

The implementation of Artificial Intelligence (AI) and Immersive Technology in E-Commerce: The Role of Customer Engagement as a Mediating Variable

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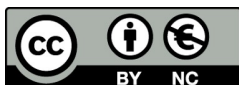
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Abstract

The headway of information and communication technology has led to significant changes in various industries, particularly in e-commerce. The integration of artificial intelligence (AI) and immersive technologies such as augmented reality (AR) and virtual reality (VR) has created new opportunities for e-commerce to improve customer experiences.

This study analyzes the effects of implementing AI and immersive technology in e-commerce, focusing on customer engagement as a mediating factor. A sample of 99 participants was examined and analyzed using PLS-SEM by SmartPLS 4 software, and the findings indicate that AI and immersive technology have a positive, significant impact on online purchase intention. Customer engagement cannot mediate the relationship between artificial intelligence and online purchase intention. However, it does mediate the relationship between immersive technology and online purchase intention.



Introduction

The rapid development of information technology has led to the evolution of marketing. Nowadays, marketing has shifted from interactive marketing to precision marketing based on big data, and the intelligence marketing stage supported by AI technology (Haleem et al., 2022; Yin & Qiu, 2021). By using AI technology in marketing strategies, marketers can leverage available data to target potential customers with personalized, attractive, commercials based on their preferences. Marketers can use AI to gain deeper consumer insights and better understand how to categorize and drive customers to the next step in their journey, providing the best possible experience (Haleem et al., 2022).

Artificial Intelligence is becoming a critical domain in digital marketing (Suliyanto et al., 2023). AI technology has been deeply applied to online shopping platforms (e-commerce) to provide more accurate and personalized services for consumers (Yin & Qiu,

2021). Some researchers have researched the implementation of AI in e-commerce. Febriani et al., (2022) have shown that Artificial Intelligence positively affects consumers' purchase intention. The research results of Jinhui & Tarofderb, (2024) also indicate that AI impacts customers' sense of social presence and subsequently influences consumers' willingness to make a purchase.

Apart from AI, “breakthroughs” in digital technology have motivated companies to provide appealing features that enable consumers to try or use products without physical contact (Viohafeni & Aliyah, 2023). This kind of technology is a part of immersive technology. Immersive technology is technology that allows humans to move and react in the digital world, such as Virtual Reality (VR) and Augmented Reality (AR) (Wang & Yan, 2019). This technology has been adopted in the industrial world, especially by e-commerce in Indonesia, such as Shopee, Lazada, Tokopedia, Blibli, Zalora and so on, as part of their experiential marketing.

The use of immersive technology in e-commerce is exemplified by features such as “BeautyCam” and “SkinCam” on Shopee, as well as “Virtual Try On” on Lazada. These features allow potential consumers to virtually try various cosmetic options without visiting a physical cosmetics store. Through this innovation, customers can use a mobile phone virtually to try various beauty products wherever and whenever (Fransiska & Candraningrum, 2020).

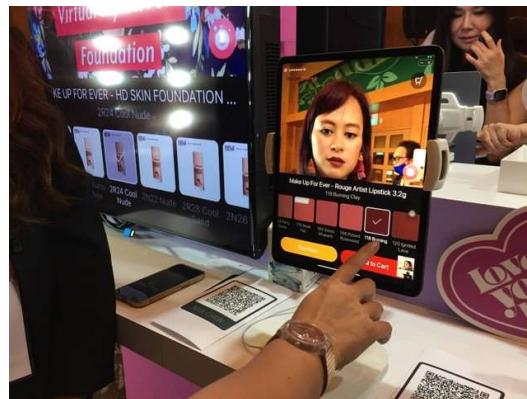


Figure 1. The Feature of “Virtual Try On” on Lazada

Several researchers have investigated the use of immersive technology in e-commerce. Leonnard et al., (2019) demonstrated that incorporating Augmented Reality (AR) into online shopping applications has a significant impact on purchasing intentions. Ario et al., (2022) also provided evidence that virtual reality (VR) can serve as an effective promotional medium. Immersive technology in e-commerce aims to create brand experiences that excite and engage customers in new ways in order to improve attitudes and encourage positive behaviors toward their brands (de Regt et al., 2021).

Implementing AI in e-commerce has enhanced brands' ability to offer personalized experiences, provide accurate product recommendations, and deliver prompt customer service (Maylinda, 2024). In addition, immersive technologies enable consumers to test products virtually before purchasing, boosting trust and satisfaction in online shopping (Viohafeni & Aliyah, 2023). Researchers argue that integrating AI and immersive

technology will create a more interactive, personalized, and engaging consumer shopping experience.

