

Influence of Augmented Reality Technology On Customer Experience In Online Shopping

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Abstract

Augmented reality offers a novel approach to enhancing online retail engagement, and its application in online commerce is expanding rapidly. Despite this growth, its influence on key customer experience outcomes remains insufficiently understood. While prior research has highlighted augmented reality's potential to enhance engagement and personalization, limited empirical evidence explains how augmented reality affects customer satisfaction and trust. Drawing on flow theory, this study investigates how perceptions of unique augmented reality features, namely interactivity, vividness, and novelty, shape customer satisfaction and trust in online shopping through the mediating roles of flow experience and customer engagement, as well as the moderating role of perceived customer support.

To test the proposed conceptual model, an online survey was conducted with 235 participants, and the data were analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM). The findings demonstrate that perceptions of augmented reality features significantly enhance the flow experience, which, in turn, fosters customer engagement and leads to higher levels of satisfaction and trust. However, the results reveal a counterintuitive moderating effect of perceived customer support, as higher levels of perceived customer support, weakens the positive relationship between flow experience and customer engagement. This finding challenges the common assumption that service support uniformly strengthens immersive technology experiences and highlights perceived customer support as a contextual boundary condition rather than a universally reinforcing factor.

This study advances theoretical understanding by integrating perceptions of augmented reality features, flow experience, customer engagement, and customer satisfaction and trust into a cohesive framework for online customer experience. Practically, the findings suggest that the effectiveness of augmented reality in online shopping depends not only on the novelty of technology but also on the underlying mechanisms to enhance the online shopping experience, leading to greater customer satisfaction and trust.

Keywords: *Augmented Reality (AR), Customer Engagement, Customer Satisfaction, Customer Trust, Flow Experience, Online Shopping*

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning. I further acknowledge that I have leveraged an AI tool (ChatGPT) to reorganize my ideas and logical flow of the content when required in accordance with Postgraduate Handbook pages 95-98.

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Ethics Approval

This study was conducted in accordance with the AUT's Code of Conduct for Research. Ethical approval (application no. 25/237) was granted by the AUT Ethics Committee (AUTEC) on July 31, 2025.

Chapter 1: Introduction

1.1 Background

Augmented reality refers to a technology that overlays computer-generated digital content onto the physical environment, allowing customers to perceive and interact with virtual elements in real time (Yim et al., 2017). By blending digital information with real-world contexts, augmented reality enhances perceptual richness and enables customers to engage with content in more intuitive and meaningful ways. Due to its ability to deliver interactive, immersive, and engaging experiences, augmented reality has gained increasing attention across a wide range of domains, including education, healthcare, entertainment, and marketing (Arghashi & Yuksel, 2022).

Within the retail and e-commerce context, augmented reality has emerged as a particularly promising technology to enhance consumer experience and engagement. One of the major limitations of traditional online shopping is the inability of consumers to physically examine products before purchase. This often leads to uncertainty regarding product size, fit, color compatibility, or suitability, resulting in dissatisfaction and higher product return rates (Barhorst et al., 2021). Augmented reality technologies help overcome these challenges by allowing consumers to visualize products in realistic settings, such as placing virtual furniture in their homes or trying on clothing and cosmetics digitally (McLean & Wilson, 2019). For example, fashion brands such as Zara and Nike offer virtual try-on features, while beauty brands including L'Oréal and Sephora enable customers to experiment with makeup products using augmented reality-based technologies (Barhorst et al., 2021). Similarly, IKEA's augmented reality technologies allow customers to visualize furniture in their own living spaces before making purchase decisions (McLean & Wilson, 2019). Luxury brands such as Gucci have also adopted augmented reality to create novel and engaging shopping experiences that align with evolving consumer expectations (Hilken et al., 2018). By narrowing the gap between online and offline shopping experiences, augmented reality enables a more immersive, informative, and personalized customer journey (Nikhashemi et al., 2021).

The growing importance of augmented reality in retail is further reflected in market trends. The global augmented reality retail market was valued at USD 2.22 billion in 2024 and is projected to grow to USD 11.64 billion by 2033 (Business Research Insights, 2025). Industry reports also indicate that consumer adoption of augmented reality is increasing rapidly, particularly among younger consumers. For instance, approximately 60% of the U.S. population is expected to use augmented reality regularly, with Gen Z showing particularly high interest in augmented reality enabled shopping experiences (BrandXR, 2025). These developments highlight the importance of

augmented reality as a strategic tool for enhancing customer experience in online retail environments.

Despite its growing adoption, the effectiveness of augmented reality in improving customer experience remains a subject of ongoing academic debate. While several studies suggest that augmented reality can enhance engagement, satisfaction, and purchase intentions (Arghashi & Yuksel, 2022; Barhorst et al., 2021; Porter & Heppelmann, 2017; Rauschnabel et al., 2019; Rese et al., 2017; Wang et al., 2019), other research reports mixed or context-dependent outcomes (McLean & Wilson, 2019; Hsu et al., 2021; Nikhashemi et al., 2021). These inconsistencies suggest that the relationship between augmented reality technology and customer experience is complex than reported in previous studies and may involve multiple factors, including specific augmented reality features, individual differences, and psychological mechanisms underlying customer interactions (Csikszentmihalyi, 1975; Barhorst et al., 2021).

1.2 Problem Statement

Although existing research recognizes augmented reality as a transformative technology within online retail, there remains limited and fragmented understanding of how and why perception of augmented reality features influence customer experience outcomes. Prior studies have largely focused on technology adoption, usage intentions, or short-term behavioral outcomes, often overlooking the deeper experiential and psychological processes through which augmented reality shapes customer responses (Nikhashemi et al., 2021; Hsu et al., 2021; McLean & Wilson, 2019). As a result, our comprehensive understanding of the influence of augmented reality on customer engagement, satisfaction, and trust is limited.

Several scholars suggest that augmented reality attributes such as interactivity, vividness, and novelty are central to creating value in digital shopping environments (Hilken et al., 2018; Yim et al., 2017; Arghashi & Yuksel, 2022; Barhorst et al., 2021; Hsu et al., 2021; McLean & Wilson, 2019; Nikhashemi et al., 2021). Interactivity enables consumers to actively manipulate and explore virtual products, vividness enhances sensory richness and realism, and novelty stimulates curiosity and interest. While these features are theoretically linked to positive customer outcomes, empirical evidence regarding their individual and combined effects remains inconclusive (Fan et al., 2020). Some studies report strong positive impacts on engagement and satisfaction (Arghashi & Yuksel, 2022; Barhorst et al., 2021), whereas others find that, these effects are contingent upon contextual and individual-level factors, such as technology readiness and perceived usefulness (Hsu et al., 2021; McLean & Wilson, 2019; Park & Yoo, 2020).

Furthermore, industry evidence suggests that augmented reality implementation does not automatically translate to sustained customer value. Reports indicate that nearly one-quarter of augmented reality technologies are abandoned after initial use, implying that novelty effects may

diminish quickly if meaningful experiential value is not delivered (Clement, 2019). This raises critical questions regarding the psychological mechanisms that underpin successful augmented reality experiences and highlights the need to move beyond surface-level adoption decisions.

One promising theoretical lens for deepening our understanding of the underlying psychological mechanisms associated with positive customer experience is flow theory. Flow represents a state of deep cognitive and emotional immersion characterized by focused attention, enjoyment, and intrinsic motivation (Csikszentmihalyi, 1975). Although prior research acknowledges that augmented reality can induce flow experiences (Barhorst et al., 2021), limited empirical work has examined flow as a central explanatory mechanism linking perception of augmented reality features to customer experience outcomes (Barhorst et al., 2021; Hosseini & Fattahi, 2014).

Trust constitutes another critical yet under-investigated dimension within augmented reality-enabled shopping environments. Trust in digital contexts is often shaped by perceptions of system reliability, information accuracy, and the quality of human–technology interaction (Sheikh et al., 2019; Shen et al., 2020). In augmented reality settings, trust may be especially important, as consumers rely on virtual representations to inform real-world purchase decisions. However, existing studies rarely integrate trust into the development of models of augmented reality-driven customer experience (Bowden, 2009; Jaakkola & Alexander, 2014; Mulcahy et al., 2022).

Taken together, these limitations reveal a clear knowledge gap. There is a need for an integrative, theory-driven model that explains how specific perception of augmented reality features influence customer experience outcomes through psychological mechanisms such as flow and engagement. Addressing this gap is essential for advancing our understanding of the influence of augmented reality on customer experience and for providing actionable insights for retailers seeking to leverage augmented reality technologies effectively.

1.2.1 Research objectives and research questions

The overarching aim of this study is to advance theoretical and empirical understanding of how perceptions of augmented reality features shape online customer experience through the lens of flow theory. Specifically, this study seeks to:

1. Develop a conceptual model grounded in flow theory (Csikszentmihalyi & Csikszentmihalyi, 1990) to explain how perceptions of augmented reality features shape flow experience, which, in turn, influences customer experience outcomes, particularly satisfaction and trust, in online shopping environments.
2. Empirically evaluate the proposed conceptual model by examining the relationships between perceived augmented reality features (interactivity, vividness, and novelty), customer outcomes, and the mediating roles of flow experience and customer engagement.

To achieve these objectives, the study addresses the following research questions:

1. How do augmented reality technologies influence key dimensions of customer experience, specifically satisfaction and trust, in online shopping?
2. What roles do flow experience and customer engagement play in linking perceptions of augmented reality features to customer satisfaction and trust?

1.2.2 Research design

This study adopts a quantitative, cross-sectional research design to empirically examine the relationships among augmented reality features, flow experience, customer engagement, satisfaction, and trust in online shopping contexts. A survey-based methodology was selected as it enables the systematic collection of perceptual and experiential data from a relatively large sample, facilitating statistical testing of the proposed conceptual model.

The target population for this study comprises consumers who have prior experience using augmented reality technologies in online shopping environments. A purposive sampling strategy was employed to ensure that respondents possessed sufficient familiarity with augmented reality-enabled retail technologies, thereby enhancing the relevance and validity of the data. Participants were recruited through the Prolific online research platform, which is widely used in academic research due to its ability to provide high-quality and diverse samples (Newman et al., 2021).

Data collection was conducted between August and September 2025 using a structured online questionnaire. The survey instrument consisted of multiple sections measuring respondents' perceptions of augmented reality features (interactivity, vividness, and novelty), flow experience, customer engagement, satisfaction, and trust. Measurement items were adapted from established and validated scales in prior literature and modified to suit the augmented reality shopping context. This approach ensured content validity while maintaining consistency with existing research. A pilot test was conducted to assess items clarity and reliability prior to full-scale data collection.

