Student perceptions of the use of VR to introduce Malang local tourism and culture

Helmi Muzaki[1] * ID , Gatut Susanto[1], Kusubakti Andajani[1], Afiyahtun Isnaeni[1], Ilham Akhsani[2], Thilip Kumar Moorthy[3]

[1] Universitas Negeri Malang, Indonesia.
[2] Politeknik Baja Tegal, Indonesia.
[3] Tunku Abdul Rahman University of Management and Technology, Malaysia.
*Corresponding Author. E-mail: helmi.muzaki.fs@um.ac.id

ARTICLE INFO

ABSTRACT

This study investigates students' perceptions of the use of Virtual Reality (VR) as a learning medium for introducing tourism and local culture in Malang. This research employed a quantitative descriptive design involving 23 first-semester students selected through purposive sampling. Data were collected using a Likert-scale questionnaire (1–5) consisting of 17 statements that measured learning effectiveness, educational value, tourism introduction, cultural understanding, and the development of knowledge and skills. The results indicate that students demonstrated highly positive perceptions of VR implementation, with an overall mean score of 4.34. The highest score was obtained in the aspect of local tourism introduction (M = 4.46), followed by local cultural understanding (M = 4.41) and learning effectiveness (M = 4.37). These findings show that VR provides an immersive and engaging learning experience that enhances students' understanding of tourism and local culture. Therefore, it is recommended that educators and institutions further integrate and develop VR as an innovative technology-based learning strategy to enrich educational practices.

INTRODUCTION

The advent of new information and communication technologies has transformed specific industries, such as education or even tourism. One of the leading modern technologies in both of these fields is VR. Unlike traditional means of relaying information, such as pictures and videos, as Bailenson (2018) stated, VR can take users into a virtual world that offers more engaging interactivity. In education, users are provided with endless opportunities to learn and discover the diverse parts of the world. Similarly, in tourism, people can visit beautiful tourist attractions and cultural landmarks without truly having to travel.

Malang City has great potential to promote the richness of local culture and lesser-known tourist destinations. The natural beauty of Mount Bromo and Teluk Asmara Beach, along with the cultural diversity of the East Javanese people, reflected in their traditions, cuisine, and daily life, are important assets that can be utilised as contextual learning resources. In this context, Virtual Reality (VR) technology offers new opportunities to provide more immersive learning experiences,

especially for students from remote geographic areas who cannot visit these locations in person (Rachmad, 2024).

However, the use of VR technology in education and local tourism still faces several challenges. One important aspect to consider is how students perceive the effectiveness of this technology in supporting the learning process and promoting local tourism. As a generation relatively familiar with digital technology, students have the potential to be primary users of VR. However, their level of acceptance and perception of the tangible benefits of VR in enhancing the learning experience remain underexplored (Zhang, 2024).

In addition to user perception, other challenges relate to accessibility and technical constraints in using VR. Hardware limitations, virtual content quality, and users' understanding of VR technology can affect its effectiveness as a learning medium and a tool for introducing tourism (Shehade & Stylianou-Lambert, 2020; Yang, 2024). Therefore, this study aims to explore students' perceptions of the use of VR in learning and in introducing local tourism in Malang City, while also examining the extent to which this technology can enrich their learning experiences in Indonesian, deepen their understanding of local culture, and enable them to explore tourist destinations more contextually.

VR offers excellent opportunities to introduce local tourism more engagingly and comprehensively. With VR, local tourism can be introduced virtually to a broader audience, giving them a first-hand experience even if they cannot physically visit (Tanvir, 2022). This certainly has the potential to increase interest in local tourism in Malang City, which, in turn, will have a positive impact on the local economy and cultural preservation.

