



## Exploring student engagement and reuse intention in a VR-based art exhibition

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### ABSTRACT

This study explores the psychological and experiential factors influencing students' intention to reuse a virtual reality (VR) art exhibition. Grounded in the Technology Acceptance Model (TAM), Flow Theory, and the Experience Economy framework, the research investigates how immersion, presence, interactivity, aesthetic appreciation, and perceived enjoyment shape behavioural responses in VR-based art education. A post-experience survey was administered to 148 fine arts students after their engagement with a VR art gallery via Oculus Quest 3. Using Pearson correlation and mediation/moderation analyses via the PROCESS macro in SPSS, the study found that perceived enjoyment significantly mediated the relationship between experiential factors (immersion, presence, interactivity, and aesthetic appreciation) and the intention to reuse the VR experience. Notably, perceived enjoyment fully mediated the effects of immersion, presence, and interactivity, and partially mediated aesthetic appreciation. Furthermore, the influence of perceived enjoyment on reuse intention was moderated by students' prior experience with e-learning technologies. The final model highlights the central role of emotional responses, particularly perceived enjoyment, as the primary pathway through which users decide to reuse VR in art education. These findings offer theoretical contributions to understanding engagement in VR environments and provide practical recommendations for designing emotionally rich, visually compelling educational experiences.

### 1. Introduction

The recent acceptance of virtual reality (VR) in educational space is attributed to its ability to create immersive and interactive environments. According to Liu et al. (2025), immersive VR learning settings significantly enhance students' experience and concentration. Dunmoye et al. (2024) also note that VR helps overcome classroom limitations by enabling deeper engagement and collaboration. Lin et al. (2024) add that VR is most effective when emotional and spatial aspects are harmonised with instructional design, which explains why VR has been widely applied in healthcare, engineering, and language education (Harms, 2024).

Despite this progress, VR in fine-arts education remains underexplored, especially in Iraq and other non-Western settings. Prior studies (e.g., Gómez-Ríos et al., 2023; Jiawei & Mokmin, 2023) show that emotional and visual aspects of VR are promising but still lack systematic investigation in art-related programmes. Fine-arts programmes focus on creative practice, aesthetic judgement, and the interpretation of

visual culture. Unlike healthcare or language education, where VR is used mainly for procedural training or conversation practice, fine-arts pedagogy emphasises sensory experience, personal expression, and critical reflection. Virtual art exhibitions are, therefore, especially suitable for VR because they replicate the gallery experience while adding interactive and spatial possibilities.

Given works such as Ros et al. (2021), which have emphasised how immersive VR can put students at the centre of the learning experience and change the role of passive engagement, the object of this study aligns with and further develops this research direction. According to Gómez-Ríos et al. (2023), VR enhances emotional and immersive learning experiences, but studies in fine arts education in this regard are scarce. In addition, the works of Tu et al. (2025) have indicated that emotional arousal, aesthetic appreciation, and spatial interaction are the main drivers of students' satisfaction and behavioural intention in VR-based art museum experiences.

To analyse this context, the study draws on the Technology Acceptance Model (TAM), the Experience Economy Theory, and the Presence

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Theory. TAM explains how perceived usefulness and ease of use shape adoption, while Presence Theory accounts for the psychological state of “being there” in VR. The Experience Economy Theory highlights how emotional and aesthetic appreciation engagement drive satisfaction. Together, these theories provide a conceptual framework for exploring how VR art exhibitions can affect student experience and behaviour.

The objective of this study is to explore the psychological and experiential factors, specifically emotional, aesthetic appreciation, and immersive dimensions, that influence students' intention to reuse VR in fine-arts education, with a particular focus on Iraqi higher education.

This study combines TAM with both Experience Economy Theory and Presence Theory to propose a unified model for this emerging context of VR art exhibitions. It also offers practical insights from a student-centred perspective, grounded in the Iraqi higher education setting, to help educators design engaging and culturally relevant VR learning experiences. In this framework, aesthetic appreciation and emotional engagement are conceptualised as core elements derived from the Experience Economy Theory, reflecting the affective and sensory richness of the VR exhibition.

### 1.1. Research questions and hypotheses

The study is guided by two main research questions.

**RQ1.** To what extent do experiential features such as immersive presence, aesthetic appreciation response, spatial engagement, and environmental realism influence students' intention to reuse VR in the teaching-learning context?

**RQ2.** In what ways do these experiential factors work collectively to define students' behavioural intention to reuse similar types of virtual exhibitions in the future?

Based on these research questions and the theoretical frameworks adopted, the following hypotheses are proposed.

**H1.** Perceived enjoyment mediates the relationship between aesthetic appreciation and students' intention to reuse the virtual exhibition.

**H2.** Perceived enjoyment mediates the relationship between interactivity and students' intention to reuse the virtual exhibition.

**H3.** Perceived enjoyment mediates the relationship between immersive presence and students' intention to reuse the virtual exhibition.

**H4.** Perceived enjoyment mediates the relationship between immersion and students' intention to reuse the virtual exhibition.

**H5.** Perceived enjoyment mediates the relationship between interactivity and students' intention to reuse the virtual exhibition.

**H6.** The relationship between perceived enjoyment and reuse intention is moderated by students' prior use of e-learning.

**H7.** The indirect effect of aesthetic appreciation on reuse intention through perceived enjoyment is moderated by students' prior use of e-learning.

## 2. Literature review

VR is gradually being introduced into art and education due to its immersive and experiential characteristics. Accumulated research has shown that VR can influence emotional engagement, spatial presence, and the aesthetic appreciation of visual content, which further enhances learning and creative development. Recent studies have started to look at which parts of the VR experience make students want to use it again, especially in learning and creative settings. The previous discussion has reviewed some of the theories and contemporary studies to uncover how immersive environments shape students' experiences and their intention to reuse VR. Different theoretical models have been tried to explain how

students interact with VR. In an earlier version of this model, the TAM claims that the acceptance of new technology by an individual can be measured in terms of fun, usefulness, and ease of use (Davis, 1989; Venkatesh & Davis, 2000). Studies conducted on VR show that perceived enjoyment is one of the major contributors to engagement and intention of reuse of technology (Li & Lv, 2024). Another theory of relevance is the Experience Economy Theory, which states that people value meaningful and memorable experiences beyond mere material benefit rather than consumption (Pine & Gilmore, 1998).