Despite much research showing the benefits of AI and immersive technologies separately, there still needs to be more understanding of how their interaction affects consumer engagement in e-commerce. Therefore, this research seeks to investigate the role of consumer engagement as a mediating factor between the use of AI and immersive technology and e-commerce performance. By understanding the role of consumer engagement as a mediating variable, this research is expected to provide deeper insight into the mechanisms underlying the influence of AI implementation and immersive technology on e-commerce performance.

Review of Literature

SOR Theory

Mehrabian and Russell first proposed the Stimulus-Organism-Response (SOR) model in 1974. The assessment process for the human body is different from that of a machine. Various stimuli in the environment (S), such as auditory, visual, and olfactory stimuli, will cause changes in the state of internal emotion and cognitive mechanisms (O) and then lead to a response (R) (Mehrabian, & Russel, 1974).



Figure 2. SOR Model

Yin & Qiu, (2021) applied the SOR model to shopping online. Current research on technology as a stimulus is mainly focused on the navigation structure of websites, the implementation of platform-assisted business technology, and the effectiveness of networks. Despite its significant industry empowerment, there is little research on the impact of AI technology as a stimulus on consumers' internal mechanisms of purchase intention. This study aims to creatively address the gaps in the Stimulus-Organism-Response (SOR) theory in applying AI technology and immersive technology in e-commerce.

Artificial Intelligence

Artificial intelligent (AI) is part of computer science and engineering programs, that display aspects of human intelligence and used in service are that make it easier, also a source today's innovation (Santy & Iffan, 2023). AI works on a big data system to make actionable decisions. AI is made with creating intelligent machines that can think dan act like humans being. AI is possible in prediction of future problem. AI can provide solution about customer behavior that can provide industry too develop their product and services (Haleem et al., 2022).

Nowadays, AI is used in e-commerce or the marketplace to inspect trends based on browsing history, order history, and other factors to determine customer behavior, which can provide more accurate and personalized recommendations. The effect of

personalized recommendation allows for the possibility of purchase intention. AI technology can increase interaction between customers, products, and services and quickly match demands (Febriani et al., 2022).

Immersive Technology

Immersion technology is connected with a certain level of sensory variety. The Human experience is distinctive in that immersion causes a series of psychological substitute (Putra et al., 2020). Augmented Reality (AR) is relatively analogous to other forms of digital technology. It is substantially penetrated through mobile bias, similar to smartphones, and offers a high level of interactivity for end users. The development of real-life simulations is made more accessible with the help of virtual reality technology, which also produces an immersive experience for users, giving them the print that they are genuinely interacting with digital surroundings (Viohafeni & Aliyah, 2023).

AR places computer generated virtual objects in real setting and allows for real time interaction thereby enhancing the user's experience of a product. E-commerce or marketplace use this kind of AR for Virtual Try On (VTO). VTO based on AR is one of innovation that developed and researched in jewelry, glasses, and make up (Viohafeni & Aliyah, 2023). The usage of VTO can improve customer experience and increase purchase intention.

Customer Engagement

Customer engagement is a process of engaging customers in conversation and experiences to support and influences their purchasing decisions (Putra et al., 2020). Costumer engagement develop through interactive brand communication and brand experience, such as process of searching, evaluating, and making decision related to brand selection, and this process can used for development of company's product and services (Ambarwati et al., 2023; Sung et al., 2021). According to Shafa et al., (2023)customer engagement plays important role to establish strong relationship between customers and companies because it will affect purchasing decision.

Research Method

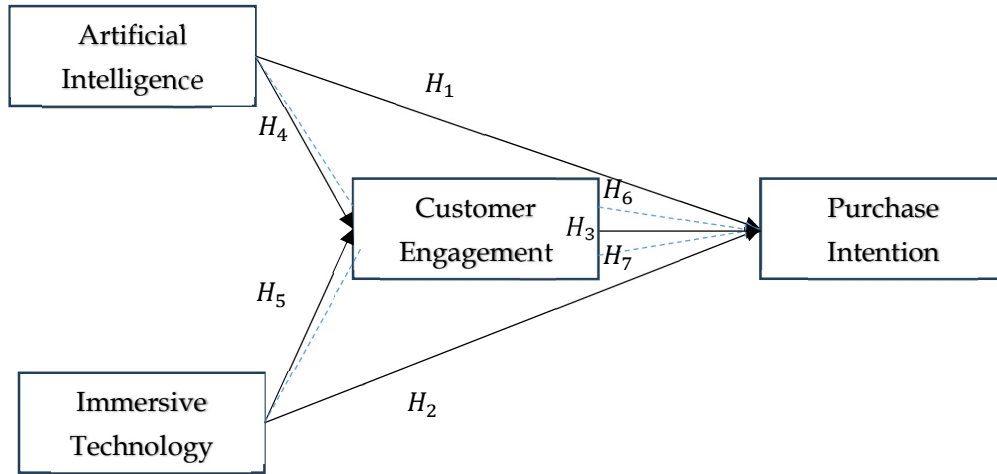
Sample, Procedures for Data Collection and Data Analysis