Previous studies related to VR have been conducted, including Alizadeh & Hawkinson (2021), who examined a case study of the use of VR in tourism schools; Yung & Khoo-Lattimore (2019) & Tussyadiah et al., (2018), who examined VR in tourism; Malik et al., (2024), who examined VR for Education; Mura et al., (2017), who examined students' perceptions of the authenticity of tourism with VR; Wang et al., (2020) & Muzaki et al., (2025), who examined the impact of VR on intercultural competence, Shadiev et al., (2020), & Harris & Seo (2024), who examined students' perceptions of the use of VR in cultural learning. Based on previous research, there is no specific research on how students view the use of VR for studying tourism and local culture. Therefore, this study investigated new students' perceptions of VR's use to introduce Malang's tourism and local culture.

METHOD

This study uses quantitative descriptive statistics to reveal perceptions and explain reasons through thematic data analysis. Data were collected primarily through a questionnaire comprising 17 closed-ended statements, rated on a Likert scale. A descriptive design is well-suited for perception studies to yield rich, detailed quantitative answers (Sugiyono, 2020). The sample size was considered appropriate because the study focused on analysing user perceptions and experiences rather than on making statistical generalisations. A total of 23 participants falls within the recommended range for evaluative research and limited trials of learning media, where a sample size of 10–30 participants is suggested to assess the feasibility and acceptability of educational technology (Hertzog, 2008; Sukserm, 2024). The sample was obtained through purposive sampling based on the following criteria: (1). new students (semester 1), (2). not yet familiar with the local Malang culture and tourism.

Research Instrument

The research instrument was a questionnaire consisting of two parts. The first part included closed-ended questions (Likert scale 1-5) in Table 1 that measured perceptions of the VR experience, learning effectiveness, potential for cultural introduction, and skill development.

Table 1. Research Instrument

Code	Statements	1	2	3	4	5
X1	The use of VR in learning makes the subject matter more straightforward to comprehend.					
X2	Using VR provides a more engaging learning experience.					
X3	I feel more involved in the learning process when VR is used.					
X4	Using VR makes me feel closer to the material being studied.					
X5	With VR, I can learn complex topics more simply.					
X6	The use of VR in education can improve learning quality compared to traditional methods.					
X7	I find it easier to understand abstract concepts using VR.					
X8	VR provides a more realistic experience of exploring tourist destinations in Malang City.					
X9	I feel more interested in visiting tourist attractions in Malang after using VR.					
X10	VR can offer various tours of Malang in a more interactive way than just watching pictures or videos.					
X11	I feel more connected to Malang's tourist attractions through the VR experience.					
X12	I find it easier to imagine difficult-to-reach tourist attractions in VR than in written descriptions or pictures.					
X13	Using VR provides a deeper understanding of Malang's history and culture.					
X14	The use of VR in introducing local tourism in Malang has increased my interest in learning more about local culture.					
X15	VR can provide a more in-depth experience of Malang's natural beauty and culture.					
X16	VR helps me develop my Indonesian language skills through more realistic experiences.					
X17	The VR experience enhanced my understanding of Malang's culture and tourist attractions.					

1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree.

Instrument Validity and Reliability

Internal reliability was assessed using Cronbach's alpha to evaluate the consistency of the questionnaire items. The test results obtained using SPSS version 27 showed an alpha value of 0.966, indicating very high reliability. This value suggests that the questionnaire items consistently measure a single central construct, namely, students' perceptions of the use of VR in learning about local tourism and culture. The high alpha value may also be influenced by the relatively large number of items and the homogeneous characteristics of the respondents, who were early VR users. Since this is a pilot study, the reliability results provide an initial indication of the instrument's consistency. Further testing with a larger sample, such as factor analysis, is recommended in future studies to more comprehensively examine the construct structure.

Data Collection Technique

Data for this study were collected using an online questionnaire created in Google Forms. The instrument was distributed to respondents through digital platforms such as WhatsApp, which was considered effective in reaching new students. Respondents independently completed the questionnaire, with an estimated completion time of ±15 minutes. The use of online questionnaires is considered appropriate and efficient, given the characteristics of the respondents as part of the digital-native generation, namely an age group that has grown up with digital technology and is accustomed to accessing information and communicating via the internet (Prensky, 2001). Students from this generation tend to prefer online survey systems that are flexible, easily accessible via mobile devices, and time-efficient. Research findings by Evans and Mathur (Prensky, 2001) indicate that the advantages of online surveys include broad accessibility, cost efficiency, and ease of real-time data analysis. Additionally, online distribution enables flexible data collection without

geographic constraints, which is particularly suitable for a student population. Automatically recorded responses also facilitate efficient tabulation and quantitative data processing.

