allows users to virtually visit historical sites (Hajirasouli et al., 2021), experience events such as cultural festivals (Dieck et al., 2021), and interact with artefacts (Alakhtar, 2020). Such immersive experiences foster a stronger emotional and cognitive connection to heritage and historical context (Zhao et al., 2023) .

Therefore, VR serves not only as a traditional advancement but also as a pedagogical tool that aligns with student-centred and experiential learning approaches. It enables students to learn through direct experiences, reflection, and emotional engagement—consistent with Kolb's learning cycle. In heritage education, VR bridges the gap between abstract knowledge and lived experience, supporting learners to interpret cultural heritage in meaningful, interactive, and inclusive ways.

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Methodology

This study introduces an innovative approach to heritage education by embedding Virtual Reality (VR) into a structured 7-week classroom intervention that bridges theoretical instruction with immersive, experiential learning. While VR has been explored in various educational fields, its integration into Malaysian heritage studies remains nascent. This initiative redefines traditional pedagogy by shifting students from passive recipients to active cultural interpreters through guided virtual visits to UNESCO World Heritage Sites using 360-degree panoramic content. Each session included theoretical input, VR immersion using goggles (Figure 1), and structured prompts for reflection on observed cultural elements. Students were encouraged to articulate how they felt, what they saw, and how they interpreted the meaning of heritage. Rather than memorising facts, this approach cultivated emotional engagement, cultural empathy, and critical interpretation.

Figure 1: Immersive Student Engagement with World Heritage via VR Goggles

This study adopted a mixed-methods design, integrating both quantitative and qualitative techniques to evaluate students' engagement and interpretive learning through Virtual Reality (VR). A total of 30 undergraduate students enrolled in the SCY3053 'Cultural Heritage Conservation' course at the Universiti Malaysia Kelantan (UMK) participated in a structured seven-week intervention. These students were selected through purposive sampling as they were directly enrolled in the course that made them relevant to the study context. During the first two weeks, students were introduced to selected UNESCO World Heritage Sites using conventional 2D images and lecture-based content. In the following weeks, they engaged in immersive exploration using Oculus VR headsets and 360-degree panoramic YouTube videos. Each VR session was paired with reflective prompts to guide students in observing architectural, cultural and spatial elements.

After completing the VR sessions, students responded to a structured survey consisting of both closed-ended and open-ended questions. The survey also included Likert-scale items (1= strongly disagree to 5= strongly agree) and open-ended questions for qualitative insights. Students were also provided with informed consent, and the study followed the university's ethical guidelines for educational research. The closed-ended items assessed their familiarity with VR and its perceived effectiveness in enhancing cultural heritage learning, while the open-ended questions explored students' emotional reactions, learning preferences, and reflections

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on their immersive experiences. Additionally, informal interviews were conducted with selected students to gain a deeper insight into their engagement and perceptions.

Data Analysis

Quantitative data were analysed using descriptive statistics, including frequency, mean, and standard deviation, to summarise students' responses. For qualitative data, thematic analysis was employed, following Braun and Clarke's (2006) six-phase framework of coding, theme development, and validation.

Table 1: Top 4 Heritage Sites Visited in VR vs. Others

Category	Heritage Site	Count	Percentage
1	Taj Mahal	6	20.0%
2	Alhambra	5	16.7%
3	Pyramids of Giza	5	16.7%
4	The Great Wall of China	3	10.0%
	Other Sites (13 unique sites)	11	36.7%
	Total	30	100%

Table 1 presents the list of World Heritage Sites explored by students during the VR sessions. The Taj Mahal emerged as the most selected site, chosen by six students (20.0%). This was followed by the Alhambra and the Pyramids of Giza, with five students each (16.7%), and the Great Wall of China with three students (10.0%). The remaining 13 sites were grouped under "Other Sites," accounting for 11 students (36.7%). These included Petra in Jordan, Stonehenge (UK), Baalbek, Serengeti National Park, Mohenjo-Daro, the Blue Mosque in Istanbul, Aswan Temple, Pompeii (Italy), Wat Phra Si Sanphet (Thailand), the Historic Centre of Mexico City, Xochimilco, and Borobudur (Indonesia). The results indicate that most students were drawn to iconic and visually striking sites, such as the Taj Mahal and Alhambra, which carry strong cultural and historical significance. At the same time, the diversity of responses in the "Other Sites" category shows students' curiosity in exploring a wider range of cultural landscapes, even beyond the most popular destinations.