A total of 235 valid responses were obtained and retained for analysis after data screening procedures. Partial Least Squares Structural Equation Modeling was employed to analyze the data and test the hypothesized relationships. Partial Least Squares Structural Equation Modeling was deemed appropriate due to its suitability for predictive research, its ability to handle complex models with multiple mediators, and its robustness when working with moderate sample sizes.

Overall, this research design enables a rigorous empirical examination of the proposed conceptual framework and provides robustness for assessing the explanatory power of flow theory in augmented reality-enabled online retail environments.

1.2.3 Research contributions

This study makes several important contributions to theory and practice.

Theoretical contributions: First, the study extends an application of flow theory to an augmented reality-based retail context to better understand the relationships between key perception of augmented reality features and flow experiences during online shopping. Second, it highlights the mechanisms through which flow experience influences customer experience outcomes by examining mediating pathway, specifically the mediating role of engagement and the moderating role of perceived customer support.

Practical implications: From a managerial perspective, the findings provide actionable guidance for online retailers on how to design and implement perception of augmented reality features that enhance customer engagement, satisfaction, and trust. From a customer perspective, the study improves an understanding of how augmented reality-based shopping influences consumer perceptions and evaluations during online interactions, enabling consumers to navigate augmented reality-enabled environments more effectively.

1.2.4 Thesis structure

The structure of the thesis consists of six chapters. Chapter One provides the motivation of the study, states the main research objectives, outlines the research questions, and highlights key theoretical contributions and practical implications. Chapter Two presents a review of the relevant literature and the grounding theoretical lens, the proposed conceptual model, and associated hypotheses. Chapter Three consists of research methodology, which includes the research process, measures, survey administration, and data analysis. Chapter Four presents the results of the analysis. Chapter Five discusses the key findings and theoretical and practical implications, along with limitations and future research directions. Finally, Chapter Six concludes the research study.

Chapter 2: Literature Review and Research Model

This chapter presents a comprehensive review of the literature relevant to the present study and develops the theoretical foundation and research model guiding the empirical investigation. Building on the research problem outlined in Chapter One, the purpose of this chapter is threefold. First, it synthesizes prior research on augmented reality in online retailing and its implications for customer experience. Second, it reviews flow theory as the central theoretical lens used to explain how augmented reality features shape customer responses. Third, drawing on flow theory and the reviewed literature, this study develops a conceptual model and associated hypotheses to explain the relationships between perceived augmented reality features, flow experience, customer engagement, customer satisfaction, and customer trust, while also theorizing the moderating role of perceived customer support.

2.1 Augmented reality technology in online shopping

Augmented reality is a relatively recent technological advancement that integrates digital information with the physical environment by overlaying virtual content onto real-world settings, thereby enhancing customer interactions within retail environments (Barhorst et al., 2021; Pantano & Servidio, 2012). Over the past decade, augmented reality has emerged as a powerful tool in online shopping, fundamentally altering how consumers search for information, evaluate products, and make purchase decisions. Unlike traditional e-commerce interfaces that rely primarily on static images and textual descriptions, augmented reality enables customers to interact dynamically with products through real-time visualization, manipulation, and spatial integration that more closely resembles physical retail experiences (Hilken et al., 2017).

Early conceptualizations of augmented reality describe it as a technology that combines real and virtual elements, operates interactively in real time, and presents content in three dimensions (Azuma, 1997). In the context of online shopping, augmented reality allows customers to visualize products through smartphones, tablets, or computers by superimposing digital elements, such as computer-generated images, three-dimensional models, animations, textual graphics, or simulated product representations onto their immediate physical surroundings (Craig, 2013; McLean & Wilson, 2019). For instance, consumers can virtually try on clothing or accessories, preview cosmetics or hair colors on their faces, place three-dimensional furniture in their living spaces to assess size and fit, or explore how home décor items align with existing interiors. These functionalities are designed to reduce the psychological distance between online and offline shopping by replicating sensory-rich evaluation processes typically available only in physical stores (Hilken et al., 2017).

From a customer perspective, augmented reality introduces an innovative shopping approach that strengthens customer–retailer relationships and fosters more favorable customer experience outcomes (Arghashi & Yuksel, 2022). By enabling consumers to actively interact with products and visualise them in personally relevant contexts, augmented reality reduces uncertainty and increases confidence during the decision-making process. This experiential enhancement is particularly valuable in online retail environments where consumers cannot physically touch, try, or test products before purchase. As a result, augmented reality has the potential to improve overall evaluations of the shopping experience.

From a business perspective, augmented reality technology serves as a strategic tool that integrates information with other media into an individual's perception of the real world, enabling business to convey value, demonstrate benefits, and achieve their objectives (Rauschnabel et al., 2019). Retailers can use augmented reality to demonstrate product benefits, convey value propositions more effectively, and differentiate their brands in increasingly competitive digital marketplaces. Compared with other immersive technologies such as virtual reality, augmented reality is particularly well suited to retail technologies because it can be seamlessly integrated into consumers' everyday environments using devices they already own, such as smartphones, tablets, laptops (Heller et al., 2019). This accessibility lowers adoption barriers and facilitates widespread consumer engagement, making augmented reality a practical and scalable solution for online retailers.

A defining feature of augmented reality is its distinctive technological characteristics. According to Azuma (1997), augmented reality is characterized by three core attributes. First, augmented reality is interactive and functions in real time, allowing customers to receive immediate feedback and dynamically manipulate digital content. Second, augmented reality presents content in three-dimensional form, enabling realistic visualization of products. Third, augmented reality blends physical and virtual environments, creating hybrid experiences that are contextually relevant and tailored to individual customers (McLean & Wilson, 2019; Nikhashemi et al., 2021). These characteristics collectively distinguish augmented reality from conventional online technologies and contribute to its experiential potential in retail contexts.

Importantly, the effectiveness of augmented reality does not depend solely on technological sophistication but also on customers' subjective perceptions of these features. Prior research suggests that perceived interactivity is shaped by individual differences, such as customers' cognitive styles, motivations, and willingness to engage with interactive media (Downes & McMillan, 2000; Newhagen et al., 1995). Even when augmented reality systems are technically capable of high levels of interactivity, customers may not perceive or experience these qualities unless they are motivated to actively participate (Yim et al., 2017). Consequently, interactivity is not merely a system-level attribute but a psychological state emerging from the interaction between the customer and the technology.

Similarly, vividness and novelty are perceptual qualities that depend on how customers experience, augmented reality features rather than on the technology itself (Yim et al., 2017). Vividness refers to the extent to which augmented reality presents rich, detailed, and lifelike sensory information. When augmented reality experiences are perceived as vivid, customers are better able to process product information because the technology provides realistic visual cues that simulate real-world product evaluation. This heightened sensory richness enhances mental imagery, reduces ambiguity, and supports more informed decision-making. Novelty, in contrast, reflects the degree to which augmented reality experiences are perceived as new, unexpected, or innovative. Novel augmented reality interactions stimulate curiosity and intrinsic motivation, encouraging customers to explore the interface more deeply and remain engaged for more extended periods.

These perceptual qualities are closely linked to customers' experiential responses. Research indicates that perceived interactivity, vividness, and novelty jointly enhance cognitive and emotional engagement by making augmented reality encounters more immersive, enjoyable, and memorable (Hilken et al., 2018; Yim et al., 2017). For example, when customers perceive augmented reality features as highly interactive, they feel a greater sense of control and involvement. When augmented reality visuals are vivid, customers experience stronger sensory immersion. When augmented reality encounters are novel, customers are motivated to explore and experiment. Together, these perceptions create conditions conducive to deeper experiential states.

An illustrative example can clarify how these augmented reality features operate in practice. Consider a customer using augmented reality to visualize a sofa in their living room (Flavián et al., 2019; Yaoyuneyong et al., 2016). Through simple touch gestures, the customer can rotate, resize, and reposition the virtual sofa, demonstrating interactivity (Huang & Liao, 2015). The presence of three-dimensional textures, accurate lighting, and spatial alignment enhances vividness by making the sofa appear realistic and contextually embedded in the physical environment. At the same time, the ability to instantly preview how a previously unseen or newly released product fits within one's personal space introduces novelty, offering an experience that differs markedly from conventional online shopping. This combination of interactivity, vividness, and novelty enables customers to form clearer mental representations of products and imagine how they would function in real-life settings (Hsu et al., 2021; Pantano et al., 2017).

Such capabilities highlight the experiential value of augmented reality in online shopping. Rather than merely providing information, augmented reality facilitates experiential learning by allowing consumers to "experience" products virtually before purchase. This experiential dimension is particularly important in categories where product fit, appearance, or contextual compatibility is a critical evaluation criterion. Consequently, augmented reality has been widely recognized as a technology with significant potential to enhance customer experience by transforming passive browsing into active exploration.

Building on this understanding, the present study focuses on customers' perceptions of three core augmented reality features, namely, interactivity, vividness, and novelty, as identified in prior research (McLean & Wilson, 2019; Nikhashemi et al., 2021). Specifically, perceived interactivity is conceptualized as a psychological state experienced by customers during their interaction with augmented reality technology, reflecting perceived control and responsiveness. Perceived vividness refers to customers' perceptions of the aesthetic quality and sensory richness of augmented reality experiences, reflecting the extent to which the augmented reality environment appears realistic, visually appealing, and engaging. Perceived novelty refers to customers' perceptions of the uniqueness and innovativeness of augmented reality features, capturing the degree to which augmented reality provides personalized, unexpected, and distinctive stimuli that differentiate the shopping experience from traditional online retail platforms.

While existing literature acknowledges the importance of the perception of augmented reality features in shaping online experiences, there remains a limited understanding of how they contribute to deeper experiential states, particularly flow, within shopping contexts (Hilken et al., 2018; Javornik, 2016; Yim et al., 2017). Flow represents a state of deep immersion, enjoyment, and focused attention that arises during optimal experiential interactions. Although augmented reality is often assumed to induce flow, empirical research has yet to clearly explain how perceptions of specific augmented reality features facilitate this state and how flow, in turn, influences customer experience outcomes. To address this gap, the following section introduces flow theory and examines its relevance to augmented reality-enabled online shopping experiences.

2.2 Flow theory as a theoretical foundation

Flow is a psychological state that arises when individuals become fully immersed in an activity, experiencing deep concentration, intrinsic enjoyment, and a sense of effortless involvement (Csikszentmihalyi, 1997). According to Csikszentmihalyi's seminal work, flow emerges when several conditions are simultaneously present, including clear goals, immediate and unambiguous feedback, a balance between perceived challenges and individual skills, intense focus on the task at hand, a strong sense of control, a loss of self-consciousness, altered perception of time, and intrinsic motivation. When individuals enter a flow state, they become absorbed in the activity for its own sake, rather than being driven by external rewards or outcomes.