VR has been applied across several domains such as healthcare, engineering, and language education. In these contexts, it improved procedural learning, technical training, and communication practice. These findings show the broad potential of VR. However, while these areas are relatively well studied, fine-arts education remains less explored and requires specific attention.

For VR art exhibitions, immersion and quality of display are major determinants. This has been observed by Wang et al. (2023) and Cheng, L., Xu, and Pan (2024), as both studies found that in terms of emotional richness in the VR environment, the greater the emotional appeal and visual attraction, the stronger the users' attachment to it and their desire to return. Presence Theory, as proposed by Slater and Wilbur (1997), helps explain how the sense of being located in the virtual environment contributes to emotional involvement. Similarly, Zibrek et al. (2021) and Yang et al. (2023) confirmed that realistic design and spatial cues enhance presence and promote emotional engagement in VR exhibitions. Earlier studies reaffirmed the importance of presence and aesthetic appreciation in the context of VR. For instance, Yang and Zhang (2022) mentioned that presence significantly increases perceived enjoyment among users while using VR to tell stories, and Modena and Parisi (2021) showed how engagement with art in the VR medium might trigger emotional and cognitive processes. For example, Bodzin et al. (2021) developed a VR learning game to promote reuse through a narrative with spatial freedom. Together, these findings indicate that immersive design, realistic cues, and aesthetic appreciation richness all contribute to stronger user attachment and reuse intention.

Immersive environments create greater emotional attachment and better visual satisfaction in users with their art, according to Zhou and Li (2024). Hui et al. (2022) also found in their investigation that even young learners were engaged and inventive during their VR productivity. Radianti et al. (2020) reported that immersive environments of virtual reality stimulate and encourage one's independence at the higher education level.

However, several similar studies have identified some gaps that need further investigation. Despite many applications of VR in education, most prior work has focused on functional training or general learning outcomes, with limited attention to fine-arts education. Samaniego et al. (2024) emphasised the importance of using immersive methods to enhance creativity in VR art. According to findings by Villalba et al. (2021), VR has the potential to enhance empathy and perspective-taking, both of which are essential features in art education. According to Jiawei and Mokmin (2023), there is a systematic review and comprehensive conclusion that although immersive forms of VR are being studied in education-related areas, the emotional, aesthetic appreciation, and visual dimensions around visual communication design remain under-researched. Together, these studies indicate that the emotional and aesthetic appreciation potential of VR is recognised but still insufficiently examined, particularly in relation to art exhibitions and fine-arts pedagogy. This gap highlights the need for research that connects immersive, emotional, and aesthetic factors to students' reuse intention, especially in underexplored contexts such as Iraqi higher education.

Other studies emphasised trust and emotional honesty. Relatedly, Horng and Hsu (2021) used the S-O-R model and determined that aesthetic appreciation stimulation increases emotional responses and memory, thus increasing reuse tendency. In this study, TAM, Presence Theory, and Experience Economy Theory are adopted to provide the

theoretical foundation for understanding how students experience and respond to virtual exhibitions.

Moreover, few studies are found to integrate both emotional and immersive factors in one model to explain student reuse intention in the arts. In conclusion, previous research emphasised the importance of emotional, immersive, and visual elements in user interactions with VR. Still, [Jiawei and Mokmin \(2023\)](#) pointed out that further research is needed to better understand how emotional and aesthetic appreciation experiences shape users' willingness to return to VR exhibitions. Their findings suggest that future studies should examine these factors in different cultural and national contexts. This need for further research is especially relevant to fine arts education in emerging contexts, particularly in settings where VR is still an emerging educational tool.

### 3. Theoretical background and research model

This study develops its theoretical framework by drawing from three complementary perspectives: the TAM, Presence Theory, and the Experience Economy Theory. Together, these frameworks explain how affective, aesthetic appreciation, and cognitive dimensions influence student engagement and behavioural intention in VR-based art education.

TAM, introduced by [Davis \(1989\)](#) and extended by [Venkatesh and Davis \(2000\)](#), explains technology adoption through perceived usefulness and perceived ease of use. Later research added perceived enjoyment as a central factor in interactive systems ([Van der Heijden, 2004](#)). In VR contexts, perceived enjoyment is often decisive in shaping acceptance. [Li and Lv \(2024\)](#) found that perceived enjoyment, presence, and interactivity strongly influenced students' intention to reuse VR and [Alturkustani et al. \(2025\)](#) similarly highlighted the motivational role of enjoyment. [Cecotti et al. \(2024\)](#) also confirmed that immersive VR in art education enhances motivation by improving perceived usefulness. [Lin et al. \(2024\)](#) emphasised that VR's success in education depends largely on affective and behavioural engagement, while [Tu et al. \(2025\)](#) showed that perceived enjoyment and emotional satisfaction are central predictors of intention to continue using VR. These findings validate the inclusion of TAM in this study, particularly its emphasis on perceived enjoyment as a mediator of user behaviour in art education.

Presence Theory adds a psychological dimension, focusing on the state of "being there" in a virtual environment. [Slater and Wilbur \(1997\)](#) argued that presence fosters emotional involvement, while [Yang et al. \(2023\)](#) demonstrated that multisensory design (sound, visuals) deepens reflection and engagement. [Oliveira and Hamari \(2025\)](#) added that a game-like, user-centred VR environment fosters student autonomy and well-being. [Kaplan-Rakowski et al. \(2024\)](#) stated that symbolic interaction and avatar-centred design are key to meaningful learning. [Yang and Zhang \(2022\)](#) found that presence enhances user perceived enjoyment in immersive storytelling, and [Weber et al. \(2021\)](#) showed that perceived realism drives emotional involvement. These insights indicate that presence does not act directly, but influences reuse intention indirectly through perceived enjoyment.

The Experience Economy Theory by [Pine and Gilmore \(1998\)](#) provides another layer by stressing the value of aesthetic appreciation and emotional experiences. VR art exhibitions rely on such experiences, where visual appeal, atmosphere, and sensory richness matter as much as functionality. [Wang et al. \(2023\)](#) and [Cheng, Xu, and Pan \(2024\)](#) showed that aesthetic appreciation quality in VR can increase user attachment. [Liu et al. \(2025\)](#) confirmed that design elements such as sound and colour enhance memory and emotional connection. [Dunmoye et al. \(2024\)](#) found that emotional design in VR supports deeper learning, while [Hornig and Hsu \(2021\)](#) applied the S-O-R framework to show that aesthetic appreciation stimulation creates pleasant emotions that guide behaviour. This confirms that perceived enjoyment is the key link between aesthetic appreciation and behavioural intention.

