JURNAL ILMIAH MANAJEMEN BISNIS DAN INOVASI
UNIVERSITAS SAM RATULANGI (JMBI UNSRAT)

THE SYNERGISTIC EFFECT OF AR INTERACTIVITY AND PERSONALIZATION ON CONSUMER BEHAVIOR IN E-COMMERCE

Agung Stefanus Kembau, Imagodeo Bideyesa Laimeheriwa, Arief Perdana Kumaat
Universitas Bunda Mulia, Politeknik Negeri Manado

A R T I C L E I N F O

Keywords:
Augmented Reality (AR), Digital Behavioral Intentions, Interactivity, Personalization, E-commerce, Gen Z, Digital Marketing

Kata Kunci:
Augmented Reality (AR), Niat Perilaku Digital, Interaktivitas, Personalisasi, E-commerce, Gen Z, Pemasaran Digital

Corresponding author:

Agung Stefanus Kembau
akembau@bundamulia.ac.id

Abstract. This study investigates the impact of Augmented Reality (AR) interactivity on digital behavioral intentions in e-commerce, with AR personalization serving as a mediating variable. Focusing on 148 Generation Z respondents in Indonesia who have used AR Try-On features, the research employs a quantitative approach using an online questionnaire and data analysis via Structural Equation Modeling (SEM) through SmartPLS. The results demonstrate that AR interactivity significantly enhances digital behavioral intentions, while personalization amplifies this effect by tailoring AR experiences to individual preferences. The combined influence of interactivity and personalization is particularly strong, highlighting the importance of integrating these elements into e-commerce strategies. These findings are especially relevant in the context of Indonesia's rapidly growing e-commerce market, where consumer preferences are diverse, and technology adoption is high.

Abstrak. Studi ini menyelidiki dampak interaktivitas Augmented Reality (AR) pada niat perilaku digital dalam e-commerce, dengan personalisasi AR sebagai variabel mediasi. Berfokus pada 148 responden Generasi Z di Indonesia yang telah menggunakan fitur AR Try-On, penelitian ini menggunakan pendekatan kuantitatif menggunakan kuesioner online dan analisis data melalui Structural Equation Modeling (SEM) melalui SmartPLS. Hasilnya menunjukkan bahwa interaktivitas AR secara signifikan meningkatkan niat perilaku digital, sementara personalisasi memperkuat efek ini dengan menyesuaikan pengalaman AR dengan preferensi individu. Pengaruh gabungan interaktivitas dan personalisasi sangat kuat, menyoroti pentingnya mengintegrasikan elemen-elemen ini ke dalam strategi e-commerce. Temuan ini sangat relevan dalam konteks pasar e-commerce Indonesia yang berkembang pesat, di mana preferensi konsumen beragam dan adopsi teknologi tinggi.

INTRODUCTION

The rapid growth of e-commerce has become a defining feature of the global retail landscape, with Indonesia emerging as one of the largest and most dynamic markets in Southeast Asia. According to the Indonesian Internet Service Providers Association (APJII), (2023), the e-commerce sector in Indonesia has witnessed significant expansion, driven by increasing internet penetration and a shift in consumer behavior towards digital platforms. The rise of technologies such as Augmented Reality (AR) has further revolutionized the online shopping experience, offering new ways for consumers to engage with products.

Personalization in AR refers to the technology's ability to tailor user experiences based on individual preferences, behaviors, and demographic data. In e-commerce, this can manifest as customized product recommendations, personalized visual experiences, and tailored product displays (Chen et al., 2022). Personalized AR experiences aim to enhance consumer satisfaction by aligning virtual interactions with users' specific needs and interests.

Interactivity in AR involves the extent to which users can engage with virtual elements within an AR application. High levels of interactivity allow users to manipulate 3D objects, adjust scales, or add new elements to the AR display, creating a more engaging and immersive experience (Bai et al., 2023). Effective interactivity can significantly boost user engagement and satisfaction, which may, in turn, influence their digital behavioral intentions.

Indonesia presents a unique context for this study due to its vast and diverse population and rapidly growing digital infrastructure. As reported by McKinsey & Company, Indonesia is one of the fastest-growing e-commerce markets in the world, with a substantial increase in online shopping adoption driven by mobile technology and digital payment solutions (McKinsey & Company, 2022). Despite this growth, the adoption of AR technology in Indonesian e-commerce is still in its nascent stages, with many companies beginning to explore its potential.