Data Analysis Techniques

This study employed descriptive quantitative analysis to examine closed-ended data collected via a Likert-scale questionnaire. Quantitative data were analysed using SPSS to identify trends in students' perceptions of VR as a learning medium for introducing local culture and tourism. The analysis procedures included calculating the mean score for each questionnaire item, tabulating frequencies and percentages to examine the distribution of responses across categories, and interpreting the results based on predetermined score intervals, as shown in Table 2.

Table 2. Criteria for Interpreting Student Response Questionnaire Scores

No.	Score Range	Perception Category
1	1.00 – 1.80	Very Low
2	1.81 – 2.60	Low
3	2.61 – 3.40	Medium
4	3.41 – 4.20	High
5	4.21 – 5.00	Very High

RESULTS AND DISCUSSION

Results

The results section presents findings based on five key aspects used to evaluate students' perceptions of the use of VR in introducing Malang local tourism and culture.

Student Perception of the Influence of VR Media in Learning

Student perceptions of the influence of VR media on learning were measured using four statement items that assessed the effectiveness, engagement, learning experience, and immediacy of understanding the material through VR. The following are students' perceptions of the influence of VR media on learning, as shown in Table 3.

Table 3. Descriptive Statistics Student Perception of the Influence of VR Media in Learning

Statistical Data	Code				Average
	X1	X2	X3	X4	
Number of Participants	23	23	23	23	
Minimum	3	3	4	3	3.25
Maximum	5	5	5	5	5
Sum	98	103	100	101	100.5
Mean	4.26	4.48	4.35	4.39	4.37
Standard Deviation	.113	.124	.102	.137	0.119

Student Perception of the Effectiveness of VR in Education

Table 4 presents descriptive statistics on students' perceptions of VR's effectiveness in education.

Table 4. Descriptive Statistics Perception of the Effectiveness of VR in Education

Statistical Data	Code			Average
	X5	X6	X7	
Number of Participants	23	23	23	
Minimum	3	3	3	3
Maximum	5	5	5	5
Sum	99	97	95	97
Mean	4.30	4.22	4.13	4.22
Standard Deviation	.132	.125	.120	0.129

Student Perception of VR Effectiveness in Introducing Malang Local Tourism

The following are descriptive statistics on students' perceptions of VR's effectiveness in promoting local tourism in Malang, as shown in Table 5.

Table 5. Descriptive Statistics Perception of VR Effectiveness in Introducing Malang Local Tourism

Statistical Data	Code					Average
	X8	X9	X10	X11	X12	
Number of Participants	23	23	23	23		
Minimum	3	3	3	3	3	2.8
Maximum	5	5	5	5	5	5
Sum	102	102	104	100	105	102.6
Mean	4.43	4.43	4.52	4.35	4.57	4.46
Standard Deviation	.123	.164	.124	.135	.123	0.1338

Student Perceptions of the Effectiveness of VR in Introducing Malang Local Culture

The following presents descriptive statistics on students' perceptions of the effectiveness of VR in introducing Malang local culture (see Table 6).

Table 6. Descriptive Statistics Perception of the Effectiveness of VR in Introducing Malang Local Culture

Statistical Data	Code			Average
	X13	X14	X15	
Number of Participants	23	23	23	
Minimum	3	3	3	3
Maximum	5	5	5	5
Sum	103	100	101	101.3
Mean	4.48	4.35	4.39	4.41
Standard Deviation	.124	.119	.137	0.127

Student Perceptions on the Influence of VR on Knowledge and Skills Development

The following presents descriptive statistics on students' perceptions of VR's influence on knowledge and skill development (Table 7).