The concept of flow ([Csikszentmihalyi, 1990](#)) also informs this framework. Flow is a state of complete absorption in an activity, marked

by perceived enjoyment and focused attention. In VR, flow-like states are represented through immersion, interactivity, and perceived enjoyment. [Makransky and Lilleholt \(2018\)](#) demonstrated that presence and perceived enjoyment contribute to flow experiences in VR learning. [Lin et al. \(2024\)](#) also reported that presence and interactivity are conditions for flow, while [Liu et al. \(2025\)](#) showed that emotional engagement predicts performance even when flow is not directly measured. In this study, flow is not tested as a separate construct but provides a conceptual basis for linking experiential factors with perceived enjoyment and reuse intention.

Finally, the model considers how past digital learning experience influences VR use. [Dubovi \(2022, 2024\)](#) and [Zhou and Li \(2024\)](#) observed that users familiar with online learning tools express stronger emotional and behavioural ties with immersive technologies. [Hornig and Hsu \(2021\)](#) further showed that previous digital experience enhances emotional responses to aesthetic appreciation stimuli. This study, therefore, examines whether students' past use of e-learning moderates the relationship between perceived enjoyment and reuse intention, as well as the indirect effect of aesthetic appreciation through perceived enjoyment.

Bringing these perspectives together, the framework positions four experiential factors — Immersion, Presence, Interactivity, and Aesthetic Appreciation — as drivers of Perceived Enjoyment, which in turn predicts Intention to Reuse. Past E-learning Use is included as a moderator. [Fig. 1](#) presents the complete conceptual model.

## 4. Methodology

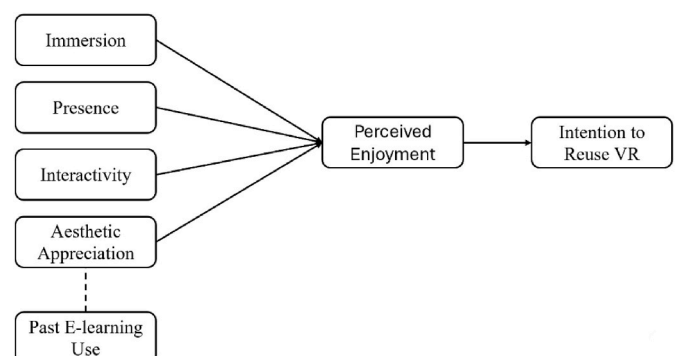
### 4.1. Design and development of the virtual environment

The virtual art exhibition was developed using Unity 3D because it works smoothly with Oculus Quest 3 headsets and supports immersive virtual environments. Unity allowed full control over lighting, textures, spatial layout, and user interaction. This made it possible to build a stable and coherent VR exhibition suitable for educational use.

The exhibition displayed 24 digital paintings created by high-performing students enrolled in digital art courses. The virtual space was designed to resemble a real university art gallery. It consisted of two large exhibition halls connected by open door frames, forming one continuous gallery. Both halls were identical in layout, size, and lighting conditions to maintain consistency throughout the experience.

Realistic visual elements were included, such as ambient lighting and focused spotlights, to enhance aesthetic appreciation and spatial presence. Movement inside the environment was based on joystick locomotion using Oculus Quest controllers. Teleportation was not used, allowing navigation that felt closer to natural walking in a physical gallery. The same version of the environment was deployed on ten Oculus Quest 3 headsets to ensure a comparable experience for all participants.

Soft background music was added to support immersion without



**Fig. 1.** Proposed model of students' reuse intention in a VR art exhibition.

distracting attention from the artworks. Although the students initially intended to organise a physical exhibition for their digital works, this was not achieved due to limitations in time, cost, and available resources. The virtual gallery, therefore, provided a practical and scalable alternative. It fulfilled the original goal of showcasing student work while introducing them to an immersive digital exhibition format. Screenshots from the development stage of the virtual environment are shown in Figs. 2 and 3.

#### 4.2. Participants and setting

This study involved 148 undergraduate students enrolled in fine arts programmes at the University of Baghdad and the University of Wasit. The students came from two academic tracks: Art Education and Plastic Arts. Participation was voluntary, and all responses were collected anonymously. Although all participants had prior experience with digital art through their university courses, none had previously used VR in an educational or exhibition context. The experiment was conducted in the computer laboratories and media rooms of both universities. Each student experienced the VR exhibition individually using Oculus Quest 3 headsets, with each session lasting approximately 10–15 min. A total of ten headsets were used, and technical support was provided throughout the sessions to assist students in operating the equipment. All participants entered the two exhibition halls in the same fixed order to ensure consistency, and no randomisation of entry sequence was applied. Each session began when the student entered the virtual environment and ended when the headset was removed. The minimum session duration was set at 10 min, with a maximum of 15 min, allowing each student to decide how long to observe the artworks at their own pace. Students were instructed to explore the gallery by moving through the space and examining the artworks from different distances and angles, as they would in a real exhibition. After the VR session, participants completed the post-experience questionnaire.

##### 4.2.1. Demographic profile of participants

A total of 148 students participated in this study, with 82.4 % aged between 20 and 23 years. The academic level was distributed across all four undergraduate stages, with a higher concentration in the third and fourth years (28.4 % and 29.7 %, respectively). In terms of field of study, the largest group came from the Plastic Arts department (44.6 %), followed by Design (31.8 %) and Art Education (23.6 %). Regarding

location, 57.4 % of participants were from Wasit, while 42.6 % were from the University of Baghdad.

#### Ethical approval

The research was ethically approved by the College of Fine Arts at the University of Baghdad and the College of Fine Arts Education at the University of Wasit. Both approvals were granted prior to data collection. Participants were informed about the study and provided written consent voluntarily. The researcher adhered to the ethical guidelines set by both institutions throughout the research.