Data was collected by distributing electronic questionnaires to people who purchased cosmetics in e-commerce using immersive technology features. The questionnaire contains several questions, which are measured with a 4 Likert scale, namely "strongly disagree," "disagree," "agree," and "strongly agree." To test the hypotheses, we surveyed 99 respondents. In this paper, we employ the judgment sampling technique, a nonprobability sampling design. As a part of the non-probability sampling technique, researchers apply judgmental sampling when purposively selecting samples corresponding to some set requirements. To analyze the data, Partial Least Squares Structural Equation Model (PLS-SEM) in SmartPLS4 has been used to analyze the various constructs.

Variable Measurement

In this paper, the indicators and questionnaires (4 items) to measure Artificial Intelligence were adopted from Huang & Rust (2018), and the indicators and questionnaires (4 items) to measure Immersive Technology were adopted from Zhang et al. (2019). To measure Customer Engagement (3 items), we adopted Vivek et al. (2014). Online Purchase Intention can be measured in 3 items adopted from Yin & Qiu (2021).

Figure 2. The Proposed Hypotheses Model



Based on previous research described in the literature review above, the hypotheses that can be developed in this research are as follows:

H_1 : Artificial Intelligence has a significant and positive impact on Online Purchase Intention

H_2 : Immersive Technology has a significant and positive impact on Online Purchase Intention

H_3 : Customer Engagement has a significant and positive impact on Online Purchase Intention

H_4 : Artificial Intelligence has a significant and positive impact on Customer Engagement

H_5 : Immersive Technology has a significant and positive impact on Customer Engagements

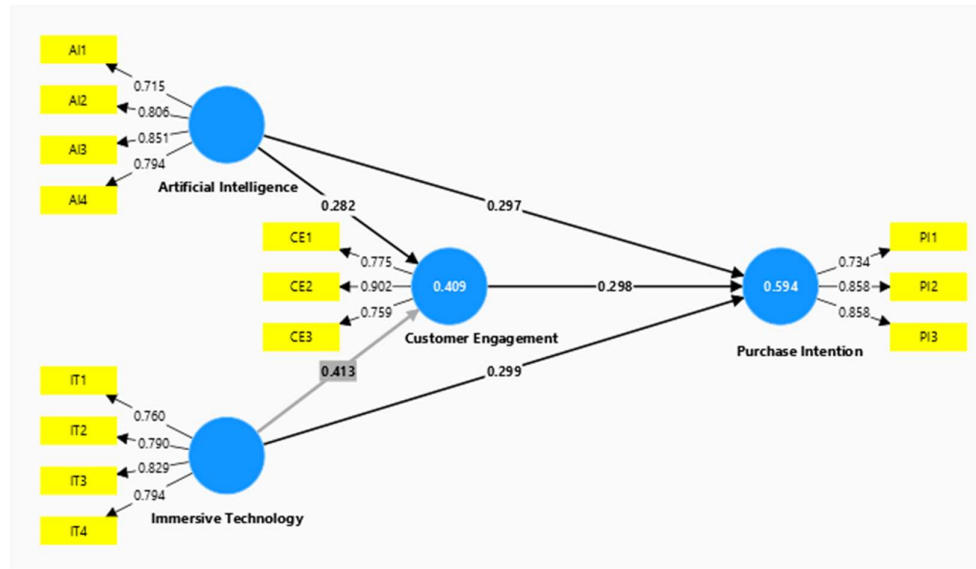
H_6 : Customer Engagement mediates the relationship between Artificial Intelligence and Online Purchase Intention

H_7 : Customer Engagement mediates the relationship between Immersive Technology and Online Purchase Intention

Results

Evaluation of Measurement/Outer Model (PLS algorithm)

Outer model evaluation aims to evaluate indicator variables. The indicator variables in the reflective model are variables that are highly correlated so that the evaluation of the reflective model is based on the reliability and validity of the indicator variables (Widarjono, 2014). Reflective model evaluation consists of:



.Figure 3. Outer Model

1. Indicator Reliability

The reliability indicator is based on the outer loading value. If the outer loading value is more than 0.7, then the indicator variable needs to be maintained. As shown in table 1, all variables have values above 0.7.