Table 7. Descriptive Statistics: Student Perceptions on the Influence of VR on Knowledge and Skills Development

Statistical Data	Code		Average
	X16	X17	
Number of Participants	23	23	
Minimum	3	3	3
Maximum	5	5	5
Sum	94	102	98
Mean	4.09	4.43	4.26
Standard Deviation	.139	.123	0.131

Discussion

Student perceptions of the effect of VR media on learning had an average score of 4.37, indicating a Very High level of perception. Several aspects were measured. First, the use of VR helped in understanding the material, with a score of 4.26. This shows that most students realise the benefits of VR in narrowing the knowledge gap regarding complex concepts. This is in accordance with the findings of Chatain et al., (2023), who stated that VR facilitates a more effective understanding of digital representation manipulation through sensorimotor stimulation with abstract concepts. Additionally, learners can manipulate the virtual world, which increases their retention of abstract concepts (MavRomatis et al., 2025). Second, VR provides increased learner engagement and

an improved teaching experience, earning a score of 4.48, the highest among all items. Since this finding shows that there is a significant motivational appeal to VR technology in teaching, it further strengthens the claims made by Menin et al., (2018) and Bowman & McMahon (2007), who showed that learning with VR technology is more motivating than traditional methods. Third, participants felt more emotionally engaged. The average score of 4.35 shows why most users feel that incorporating VR allows for greater attention, making it easier for educators who want user-centred education to achieve successful outcomes by offering an engaging, demonstrative environment (Radianti et al., 2020). This illustrates that VR increases student engagement through its high interactivity, thereby encouraging deeper learning. Fourth, the application of VR technology provides a sense of closeness to the material being studied, with a score of 4.39 on the measurement scale. This shows that VR can foster an affective bond among learners and educational content. Huang et al., (2010) note that feelings of closeness to the subject matter are an important indicator of experiential learning, which is best supported by VR technology. These outcomes show that students have a positive perception of VR technology and greatly appreciate its effectiveness in improving the quality of the learning process.

Students' perceptions of VR's effectiveness in education show positive scores, averaging 4.22 and falling into the Very High category. Specifically, VR can teach complex topics more simply, with a score of 4.30. This shows that students feel the real benefits of VR-based learning experiences. Cognitively, VR can reduce cognitive load (Chao et al., 2017). This is done by transforming abstract concepts into visualisations that can be observed and manipulated directly. Second, the use of VR in education can improve the quality of learning compared to traditional methods, by a score of 4.22. This outcome reflects students' belief in the superiority of technology-based approaches over conventional approaches. The use of VR significantly improves learning outcomes, especially in education (Leong et al., 2024), engineering (Ishihara & Komori, 2016), and medicine (Mazurek et al., 2019; Wenli Lian, 2023). The quality of learning improves because VR provides experience-based learning that activates more visual, kinesthetic, and even emotional cognitive pathways. Third, respondents found it easier to understand abstract concepts utilising VR, with a score of 4.13, which falls into the "High" category. Although slightly lower than the other two indicators, this score still indicates students' recognition that VR can transform abstract concepts into concrete experiences. This aligns with constructivist theory, which states that individuals actively construct knowledge through direct experience (Jumaat et al., 2017; Llanas, 2018).