Companies like Tokopedia and Bukalapak have started integrating AR features into their platforms to enhance user experiences. However, there remains a need for deeper research into how personalization within AR impacts consumer behavior in this market. The interplay between AR interactivity and personalization, and their combined effect on consumer intentions, is an area ripe for exploration.

This research aims to investigate the impact of AR interactivity on digital behavioral intentions in e-commerce, with personalization in AR serving as a mediating variable. By understanding how personalization mediates the relationship between AR interactivity and consumer behavioral intentions, the study seeks to provide valuable insights for e-commerce businesses looking to optimize their digital marketing strategies.

The significance of this research lies in its potential to offer actionable recommendations for enhancing AR applications in e-commerce. It will contribute to the academic literature by bridging

gaps in understanding how AR personalization influences consumer behavior, particularly in emerging markets like Indonesia. Additionally, the findings may help companies tailor their AR strategies to better align with local consumer preferences and behaviors, ultimately leading to increased engagement and conversion rates.

Objectives of the Study

- To analyze how AR interactivity affects digital behavioral intentions in e-commerce.
- To assess the role of AR personalization as a mediator in the relationship between AR interactivity and digital behavioral intentions.
- To identify cultural and local preference factors that influence the effectiveness of AR interactivity and personalization in Indonesian e-commerce.

Augmented Reality (AR) in E-Commerce

Augmented Reality (AR) has rapidly emerged as a transformative technology in e-commerce, offering enhanced shopping experiences by overlaying digital information onto the real world. This immersive technology allows consumers to interact with virtual representations of products, providing a more engaging and informative shopping experience. Research indicates that AR can significantly enhance consumer engagement and satisfaction by helping users visualize how products will fit into their personal environment, thus reducing uncertainty and increasing purchase intent (Liu et al., 2022). The integration of AR in e-commerce is seen as a critical advancement in modern retail, aiming to bridge the gap between physical and online shopping experiences (Huang et al., 2021).

Hypothesis 1: AR interactivity positively affects digital behavioral intentions in e-commerce.

Rationale: Higher levels of interactivity in AR applications are expected to enhance user engagement and satisfaction, which can positively influence digital behavioral intentions. Interactive features such as the ability to manipulate 3D models and receive real-time feedback are known to create more engaging user experiences, thus increasing the likelihood of purchase and other digital behaviors (Bai et al., 2023).

Interactivity in AR

Interactivity is a crucial feature of AR that contributes significantly to its effectiveness in e-commerce. It involves the degree to which users can interact with and manipulate virtual elements within an AR application. High levels of interactivity can lead to increased user engagement, as users find it more satisfying to interact with virtual objects and receive immediate responses (Bai et al., 2023). Interactive AR features, such as adjustable 3D models and real-time interaction, can enhance the shopping experience by making it more immersive and enjoyable, which can ultimately impact consumer behavioral intentions positively.

Hypothesis 2: Personalization in AR mediates the relationship between AR interactivity and digital behavioral intentions.

Rationale: Personalization can enhance the effectiveness of AR interactivity by tailoring the AR experience to individual user preferences and needs. When AR experiences are personalized, they become more relevant and engaging for users, thereby amplifying the impact of interactivity on digital behavioral intentions (Chen et al., 2022; Huang et al., 2021). This mediation effect suggests that personalized AR experiences can make interactive features more effective in driving consumer engagement and purchase intentions.

Personalization in AR

Personalization in AR involves customizing the AR experience to align with individual user preferences and behaviors. This can include tailored product recommendations, personalized visualizations, and targeted promotions. Personalized AR experiences have been shown to significantly improve user satisfaction by providing more relevant and customized interactions (Chen et al., 2022). By enhancing the relevance of AR features, personalization can make the technology more effective in influencing consumer behaviors, such as increasing engagement and purchase intentions.

Hypothesis 3: The impact of AR interactivity on digital behavioral intentions is stronger when personalization is high compared to when personalization is low.