Flow has been observed across a wide range of activities, such as playing sports, engaging in strategic games (e.g., chess), dancing, performing complex professional tasks such as surgery, and participating in leisure or consumption-related activities, including shopping in both online and offline contexts (Hoffman & Novak, 2009; Koufaris, 2002). In consumer settings, flow represents a particularly valuable experiential state, as it reflects optimal engagement and enjoyment during interactions with products, services, or technologies. Early research on flow in digital environments focused on how individuals experience this state while interacting with computers, websites, and

internet-based technologies (Hoffman & Novak, 2009). These studies demonstrated that flow can occur during online interactions when customers perceive the activity as engaging, interactive, and cognitively absorbing.

Importantly, research suggests that individuals differ in their propensity to experience flow. Novak et al. (2000) argue that personal characteristics, such as skills, prior experience, cognitive involvement, and motivational orientation, influence whether and how easily individuals enter a flow state. As a result, flow is not a universal or automatic outcome of digital interaction but instead emerges from the dynamic interplay between users characteristics and system features. This insight is particularly relevant in technology-mediated environments, where the design and functionality of the platform play a critical role in shaping customer experiences.

Novak et al. (2003) further illustrate how consumers may experience flow during online activities, including those enhanced by augmented reality features. In such contexts, goal-directed behavior can gradually shift into exploratory and experiential engagement when flow is achieved (Trevino & Webster, 1992). For example, a consumer interacting with an augmented reality-based furniture visualization tool may initially aim to find a sofa that fits their living space. However, as the interaction becomes increasingly immersive and enjoyable, the consumer may lose awareness of the original task-oriented goal and instead engage in repeated exploration of different styles, colors, and configurations. The interactive and vivid nature of augmented reality experiences continuously provides immediate feedback and personalized stimuli, sustaining attention and encouraging ongoing engagement. This shift from instrumental behavior to intrinsically motivated exploration exemplifies the experiential transformation characteristic of flow.

The concept of flow has therefore been widely recognized as a powerful theoretical lens for understanding online consumer behavior (Choi et al., 2007; Lee et al., 2019). However, despite its widespread application, the definition and measurement of flow remain subjects of ongoing debate. Prior studies highlight the lack of a universally accepted operationalization of flow within customer experience research, particularly in digital and technology-enabled contexts (Barhorst et al., 2021; Choi et al., 2007; Ghani & Deshpande, 1994; Hoffman & Novak, 2009; Novak et al., 2003). Some scholars conceptualize flow primarily as a cognitive state characterized by focused attention (Koufaris, 2002; Sanchez-Franco, 2006), while others emphasize its affective and hedonic dimensions, such as enjoyment and intrinsic motivation (Barhorst et al., 2021; Hsu et al., 2021). This conceptual ambiguity underscores the need for context-specific investigations of flow, especially in emerging technological environments such as augmented reality-enabled online shopping.

Recent research has increasingly examined both the antecedents and consequences of flow in digital environments (Lee et al., 2019). Identified antecedents include platform interactivity, challenge–skill balance, vivid and immersive content, perceived control, and the presence of clear

goals accompanied by immediate feedback. These factors facilitate customers' absorption in the activity and increase the likelihood of entering a flow state. Collectively, these findings highlight flow as a central psychological mechanism that connects technological features with favorable customer experience outcomes.

Within the context of online retail, flow is particularly relevant because shopping activities often involve both utilitarian and hedonic motivations (Hsu et al., 2021). While conventional e-commerce platforms typically emphasize efficiency, convenience, and information provision, they may not always support the experiential conditions necessary for flow (Novak et al., 2000; Richard & Chandra, 2005; Shin, 2006). As a result, consumers seeking engaging and immersive shopping experiences may find traditional online interfaces insufficient. Prior studies indicate that individuals, who experience flow, tend to prefer digital platforms that are easy to navigate, highly interactive, and capable of sustaining attention through rich sensory and cognitive stimulation (Koufaris, 2002; Sanchez-Franco, 2006).

Augmented reality features have the potential to address these limitations by transforming the nature of online interactions. Augmented reality-enabled shopping platforms can offer more engaging and immersive experiences than conventional e-commerce platforms by allowing customers to interact with virtual products in real-world contexts (Wang et al., 2023). The interactive, vivid, and novel characteristics of augmented reality align closely with the antecedents of flow identified in the literature. By enabling real-time manipulation of products, providing realistic visual representations, and introducing innovative experiential elements, augmented reality creates conditions that are conducive to deep involvement and intrinsic enjoyment.

Empirical research supports the notion that augmented reality-enabled shopping experiences can facilitate flow and, in turn, generate positive customer outcomes. Studies have shown that flow experiences in augmented contexts are associated with higher levels of engagement, satisfaction, trust, and favourable attitudes toward both the technology and the retailer (Arghashi & Yuksel, 2022; Barhorst et al., 2021; Nikhashemi et al., 2021). However, despite these insights, important gaps remain. In particular, there is limited understanding of which specific augmented features most effectively induce flow and how flow functions as a mediating mechanism between consumers' perceptions of augmented features and key customer experience outcomes. Accordingly, the present study positions flow as a central explanatory construct that links consumers' perceptions of augmented features with customer engagement, satisfaction, and trust in online shopping platforms.

2.3 Customer experience in augmented reality-enabled online shopping

Customer experience is commonly defined as customers' spontaneous, subjective, and unplanned responses to stimuli encountered throughout their interaction journey with a firm (Becker & Jaakkola, 2020). These responses emerge as customers engage with various touch points before, during, and after consumption. As such, customer experience is widely recognized as a holistic and multidimensional construct encompassing cognitive, emotional, behavioral, relational, and sensory components (Lemon & Verhoef, 2016; Schmitt, 1999). Rather than being limited to isolated transactions, customer experience unfolds over time and reflects the cumulative impact of multiple interactions between customers and retailers across physical and digital environments.

Despite its growing prominence in marketing and retail research, customer experience remains conceptually complex and difficult to operationalize. Scholars argue that its multifaceted nature makes it challenging to capture in a unified framework (Lemon & Verhoef, 2016; Schmitt, 1999; Becker & Jaakkola, 2020), thereby necessitating further conceptual refinement, and empirical investigation (Moore et al., 2022). Recent research calls for a more integrated and dynamic understanding of customer experience that situates individual encounters within the broader customer journey (De Keyser et al., 2020; Homburg et al., 2017; Lemon & Verhoef, 2016). Such an approach is particularly important in contemporary retail environments characterized by rapid technological change, where customer experiences are continuously shaped by evolving digital platforms and service innovations.

Technological advancements have fundamentally transformed the retail landscape, altering how consumers interact with businesses and experience shopping journeys. The increasing adoption of in-store and online technologies has reduced the need for direct human interaction, often resulting in more self-directed and technology-mediated purchasing processes (Grewal et al., 2017; Lee & Yang, 2013). While these developments offer efficiency and convenience, they also raise concerns about the potential loss of personalization and emotional connection in the buying process. At the same time, the proliferation of digital technologies within physical retail spaces has reshaped traditional shopping experiences, creating hybrid environments that blend physical and digital elements (Bulmer et al., 2018; Inman & Nikolova, 2017).

In this evolving context, customer experiences increasingly involve a combination of physical reality, virtual enhancements, and imaginative engagement (Hoyer et al., 2020). Advances in immersive technologies have enabled retailers to embed digital objects and interactive content into real-world environments, thereby enriching the experiential value offered to customers (Barhorst et al., 2021; Hilken et al., 2017). Among these technologies, augmented reality stands out as a powerful tool capable of enhancing customer experience by overlaying digital information onto the

physical world in real time. Augmented reality allows customers to interact with products in novel ways, bridging the gap between online and offline shopping experiences and offering greater experiential richness.

As augmented reality introduces new opportunities and complexities for both customers and retailers, businesses increasingly seek guidance on how to leverage augmented reality effectively to enhance customer experience (Moore et al., 2022). From a customer perspective, augmented reality can reduce uncertainty, increase confidence in decision-making, and create more engaging and enjoyable shopping experiences. From a managerial perspective, augmented reality offers a means to differentiate the retail offering, strengthen customer relationships, and foster deeper engagement across digital touch points. However, understanding how augmented reality features translate into meaningful customer experience outcomes remains an important area for scholarly inquiry.

Existing research has examined customer experience with augmented reality across multiple contexts. In the domain of augmented reality-enabled shopping, augmented reality refers to technologies that allow consumers to virtually try on products, visualize items within their personal environments, or interact with three-dimensional representations of products in real time (Barhorst et al., 2021; Wang et al., 2023; Yim et al., 2017; Yuan et al., 2021). Such technologies are particularly valuable in online shopping contexts, where the inability to physically inspect products often leads to uncertainty and perceived risk. By enabling customers to visualize products more realistically, augmented reality enhances perceived diagnosticity and supports more informed purchase decisions.

Beyond shopping technologies, augmented reality has also been widely used in branding and marketing communications. Augmented reality-based branding initiatives often involve interactive advertisements, virtual brand experiences, or immersive storytelling elements designed to capture consumers' attention and enhance brand engagement (Arghashi & Yuksel, 2022; McLean & Wilson, 2019). Similarly, augmented reality-enhanced packaging allows customers to access additional digital content by scanning physical products, thereby increasing memorability, emotional connection, and perceived brand value (Hoyer et al., 2020). These technologies demonstrate the versatility of augmented reality in shaping customer experiences across different stages of the customer journey.

The literature on augmented reality shopping and branding frequently focuses on key customer experience outcomes, particularly satisfaction and trust. Customer satisfaction reflects customers' overall evaluative judgments of their experiences with augmented reality-enabled online platforms, encompassing both functional performance and experiential enjoyment (Barhorst et al., 2021; McLean & Wilson, 2019; Wang et al., 2023). Satisfaction is often viewed as a critical indicator of

experience quality and a precursor to favorable behavioral intentions, such as repeat usage and positive word-of-mouth.

Trust represents another central outcome in augmented reality mediated customer experiences. In digital and technology-driven contexts, trust relates to consumers' confidence in the technology itself, the retailer providing the augmented reality experience, and the reliability of the information used to support purchase decisions (Cheung & Lee, 2000; Gefen et al., 2003; Yoon & Occeña, 2015; Yuan et al., 2021). Given the novelty and perceived complexity of augmented reality technologies, trust plays a particularly important role in shaping customers' willingness to engage with augmented reality features and rely on them during decision-making processes.