Student perceptions of VR's effectiveness in introducing local tourism in Malang are positive, with an average score of 4.45. First, VR is considered to provide a more realistic experience for exploring Malang's tourist destinations, with a score of 4.43. This indicates that VR can provide an immersive experience, enabling users to feel a virtual presence that is close to reality (Chang & Suh, 2025; Guerra-Tamez, 2023). This positions it as a superior learning medium compared to traditional learning media. Second, students showed an increased interest in visiting Malang after engaging in VR, with a score of 4.43. These findings are consistent with those of Kieanwatana & Vongvit (2024) and Alkhalifah et al., (2025), who demonstrated that VR experiences can directly enhance user interest in visiting tourist sites. VR offers both visual and emotional stimulation, thereby heightening users' interest and curiosity about tourist destinations viewed through VR. Third, the introduction of tourism via VR was deemed more effective than videos or images, with a score of 4.53. According to Hamilton et al., (2021), VR offers advantages over image or video media because VR users actively explore virtual environments. This cannot be achieved with passive media such as images and videos. Fourth, students had a greater emotional bond with tourist attractions in Malang, scoring 4.35. This shows that VR can foster an emotional connection with the tourist attractions. With VR, users feel as if they are in or visiting a place, which can create an emotional connection. Huang et al., (2010) and Skard et al., (2021), reported that strong emotional involvement is significant for forming a psychological bond with a place. Emotional bonds can also directly influence students' decisions to visit tourist destinations. Fifth, VR makes it easier for users to imagine tourist attractions, with a score of 4.57. This strengthens Han et al., (2013), statement that VR functions as a very effective simulation medium for introducing destinations that have been described or are less well known to the public.

The use of VR technology to introduce Malang's local culture has shown significant effectiveness in increasing students' understanding, interest, experience, and involvement with it. Three question items were used to measure students' perceptions of VR's effectiveness in introducing Malang's local culture, yielding the following results. First, the understanding of Malang's culture and history gained through VR was 4.48. This shows that students felt VR technology helped deepen their understanding of Malang's local culture, and that using VR as a learning medium allows them to access historical and cultural information in a more engaging way than traditional methods, such as reading textbooks or watching documentaries. As stated by Slater & Wilbur (1997), one significant advantage of using virtual presence-based teaching aids is the ability to build a strong sense of presence during learning, so that the learning experience can be felt directly rather than just read or seen. Using VR allows students to participate in 3D cultural tour simulations. Another advantage is that, by using VR, users can access aspects of culture that are difficult to reach through conventional media. For example, VR can take students on a simulated historical or cultural journey in Malang that is physically impossible, such as visiting historical sites located far inland or introducing local cultures rarely exposed.

Second, the application of VR technology in local tourism learning for students from other regions increased their interest in uncovering local culture, with an average score of 4.35. This finding indicates that students are more inclined to learn about culture after a direct VR experience. This also implies that VR plays an important role not only as a tool for transmitting information but also for increasing one's interest in culture. This phenomenon is not surprising because the possibilities offered by VR technology are much more comprehensive in terms of interactivity than in traditional classroom settings. The interactivity provided by VR, where users can choose which objects to explore and teleport, easily motivates students and draws their attention much better than traditional methods. Tussyadiah et al., (2018) have shown through research how the immersive experience provided by VR greatly increases motivation to learn, especially in the context of tourism and cultural education.

Third, VR can provide a more in-depth experience of Malang's natural and cultural scenery, earning a score of 4.39. This shows that students feel that they have deepened their experience of Malang's nature and culture using VR technology. Students can virtually visit local tourist attractions in Malang and experience a unique cultural atmosphere without leaving their homes. VR provides a more precise, detailed projection of the environment and culture.

The study's results showed that across two questions measuring students' perceptions of the influence of VR Media on learning, the average score was above 4.26, indicating a very high perception category. The results are as follows.

First, VR helps respondents develop Indonesian language skills through more real experiences, with a score of 4.09. These results indicate that students perceive VR as beneficial for improving their Indonesian-language skills. VR provides direct experiences that facilitate language learning in an authentic, contextual way. The use of VR allows students to interact with various real communication situations, for example, by speaking in simulated situations at tourist attractions or in social situations involving Indonesian.

In the context of language learning, contextual learning theory states that learning in relevant and realistic contexts can strengthen understanding and application of knowledge (Bransford et al., 2000). With VR, students not only learn vocabulary and sentence structures, but also feel and interact in real-world situations involving Indonesian. This makes language learning more interesting and memorable, as well as more relevant to real life.