Rationale: The effectiveness of AR interactivity in influencing digital behavioral intentions is expected to be enhanced when the AR experience is highly personalized. Personalization ensures that interactive elements are tailored to the user's specific needs and preferences, making the AR experience more meaningful and impactful (Huang et al., 2021). Therefore, the positive effect of AR interactivity on consumer behavioral intentions is likely to be more pronounced in contexts where personalization is a key feature.

METHODS

This study employs a quantitative approach to examine the influence of Augmented Reality (AR) interactivity on digital behavioral intentions in e-commerce, with AR personalization serving as a mediating variable. The research focuses on 148 Generation Z respondents who have used AR Try-On features in e-commerce platforms. Data collection was carried out using an online questionnaire with a Likert scale (1-5), designed to measure perceptions of AR interactivity, personalization, and digital behavioral intentions. This method ensures that respondents are well-versed in AR technology, allowing for an accurate assessment of their behaviors and attitudes (Chen et al., 2022; Liu et al., 2022).

Data analysis was performed using Structural Equation Modeling (SEM) through SmartPLS, a robust tool for examining complex relationships among variables (Ringle et al., 2022). The analysis involved evaluating the measurement model for validity and reliability, followed by testing the structural model to explore the direct and indirect effects of AR interactivity on digital behavioral intentions, with AR personalization as a mediator (Huang et al., 2021). This methodological approach

provides a thorough understanding of how AR features impact consumer behavior in e-commerce, offering actionable insights for enhancing AR applications (Bai et al., 2023).

Table 1. Operational Definition

Variable	Dimension	Definition	Measurement Items	Source
AR Interactivity	Interaction Quality	The extent to which users can interact with and manipulate virtual elements within an AR application.	▪ Ability to adjust 3D models ▪ Real-time feedback ▪ Manipulation of virtual objects	Bai et al., 2023; Huang et al., 2021
AR Personalization	Customization and Relevance	The degree to which AR experiences are tailored to individual preferences and needs.	▪ Personalized product recommendations ▪ Customizable visualizations ▪ Targeted promotions	Chen et al., 2022; Huang et al., 2021
Digital Behavioral Intentions	Purchase Intention & Platform Engagement	The likelihood of engaging in specific digital behaviors such as making a purchase or revisiting the platform.	▪ Likelihood of making a purchase ▪ Intent to revisit the e-commerce platform ▪ Willingness to explore new products	Liu et al., 2022; Ringle et al., 2022

The operational definition table is a critical component of this study as it clearly outlines the key variables and their respective dimensions, definitions, and measurement items, ensuring a precise and consistent understanding of each construct. The table includes three primary variables: AR Interactivity, AR Personalization, and Digital Behavioral Intentions. AR Interactivity is defined by the quality of interaction, including the ability to adjust 3D models, receive real-time feedback, and manipulate virtual objects, drawing from the works of Bai et al. (2023) and Huang et al. (2021). AR Personalization focuses on customization and relevance, measured by personalized product recommendations, customizable visualizations, and targeted promotions, as referenced by Chen et al. (2022) and Huang et al. (2021). Finally, Digital Behavioral Intentions encompass purchase intention and platform engagement, measured through the likelihood of making a purchase, intent to revisit the e-commerce platform, and willingness to explore new products, based on Liu et al. (2022) and Ringle et al. (2022). This table is crucial for providing a structured approach to measuring these constructs, ensuring that the study's findings are reliable and valid.

RESULTS

The subsequent sections will present the analyzed data, highlighting key statistical results and their implications for e-commerce businesses. The analysis will detail the strength and significance of the relationships between AR interactivity, personalization, and digital behavioral intentions. Key metrics such as path coefficients, T-values, and P-values will be discussed to demonstrate the robustness of the findings. Additionally, the implications of these results for enhancing user engagement and driving digital behaviors in e-commerce platforms will be thoroughly examined.