Accordingly, this study aligns with the growing body of research that seeks to understand how augmented reality influences customer experience outcomes in online retail settings. By examining satisfaction and trust alongside engagement-related responses, the study contributes to a more comprehensive understanding of how augmented reality-enabled experiences shape customer perceptions and behaviors.

2.4 Conceptual model and hypotheses development

Building on the preceding review of augmented reality technology in online shopping, flow theory, and customer experience research, this section develops the conceptual model (Figure 1) that underpins the present study. The purpose of this section is threefold. First, it integrates key theoretical perspectives to explain how customers' perceptions of augmented reality features shape experiential and behavioral outcomes in online shopping contexts. Second, it clarifies the role of flow as a central psychological mechanism linking perceptions of augmented reality features to customer experience outcomes. Third, it introduces perceived customer support (PCS) as a contextual factor that influences customer engagement within augmented reality-enabled environments. Together, these elements form a conceptual model that guides hypothesis development and empirical testing.

Contemporary online retail environments are increasingly characterized by immersive and interactive technologies that go beyond traditional information-based online shopping platforms. As discussed in Sections 2.1 and 2.3, augmented reality-enabled shopping experiences allow customers to interact with digital representations of products in real-world contexts, thereby transforming online shopping from a passive information-processing activity into an active and experiential process. However, despite growing managerial interest in augmented reality, academic research has yet to fully explain the psychological mechanisms through which augmented reality features influence customer experience outcomes. Addressing this gap requires a theoretical framework that accounts for both technological attributes and consumers' experiential responses.

To this end, the present study integrates flow theory with customer experience and technology-mediated engagement literature. Flow theory provides a particularly relevant lens for understanding augmented reality-enabled shopping because it emphasizes deep involvement, intrinsic enjoyment, and optimal experiential states that emerge during interactive activities (Csikszentmihalyi, 1997; Hoffman & Novak, 2009). As established in Section 2.2, flow arises when individuals perceive a balance between challenge and skill, receive immediate feedback, and experience a sense of control and focused attention. These conditions closely align with the defining characteristics of augmented reality technology namely, interactivity, vividness, and novelty making flow a theoretically appropriate mechanism for explaining how perception of augmented reality features influence customer outcomes.

The conceptual model proposed in this study posits that customers' perceptions of augmented reality features, specifically interactivity, vividness, and novelty, serve as key antecedents of flow experience in online shopping environments. These perceptual dimensions reflect how customers subjectively experience augmented reality technology rather than its objective technical capabilities. Prior research suggests that such perceptions are critical in shaping experiential responses, as consumers evaluate technologies based on how engaging, realistic, and innovative they feel during use (Hilken et al., 2018; Yim et al., 2017). Accordingly, the model conceptualizes augmented reality features from a perceptual perspective to evaluate their psychological impact on customers.

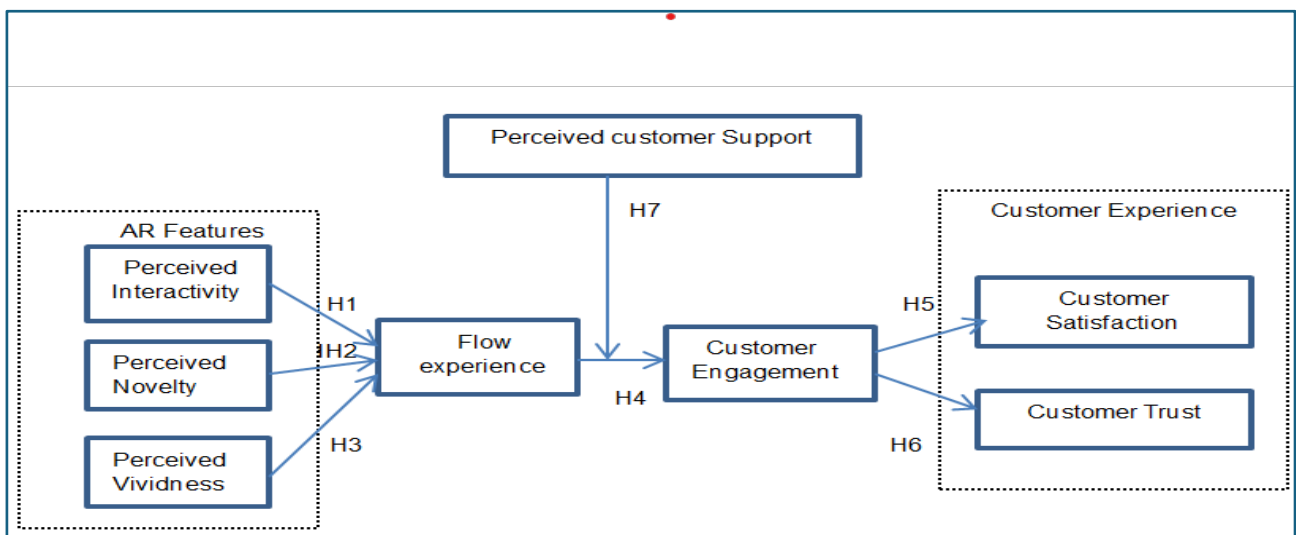
Flow, in turn, is positioned as a central mediator between perceived augmented reality features and customer engagement. Engagement represents a higher-order experiential outcome reflecting customers' cognitive, emotional, and behavioral investment in their interaction with the retailer or platform. In augmented reality-enabled shopping contexts, flow is expected to facilitate engagement by sustaining attention, enhancing enjoyment, and encouraging exploratory behavior. When customers experience flow, they are more likely to become deeply involved in the shopping activity, interact extensively with the platform, and develop positive experiential responses that extend beyond the immediate task.

Beyond engagement, the conceptual model further recognizes satisfaction and trust as critical customer experience outcomes. Satisfaction reflects customers' overall evaluative judgments of their augmented reality enabled shopping experiences, while trust captures their confidence in the technology, the retailer, and the purchase decisions supported by augmented reality interfaces. Consistent with prior research, the model assumes that engagement serves as a key pathway through which flow influences these outcomes. Engaged customers are more likely to evaluate their experiences positively and develop trust in the platform and the retailer, particularly in technology-mediated environments.

Importantly, the conceptual model also incorporates perceived customer support as a contextual factor influencing customer engagement. In digital retail environments, customer support encompasses consumers' perceptions of the availability, responsiveness, and effectiveness of assistance provided by the retailer. While augmented reality technologies can enhance experiential richness, they may also introduce complexity, especially for less technologically experienced customers. As a result, the presence of effective customer support may play a critical role in shaping how customers translate immersive experiences into meaningful engagement. Drawing on service and technology adoption literature (Bettencourt, 1997; Gefen et al., 2003; Grisse mann & Stokburger-Sauer, 2012), the model proposes that PCS moderates the relationship between flow experience and customer engagement, such that the strength of this relationship depends on the level of perceived support available to customers.

Taken together, the proposed conceptual model reflects a process-oriented view of augmented reality-enabled customer experience. It suggests that perceptions of augmented reality features first influence customers' internal experiential states (flow), which then drive engagement and subsequent evaluative outcomes (satisfaction and trust), with PCS shaping the process. This integrated model responds to calls for more holistic and theoretically grounded models of customer experience in technology-mediated retail settings (De Keyser et al., 2020; Lemon & Verhoef, 2016).

The following subsections (Sections 2.4.1–2.4.7) develop the specific hypotheses associated with each relationship in the conceptual model. Each hypothesis is grounded in prior literature and aligned with the theoretical arguments outlined below.



Control variables: Age, Gender, Education, Occupational Experience, Frequency of online shopping and Previous AR platform experience

Figure 1: Conceptual Model

2.4.1. Relationship between perceived interactivity and flow experience

Interactivity is widely recognized as a central characteristic of digital and immersive technologies and a key antecedent of flow experiences (Hoffman & Novak, 2009; Van Noort et al., 2012). Perceived interactivity refers to the extent to which customers perceive that they can actively control, manipulate, and influence the content and form of mediated environments in real time (Steuer, 1992). In online shopping contexts, interactivity enables consumers to move beyond passive information consumption and become active participants in the shopping experience.

Importantly, interactivity can be conceptualized from both a technological and a perceptual perspective. While system-level interactivity reflects the objective features embedded in a platform, perceived interactivity reflects the customer's subjective sense of control, responsiveness, and two-way communication during interaction (Yim et al., 2017; Petit et al., 2019). Prior research suggests that perceived interactivity is particularly relevant for understanding experiential outcomes, as customers respond not to the technology itself but to how interactive it feels during use.

In augmented reality-enabled shopping environments, perceived interactivity plays a particularly salient role because customers can directly manipulate virtual objects within their physical surroundings. For example, customers can rotate, resize, reposition, and examine products from multiple angles, creating a sense of agency and involvement that is largely absent in traditional e-commerce interfaces (Barhorst et al., 2021; Javornik, 2016). This heightened sense of control aligns closely with the conditions required for flow, particularly the perception of control and immediate feedback (Csikszentmihalyi, 1997).

Empirical studies consistently demonstrate a positive relationship between interactivity and flow across digital contexts. Huang and Liu (2014) found that interactive media environments increase customers' likelihood of entering a flow state, while Van Noort et al. (2012) showed that higher levels of website interactivity significantly enhance flow experiences. Similarly, Animesh et al. (2011) argue that interactive features encourage deeper cognitive involvement, which facilitates absorption and sustained attention.

Given that augmented reality interactivity extends beyond screen-based interaction to include spatial and contextual engagement with the real world, its potential to induce flow is particularly strong. By allowing consumers to actively explore products in personalized contexts, augmented reality interactivity creates immersive conditions that support deep involvement and intrinsic enjoyment. Accordingly, the following hypothesis is proposed:

H1: Perceived Interactivity of augmented reality positively influences flow experience.

2.4.2. Relationship between perceived novelty and flow experience

Novelty is another critical experiential characteristic of augmented reality that distinguishes it from conventional online shopping technologies. Perceived novelty refers to the extent to which an experience is considered new, unique, unexpected, or different from prior experiences (McLean & Wilson, 2019). In augmented reality contexts, novelty does not simply reflect the newness of the technology itself but rather the uniqueness and personalization of the stimuli encountered during each interaction (Barhorst et al., 2021).

Augmented reality enables dynamic and context-specific content that varies depending on the customer's environment, preferences, and actions. As a result, each augmented reality interaction can produce a distinct experience, even when the same application is used repeatedly. For example, branded augmented reality storytelling technologies, such as interactive product packaging or animated brand narratives, introduce elements of surprise and discovery that enhance perceived novelty.

From a cognitive perspective, novelty plays a crucial role in capturing attention and stimulating deeper information processing. According to cue utilization theory (Easterbrook, 1959), novel stimuli narrow attentional focus and increase cognitive engagement. When consumers encounter unexpected or unique information, they are more likely to allocate mental resources to processing the experience, thereby increasing immersion. In contrast, familiar and repetitive stimuli tend to generate lower levels of engagement and are less likely to sustain attention over time (Yim et al., 2017).