#### 4.3. Survey instrument development

Using a survey-based approach, this study implemented a post-experience questionnaire to assess students' reactions after exploring the VR exhibition. The questionnaire was administered immediately after each VR session in laboratory/media rooms or supervised studio spaces, responses were collected anonymously, and the survey was completed on paper. The instrument consisted of 37 items, grouped into six constructs: Immersion, Presence, Interactivity, Perceived Enjoyment, Aesthetic Appreciation, and Intention to Reuse. All responses were measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Most items were adapted from validated instruments in VR and technology acceptance research (see Appendix A). The questionnaire was reviewed by experts in art education and educational technology to ensure content validity, and a pilot test was conducted to ensure clarity and usability. A small pilot was used to check clarity and timing, leading to minor wording adjustments; for Arabic administration, items were reviewed by bilingual experts to ensure semantic equivalence.

#### 4.4. Data collection

The data were analysed using IBM SPSS Statistics (Version 27). Descriptive statistics (mean and standard deviation) were calculated. Pearson correlation tests were conducted to explore the relationships among variables and assess students' intention to reuse the VR exhibition. The PROCESS macro for SPSS (Version 4.2), developed by Hayes (2022), was used to perform mediation and moderation analyses, employing 5000 bootstrap samples with a 95 % confidence level.



Fig. 2. Screenshot of the virtual exhibition design in Unity.

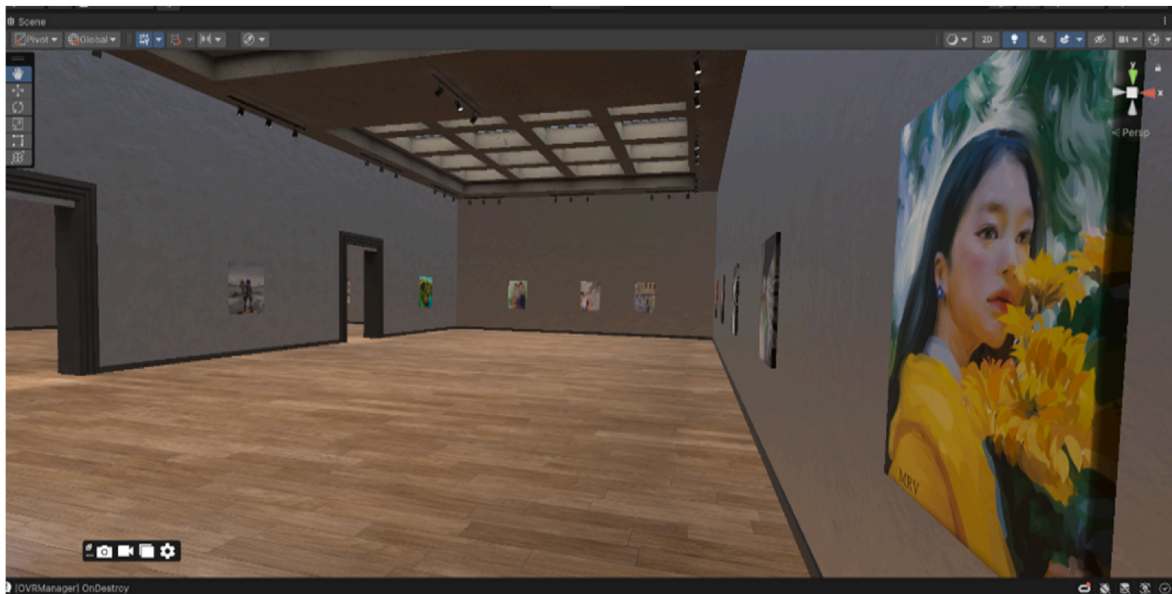


Fig. 3. Final VR exhibition setup in Unity with realistic lighting and textures.

Techniques for navigating the gondola had to be provided to the students in a concise and clear manner before their actual entry into the VR exhibition. To ensure this, brief introductory instructions were given individually to help them move more effectively through the environment. A few students experienced some initial confusion when entering the system for the first time, indicating that greater clarity should be emphasised during onboarding in future implementations.

4.5. Data analysis

Descriptive statistics (mean and standard deviation) were used to summarise the data. Pearson correlation tests were employed to examine associations among study variables and assess students' behavioural intention to reuse the VR experience.

5. Results

This chapter presents the results of the statistical analysis. It includes two main parts: descriptive statistics of the key experiential factors and the results of hypothesis testing based on the simplified conceptual model.

5.1. Reliability and descriptive statistics

This section reports the reliability and descriptive statistics for the six key constructs. A total of 148 students participated in the VR art exhibition and completed the questionnaire. As shown in Table 1, all constructs demonstrated good internal consistency, with Cronbach's Alpha values above 0.80. Immersion had the highest reliability ( $\alpha = .90$ ), followed by perceived enjoyment ( $\alpha = .87$ ) and aesthetic appreciation ( $\alpha = .86$ ). The lowest was for interactivity ( $\alpha = .81$ ), which is still

Table 1  
Descriptive statistics and reliability for each construct (N = 148).

Variable	Number of Items	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
Immersion	7	1.29	5.00	3.84	0.79	0.90
Presence	7	1.57	5.00	3.74	0.70	0.86
Interactivity	5	1.80	5.00	3.85	0.70	0.81
Perceived Enjoyment	7	2.00	5.00	4.09	0.63	0.87
Aesthetic Appreciation	7	2.00	5.00	3.92	0.70	0.86
Intention to Reuse	4	1.50	5.00	3.95	0.71	0.84

acceptable. The descriptive results indicate generally positive experiences. Perceived enjoyment had the highest mean score ( $M = 4.09$ ), suggesting students found the experience enjoyable. Intention to reuse was also high ( $M = 3.95$ ), indicating interest in future use. Immersion ( $M = 3.84$ ), interactivity ( $M = 3.85$ ), and aesthetic appreciation ( $M = 3.92$ ) also received positive ratings. Presence had the lowest score ( $M = 3.74$ ), though still above the midpoint. All standard deviations were below 0.80, showing limited variability and consistent responses across participants.