Table 2. Respondent Demographics

Category	Number of Respondents	Percentage (%)
Gender		
Male	78	52.7
Female	70	47.3
Occupation		
Student	65	43.9
Private Sector Employee	55	37.2
Government Employee	15	10.1
Entrepreneur	13	8.8
Income		
< Rp 2,000,000	40	27.0
Rp 2,000,000 - Rp 5,000,000	68	45.9
Rp 5,000,001 - Rp 10,000,000	30	20.3
> Rp 10,000,000	10	6.8
Types of Products Most Frequently Purchased on E-Commerce		
Fashion	50	33.8
Electronics	35	23.6
Cosmetics	28	18.9
Books	20	13.5
Others	15	10.2

The income distribution shows that a significant portion of respondents earn between Rp 2,000,000 and Rp 5,000,000 (45.9%), suggesting a middle-income group that has disposable income for online shopping and potentially AR-enhanced experiences. The preference for fashion (33.8%), electronics (23.6%), and cosmetics (18.9%) as the most frequently purchased products highlights the types of goods where AR try-on features could be most impactful. These product categories benefit greatly from AR interactivity, as it allows consumers to visualize and engage with products more effectively before making a purchase decision. Understanding these demographic insights helps tailor the research to focus on how AR personalization and interactivity can enhance consumer satisfaction and influence digital behavioral intentions within this specific market context.

Validity and Reliability

The validity and reliability test results indicate that the constructs used in this study—AR Interactivity, AR Personalization, and Behavioral Intention—are both reliable and valid. The Cronbach's Alpha (CA) values for all constructs are above the threshold of 0.7, with AR Interactivity at 0.85, AR Personalization at 0.87, and Behavioral Intention at 0.89. These high CA values suggest that the items within each construct are consistent and measure the same underlying concept. Additionally, the Composite Reliability (CR) values exceed 0.8 for all constructs, further confirming the high internal consistency and reliability of the measurement model.

Table 3. Validity and Reliability

Construct	Cronbach's Alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)	Discriminant Validity (Fornell-Larcker Criterion)
AR Interactivity	0.85	0.88	0.62	AR Interactivity: 0.79
AR Personalization	0.87	0.90	0.65	AR Personalization: 0.81
Behavioral Intention	0.89	0.91	0.67	Behavioral Intention: 0.82

The Average Variance Extracted (AVE) values for AR Interactivity, AR Personalization, and Behavioral Intention are 0.62, 0.65, and 0.67, respectively, indicating that more than half of the variance is captured by the constructs rather than by measurement error. This high level of AVE demonstrates good convergent validity, meaning that the indicators within each construct are well-correlated with the construct itself. Furthermore, the Fornell-Larcker Criterion confirms discriminant validity, as the square root of the AVE for each construct is higher than its correlations with other constructs. This implies that each construct is distinct and measures a unique aspect of AR interactivity, personalization, and behavioral intentions. These findings ensure that the study's results will be robust and reliable, providing a solid foundation for understanding the impact of AR features on consumer behavior in e-commerce.

Table 4. Model Fit and Coefficient of Determination

Model Fit	Value
SRMR (Saturated Model)	0.056
SRMR (Estimated Model)	0.062
NFI (Saturated Model)	0.912
NFI (Estimated Model)	0.905
Coefficient of Determination	
R^2 (Digital Behavioral Intention)	0.548
Predictive Relevance	
Q^2 (Digital Behavioral Intention)	0.423

The inner model evaluation reveals a strong fit and predictive capability for the research model, highlighting the significant influence of AR interactivity and personalization on digital behavioral intentions in e-commerce. The SRMR values, both for the Saturated Model (0.056) and the Estimated Model (0.062), fall well below the acceptable threshold of 0.08, indicating a good model fit. Additionally, the high NFI values (0.912 for the Saturated Model and 0.905 for the Estimated Model) further affirm the model's robustness in capturing the underlying data structure. These fit indices suggest that the model accurately represents the observed relationships between AR features and consumer behavior.

Furthermore, the R^2 value of 0.548 indicates that 54.8% of the variance in digital behavioral intentions is explained by AR interactivity and personalization, underscoring their critical role as predictors. The Q^2 value of 0.423 confirms the model's strong predictive relevance, demonstrating its capability to accurately forecast future consumer behaviors. These findings provide compelling evidence that AR technologies can significantly enhance consumer engagement and influence purchasing decisions in e-commerce. Consequently, e-commerce businesses can leverage these insights to optimize their AR strategies, aligning them more closely with consumer preferences to drive higher engagement and conversion rates.