The relationship between novelty and flow has been supported in prior research on digital and experiential environments. Hoffman and Novak (2009) argue that novel experiences enhance intrinsic motivation, which is a core component of flow. Similarly, Kover and James (1993) suggest that novelty-driven curiosity encourages exploratory behavior, which aligns with the experiential nature of flow. In augmented reality-enabled shopping, novelty can transform task-oriented shopping into an exploratory and enjoyable activity, thereby increasing the likelihood of flow.

By offering unique, personalized, and continually changing experiences, augmented reality novelty stimulates curiosity and intrinsic interest, creating conditions conducive to deep absorption. Therefore, it is hypothesized that:

H2: Perceived novelty of augmented reality positively influences flow experience.

2.4.3. Relationship between perceived vividness and flow experience

Perceived vividness refers to the extent to which a mediated environment provides rich, detailed, and realistic sensory information to users (Steuer, 1992). Vivid experiences engage multiple senses and enhance the clarity and realism of mental representations, making mediated

interactions feel more lifelike and immersive. In digital retail environments, vividness is a critical determinant of experiential quality because it influences how effectively consumers can imagine products and usage scenarios.

Augmented reality is particularly well-suited to delivering vivid experiences because it overlays high-quality digital content onto the physical world. Through three-dimensional models, realistic textures, accurate lighting, and spatial alignment, AR allows consumers to see products as if they were physically present in their environment (McLean & Wilson, 2019). This sensory richness reduces ambiguity and supports more vivid mental imagery, which is essential for effective product evaluation in online shopping contexts.

Prior research demonstrates that vivid content enhances cognitive engagement and information processing. Jiang and Benbasat (2007) show that vivid product presentations increase perceived diagnosticity and user involvement, while Phillips et al. (1995) argue that vivid imagery facilitates mental simulation of future experiences. In experiential consumption settings, vividness has also been linked to increased enjoyment and immersion, both of which are core components of flow (Hilken et al., 2017; Hilken et al., 2018).

Within flow theory, vividness contributes to the absorption and focused attention required for flow by reducing cognitive effort and enhancing perceptual engagement. When consumers do not need to imagine how a product might look or function, they can devote more cognitive resources to exploring and enjoying the experience itself. In augmented reality-enabled shopping, vivid visual representations help sustain attention and deepen involvement, thereby increasing the likelihood of flow. Accordingly, the following hypothesis is proposed:

H3: The perceived vividness of augmented reality positively influences flow experience.

2.4.4. Relationship between flow experience and customer engagement

Flow experience represents a state of optimal psychological involvement characterized by deep concentration, intrinsic enjoyment, and loss of self-consciousness (Csikszentmihalyi, 1997). In online shopping contexts, flow has been widely recognized as a key driver of customer engagement, as it reflects a high-quality experiential state that motivates continued interaction (Hoffman & Novak, 2009; Koufaris, 2002).

Customer engagement refers to a customer's cognitive, emotional, and behavioral investment in interactions with a brand or platform (Brodie et al., 2011). When customers experience flow, they become deeply absorbed in the activity, often losing track of time and focusing entirely on the interaction. This heightened involvement aligns closely with the core dimensions of engagement, including attention, enthusiasm, and immersion.

Empirical evidence supports a strong link between flow and engagement in digital environments. Rodríguez-Ardura and Meseguer-Artola (2019) show that flow experiences increase sustained engagement and platform involvement, while Kang et al. (2020) demonstrate that flow enhances customers' motivation to continue interacting with digital content. In augmented reality contexts, Barhorst et al. (2021) find that immersive augmented reality experiences facilitate flow, which subsequently enhances consumer engagement.

Because augmented reality technologies are uniquely capable of creating immersive and enjoyable experiences, flow is expected to play a central role in translating perceptions of augmented reality features into engagement outcomes. When consumers experience flow during augmented reality-enabled shopping, they are more likely to remain engaged, explore additional content, and develop stronger psychological connections with the platform. Thus, the following hypothesis is proposed:

H4: Flow experience in augmented reality positively influences customer engagement.

2.4.5. Relationship between customer engagement and customer satisfaction

Customer satisfaction reflects customers' overall evaluative judgments of their experiences with a product, service, or platform. In experiential consumption settings, satisfaction is influenced not only by functional performance but also by the quality of engagement and enjoyment during interaction (Lemon & Verhoef, 2016). Flow experiences, which involve a deep sense of engagement and enjoyment, are considered crucial for enhancing the overall customer experience. However, the role of augmented reality in strengthening these flow experiences and their impact on satisfaction is still not fully understood.

Engaged customers are more likely to derive enjoyment, perceive higher value, and develop positive evaluations of their experiences. Prior research in experiential marketing suggests that engagement-driven experiences enhance satisfaction by creating emotional resonance and meaningful interactions (Poulsson & Kale, 2004; Tynan & McKechnie, 2009). In augmented reality-enabled shopping, engagement is fostered through immersive, interactive, and enjoyable experiences that go beyond transactional efficiency.

Empirical studies indicate that augmented reality enhanced engagement positively influences satisfaction by increasing enjoyment and perceived usefulness (Barhorst et al., 2021; McLean & Wilson, 2019). When customers feel cognitively and emotionally invested in the shopping experience, they are more likely to evaluate it favorably.

Despite these insights, it remains empirically unclear in the current literature whether engagement has a stronger effect on customer satisfaction when augmented reality is involved in online shopping experiences. However, given the immersive qualities of augmented reality and its ability to foster engagement through interactive, novel and vivid features, it is reasonable to assume that

augmented reality enabled engagement may lead to higher satisfaction. Accordingly, the following hypothesis is proposed:

H5: Customer engagement in an augmented reality environment positively affects satisfaction.

2.4.6. Relationship between customer engagement and customer trust

Trust is a critical determinant of success in online and technology-mediated retail environments. It reflects consumers' confidence in the reliability, credibility, and integrity of both the technology and the retailer (Gefen et al., 2003). In augmented reality-enabled shopping, trust is particularly important because consumers rely on virtual representations to inform real-world purchase decisions.

Customer engagement plays an important role in building trust by fostering repeated interactions, emotional bonds, and psychological ownership (Bowden, 2009; Jaakkola & Alexander, 2014). Engaged customers are more likely to perceive the platform as reliable and supportive, thereby strengthening trust.

Prior studies suggest that immersive and engaging augmented reality experiences enhance trust by increasing transparency and perceived authenticity (McLean & Wilson, 2019; Yuan et al., 2021). When consumers actively interact with augmented reality features and feel confident in their evaluations, they are more likely to trust both the technology and the retailer. Therefore, the hypothesis is proposed:

H6: Customer engagement in an augmented reality environment positively affects trust.

2.4.7. The moderating role of perceived customer support

Perceived customer support refers to customers' beliefs that a platform or retailer is attentive, responsive, and willing to assist them when needed (Hsu et al., 2021). In technology-mediated environments, customer support plays a crucial role in shaping experiential outcomes by reducing uncertainty and enhancing confidence during interaction.

From a theoretical perspective, perceived customer support can strengthen the relationship between flow experience and engagement by providing reassurance and facilitating seamless interaction. When customers feel supported, they are more likely to translate immersive flow experiences into sustained engagement, rather than experiencing frustration or uncertainty.

Prior research suggests that supportive service environments enhance customer participation and engagement (Bettencourt, 1997; Grisseemann & Stokburger-Sauer, 2012). In augmented reality-enabled shopping, perceived customer support may attenuate or enhance the influence of flow experience on customer engagement with augmented reality. Therefore, along with previous theoretical arguments, it is hypothesized that:

H7: Perceived customer support positively influences the relationship between flow experience and customer engagement in an augmented reality environment.

Chapter 3: Research Methodology

This chapter outlines the research methodology adopted to empirically test the conceptual model and hypotheses developed in Chapter Two. The purpose of this chapter is to explain and justify the methodological choices made in the study and to demonstrate how the research objectives were systematically addressed.

Specifically, this chapter describes the overall research design, the research process, measurement development, survey administration, and data analysis techniques. Given the study's aim to examine the relationships among perceptions of augmented reality features, flow experience, customer engagement, satisfaction, and trust, a quantitative research approach was deemed most appropriate (Bryman, 2016). This approach allows for statistical testing of hypothesized relationships and provides objective and generalizable insights into customer experience in augmented reality-enabled online shopping contexts.

Data were collected through a structured online questionnaire administered to consumers with prior experience using augmented reality in online shopping. The collected data were analyzed using Partial Least Squares Structural Equation Modeling, which is well-suited for theory testing and prediction in complex models involving multiple latent constructs and mediating relationships. The methodological procedures employed in this study follow established guidelines in marketing and information systems research to ensure rigor, reliability, and validity.

The chapter is structured as follows. Section 3.1 describes the overall research process. Section 3.2 explains the development and measurement of constructs. Section 3.3 details the survey administration and data collection procedures. Section 3.4 outlines the data analysis techniques and the criteria used to evaluate the measurement and structural models.

3.1 Research process

The research process adopted a systematic, theory driven research process comprising several sequential stages, as illustrated in Figure 2. All research procedures were conducted in accordance with institutional ethical guidelines, and data were collected using an online survey administered via the Qualtrics platform following formal ethics approval (available in Appendices A, B and C).

The first stage involved an extensive review of the existing literature on augmented reality in online shopping, customer experience, flow theory, and customer engagement. This review helped identify key research gaps and informed the selection of flow theory as the primary theoretical lens. Based on this theoretical grounding and prior empirical findings, a conceptual model was

developed that explains how customers' perceptions of augmented reality features (interactivity, vividness, and novelty) influence flow experience, customer engagement, satisfaction, and trust, while accounting for the moderating role of perceived customer support. Additionally, in this stage, research hypotheses were formulated to specify the expected relationships among the constructs in the conceptual model. These hypotheses were derived from established theories and empirical evidence in marketing, information systems, and consumer behavior literature.

The second stage involved the development of the survey instrument. Measurement items were adapted from validated scales used in prior studies to ensure content validity and reliability. All items were contextualized to reflect augmented reality-enabled online shopping experiences. The questionnaire was reviewed for clarity, wording, and relevance, and a pilot test was conducted with a small group of participants to identify potential ambiguities and refine the instrument before full-scale data collection.