5.2. Correlation analysis

Pearson correlation analysis was conducted to explore the relationships among the key constructs. Table 2 shows significant and positive correlations between most variables. Perceived enjoyment was strongly correlated with both aesthetic appreciation ( $r = 0.837, p < .001$ ) and immersion ( $r = 0.847, p < .001$ ), suggesting that students who appreciated the visual quality and felt immersed in the VR space were more likely to enjoy the experience. Perceived enjoyment was also significantly related to intention to reuse ( $r = 0.745, p < .001$ ), as was aesthetic appreciation ( $r = 0.790, p < .001$ ), indicating their importance in shaping students' behavioural intentions. Presence showed strong correlations with both perceived enjoyment ( $r = 0.746, p < .001$ ) and aesthetic appreciation ( $r = 0.691, p < .001$ ). Interactivity had weaker correlations overall, including a modest link with presence ( $r = 0.283, p < .001$ ) and a weak association with Intention ( $r = 0.200, p < .05$ ). These results suggest that while interactivity plays a role, emotional and aesthetic appreciation aspects are more influential in predicting students' reuse intention.

**Table 2**  
Pearson correlation matrix of key study variables (N = 148).

Variable	Immersion	Presence	Perceived Enjoyment	Interactivity	Aesthetic appreciation	Intention
Immersion	1	0.782**	0.847**	0.224*	0.728**	0.647**
Presence	0.782**	1	0.746**	0.283**	0.691**	0.605**
Perceived Enjoyment	0.847**	0.746**	1	0.207*	0.837**	0.745**
Interactivity	0.224*	0.283**	0.207*	1	0.118	0.200*
Aesthetic Appreciation	0.728**	0.691**	0.837**	0.118	1	0.790**
Intention	0.647**	0.605**	0.745**	0.200*	0.790**	1

\* Correlation is significant at the 0.05 level (2-tailed).  
\*\* Correlation is significant at the 0.01 level (2-tailed).

5.3. Regression analysis

A multiple regression analysis was performed to identify which experiential factors significantly predicted students' intention to reuse the VR art exhibition. The independent variables included immersion, presence, perceived enjoyment, interactivity, and aesthetic appreciation. The outcome variable was intention to reuse. Results are shown in Table 3. Among the predictors, aesthetic appreciation had the strongest effect ( $\beta = 0.572, p < .001$ ), indicating that students who valued the artistic and visual quality of the exhibition were more likely to consider using VR again. Perceived enjoyment also had a significant effect ( $\beta = 0.244, p = .040$ ), showing that emotional engagement contributed meaningfully to reuse intention. In contrast, immersion, presence, and interactivity were not significant predictors ( $p > .05$ ). While they may have contributed to the overall experience, their influence on reuse intention appears to be indirect, possibly operating through perceived enjoyment or aesthetic appreciation. The model as a whole was statistically significant and accounted for 65.4 % of the variance in reuse intention ( $R^2 = 0.654, \text{Adjusted } R^2 = 0.642$ ). This suggests a strong explanatory power of the selected variables. Collinearity diagnostics were examined to assess multicollinearity. Variance inflation factor (VIF) values ranged from 1.111 to 5.669, all within acceptable limits. Although perceived enjoyment had the highest VIF (5.669) and the lowest tolerance (0.176), this does not indicate serious multicollinearity. The regression estimates were therefore deemed stable and interpretable.

5.4. Mediation analysis

5.4.1. Mediation via perceived enjoyment (aesthetic appreciation → perceived enjoyment → intention)

This analysis looked at whether perceived enjoyment explains the link between aesthetic appreciation and students' willingness to reuse the VR art exhibition. Using PROCESS Model 4 with 5000 samples and 95 % confidence, the findings showed that aesthetic appreciation significantly predicted perceived enjoyment ( $\beta = 0.752, p < .001$ ), and perceived enjoyment, in turn, significantly predicted reuse intention ( $\beta = 0.314, p = .002$ ). Aesthetic appreciation also had a strong impact on intention ( $\beta = 0.565, p < .001$ ), and the overall effect was significant ( $\beta = 0.801, p < .001$ ). The indirect path through perceived enjoyment was also significant ( $\beta = 0.236, 95\% \text{ CI } [0.039, 0.445]$ ), and zero was not in the confidence interval. This confirms a partial link. This suggests that students who appreciated the visual and artistic qualities of the exhibition enjoyed the experience more, which in turn increased their

**Table 3**  
Multiple regression results for predicting students' intention to reuse the VR art exhibition (N = 148).

Variable	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
Immersion	0.005	0.092	0.006	0.059	0.953	0.232	4.319
Presence	0.000	0.087	0.000	0.005	0.996	0.339	2.953
Perceived Enjoyment	0.275	0.133	0.244	2.077	0.040	0.176	5.669
Interactivity	0.081	0.053	0.080	1.536	0.127	0.900	1.111
Aesthetic Appreciation	0.579	0.094	0.572	6.160	<0.001	0.283	3.533

willingness to use VR for similar experiences in the future. These results are summarised in Table 4.

5.4.2. Mediation via perceived enjoyment (immersion → perceived enjoyment → intention)

This analysis looked into whether perceived enjoyment explains the connection between immersion and students' willingness to revisit the VR art exhibition. The test used PROCESS Model 4 with 5000 samples and a 95 % confidence level. The results revealed that immersion significantly predicted perceived enjoyment ( $\beta = 0.674, p < .001$ ), suggesting that a stronger sense of immersion led to greater emotional perceived enjoyment. Perceived enjoyment also significantly predicted reuse intention ( $\beta = 0.784, p < .001$ ). Although the overall impact of immersion on willingness to reuse was significant ( $\beta = 0.581, p < .001$ ), the direct path was no longer significant after adding perceived enjoyment to the model ( $\beta = 0.053, p = .583$ ). This shift confirms full mediation. The indirect link from immersion to intention via perceived enjoyment was significant too ( $\beta = 0.528, 95\% \text{ CI } [0.335, 0.694]$ ), and zero was not in the confidence range. These findings confirm that perceived enjoyment fully explains the effect of immersion on students' willingness to reuse VR in future art experiences. Full mediation is confirmed, and the results are detailed in Table 4.

5.4.3. Mediation via perceived enjoyment (interactivity → perceived enjoyment → reuse intention)

This analysis looked at whether perceived enjoyment helps explain the connection between interactivity and students' intention to reuse the virtual reality art exhibition. A test was done using PROCESS Model 4 with 5000 samples and a 95 % confidence level. The findings showed that interactivity significantly predicted enjoyment ( $\beta = 0.187, p = .011$ ), and perceived enjoyment strongly predicted reuse intention ( $\beta = 0.829, p < .001$ ).