Table 5. Hypothesis Test Results for Direct and Indirect Effects

Hypothesis	Path Coefficient	T-Value	P-Value	Result
H1: AR interactivity positively affects digital behavioral intentions in e-commerce	0.45	5.67	0.000	Supported
H2: Personalization in AR mediates the relationship between AR interactivity and digital behavioral intentions	0.30	4.32	0.000	Supported
H3: The impact of AR interactivity on digital behavioral intentions is stronger when personalization is high compared to when personalization is low	0.25	3.89	0.000	Supported

The hypothesis testing results confirm the significant roles of AR interactivity and personalization in influencing digital behavioral intentions in e-commerce. Hypothesis 1 is supported with a path coefficient of 0.45 (T-value: 5.67, P-value: 0.000), indicating that higher levels of interactivity in AR applications significantly enhance user engagement and satisfaction, thereby positively affecting consumers' digital behavioral intentions. Hypothesis 2, which posits that personalization mediates the relationship between AR interactivity and digital behavioral intentions, is also supported (path coefficient: 0.30, T-value: 4.32, P-value: 0.000). This suggests that tailoring AR experiences to individual preferences makes the interactivity features more effective in driving consumer behavior.

Moreover, Hypothesis 3 demonstrates that the impact of AR interactivity on digital behavioral intentions is stronger when personalization is high (path coefficient: 0.25, T-value: 3.89, P-value: 0.000). This finding emphasizes the importance of integrating personalization features in AR applications to maximize their influence on consumer engagement and behavior. Overall, the results highlight that e-commerce businesses should focus on developing highly interactive and personalized AR experiences to enhance consumer satisfaction, engagement, and ultimately, digital behavioral outcomes.

DISCUSSION

The findings of this study provide substantial insights into the relationships between AR interactivity, personalization, and digital behavioral intentions in the context of e-commerce. These relationships are analyzed and discussed in light of the results, existing literature, theoretical frameworks, and the demographic profile of respondents.

AR Interactivity and Digital Behavioral Intentions

The results indicate that AR interactivity significantly enhances digital behavioral intentions in e-commerce. Higher levels of interactivity in AR applications increase user engagement and satisfaction, which in turn positively influence their intentions to engage in digital behaviors such as making purchases or spending more time on the platform. This finding aligns with prior research, which highlights the importance of interactive features in creating immersive and engaging user experiences. By allowing users to manipulate 3D models and receive real-time feedback, AR interactivity reduces uncertainty and increases consumer confidence in their purchasing decisions (Bai et al., 2023; Liu et al., 2022). The immersive nature of AR helps bridge the gap between physical and online shopping experiences, making it easier for consumers to visualize how products fit into their personal environment (Huang et al., 2021).

In the context of Indonesia, where e-commerce is rapidly growing, these findings are particularly relevant. Indonesia's diverse and tech-savvy population, especially Generation Z, who are well-versed in digital technologies, represents a significant market for AR-enhanced shopping experiences. According to the Indonesian Internet Service Providers Association (APJII, 2023), increasing internet penetration and mobile device usage are driving the growth of e-commerce. This demographic's familiarity with AR technology makes them an ideal target for AR interactivity features that can enhance their online shopping experience.

Personalization as a Mediator

Personalization in AR mediates the relationship between AR interactivity and digital behavioral intentions, amplifying the positive effects of interactivity. Personalized AR experiences, tailored to individual user preferences and behaviors, enhance user engagement and satisfaction (Chen et al., 2022; Huang et al., 2021). This mediation effect is supported by existing literature, which suggests that personalization increases the relevance and appeal of AR features, making them more

meaningful and impactful for users. Personalized AR can include customized product recommendations, tailored visualizations, and targeted promotions, all of which contribute to a more engaging and satisfying shopping experience (Liu et al., 2022).

In the Indonesian market, personalization is crucial due to the country's diverse cultural and consumer preferences. E-commerce giants like Tokopedia and Bukalapak have begun integrating AR features to cater to local tastes and preferences, indicating the importance of customization in driving consumer engagement. McKinsey & Company (2022) reported that personalization strategies significantly boost consumer satisfaction and loyalty in the Indonesian e-commerce sector, highlighting the need for tailored AR experiences that resonate with local users.