The third stage consisted of data collection. An online survey was administered using Qualtrics and distributed through the Prolific platform to recruit participants who met the screening criteria, namely being 18 years or older and having prior experience with augmented reality-enabled online shopping. This ensured that respondents were capable of providing informed and meaningful evaluations of the constructs under investigation. Furthermore, in this stage involved data screening and analysis. After removing incomplete and invalid responses, the final dataset was analyzed using Partial Least Squares Structural Equation Modeling. The analysis followed a two-step approach, beginning with the assessment of the measurement model to evaluate reliability and validity, followed by the assessment of the structural model to test the hypothesized relationships and the predictive power of the model.

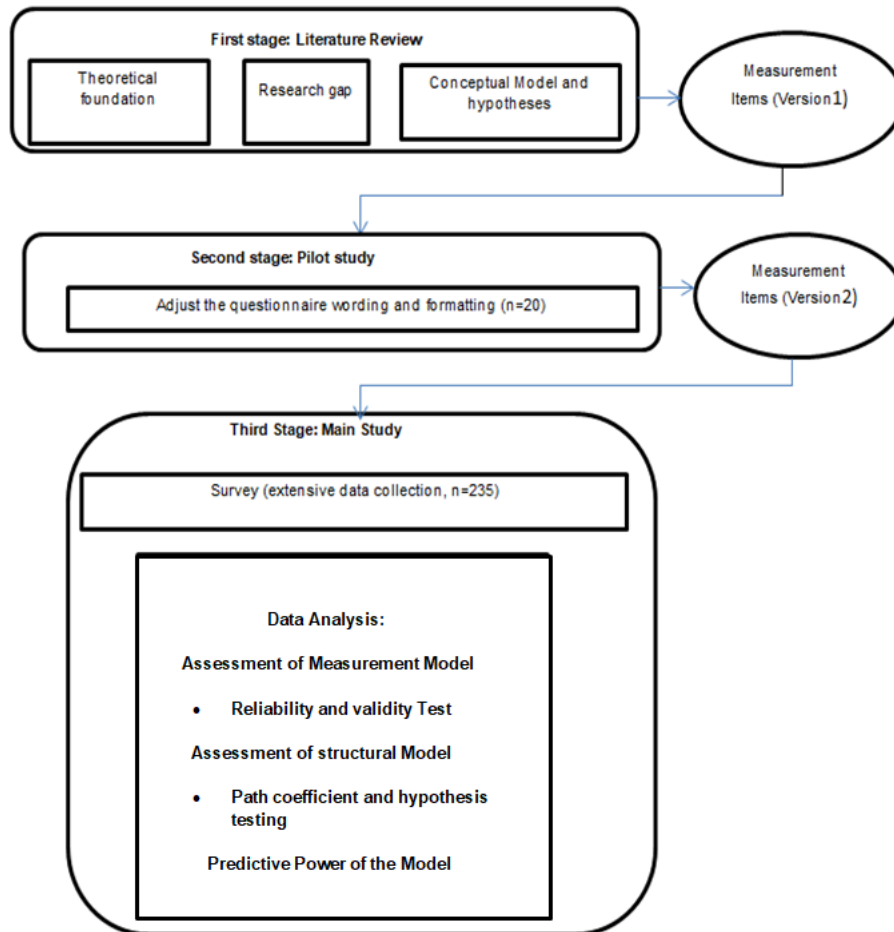


Figure 2: Research Process

3.2 Measures

To empirically test the proposed conceptual model, this study employed measurement scales adapted from established and validated instruments in prior literature. All constructs were operationalized using reflective measures and tailored to the context of augmented reality-enabled online shopping to ensure contextual relevance while maintaining content validity. All measurement items were assessed using a seven-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree, which is consistent with prior augmented reality and customer experience research and appropriate for capturing respondents' perceptual evaluations.

Perceived interactivity was measured using three items adapted from McLean and Wilson (2019), originally based on Yim et al. (2017). These items capture customers' perceived control, responsiveness, and ability to navigate augmented reality features during online shopping.

Perceived novelty was assessed with four items adapted from McLean and Wilson (2019), reflecting the extent to which augmented reality features are perceived as new, unique, and

different across usage occasions. These items emphasize the experiential uniqueness and personalization of augmented reality interactions rather than mere technological newness.

Perceived vividness was measured using six items adapted from McLean and Wilson (2019), modified from Yim et al. (2017). These items evaluate the clarity, detail, sharpness, and overall visual richness of the augmented reality display, capturing the sensory realism of augmented reality-enabled product presentations. Flow experience was operationalized using three items adapted from Arghashi and Yuksel (2022). These items assess the extent to which respondents' experience deep immersion, enjoyment, and absorption while using augmented reality enabled online shopping platforms. Likewise, customer engagement was measured using twenty items adapted from Cheung et al. (2011). These items capture the cognitive, emotional, and behavioral dimensions of engagement, including attention, immersion, enthusiasm, focus, and excitement during interaction with augmented reality-enabled online shopping platforms.

Customer satisfaction was measured using three items adapted from Barhorst et al. (2021). These items assess respondents' overall evaluative judgments regarding their augmented reality-enabled online shopping experience. Also, customer trust was measured using three items adapted from Arghashi and Yuksel (2022). These items reflect respondents' perceptions of the reliability and dependability of augmented reality-enabled online shopping platforms. Finally, perceived customer support was measured using five items adapted from Hsu et al. (2021). These items capture respondents' beliefs regarding the availability, responsiveness, and helpfulness of support provided by augmented reality-enabled online shopping platforms, including guidance and assistance during usage.

A summary of construct definitions, measurement items, and sources is presented in Table 1. All scales demonstrated acceptable reliability and validity, which were further assessed and reported in Chapter 4.

Table1: Construct definition and operationalization

Construct	Construct Definition	Item code and wording	Source
Perceived Interactivity	A psychological state experienced by a user during their interaction with augmented reality technology.	ARPI1: I was in control of my navigation through the augmented reality technology. ARPI2: I had some control of the augmented reality technology that I wanted to see. ARPI3: The augmented reality technology had the ability to respond to my specific needs quickly and efficiently.	McLean et al., 2019 modified from Yim et al., 2017
Perceived Novelty	The unique, personalized, and often unexpected stimuli that users encounter each time they engage with augmented reality technology.	ARPN1: Using the augmented reality feature offers something new each time. ARPN2: Using the augmented reality feature offers unique information. ARPN3: Using the augmented reality feature is something different each time. ARPN4: Using the augmented reality feature offers specific content.	McLean et al., 2019 modified from Yim et al., 2017
Perceived Vividness	Vividness is the aesthetic appeal of augmented reality experiences.	ARPV1: The visual display through the AR technology was clear. ARPV2: The visual display through the AR technology was detailed. ARPV3: The visual display through the AR technology was vague.* APRV4: The visual display through the AR technology was vivid. ARPV5: The visual display through the AR technology was sharp. ARPV6: The visual display through the AR technology was well-defined.	McLean et al., 2019 modified from Yim et al., 2017
Flow Experience	A state of mind experienced by people who are deeply involved in an activity. When an individual is in a flow state, time may seem to stand still and nothing else seems to matter. Typically, flow is described as a pleasurable experience.	FE1: I have experienced “flow” on this online shopping platform. FE2: Most of the time I use this online shopping platform; I feel that I am in “flow”. FE3: While using this AR-enabled online shopping platform, I undergo a “flow”.	Adapted from Arghashi et al., 2022
Customer Engagement	Heightened attention and a sense of immersion that AR technology facilitates.	CENG1: I can continue using AR enabled online shopping platform for a long period at a time.* CENG2: I feel strong and vigorous when I am using AR enabled online shopping platform. CENG3: I feel very resilient, mentally, as far as AR enabled online shopping platform is concerned.* CENG4: In AR enabled online shopping platform, I always preserve when things do	Adapted from Cheung et al., 2011

		<p>not go well.*</p> <p>CENG5: I devote a lot of energy to AR enabled online shopping platform.*</p> <p>CENG6: I try my hardest to perform well on AR enabled online shopping platform.</p> <p>CENG7: Time flies when I am using AR enabled online shopping platform.</p> <p>CENG8: Using AR enabled online shopping platform is so absorbing that I forgot about everything else.*</p> <p>CENG9: I am rarely distracted when using AR enabled online shopping platform.*</p> <p>CENG10: I am immersed in AR enabled online shopping platform.</p> <p>CENG11: I am immersed in AR enabled online shopping platform.</p> <p>CENG12: My mind is focused when using AR enabled online shopping platform.</p> <p>CENG13: I pay a lot of attention to this AR enabled online shopping platform.</p> <p>CENG14: I am enthusiastic in this AR enabled online shopping platform.</p> <p>CENG15: This AR enabled online shopping platform inspires me.</p> <p>CENG16: I found AR enabled online shopping platform full of meaning and purpose.</p> <p>CENG17: I am excited when using AR enabled online shopping platform.</p> <p>CENG18: I am excited when using AR enabled online shopping platform.</p> <p>CENG19: I am interested in AR enabled online shopping platform.</p> <p>CENG20: I am proud of using AR enabled online shopping platform.</p>	
Customer Satisfaction	The customer's contentment with online shopping experience shaped by using augmented reality technology.	<p>CEXPS1: I am satisfied with the online shopping with AR experience.</p> <p>CEXPS2: Online shopping with AR experience is exactly what I needed.</p> <p>CEXPS3: Online shopping with AR experience hasn't worked out as well as I thought it would.*</p>	Barhorst et al., 2021
Customer Trust	The degree that customers believe, online shopping with AR is dependable and provides reliable services for them.	<p>CEXPT1: The AR technology in online shopping platform meets my expectations*.</p> <p>CEXPT2: I can trust the AR technology enabled online shopping platform performance.</p> <p>CEXPT3: The AR technology is reliable for trying online shopping.</p>	Arghashi et al., 2022
Perceived Customer Support	Perceived Customer Support is customer's belief that a company is attentive, responsive and will assist to with their needs and	<p>CS1: The AR enabled online shopping platform considers my needs and wants.</p> <p>CS2: The AR enabled online shopping platform cares about my opinions.</p> <p>CS3: The AR enabled online shopping platform tries to provide the best service possible.</p>	Hsu et al., 2021

	requirements.	CS4: The AR enabled online shopping platform explains how to use it via step-by-step instructions. CS5: The AR enabled online shopping platform is willing to help me when I have a special request.	
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Note- asterisk (*) items are removed after the scale purification.

3.3 Survey administration

The survey was administered using Qualtrics, an online survey platform widely used in academic research for its reliability and flexibility in questionnaire design. An anonymous survey link was generated and integrated with the Prolific online research platform, which was used to recruit participants. Prolific was selected due to its ability to provide high-quality, diverse samples and its increasing acceptance in peer-reviewed research (Newman et al., 2021).