2. Convergent validity

Average Variance Extract (AVE) is used to evaluate convergent validity. AVE value must be more than 0.5.

3. Discriminant validity

Discriminant validity can be evaluated by using Fornell-Larcker criterion. The Fornell-Larcker criterion evaluates discriminant validity by examining the square root of AVE for each latent variable. According to this criterion, the square root of AVE of each of the latent variables should be greater than its correlation with another latent variable. The results confirmed that the square root of AVE of each latent variable is greater than its correlation with other latent variables, as shown in Table 1.

4. Composite Reliability

Composite reliability is used to evaluate internal consistency. Reliability test using method PLS has criteria for a composite reliability value > 0.7 and a Cronbach's alpha value > 0.6 (Ghazali & Latan, 2015)

Table 1. Analysis of reliability and validity

Latent Variable	Item	Factor Load	Cronbach's	Composite Reliability	AVE
Artificial Intelligence	AI1	0.715	0.806	0.832	0.629
	AI2	0.806			
	AI3	0.851			
	AI4	0.794			
Customer Engagement	CE1	0.775	0.744	0.758	0.663
	CE2	0.902			
	CE3	0.759			
Immersive Technology	IT1	0.760	0.804	0.804	0.630
	IT2	0.790			
	IT3	0.829			
	IT4	0.794			
Purchase Intention	PI1	0.734	0.751	0.755	0.670
	PI2	0.858			
	PI3	0.858			

Source: Source name (Year)

Otherwise, discriminant validity test can be tested using Fornell-Larcker criterion. The test using Fornell-Larcker criterion using correlation between each contrast. If correlation between each construct with its own construct is higher than other construct, it means model has good discriminant validity (Leonnard et al., 2019). Table 2 shows that model has good discriminant validity.

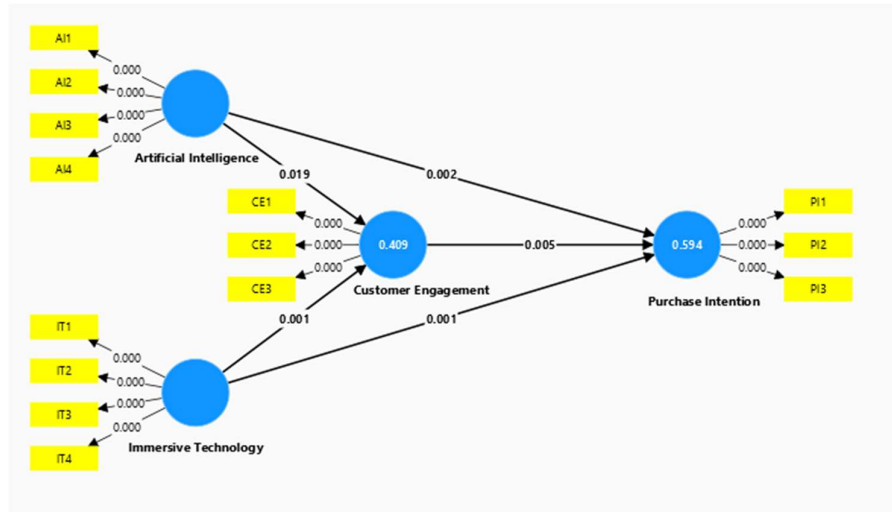
Table 2. Fornell-Larcker criterion

	Artificial Intelligence	Customer Engagement	Immersive Technology	Purchase Intention
Artificial Intelligence	0.793			
Customer Engagement	0.563	0.815		
Immersive Technology	0.680	0.605	0.794	
Purchase Intention	0.667	0.645	0.680	0.819

Evaluation of Structural (Inner Model)

The next evaluation after outer model accomplished based on Table 1 dan 2 in the above is inner model using bootstrapping. Inner model is used to evaluate between laten variable based on path model. Figure 4 shows inner model for this research.

Figure 4. Inner Model



1. Coefficient Determinance (R Square)

R-square is used to know if model built has best model criteria . R-square values is shown through Table 3.