Table 2: The Use of Virtual Reality (VR) in Understanding and Interpreting Heritage

The Use of Virtual Reality (VR) in Understanding and Interpreting Heritage	Means	Std. Dev.
The use of Virtual Reality enhances my ability to appreciate the spatial layout and scale of the World Heritage Site.	4.425	0.594
Virtual Reality helps me develop a stronger emotional connection to the World Heritage Site and its cultural significance	4.4	0.545
Virtual Reality provides a more inclusive and accessible way for individuals with physical limitations to experience and understand the World Heritage Site	4.4	0.744
Virtual Reality enables me to explore different aspects of the heritage site, such as architecture, artefacts, and cultural practices, in a more interactive and immersive manner	4.4	0.744

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Virtual Reality enhances my ability to visualise and comprehend the architectural and cultural elements of the World Heritage Site	4.375	0.7403
The use of Virtual Reality significantly enhances the educational value of visiting a World Heritage Site	4.375	0.7403
VR experiences provide a more engaging and memorable way of learning about the history and heritage of the World Heritage Site	4.35	0.736

Table 2 summarises students' perceptions of using Virtual Reality (VR) to understand and interpret heritage. Overall, the items recorded consistently high mean scores with the strongest response indicating that VR improved students' ability to understand the size, space, and layout of heritage sites (M: 4.425, SD: 0.594), a level of spatial awareness that could not be achieved through 2D visuals. VR also appeared to deepen emotional connection towards World Heritage Sites (M: 4.4, SD: 0.545), and VR was recognised as a tool to remove barriers for those with physical limitations or financial constraints, making it more inclusive and accessible (M: 4.4, SD: 0.744). Furthermore, students indicated that VR supported more interactive exploration of heritage and allowed for a detailed examination of architecture, artefacts, and cultural practices (M: 4.4, SD: 0.744). They also found that VR was helpful in visualising and understanding the architectural and cultural elements of World Heritage Sites (M: 4.375, SD: 0.7403), while at the same time enhancing the educational value of virtual visits (M: 4.375, SD: 0.7403). Lastly, students' VR provided a more engaging and memorable learning experience (M: 4.35, SD: 0.736), although not as strong as the benefits in terms of spatial and emotional engagement.

Furthermore, this study revealed students' perspectives on the use of VR in understanding World Heritage Sites. Therefore, thematic analysis following Braun and Clarke's (2006) approach was applied to analyse the open-ended survey questions. Through initial coding, theme development, and validation by researcher discussion, six themes were identified, as shown in Table 3 below.

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Table 3: Quantitative Analysis of Reasons for Interest in VR for Heritage

No.	Themes	Number of Responses	Percentage of Students
1	Immersive & Realistic Experience ("Feel like I'm really there")	19	63.3%
2	Accessibility & Cost-Effectiveness ("Save money", "Don't need to travel")	16	53.3%
3	Enhanced Learning & Understanding ("Learn more", "Study in detail")	15	50.0%
4	Detailed Visualization & Exploration ("See inside", "Explore the whole site")	8	26.7%
5	Novelty, Technology, and Fun ("New technology", "Fun to use")	4	13.3%
6	Emotional Connection ("Feel the emotion", "Appreciate more")	3	10.0%
Total Students		30	100%

Table 3 illustrates the reasons for students' interest in using Virtual Reality (VR) for heritage learning. The highest percentage was linked to immersive and realistic experience (63.3%), followed by accessibility and cost-effectiveness (53.3%). Half of the students (50.0%) also noted that VR enhanced their learning and understanding. A smaller group mentioned detailed visualisation and exploration (26.7%), while novelty, technology, and fun accounted for 13.3%. The lowest response was for emotional connection (10.0%). These findings suggest that students value VR primarily for its immersive quality and accessibility, with novelty and emotional connection being secondary factors.

Discussion

The study's results show that most students strongly agreed that VR offers numerous benefits in their learning process, particularly in heritage studies. The use of virtual reality (VR) demonstrates strong potential to transform teaching and learning methods in the classroom, moving from conventional or traditional approaches to more engaging and immersive ones, especially those based on student-centred and experiential learning. This is supported by students' responses where the use of VR helps users visualise the real setting of the World Heritage Sites, particularly in terms of building arrangements, layout, distances between objects, and overall physical environment. In comparison to conventional learning, which often relies on 2D images, students reported difficulty in fully grasping these spatial relationships or the true size of sites. However, with VR, students could experience the feeling of virtually walking through the heritage site. This immersive experience allowed them to understand

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distance, depth, and scale more accurately, as if they were visiting a World Heritage Sites in person.

Apart from spatial understanding, VR also evoked emotional responses among students. The use of VR extends beyond delivering information, and it creates affective experiences that foster empathy and encourage appreciation of the cultural significance of World Heritage Sites. Previous studies, such as Zhou et al. (2024), have shown that the role of immersive technology increases emotional presence and provides a sense of authenticity, which is crucial in heritage interpretation. In addition, students highlighted that VR is more inclusive and provides valuable experiences to those who face physical and financial constraints to travel and visit World Heritage Sites in person. In this sense, VR becomes an alternative form of virtual presence that is affordable and widely accessible. These findings are consistent with Mallek et al. (2024) who also argued that the VR enhances access to education and heritage.

Furthermore, VR provides a more inclusive platform that allows students to visualise and understand cultural elements more deeply compared to conventional methods, which often restrict learning to static images and text descriptions. Through VR, students could directly observe architectural details, cultural values, and intangible cultural heritage embedded in the heritage site. This enriched their appreciation not only of built heritage but also of the intangible cultural heritage associated with the sites. Therefore, VR acts as a medium that bridges abstract knowledge with direct visual and experiential learning.