The Moderating Role of Personalization

The impact of AR interactivity on digital behavioral intentions is stronger when personalization is high. This finding emphasizes the importance of integrating personalization features in AR applications to maximize their effectiveness. Personalization ensures that interactive elements are aligned with the user's specific needs and preferences, enhancing the relevance and engagement of the AR experience (Huang et al., 2021). The literature supports this view, indicating that personalized AR experiences are more effective in driving consumer engagement and purchase intentions compared to non-personalized experiences (Chen et al., 2022). Given Indonesia's diverse consumer base, the ability to customize AR experiences to meet specific regional and cultural preferences can significantly enhance the effectiveness of these technologies. The integration of localized content and personalized recommendations can make AR features more appealing and relevant to Indonesian consumers, thereby increasing their likelihood of engaging in positive digital behaviors. This approach is essential for e-commerce businesses aiming to capture and retain a broad audience in this rapidly evolving market.

Managerial Implications

The findings from this study offer several critical implications for marketing and digital business strategies in e-commerce, particularly in emerging markets like Indonesia. E-commerce managers should focus on developing and integrating highly interactive AR features into their platforms. Interactive elements, such as the ability to manipulate 3D models and visualize products in different settings, significantly enhance user engagement and satisfaction. These immersive experiences encourage more frequent and extended interactions with the platform. For instance, allowing consumers to virtually try on clothing or see how furniture fits in their home reduces uncertainty and increases purchase intent, thereby driving higher conversion rates (Javornik, 2016; Poushneh & Vasquez-Parraga, 2017).

Personalization is equally essential in AR strategies for e-commerce. By leveraging data analytics and machine learning algorithms, businesses can create personalized AR experiences tailored to individual preferences, behaviors, and demographics. Personalized product recommendations, customized visualizations, and targeted promotions make interactions more

engaging and relevant, boosting user satisfaction and loyalty (Grewal et al., 2017; Pantano et al., 2017). In Indonesia, where consumer preferences are diverse across regions and cultures, personalization is particularly crucial. Customizing AR features to reflect local tastes and preferences enhances their appeal and effectiveness, leading to improved customer retention and higher sales (Laimeheriwa & Kembau, 2024; Wardhana et al., 2023).

Combining interactivity with personalization has a synergistic effect on digital behavioral intentions, making it imperative for e-commerce businesses to seamlessly integrate these elements into their marketing strategies. Targeting tech-savvy demographics, particularly Generation Z, who are highly responsive to AR interactivity and personalization, can amplify these efforts (Djafarova & Bowes, 2021). Marketing campaigns that emphasize the innovative and personalized aspects of AR features can attract this audience, while exclusive AR experiences or incentives for using AR features can further drive engagement. Continuous innovation and user feedback are also vital, as regularly updating AR features based on user insights and technological advancements ensures that AR applications remain relevant and effective (Firellsya et al., 2024; Hoyer et al., 2020). This proactive approach keeps businesses competitive in the rapidly evolving e-commerce landscape, particularly in dynamic markets like Indonesia, ultimately leading to sustained growth and success.

CONCLUSION

In conclusion, the study demonstrates that both AR interactivity and personalization play critical roles in shaping digital behavioral intentions in e-commerce. Higher levels of interactivity lead to increased engagement and satisfaction, while personalization enhances the relevance and impact of these interactive features. These insights provide valuable guidance for e-commerce businesses aiming to optimize their AR strategies, ensuring that they cater to the specific needs and preferences of their target audience, thereby driving higher engagement and conversion rates. This research contributes to the academic literature by bridging gaps in understanding how AR personalization influences consumer behavior, particularly in emerging markets like Indonesia, and offers actionable recommendations for enhancing AR applications in e-commerce. By focusing on the interplay between interactivity and personalization, e-commerce platforms can create more immersive, engaging, and satisfying shopping experiences that cater to the diverse and growing Indonesian market.

Limitations

This study, while providing valuable insights into the impact of AR interactivity and personalization on digital behavioral intentions in e-commerce, has several limitations. The sample size is limited to 148 Generation Z respondents, which may not fully represent the broader consumer population in Indonesia or other emerging markets. Additionally, the study relies on self-reported data collected through online questionnaires, which can be subject to biases such as social desirability and recall bias. The cross-sectional nature of the research also limits the ability to establish causality

between the variables. Future research should consider longitudinal designs and larger, more diverse samples to validate these findings and explore the long-term effects of AR interactivity and personalization on consumer behavior.

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