Table 3. R-square value

	R-square
Customer Engagment	0.409
Purchase Intention	0.59

Based on Table 3, R-square value for latent variable customer engagement is 0.409 or 40.9%. It means that diversity or varians of latent variabel which can be shown is 40.9%, meanwhile 59.1% can be explained by others latent variables. R-square value for latent variable purchase intention is 0.59 or 59%. It means that diversity or varians of latent variabel which can be shown is 59%, meanwhile 41% can be explained by others latent variables.

2. Effect Size (f Square)

Effect size or f square is used for measure latent variable in structural model possibility affected by number of variety variables. The criterion of f square is 0.02 (small influence), 0.15 (medium influence), and 0.35 (large influence) (Elvarina & Murhadi, 2023).

Based on Table 4, it can be shown that f-square Artificial Intelligence to Purchase Intention is 0.109. Immersive Technology to Purchase Intention is 0.102. Customer Engagement to Purchase Intention is 0.129. Artificial Intelligence to Customer Engagement is 0.072. Immersive Technology to Customer Engagement is 0.155. Overall f-square for this research is small and medium influence.

Table 4. f square value

	Artificial Intelligence	Customer Engagement	Immersive Technology	Purchase Intention
Artificial Intelligence		0.072		0.109
Customer Engagement				0.129
Immersive Technology		0.155		0.102
Purchase Intention				

3. *The standardized root mean square residual (SRMR)*

The SRMR is used to provide statistical justification for the model fit. Recommendation SRMR value for model good fit is between 0 until 0.08 and NFI value is greater than 0.90 (Pineda et al., 2022).

Table 5. Model Fit Summary

Parameter	Fit Recommendation	Estimated Model
SRMR	<0.08	0.085
NFI	>0.09	0.729

Based on Table 5, it can be shown that SRMR value is overestimated because, the SRMR's estimated value is 0.085. Meanwhile NFI value is less than 0.09, it means that model is moderated.

4. *Q square or predictive relevance*

Q-square value is used to test a model has good prediction (Suliyanto et al., 2023b). Q-square value for this model can be examined by following equation.

$$Q^2 = 1 - (1 - R_1^2)(1 - R_2^2)$$

$$= 1 - (1 - 0.409)(1 - 0.59) = 0.7441$$

Q-square value is 0.7441 which means that Q-square more than 0 and closer to 1, it can be concluded that model has good predictive (Perkasa & Faritzal, 2022).

5. *Structural estimates (hypotheses testing)*

The statistical test was used to test the effect of exogenous latent variable on endogenous latent variable. The criterion that used in this research is compared p-value with alpha (5%). The statistical test in this research is consist of direct effect and indirect effect.

Based on Table 7 shown statistical test in this research. H1 states that Artificial Intelligence has a significant and positive impact on Online Purchase Intention. Table 6 shown that H1 has p-value (0.019) < alpha (0.05), it means H1 is accepted. H2 states that

Immersive Technology has a significant and positive impact on Online Purchase Intention. Tabel 6 shown that H2 has p-value (0.002)<alpha(0.005), it means H2 is accepted. H3 states that Customer Engagement has a significant and positive impact on Online Purchase Intention. H3 has p-value (0.005)<alpha(0.05), it means H3 is accepted. H4 states that Artificial Intelligence has a significant and positive impact on Customer Engagement. H4 has p-value (0.001)<alpha(0.05), it means H4 is accepted. H5 states that Immersive Technology has a significant and positive impact on Customer Engagements. H5 has p-value(0.001)<alpha(0.05), it means H5 accepted.

Table 6. Path Coefficient

	Original Sample	Sample Mean	Std. Dev	T- Stat	P- value
Artificial Intelligence→Customer Engagement	0.282	0.278	0.121	2.339	0.019
Artificial Intelligence→Purchase Intention	0.297	0.302	0.094	3.158	0.002
Customer Engagement→Purchase Intention	0.298	0.293	0.105	2.829	0.005
Immerse Technology→Customer Intelligence	0.413	0.423	0.127	3.258	0.001
Immerse Technology→Purchase Intention	0.299	0.301	0.092	3.262	0.001

6. Indirect Effect of Mediation Variable

This research has mediation variable which is possible to test indirect effect. Indirect effect for this model is shown following Tabel 7.