However, the direct link from interactivity to reuse intention was not significant ( $\beta = 0.048, p = .406$ ), while the indirect link through perceived enjoyment was significant ( $\beta = 0.155, 95\% \text{ CI } [0.036, 0.289]$ ). Since zero was not in the confidence range and the direct path wasn't significant, these results support a full mediation model. This means that students' perception of interactivity inside the virtual exhibition increased their reuse intention mainly through the perceived enjoyment they experienced. All values are summarised in Table 4.

5.4.4. Mediation via perceived enjoyment (presence → perceived enjoyment → intention)

This analysis explored whether perceived enjoyment helps explain

**Table 4**  
Summary of mediation results involving perceived enjoyment as a mediator.

Predictor	a-path (X→M)	b-path (M→Y)	Indirect Effect	CI (95 %)	Direct Effect (X→Y)	Mediation Type
Aesthetic Appreciation → Perceived Enjoyment	0.752**	0.314**	0.236*	[0.039, 0.445]	0.565**	Partial mediation
Immersion → Perceived Enjoyment	0.674**	0.784**	0.528**	[0.335, 0.694]	0.053 (ns)	Full mediation
Presence → Perceived Enjoyment	0.676**	0.746**	0.505**	[0.293, 0.657]	0.114 (ns)	Full mediation
Interactivity → Perceived Enjoyment	0.187*	0.829*	0.155*	[0.036, 0.289]	0.048 (ns)	Full mediation

the link between presence and students' intention to reuse the virtual exhibition. A test was carried out using PROCESS Model 4 with 5000 samples and 95 % confidence. The results revealed that presence significantly led to perceived enjoyment ( $\beta = 0.676, p < .001$ ), and perceived enjoyment in turn significantly predicted reuse intention ( $\beta = 0.746, p < .001$ ). However, the direct effect of presence on reuse intention wasn't significant ( $\beta = 0.114, p = .179$ ), while the overall effect was strong ( $\beta = 0.619, p < .001$ ).

The indirect effect through perceived enjoyment was also clear ( $\beta = 0.505, 95\% \text{ CI } [0.292, 0.665]$ ). Since zero wasn't in the confidence range and the direct link wasn't significant, these findings support full mediation. This shows that a strong sense of presence increases students' enjoyment, which helps improve their willingness to use VR again in the future. All mediation results are summarised in Table 4.

- $p < .05, **p < .01$
- (ns) = not significant.
- Mediation is considered significant when the 95 % CI does not include zero.

**5.5. Moderation and conditional process analysis: the role of e-learning experience**

**5.5.1. Past use of e-learning as a moderator between perceived enjoyment and reuse intention**

This analysis examined whether students' prior experience with e-learning shaped the connection between their perceived enjoyment of the virtual art exhibition and their intention to reuse similar VR experiences. The test was conducted using PROCESS Model 1 with 5000 bootstrap samples and a 95 % confidence level.

As presented in Table 5, the interaction between perceived enjoyment and previous e-learning experience was statistically meaningful ( $\beta = 0.319, p = .009$ ). This means that the impact of perceived enjoyment on reuse intention varied depending on whether students had previously used e-learning platforms. For those without prior e-learning experience, perceived enjoyment had a clear and positive influence on reuse intention ( $\beta = 0.688, p < .001$ ). The impact was even more pronounced among students with prior e-learning experience ( $\beta = 1.007, p < .001$ ). These findings imply that students who are already comfortable with digital learning tools are more strongly influenced by their perceived enjoyment when deciding to reuse VR in the future.

**Table 5**  
Effect of E-learning experience on perceived Enjoyment's impact on reuse intention.

Term	Coefficient ( $\beta$ )	SE	t	p	LLCI	ULCI
Constant	4.010	0.055	72.572	0.0000	3.900	4.118
Perceived Enjoyment (X)	0.688	0.085	8.056	0.0000	0.519	0.857
Past E-learning Use (W)	-0.132	0.077	-1.727	0.0862	-0.284	0.019
X × W (Interaction Term)	0.319	0.122	2.625	0.0096	0.079	0.559

**5.6. Conditional process analysis (moderated mediation)**

This analysis looked at whether the indirect effect of aesthetic appreciation on reuse intention through perceived enjoyment changed based on students' past experience with e-learning. The test was done using PROCESS Model 7 (Hayes, 2022), with 5000 bootstrap samples and a 95 % confidence level. As shown in Table 6, aesthetic appreciation had a clear direct effect on reuse intention ( $\beta = 0.565, p < .001$ ), and also showed an indirect effect through perceived enjoyment. For students without e-learning experience, the indirect effect was 0.246 (95 % CI [0.044, 0.462]). For students with e-learning experience, the effect was close, at 0.228 (95 % CI [0.041, 0.435]). However, the moderated mediation result was not significant (Index = -0.018, 95 % CI [-0.078, 0.034]), meaning the strength of the indirect effect did not really change based on e-learning experience.

Also, the interaction between aesthetic appreciation and e-learning history on perceived enjoyment was not significant ( $\beta = -0.056, p = .495$ ). These results suggest that aesthetic appreciation affects reuse intention both directly and indirectly through perceived enjoyment, and that this pattern is similar whether or not students had used e-learning before.

**5.7. Final model overview**

Based on the findings from the regression, mediation and moderation analyses, a final empirical model was constructed to illustrate the validated relationships among the study variables. As shown in Fig. 4, the model highlights both direct effects from Aesthetic Appreciation and Perceived Enjoyment to Reuse Intention, as well as indirect effects that are mediated by Perceived Enjoyment. All four experiential constructs, which are Immersion, Presence, Interactivity and Aesthetic Appreciation, exert an indirect influence on Reuse Intention through their impact on Perceived Enjoyment. In addition, the pathway from Perceived Enjoyment to Reuse Intention is moderated by students' prior experience with E-learning Use.