These findings are consistent with Kolb's Experiential Learning Theory, which explains learning as a cycle of experience, reflection, conceptualisation, and application. In this study, VR provided students with concrete experiences of exploring heritage sites virtually. The reflective prompts guided them through reflective observation, while their survey responses and discussions indicated abstract conceptualisation, where they connected observations to cultural meaning. Finally, the act of interpreting heritage sites through VR represents active experimentation, where students applied new insights in meaning-making. This shows that VR not only delivers content but also supports the full cycle of experiential learning.

VR also enables students to interpret rather than simply observe on a surface level. The opportunity to explore virtually is also in line with educational goals that emphasise interpretation and meaning-making are valued more than memorisation. In the context of cultural heritage studies, Interpretation is central as it allows learners to develop a deeper understanding, engagement and reflective thinking. Thus, interpretation becomes the foundation for appreciating heritage, revealing the meaning, value, and significance of heritage sites, objects, and traditions. In this context, learning method shifts from passive observation to active meaning-making, enabling both experts and the public to construct personal and collective connections with heritage. Furthermore, interpretation in heritage studies is also considered a form of creative dialogue process that connects memory, knowledge, and values, ultimately helping individuals and communities understand heritage in a more meaningful way (Nyaupane, 2023; Pirkovič & Kocbek, 2023).

These findings were also supported by students who reported a strong sense of presence that similar to that experienced during physical visitation. This aligns with Kolb's notion of concrete experience, where learning is strengthened through direct sensory engagement. Students described the feeling of "being there", indicating that immersion acted as a catalyst

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for deeper cognitive processing, consistent with findings by Vola et al. (2025) and Monaro et al. (2024). These findings align with Li et al. (2025) whose study also showed that VR supports remote exploration of architectural heritage and makes historical have been similarly observed that VR allows students to explore architectural heritage without travelling, making historical context accessible from a distance, particularly within their own classroom.

In addition, students agreed that VR provides cost-effective alternatives to physical visits. Students recognised VR as a practical alternative for those constrained by financial, geographical or physical barriers. Mallek et al. (2024) also claimed that VR bridges inequities in educational access and suggested that technology carries broader social value beyond pedagogical enhancement. VR also enhanced their learning and understanding, which supports quantitative results indicating strong cognitive benefits. Students also gave some reflection by claiming that they were able to "study details" and "learn more efficiently", suggesting that VR supports abstracts conceptualisation within Kolb's cycle by helping learners make connections between visual input and theoretical content.

Students were also able to feed their curiosity through VR, as the technology provided more detailed visualisation and made the exploration of World Heritage Sites more enjoyable. Some students mentioned that they could "explore inside" and found the experience "fun to use," which shows that they appreciated having the freedom to navigate the site on their own. This sense of autonomy and active experimentation reflects key aspects of experiential learning. The pattern also supports findings by Dieck et al. (2021), who reported that the novelty of VR can encourage sustained engagement in cultural experiences.

VR also effectively supports emotional connections. VR was described as a tool to stimulate the senses, allowing feelings and emotions to influence how heritage is perceived. Unlike physical visits where sensory and social cues are abundant, VR may not fully replicate the affective depth of on-site experience. This finding refines existing literature such as in Zhao et al. (2023) indicating that emotional immersion in VR is not automatic but context dependent. Therefore, students valued VR primarily for its immersive, inclusive and educational qualities, rather than as mere entertainment. This confirms the role of VR as a bridge between experiential learning and students, enabling mobile heritage education.

Conclusion

This study demonstrates the transformative potential of Virtual Reality (VR) in heritage education, particularly in connecting theoretical instruction with immersive experience and experiential engagement. Findings from both surveys and thematic analyses reveal that VR significantly enhances students' comprehension of cultural heritage, deepens spatial and emotional engagement, and promotes inclusive access for learners facing physical or financial limitations. Beyond improved understanding, students also assumed interpretive roles, developing reflective, empathetic, and critical perspectives toward heritage. To advance this innovation further, future efforts should focus on developing customised VR content tailored to local Malaysian heritage sites, in collaboration with cultural institutions and museums. At the same time, future research may address current limitations, such as a small sample size, a short intervention period, and reliance on generalised VR resources, by adopting longitudinal and comparative designs. These refinements allow strong validation of VR's pedagogical impact. As the demand for student-centred and technology-integrated instruction continues to rise, this project offers a scalable, cost-effective, and replicable model for enhancing heritage

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education in the digital era. Consistent with Kolb's Experiential Learning Theory, VR supports the full cycle of concrete experience, reflection, conceptualisation and application, making it a practical innovation that is adaptable to other fields of study using accessible 360 content and basic VR tools.This study offers new perspectives on VR-based heritage learning by demonstrating how immersive tools can support interpretation, emotional engagement, and accessibility in ways that conventional teaching may not achieve. It also offers early evidence from the Malaysian higher education context, which has been underrepresented in past research.

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