A non-probability convenience sampling approach was employed, as the study required respondents with specific prior experience (Wright, 2017). To ensure the relevance and validity of responses, screening questions were incorporated at the beginning of the questionnaire. Only participants who (1) were 18 years or older and (2) had prior experience using augmented reality technology in online shopping contexts were permitted to proceed with the survey. Respondents who did not meet these criteria were automatically excluded.

Participants who completed the survey were compensated in accordance with Prolific's ethical payment guidelines, receiving a monetary incentive ranging between USD 1.72 and USD 2.89, depending on completion time. This incentive level was designed to encourage thoughtful participation while minimizing response bias.

The questionnaire was structured into three main sections. The first section consisted of screening questions to confirm eligibility. The second section collected demographic information, including age, gender, education level, work experience, frequency of online shopping, and prior augmented reality platform usage. The third section comprised the formal measurement items for all constructs included in the research model, namely perceived interactivity, perceived novelty, perceived vividness, flow experience, customer engagement, customer satisfaction, customer trust, and perceived customer support.

All construct items were presented in a randomized order to reduce potential common method bias. Respondents were asked to reflect on their most recent augmented reality-enabled online shopping experience when answering the questions. In addition to the structured Likert-scale items, the survey included one open-ended descriptive question designed to capture spontaneous brand recall related to augmented reality-enabled online shopping.

Prior to the main data collection, the survey instrument was pilot tested with 20 participants who met the study's screening criteria. Feedback from the pilot test was used to refine the wording of 35 items, improve clarity, and ensure that the questionnaire length and flow were appropriate. No major structural changes were required following the pilot test, indicating that the instrument was suitable for full-scale administration.

Data collection was conducted from August 2025 to September 2025, after which responses were downloaded from Qualtrics for screening and analysis. Responses with substantial missing data, straight-lining behavior, or duplicate entries were removed prior to analysis to ensure data quality. The final dataset was then retained for subsequent statistical analysis using PLS-SEM, as described in the following section.

3.4 Data analysis

Firstly, descriptive statistics were used to summarize the data. Secondly, partial least squares structural equation modeling was applied to test the hypotheses and validate the proposed model (Hair Jr et al., 2021).

3.4.1 Data analysis method

Structural equation modeling is a comprehensive statistical approach that examines relationships between observed and latent variables (Hoyle, 1995). Partial Least Squares Structural Equation Modeling was specifically chosen for this study because it is well-suited to models with reflective indicators (Lowry & Gaskin, 2014) and is appropriate for exploratory and predictive research (Hair et al., 2017; Lowry & Gaskin, 2014; Sarstedt et al., 2024).

This analysis follows a two-step approach: (1) evaluation of the measurement model, and (2) evaluation of the structural model (Henseler & Chin, 2010).

3.4.2 Measurement model analysis

The standard used to evaluate the measurement model includes Cronbach's alpha, Composite Reliability (CR), Average Variance Extracted (AVE), Outer Loadings, and Discriminant Validity.

Scale Reliability. Cronbach's alpha and Composite Reliability (CR) are used to evaluate the reliability of the measurement scales. Cronbach's α values range from 0 to 1, with values of 0.7 or higher generally considered acceptable for internal consistency (Hair Jr et al., 2021). Similarly, CR evaluates the reliability of a set of observed variables that represent a latent construct. A CR value of 0.7 or above indicates good internal consistency and is deemed acceptable (Hair Jr et al., 2021).

Convergent Validity. Convergent validity is evaluated through the Average Variance Extracted (AVE) and Outer Loadings. AVE is calculated as the average of the squared standardized factor loadings and provides a summary indicator of convergence. According to Hair Jr et al. (2021), an

AVE value greater than 0.5 shows that the construct explains more than half of the variance in its observed variables, thus exhibiting satisfactory convergent validity. Values of Outer Loadings above 0.7 are generally recommended as they indicate strong relationships between observed variables and their respective latent variables. However, in exploratory research, loading values between 0.3 and 0.4 may be considered acceptable indicators of a significant contribution (Hair Jr et al., 2021).

Discriminant Validity. Discriminant validity refers to the degree to which a latent construct is truly distinct from other constructs in the model. According to Hair Jr et al. (2021), discriminant validity is established when the square root of the AVE for a construct is greater than its correlations with other constructs. Additionally, Henseler et al. (2015) propose the Heterotrait-Monotrait (HTMT) ratio as a more robust criterion. The HTMT value should be below 0.90 to confirm suitable discriminant validity.

Common Method Bias. Self-reported data may be susceptible to common method bias, which may lead to inflated or deflated correlations between variables (Podsakoff et al., 2003). To mitigate this concern, a thorough assessment of common method bias was conducted using a full collinearity test in Partial Least Squares (PLS). Specifically, the Variance Inflation Factor (VIF) values were examined to determine the presence of multicollinearity, which can be an indicator of common method bias. If all VIFs in the inner model are equal to or less than the conservative threshold of 3.3, it can be inferred that the model is unlikely to be contaminated by common method bias (Kock, 2015).

3.4.3 Structural model analysis

The structural model is evaluated with bootstrap estimation. The path coefficients were calculated, and the model's fit and explanatory power were assessed using R-squared and f-squared.

Bootstrap estimation. The bootstrap estimation test is a resampling method used to evaluate the stability and reliability of parameter estimates. It involves repeated sampling with replacement, commonly with 10,000 iterations, to estimate standard errors and confidence intervals. In the context of this study, estimates are considered statistically significant if the critical ratio (CR) exceeds an absolute value of 2 and the confidence level is greater than 95%.

Path coefficients. Path coefficients reflect the strength and direction of relationships between constructs in the PLS-SEM model. These values are used to assess the impact of independent variables on dependent variables. According to Chin et al. (1998), coefficients of 0.02, 0.15, and 0.35 indicate weak, moderate, and strong effects, respectively. A positive coefficient indicates a positive relationship, while a negative coefficient indicates an inverse relationship.

R-squared (R^2). The R-squared value measures the model's explanatory power, indicating how well the independent variables explain the variance in the dependent variables. The closer the R-

squared value is to 1, the greater the model's explanatory power; a value near 0 suggests little to no explanatory power. According to Henseler et al. (2015), R-squared values of 0.75, 0.50, and 0.25 are considered strong, moderate, and weak, respectively.

f-squared (f^2). The f-squared effect size assesses the contribution of each independent variable to the R-squared value of the dependent variable. According to Hair et al. (2019), an f-squared value below 0.02 indicates a negligible effect, a value between 0.02 and 0.15 indicates a small effect, a value between 0.15 and 0.35 indicates a medium effect, and a value above 0.35 indicates a large effect.

Predictive capabilities of the model. The Q-squared statistic provides an internal measure of consistency between the original values and the values predicted through cross-validation. In the linear model (LM) approach, all exogenous indicator variables are regressed on each endogenous indicator variable to generate predictions. It should be noted that LM prediction errors are available only for manifest variables and not for latent variables. The out-of-sample predictions produced by PLS-predict enable researchers to assess the predictive capabilities of their model. Consequently, PLS-predict should be incorporated into the evaluation of Partial Least Squares Structural Equation Modeling results (Hair et al., 2019; Hair Jr. et al., 2021). A Q-squared value closer to 1 indicates stronger predictive power, whereas a value closer to 0 indicates weaker predictive power. Values greater than zero suggest that the model possesses predictive relevance.

Chapter 4: Results

4.1 Descriptive statistics

Prior to hypothesis testing, descriptive statistics were examined to understand the characteristics of the sample and to ensure the suitability of the data for subsequent analysis. Following the guidelines proposed by Hair et al. (2021) for PLS-SEM, a total of 325 survey responses were initially collected. Each response was carefully screened for data quality. Responses were excluded if they contained substantial missing data, exhibited straight-lining behavior, or were identified as duplicate entries based on IP address checks. After this screening process, 235 valid responses were retained for the final analysis, higher than the minimum sample size of 200 recommended for PLS-SEM and are sufficient to support the complexity of the proposed model.

The demographic characteristics of the respondents are summarized in Table 2. The sample was predominantly composed of young adults, with 42.80% of respondents aged between 25 and 34 years, followed by 23.73% aged 18–24 years. In terms of gender, 58.05% of respondents identified as female and 41.95% as male. With respect to education, the sample was highly educated, with 49.58% holding a university or college degree and 41.53% possessing postgraduate qualifications. This indicates a sample with a strong capacity to engage with technology-enabled shopping platforms and provide informed evaluations.

Regarding work experience, a substantial proportion of respondents reported 1–3 years (27.12%) or 3–5 years (24.15%) of professional experience, suggesting that the sample largely represents early- to mid-career individuals. The frequency of online shopping among respondents was relatively high. Approximately 42.80% of participants reported shopping online on a weekly basis, while 24.58% shopped biweekly. This high level of online shopping engagement supports the relevance of the sample for examining customer experience in augmented reality-enabled online retail contexts. With respect to augmented reality platform usage, mobile technologies were the most commonly used channel (39.83%), followed by desktop or laptop websites (25.85%) and mobile app browsers (19.07%).

In addition to the closed-ended measurement items, the survey included one open-ended descriptive question that invited respondents to list brand names they associated with augmented reality-enabled online shopping based on their personal experiences. This item was deliberately designed as an exploratory, non-categorical question rather than a Likert-scale measure, with the aim of capturing spontaneous brand recall. As respondents were free to mention multiple brands, the resulting data were qualitative and non-mutually exclusive. Consequently, reporting percentages or proportional statistics was not methodologically appropriate. Instead, the responses

were analyzed descriptively, and word cloud visualization was employed to illustrate the relative prominence and frequency of brand mentions. This visualization provides an intuitive overview of commonly cited brands, including Nike, Amazon, Zara, Sephora, Gucci, Adidas, IKEA, and Apple, as illustrated in Figure 3. Fashion and apparel brands emerged as the most frequently used augmented reality platforms, followed by e-commerce marketplaces, beauty and personal care brands, home furnishing retailers, and technology companies. This variety suggests that respondents had broad exposure to augmented reality technologies across multiple retail sectors.

Overall, the sample is characterized by young, well-educated, and digitally active consumers with substantial experience in online shopping and exposure to augmented reality-enabled retail platforms. These characteristics should be considered when interpreting the findings.