All coefficients represent standardised beta values. Aesthetic appreciation and perceived enjoyment were significant predictors of students' intention to reuse VR. Perceived enjoyment mediated the effects of immersion, presence, interactivity, and aesthetic appreciation. Prior e-learning use significantly moderated the relationship between perceived enjoyment and reuse intention. ( $p < .05, p < .01$ ). Fig. 4 Final empirical model illustrating the validated structural relationships. Standardised beta coefficients are reported along the paths. Solid arrows indicate statistically significant effects ( $p < .05, p < .01$ ), while dashed arrows represent non-significant paths. Perceived enjoyment mediates the effects of immersion, presence, interactivity, and aesthetic appreciation on reuse intention. Additionally, the strength of the Perceived enjoyment → reuse intention link is moderated by students' prior experience with e-learning.

**6. Discussion**

This section discusses the findings in relation to the two research questions (RQ1 and RQ2) and the seven hypotheses (H1–H7). Each result is interpreted with reference to the TAM, Presence Theory, Experience Economy Theory, and Flow.

**Table 6**  
Conditional process analysis of the moderated mediation model.

Effect Type	Path	Coefficient ( $\beta$ )	SE	t	p	95 % CI
Direct Effect	Aesthetic Appreciation → Reuse Intention	0.565	0.091	6.18	0.000	[0.384, 0.745]
Indirect Effect (No prior use)	Aesthetic Appreciation → Perceived Enjoyment → Reuse Intention	0.246	0.106	–	–	[0.044, 0.462]
Indirect Effect (Past use)	Aesthetic Appreciation → Perceived Enjoyment → Reuse Intention	0.228	0.099	–	–	[0.041, 0.435]
Index of Moderated Mediation	–	–0.018	0.028	–	–	[-0.078, 0.034]

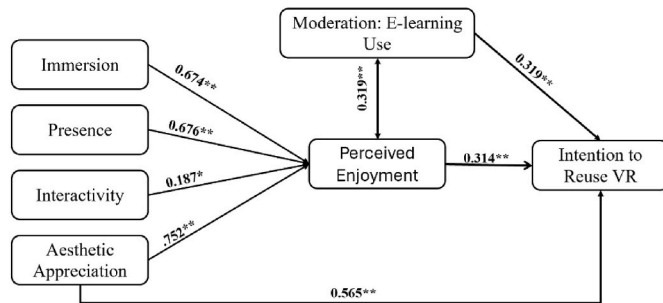


Fig. 4. Final empirical model.

6.1. Research questions

Regarding RQ1, the results showed that aesthetic appreciation and immersion were strongly linked with perceived enjoyment, which in turn predicted intention to reuse the VR exhibition. Presence also supported enjoyment, although its direct effect on intention was not significant. Interactivity played a smaller role but gained importance when mediated through perceived enjoyment (Yang, 2022). These results highlight that in fine-arts education, emotional and aesthetic appreciation qualities matter more than technical features. This finding supports the Experience Economy Theory, which stresses the value of memorable and aesthetic appreciation experiences, and aligns with Flow Theory, where perceived enjoyment acts as the channel that transforms immersion into motivation.

Regarding RQ2, the mediation and moderation analyses confirmed that the experiential factors worked together through perceived enjoyment to explain reuse intention. Aesthetic appreciation had the strongest direct and indirect effects, while immersion, presence, and interactivity all influenced intention indirectly. Perceived enjoyment fully mediated several of these links, confirming its role as the central pathway. This result extends TAM by showing that in art education, perceived enjoyment is more decisive than usefulness or ease of use. The moderation analysis further showed that perceived enjoyment had a stronger effect among students with prior e-learning experience, supporting findings by Dubovi (2022) and Zhou and Li (2024) that digital familiarity amplifies emotional responses.

6.2. Hypotheses

- H1–H5 were supported. Perceived enjoyment mediated the effects of aesthetic appreciation, immersion, presence, and interactivity on reuse intention. This confirms that perceived enjoyment is the key mechanism linking experiential qualities with behaviour, as argued by Csikszentmihalyi (1990) in flow theory.
- H6 was supported. The link between perceived enjoyment and intention was stronger for students with prior e-learning experience. This suggests that digital familiarity makes students more responsive to emotional engagement.
- H7 was not supported. The moderated mediation pathway was not significant. This indicates that while prior e-learning strengthens the direct link between perceived enjoyment and intention, it does not change the indirect role of perceived enjoyment between aesthetic appreciation and reuse.

Unexpected finding: The lack of support for H7 suggests that cultural and pedagogical factors may play a stronger role than prior digital familiarity when students evaluate aesthetic appreciation quality. This nuance is important because it shows that perceived enjoyment and aesthetic appreciation remain stable drivers even in contexts where technological exposure differs.

6.3. Theoretical contributions

The findings extend TAM by demonstrating that perceived enjoyment, rather than usefulness or ease of use, is the strongest predictor of intention in fine-arts contexts. Presence Theory is supported, as the sense of “being there” increased perceived enjoyment, which then influenced reuse indirectly. Experience Economy Theory is reinforced, since sensory and aesthetic appreciation richness contributed to emotional engagement and meaningful learning. Finally, Flow Theory is reflected in the way immersion, attention, and perceived enjoyment together created flow-like experiences that motivated reuse.

6.4. Practical contributions

This study shows that VR art exhibitions work better when they are used as learning activities, not just as visual tours. Giving students clear guidance at the start and adding short reflection questions helps them stay focused and interact more with the virtual space. Asking students to share their opinions about the artworks and linking the content to local cultural themes can increase the learning value for students in Iraqi higher education. From a design side, the study shows that immersion and interaction are more important than technical details. The results suggest that it is not necessary to focus on specific interfaces or lighting systems. What matters more is using clear and consistent design choices that support presence, interaction, and easy movement inside the VR environment. These points can help universities use VR art exhibitions in teaching, even when resources are limited.

6.5. Original contribution

This study is among the first to validate TAM, Presence Theory, and Experience Economy Theory together in a fine-arts VR context within a non-Western setting. It demonstrates that emotional and aesthetic appreciation engagement, rather than technical utility, are the strongest drivers of behavioural intention. This originality adds both theoretical depth and cultural relevance to the literature on VR in education.