Table 7. Indirect Effect

	Original Sample	Sample Mean	Std. Dev	T-Statistic	P-value
Artificial Intelligence→Customer Engagement→Purchase Intention	0.084	0.083	0.051	1.648	0.099
Immerse Technology→Customer Engagement→Purchase Intention	0.123	0.122	0.058	2.130	0.033

Based on Table 7, p-value for H6 which is states that Customer Engagement mediates the relationship between Artificial Intelligence and Online Purchase Intention is 0.099. This value is greater than alpha (0.05). The conclusion of H6 is rejected. Customer Engagement can't mediated the relationship between Artificial Intelligence and Online Purchase Intention. Besides, H7 states that Customer Engagement mediates the relationship between Immersive Technology and Online Purchase Intention. H7 has p-

value(0.033)<alpha(0.05), it means H7 is accepted, Customer Engagement can mediate the relationship between Immersive Technology and Online Purchase Intention.

Even though, Customer Engagement can mediate the relationship between Immersive Technology and Online Purchase Intention, value of affect between direct effect and indirect effect has different value. This research revealed that value effect of direct effect has greater value than indirect effect. It means that, without Customer Engagement, Immersive Technology and Online Purchase Intention has significant and positive relationship.

Discussion

Results provide empirical evidence of the positive relationship between Artificial Intelligence and Purchase Intention. This suggests the more AI is utilized in e-commerce, the more significant the impact on consumer purchasing intention. AI allows e-commerce to provide highly relevant and personalized product recommendations. Machine learning algorithms can assess historical purchase data, browsing behavior, and individual preferences to suggest appropriate products.

Three-stage framework developed by Huang & Rust, (2018) for strategic marketing planning, incorporating multiple artificial intelligence (AI) benefits: mechanical AI for automating repetitive marketing functions and activities, thinking AI for processing data to arrive at decisions, and feeling AI for analyzing interactions and human emotions, has been proven to be a stimulus to increase purchasing decisions.

AI can predict consumer behavior by analyzing data gathered from diverse sources, such as purchase history, browsing patterns, and demographic information. These forecasts empower e-commerce entities to proactively address consumer needs and preferences, enabling them to refine product offerings and marketing approaches with greater precision. Studies indicate that the capacity to predict and fulfill consumer needs can lead to elevated retention and conversion rates. These findings are consistent with studies carried out by Yin & Qiu, (2021). The results of this research strengthen the research conducted by Febriani et al., (2022); Jinhui & Tarofderb, (2024); and Suliyanto et al.,(2023).

In line with AI, immersive technology in e-commerce can also improve purchasing intention. Immersive technology allows consumers to view and interact with products in a highly realistic virtual environment. They can try products without coming to an offline outlet or shop. Research shows that this better visual experience can increase consumers' confidence in making purchasing decisions because they can see the product in more detail and depth.

Apart from that, using immersive features can also personalize products in real time. Consumers can use these features to customize products according to their preferences, such as choosing color, size, or additional features. Research shows that the ability to personalize products can increase consumers' emotional engagement and make them feel more connected to the product, which increases the likelihood of purchase. These results are in line with research conducted by Leonnard et al., (2019) and Viohafeni & Aliyah, (2023).

The use of AI and immersive technology in e-commerce can increase consumer engagement. These two technologies can also provide customers with a pleasant shopping experience, improving consumer mood and engagement and influencing positive attitudes toward products.

However, the research results also show that customer engagement cannot mediate the relationship between artificial intelligence and purchase intention. This means that AI may have a substantial direct influence on purchase intention without necessarily increasing customer engagement. For example, AI features such as personalized product recommendations and purchase data analysis may be powerful enough to drive a customer's intention to purchase without significantly affecting their engagement levels.

AI is a technology that has a mechanism works behind the scenes and is automatic (Huynh-The et al., 2023). This can result in customers perhaps being unaware of or too emotionally engage with the use of AI.

Different results show that customer engagement can mediate the relationship between immersive technology and purchase intention. Immersive technology in e-commerce, such as "BeautyCam" and "SkinCam" in e-commerce, is interactive. The presence of this feature can increase customer engagement significantly. Immersive technology tends to create more robust emotional engagement. When customers feel emotionally engaged and entertained by this technology, they are more likely to feel satisfied and motivated to make a purchase.

Conclusion

The research findings demonstrate that the simultaneous use of AI and immersive technology can significantly enhance purchasing intention. These technologies contribute to an enriched shopping experience and heightened customer engagement when integrated. However, it is noteworthy that customer engagement does not serve as a mediating variable in the relationship between AI and purchasing decisions. This suggests that AI may exert a direct influence on purchase intention independent of its impact on customer engagement. Conversely, it is observed that customer engagement can mediate the association between immersive technology and purchasing intention.

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