Second, the experience of using VR technology significantly enhanced students' understanding of Malang's culture and tourist destinations. A score of 4.43 reflects this. Students felt that VR provided an opportunity to explore various aspects of culture and tourist attractions more closely, even though they were not physically present at the location. Unlike media such as images or videos, VR provides a more immersive experience, as if they were actually there.

This study has several limitations that should be noted. First, the research was conducted with a relatively small sample drawn from a single student group, limiting the generalizability of the findings to other educational contexts. Second, the study focused mainly on students' perceptions of

VR as a learning medium without directly measuring objective learning outcomes or long-term understanding of local culture and tourism. Other influential factors, such as learning motivation, instructional design quality, and digital readiness, were also not examined in this study. Given these limitations, it is recommended that future research use larger, more diverse samples to yield more representative results. Additionally, subsequent studies could incorporate objective performance measures and additional variables, such as motivation, engagement, and instructional design factors, to provide a more comprehensive understanding of VR's effectiveness in supporting cultural and tourism education.

CONCLUSION

Based on the findings, students perceive Virtual Reality (VR) as an effective learning medium for introducing Malang's local tourism and culture, as its immersive features help learners gain a more realistic, contextual understanding, even without direct physical visits. This conclusion answers the research objective by confirming that VR supports students' comprehension and engagement in learning about local cultural and tourism content. Based on these findings, integrating VR into educational practice can serve as an operational strategy to enhance local wisdom-based learning, strengthen cultural literacy, and promote innovative approaches to cultural preservation through technology-supported instruction. However, because the study was limited to a small sample and focused primarily on students' perceptions rather than measurable learning outcomes, the conclusions should be interpreted cautiously. Future educational practice should combine VR with structured instructional design and evaluation methods. At the same time, further research is suggested to involve broader participant groups and experimental approaches to more comprehensively assess the effectiveness of VR in cultural and tourism education.

ACKNOWLEDGEMENT

REFERENCES

Alizadeh, M., & Hawkinson, E. (2021). Case study 10, Japan: Smartphone virtual reality for tourism education-a case study. In *Language Learning with Technology: Perspectives from Asia* (pp. 211–222). Scopus. https://doi.org/10.1007/978-981-16-2697-5_17

Alkhalifah, E., Hammady, R., Abdelrahman, M., Darwish, A., Cranmer, E., Al-Shamaileh, O., Bourazeri, A., & Jung, T. (2025). Virtual reality's impact on tourist attitudes in islamic religious tourism: Exploring emotional attachment and VR presence. *Human Behavior and Emerging Technologies*, *2025*(1), 1-25. https://doi.org/10.1155/hbe2/8818559

Bailenson, J. (2018). *Experience on demand: What virtual reality is, how it works, and what it can do*. W.W. Norton & Company.

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

Bransford, J., National Research Council (U.S.), & National Research Council (U.S.) (Eds.). (2000). *How people learn: Brain, mind, experience, and school* (Expanded ed). National Academy Press. http://www.csun.edu/~SB4310/How%20People%20Learn.pdf

Chang, S., & Suh, J. (2025). The impact of VR exhibition experiences on presence, interaction, immersion, and satisfaction: Focusing on the experience economy theory (4Es). *Systems*, *13*(1), 1-18. https://doi.org/10.3390/systems13010055

Chao, C., Wu, S., Yau, Y., Feng, W., & Tseng, F. (2017). Effects of three-dimensional virtual reality and traditional training methods on mental workload and training performance. *Human*

Factors and Ergonomics in Manufacturing & Service Industries, *27*(4), 187–196. https://doi.org/10.1002/hfm.20702

Chatain, J., Kapur, M., & Sumner, R. W. (2023). Three perspectives on embodied learning in virtual reality: Opportunities for interaction design. *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems*, 1–8. https://doi.org/10.1145/3544549.3585805

Evans, J. R., & Mathur, A. (2005). The value of online surveys. *Internet Research*, *15*(2), 195–219. https://doi.org/10.1108/10662240510590360