6.6. Limitations and future research

This study has several limitations to consider. First, the participants were limited to art students from two institutions, which may restrict the generalisability of the findings. Future research should encompass a broader sample across multiple disciplines and cultures. Second, data were only collected through a questionnaire after the experience. Supplementing such information with qualitative methods, such as interviews, focus groups, or tracking user behaviour in VR, can provide deeper insights. While the model explained a fair part of reuse intention, there are likely other relevant influencing factors not captured by the model. Furthermore, issues specific to the practical application of VR technology in art education have emerged. Many students found it

difficult to navigate the system without step-by-step guidance, highlighting the need for advanced training during pre-session briefings or integrated tutorials. In addition, some students reported mild physical discomfort due to the weight of the headset, which should be considered in future implementations. Unfortunately, the absence of complementary and fully equipped VR infrastructure in some university facilities has limited the scalability of such initiatives. These challenges may be especially relevant in non-Western contexts such as Iraq, where access to equipment and training resources is still developing. Essentially, this indicates that incorporating VR technology into teaching and learning, as part of the curriculum, will require a larger budget for infrastructure development and support for effective user onboarding. The study also extends TAM, Flow Theory, and the Experience Economy framework into a fine-arts context, but further validation is needed to consolidate these theoretical contributions.

Future research could include exploring usability, accessibility, emotional fatigue or long-term engagement among others. Testing this model in different VR environments, such as a virtual theatre or historical simulations, might also help validate and extend the framework. Finally, while the current study followed a direct effect approach with mediation through perceived enjoyment, future research may include additional mediators such as satisfaction or emotional engagement in order to better understand the psychological mechanisms involved.

### 7. Conclusion

The study investigated the psychological and experiential determinants of student intention to visit and reuse a VR art exhibition. The results reveal that aesthetic appreciation and perceived enjoyment are the strongest predictors of reuse intentions. Emotional engagement through perceived enjoyment acted as the major mediating mechanism linking the constructs of immersion, interactivity and presence to behavioural outcomes. These results highlight the importance of designing emotionally engaging and visually rich VR environments in art education. In direct response to RQ1, the study shows that aesthetic appreciation and perceived enjoyment are the main factors influencing reuse intention, while immersion, presence, and interactivity contribute indirectly. In relation to RQ2, the findings confirm that perceived enjoyment is the psychological bridge through which these experiential factors work together to shape behavioural intention. Hypotheses H1–H6 were supported, while H7 was not, showing that prior e-learning use strengthened perceived enjoyment but did not alter the indirect effect of aesthetic appreciation. The study, therefore, extends TAM, Flow Theory, and the Experience Economy by demonstrating that emotional

and aesthetic appreciation responses are central in a fine-arts setting. Practically, the results suggest that VR design in Iraq and similar contexts should emphasise visual clarity, aesthetic appreciation quality, and comfort to maximise perceived enjoyment and encourage sustainable reuse.

### CRedit authorship contribution statement

**Faris Al-Fayyadh:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Attila Gilányi:** Writing – review & editing, Supervision, Methodology.

### Consent for publication

No potential conflict of interest was reported by the authors.

### Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this article, the authors used ChatGPT 4 to help check grammar, spelling, and improve the clarity of some sentences. After using the tool, the authors carefully reviewed and edited the content and take full responsibility for the final version of the article.

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### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix 1

Survey Items for the Virtual Art Exhibition Experience.

Constructs	Code	Items	Sources
Immersion	IM1	I felt like I was truly inside the virtual art exhibition, not just observing it.	Adapted from Cheng, L. et al. (2024); Wang et al. (2023).
	IM2	I was so focused on the artworks that I forgot about my surroundings.	
	IM3	I lost track of time while immersed in the virtual experience.	
	IM4	I didn't want the virtual exhibition experience to end.	
	IM5	I felt transported to a different place during the exhibition.	
	IM6	I was fully absorbed and disconnected from the outside world.	
	IM7	I felt like I stepped into a new virtual world rather than just viewing content.	
Presence	PR1	I felt like I was physically present inside the virtual exhibition.	Adapted from Cheng, L. et al. (2024); Wang et al. (2023).
	PR2	The virtual environment felt realistic and immersive.	
	PR3	I felt surrounded by the artworks, as if they were physically around me.	
	PR4	I had the sensation of walking through a real exhibition space.	
	PR5	I was not aware of using a device; I felt part of the virtual environment.	
	PR6	My sense of space and location inside the VR gallery was convincing.	

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Constructs	Code	Items	Sources	
Interactivity	PR7	I felt as if I participated in the virtual exhibition, not just viewed it	Adapted from Tcha-Tokey et al. (2018); Li and Lv (2024); Sutcliffe and Gault (2004)	
	IN1	I was able to move freely within the virtual exhibition space.		
	IN2	I could explore the artworks at my own pace by approaching or stepping back.		
	IN3	The freedom of movement allowed me to engage more deeply with the artworks.		
	IN4	I felt in control of how I navigated and viewed the exhibition.		
Perceived Enjoyment	IN5	Being able to physically move through the exhibition enhanced my personal exploration.	Adapted from Wang et al. (2023); Li and Lv (2024)	
	EN1	I found the virtual exhibition enjoyable.		
	EN2	I enjoyed exploring the artworks during the VR experience.		
	EN3	I found the experience fun and pleasant.		
	EN4	I felt happy while interacting with the virtual environment.		
	EN5	The VR exhibition was entertaining on its own.		
	EN6	I would enjoy spending more time in a virtual exhibition like this.		
Aesthetic Appreciation	EN7	I found the overall VR experience to be pleasurable.	Adapted from Cheng, L. et al. (2024); Wang et al. (2023).	
	AE1	The artworks in the virtual exhibition were visually appealing.		
	AE2	I liked how the artworks were arranged and displayed.		
	AE3	I experienced a sense of visual balance and coherence in the exhibition space.		
	AE4	The colours and designs of the artworks impressed me.		
	AE5	I noticed artistic details I hadn't seen before.		
	AE6	The exhibition environment supported artistic reflection and contemplation.		
Intention to Reuse	AE7	The use of VR added depth to my appreciation of the artworks.	Adapted from Cheng, L. et al. (2024); Wang et al. (2023).	
	IR1	I intend to reuse virtual reality for future digital art exhibition experiences.		
	IR2	I plan to use VR again for similar artistic or learning purposes.		
	IR3	I will continue using VR technology to engage with digital art.		
		IR4	I am likely to reuse VR applications for art-related activities in the future.	

## Data availability

Data will be made available on request.

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