Guerra-Tamez, C. R. (2023). The impact of immersion through virtual reality in the learning experiences of art and design students: The mediating effect of the flow experience. *Education Sciences*, *13*(2), 1-18. https://doi.org/10.3390/educsci13020185

Hamilton, D., McKechnie, J., Edgerton, E., & Wilson, C. (2021). Immersive virtual reality as a pedagogical tool in education: A systematic literature review of quantitative learning outcomes and experimental design. *Journal of Computers in Education*, *8*(1), 1–32. https://doi.org/10.1007/s40692-020-00169-2

Han, D.-I., Jung, T., & Gibson, A. (2013). Dublin AR: Implementing augmented reality in tourism. In Z. Xiang & I. Tussyadiah (Eds), *Information and Communication Technologies in Tourism 2014* (pp. 511–523). Springer International Publishing. https://doi.org/10.1007/978-3-319-03973-2_37

Harris, J. M., & Seo, M. (2024). Student reflections on enhancing cultural awareness in health education specialists: Insights from a collaborative online international learning (COIL) Experience. *Pedagogy in Health Promotion*, *10*(2), 105–113. https://doi.org/10.1177/23733799241230499

Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. *Research in Nursing & Health*, *31*(2), 180–191. https://doi.org/10.1002/nur.20247

Huang, H.-M., Rauch, U., & Liaw, S.-S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education*, *55*(3), 1171–1182. https://doi.org/10.1016/j.compedu.2010.05.014

Ishihara, M., & Komori, T. (2016). Auditory and visual properties in the virtual reality using haptic device. In S. Lackey & R. Shumaker (Eds), *Virtual, Augmented and Mixed Reality* (Vol. 9740, pp. 135–146). Springer International Publishing. https://doi.org/10.1007/978-3-319-39907-2_13

Jumaat, N. F., Tasir, Z., Halim, N. D. A., & Ashari, Z. M. (2017). Project-based learning from constructivism point of view. *Advanced Science Letters*, *23*(8), 7904–7906. https://doi.org/10.1166/asl.2017.9605

Kieanwatana, K., & Vongvit, R. (2024). Virtual reality in tourism: The impact of virtual experiences and destination image on the travel intention. *Results in Engineering*, *24*, 1-12. https://doi.org/10.1016/j.rineng.2024.103650

Leong, W. Y., Leong, Y. Z., & Leong, W. S. (2024). Virtual reality in education: Case studies and applications. *IET Conference Proceedings*, *2023*(35), 186–187. https://doi.org/10.1049/icp.2023.3332

Llanas, I. S. (2018). Brevísimo análisis doxográfico sobre el constructivismo: De los presocráticos a la cibernética de segundo orden. *Bajo Palabra*, *2018*, 61–76. https://doi.org/10.15366/bp2018.18.003

Malik, R., Sharma, A., & Chaudhary, P. (2024). *Transforming education with virtual reality*. John Wiley & Sons, Inc. https://doi.org/10.1002/9781394200498

MavRomatis, M., Gaugne, R., Coulon, R., & Gouranton, V. (2025). A problem-driven approach to XR in education: Teaching non-euclidean geometries through virtual reality. *2025 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 220–223. https://doi.org/10.1109/VRW66409.2025.00054

Mazurek, J., Kiper, P., Cieślik, B., Rutkowski, S., Mehlich, K., Turolla, A., & Szczepańska-Gieracha, J. (2019). Virtual reality in medicine: A brief overview and future research directions. *Human Movement*, *20*(3), 16–22. https://doi.org/10.5114/hm.2019.83529

Menin, A., Torchelsen, R., & Nedel, L. (2018). An analysis of VR Technology used in immersive simulations with a serious game perspective. *IEEE Computer Graphics and Applications*, *38*(2), 57–73. https://doi.org/10.1109/MCG.2018.021951633

Mura, P., Tavakoli, R., & Pahlevan Sharif, S. (2017). 'Authentic but not too much': Exploring perceptions of authenticity of virtual tourism. *Information Technology and Tourism*, *17*(2), 145–159. Scopus. https://doi.org/10.1007/s40558-016-0059-y

Muzaki, H., Susanto, G., Andajani, K., Widyartono, D., Akhsani, I., & Moorthy, T. K. (2025). Pengembangan media pembelajaran virtual reality (VR) untuk mengenalkan budaya lokal Malang ke pembelajar BIPA: *Diglosia: Jurnal Kajian Bahasa, Sastra, dan Pengajarannya*, *8*(4), 955–968. https://doi.org/10.30872/diglosia.v8i4.1324

Prensky, M. (2001). Digital natives, digital immigrants part 1. *On the Horizon*, *9*(5), 1–6. https://doi.org/10.1108/10748120110424816

Rachmad, Y. E. (2024). *Virtual Getaways: Exploring the impact of virtual reality on tourism*. ResearchGate. https://doi.org/10.17605/OSF.IO/57VBC

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*, 1-29. https://doi.org/10.1016/j.compedu.2019.103778

Shadiev, R., Xueying, W., & Huang, Y. M. (2020). Promoting Intercultural competence in a learning activity supported by virtual reality technology. *International Review of Research in Open and Distributed Learning*, *21*(3), 157–174. https://doi.org/10.19173/irrodl.v21i3.4752

Shehade, M., & Stylianou-Lambert, T. (2020). Virtual reality in museums: Exploring the experiences of museum professionals. *Applied Sciences*, *10*(11), 1-20. https://doi.org/10.3390/app10114031

Skard, S., Knudsen, E. S., Sjåstad, H., & Thorbjørnsen, H. (2021). How virtual reality influences travel intentions: The role of mental imagery and happiness forecasting. *Tourism Management*, *87*, 1-9. https://doi.org/10.1016/j.tourman.2021.104360

Slater, M., & Wilbur, S. (1997). A Framework for immersive virtual environments (FIVE): speculations on the role of presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, *6*(6), 603–616. https://doi.org/10.1162/pres.1997.6.6.603

Sugiyono. (2020). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Alfabeta.

Sukserm, P. (2024). Determining the appropriate sample size in EFL pilot studies. *Journal of Research Methodology*, *37*(3), 245–264. https://so12.tci-thaijo.org/index.php/jrm/article/view/1532

Tanvir, A. (2022). *The Value of experience: Virtual Reality as a form of barrier-free tourism*. ResearchGate. https://doi.org/10.13140/RG.2.2.32842.24001

Tussyadiah, I. P., Wang, D., Jung, T. H., & Tom Dieck, M. C. (2018). Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tourism Management*, *66*, 140–154. https://doi.org/10.1016/j.tourman.2017.12.003

Wang, X., Rahimova, S., Shadiev, N., Fayziev, M., Gaevskaya, E., & Shadiev, R. (2020). The effects of a learning activity supported by VR technology on intercultural competence in Chinese students. *Global Chinese Conference on Computers in Education Main Conference Proceedings (English Paper)*, *2020*, 745–748. Scopus.

Wenli, L. (2023). Application of virtual reality technology and its impact on digital health in healthcare industry. *Journal of Commercial Biotechnology*, *27*(4). https://doi.org/10.5912/jcb1320

Yang, Y. (2024). Technical challenges affecting the popularization of virtual reality technology. in Y. Yue (Ed.), *Proceedings of the 2024 International Conference on Mechanics, Electronics Engineering and Automation (ICMEEA 2024)* (Vol. 240, pp. 261–272). Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-518-8_26

Yung, R., & Khoo-Lattimore, C. (2019). New realities: A systematic literature review on virtual reality and augmented reality in tourism research. *Current Issues in Tourism*, *22*(17), 2056–2081. https://doi.org/10.1080/13683500.2017.1417359

Zhang, J. (2024). Application and challenges of virtual reality technology in language immersive learning. *The Journal of Education Insights*, *2*(3), 25–28. https://doi.org/10.37155/2972-4856-0203-6