Table 2: Demographics of respondents

Demographic Variables		%	Count
Age	18-24	23.73%	112
	25-34	42.80%	303
	35-44	17.37%	164
	45-54	8.47%	100
	55 and above	7.63%	108
Gender	Male	41.95%	58
	Female	58.05%	79
Education	High School	8.90%	28
	University and college	49.58%	155
	Postgraduate and above	41.53%	129
Work experience	Under 1 year	3.39%	20
	1-3 years	27.12%	161
	>3-5 years	24.15%	143
	>5-8 years	17.80%	105
	>8-15 years	13.98%	83
	more than 15 years	13.56%	80
Frequency of shopping online	Less than weekly	7.63%	40
	Weekly	42.80%	227
	Biweekly	24.58%	130
	Once a month	17.37%	92
	Once every three months or less	7.63%	40
AR platform used	Platform mobile app	39.83%	94
	Mobile app browser	19.07%	90
	Desktop/laptop website	25.85%	183
	Instore AR device	10.59%	100
	Social media platform	3.39%	40
	Others	1.27%	18

4.2.1 Reliability and Convergent Validity

Internal consistency reliability was assessed using Cronbach's alpha, composite reliability (rho_a), and composite reliability (rho_c). As shown in Table 3, all constructs exceeded the recommended threshold of 0.70, indicating satisfactory internal consistency. Specifically, Cronbach's alpha values ranged from 0.757 to 0.952, while composite reliability values (rho_c) ranged from 0.857 to 0.958. These results confirm that the measurement scales demonstrate strong reliability and are appropriate for further analysis.

Convergent validity was evaluated using average variance extracted (AVE) and outer loadings. As reported in Table 3, all constructs achieved AVE values above the recommended minimum of 0.50, indicating that each construct explains more than half of the variance of its indicators.

The individual item loadings are presented in Table 4. All retained items exhibited outer loadings above 0.70, demonstrating strong indicator reliability. No items were removed, as all indicators contributed meaningfully to their respective constructs and satisfied recommended thresholds. Collectively, these findings confirm adequate convergent validity for the measurement model.

Table 3: Construct reliability and validity

Construct	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
ARPI	0.757	0.796	0.857	0.668
ARNP	0.816	0.831	0.879	0.645
ARPV	0.885	0.894	0.921	0.744
CENG	0.952	0.955	0.958	0.657
CEXPS	0.853	0.864	0.931	0.871
CEXPT	0.865	0.866	0.937	0.881
FE	0.931	0.933	0.956	0.879
PCS	0.905	0.907	0.930	0.726

Table 4: Outer Loadings

Variables	ARPI	ARNP	ARPV	CENG	CEXPS	CEXPT	FE	PCS	PCS x FE
ARPI1	0.852								
ARPI2	0.742								
ARPI3	0.852								
ARNP1		0.864							
ARNP2		0.754							
ARNP3		0.829							
ARNP4		0.76							
ARPV1			0.843						
ARPV2			0.88						
ARPV4			0.822						
ARPV5			0.905						
CENG10				0.758					
CENG11				0.826					
CENG12				0.831					
CENG13				0.768					
CENG14				0.867					
CENG15				0.849					
CENG16				0.869					
CENG17				0.818					
CENG18				0.876					
CENG2				0.804					
CENG6				0.72					
CENG7				0.722					
CEXPS1					0.924				
CEXPS2					0.943				
CEXPT2						0.941			
CEXPT3						0.936			
CS1								0.861	
CS2								0.887	
CS3								0.855	
CS4								0.799	
CS5								0.855	
FE1							0.939		
FE2							0.941		
FE3							0.933		
PCS x FE									1

Table 5: Discriminant Validity

Variables	ARPI	ARNP	ARPV	CENG	CEXPS	CEXPT	FE	PCS
ARPI	0.817							
ARNP	0.561	0.803						
ARPV	0.726	0.581	0.863					
CENG	0.668	0.665	0.722	0.811				
CEXPS	0.695	0.606	0.767	0.802	0.933			
CEXPT	0.701	0.606	0.718	0.821	0.806	0.938		
FE	0.634	0.593	0.653	0.785	0.685	0.684	0.938	
PCS	0.624	0.596	0.669	0.845	0.721	0.802	0.691	0.852

Note: Diagonal elements are the square root of AVE of each construct.

Table 6: Heterotrait-monotrait (HTMT) matrix

Variables	ARPI	ARNP	ARPV	CENG	CEXPS	CEXPT	FE	PCS	PCS x FE
ARPI									
ARNP	0.700								
ARPV	0.868	0.678							
CENG	0.761	0.751	0.778						
CEXPS	0.843	0.726	0.880	0.883					
CEXPT	0.842	0.724	0.817	0.902	0.937				
FE	0.727	0.672	0.713	0.833	0.765	0.762			
PCS	0.723	0.690	0.743	0.906	0.819	0.908	0.751		
PCS x FE	0.357	0.366	0.352	0.610	0.479	0.570	0.589	0.551	

4.2.2 Common method bias

This study recognizes the potential for common method bias inherent in self-reported data, which may lead to inflated or deflated correlations between variables (Podsakoff et al., 2003). To mitigate this concern, a thorough assessment of common method bias was conducted using a full collinearity test in Partial Least Squares (PLS). Specifically, the Variance Inflation Factor (VIF) values were examined to determine the presence of multicollinearity, which can be an indicator of common method bias. According to Kock (2015), if all VIFs in the inner model are equal to or less than the conservative threshold of 3.3, it can be inferred that the model is unlikely to be contaminated by common method bias. As presented in Table 7, the VIF values for all constructs are indeed less than or equal to 3.3, thereby suggesting that common method bias is not a significant concern in this study.

Table 7: VIF Results

Variables	ARPI	ARNP	ARPV	CENG	CEXPS	CEXPT	FE	PCS	PCS x FE
ARPI							2.255		
ARNP							1.609		
ARPV							2.335		
CENG					1.000	1.000			
CEXPS									
CEXPT									
FE				2.153					
PCS				2.013					
PCS x FE				1.555					

Overall, the measurement model’s all constructs exhibit satisfactory reliability, convergent validity, and discriminant validity, and no evidence of common method bias was detected. These results confirm that the measurement model is robust and suitable for evaluating the proposed structural relationships. Accordingly, the analysis proceeded to the assessment of the structural model, which is presented in the following section.

4.3 Structural model assessment

Following the confirmation of the measurement model’s reliability and validity, the structural model was assessed to examine the hypothesized relationships among constructs. The structural model evaluation was conducted using bootstrapping with 10,000 resamples in SmartPLS 4.0 (Ringle et al., 2024), in line with established PLS-SEM guidelines (Hair et al., 2021).

The assessment focused on path coefficients, coefficients of determination (R^2), effect sizes (f^2), and predictive relevance (Q^2) to evaluate the explanatory and predictive power of the proposed model.

4.3.1 Coefficient of determination (R^2) and adjusted R^2

The coefficient of determination (R^2) indicates the proportion of variance in each independent variables explained by its predictor variables. The R^2 and adjusted R^2 values for the dependent variables are reported in Table 8.

The results show that the model explains a substantial proportion of variance in the key dependent variables. Specifically, the R^2 value for flow experience indicates that perceived interactivity, novelty, and vividness jointly explain a meaningful portion of variance in flow. Similarly, the R^2 value for customer engagement demonstrates that flow experience (and its interaction with

perceived customer support) provides strong explanatory power. The R^2 values for customer satisfaction and customer trust further indicate that customer engagement explains a moderate to substantial level of variance in these outcome variables.

According to the thresholds proposed by Henseler et al. (2015), the R^2 values observed in this study range from moderate to substantial, supporting the explanatory adequacy of the proposed structural model.

Table 8: R^2 and adjusted R^2

Dependent Variable	R^2	adjusted R^2
CENG	0.800	0.797
CEXPS	0.644	0.643
CEXPT	0.675	0.673
FE	0.525	0.519

4.3.2 Effect size (f^2)

While the coefficient of determination (R^2) indicates the overall explanatory power of the structural model, the effect size (f^2) assesses the individual contribution of each an independent variable to a dependent variable. The f^2 values for the hypothesized relationships are reported in Table 9. Following Hair et al. (2019), f^2 values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively. The f^2 statistic reflects the change in a dependent variable's R^2 value when a specific predictor is omitted from the model, thereby indicating the practical relevance of each predictor.

The results show that customer engagement (CENG) exerts a large effect on both customer satisfaction (CEXPS) ($f^2 = 1.81$) and customer trust (CEXPT) ($f^2 = 2.07$), highlighting its dominant role in driving key customer experience outcomes. In addition, flow experience (FE) demonstrates a medium to large effect on customer engagement, underscoring its central role in translating augmented reality feature perceptions into engagement outcomes. Perceived customer support (PCS) also exhibits a substantial effect on customer engagement. In contrast, perceived interactivity, perceived novelty, and perceived vividness display small to medium effects on flow experience, with f^2 values ranging from 0.04 to 0.09. Overall, these findings indicate that while augmented reality features contribute incrementally to flow experience, engagement-related constructs exert the strongest and most practically meaningful effects within the structural model.

Table 9: Effect size f^2

Variables	ARPI	ARNP	ARPV	CENG	CEXPS	CEXPT	FE	PCS	PCS x FE
ARPI							0.063		
ARNP							0.094		
ARPV							0.086		
CENG					1.807	2.068			
CEXPS									
CEXPT									
FE				0.270					
PCS				0.754					
PCS x FE				0.040					

4.3.3 Predictive Relevance (Q^2)

The predictive relevance of the model was assessed using the Stone–Geisser Q^2 value obtained through the PLS-predict procedure (Götz et al., 2009). The Q^2 values for the dependent variables are presented in Table 10.

All dependent variables exhibit Q^2 values greater than zero, indicating that the model has satisfactory predictive relevance. These findings suggest that the proposed model not only explains variance in the sample data but also demonstrates adequate out-of-sample predictive capability.

Consistent with Hair et al. (2019), the positive Q^2 values support the model’s suitability for predictive research in AR-enabled online shopping contexts.

Table 10: Q^2 predict

Dependent Variables	Q^2 predict
CENG	0.775
CEXPS	0.599
CEXPT	0.681
FE	0.495

4.3.4 Path coefficients and hypothesis testing

The hypothesized relationships were tested by examining the path coefficients, t-values, and p-values obtained through bootstrapping. The results of hypothesis testing are summarized in Table 11, while the structural model with standardized path coefficients is presented in Figure 4.

The results indicate that perceived interactivity has a positive and statistically significant effect on flow experience, supporting H1. Similarly, perceived novelty positively influences flow experience, providing support for H2, while perceived vividness also exhibits a positive and significant effect on flow experience, supporting H3.

Furthermore, flow experience has a positive and significant effect on customer engagement, supporting H4. In turn, customer engagement positively influences customer satisfaction and customer trust, providing support for H5 and H6, respectively.

In addition, perceived customer support (PCS) was found to be a statistically significant moderator of the relationship between flow experience (FE) and customer engagement (CENG). However, the negative path coefficient -0.063 indicates that perceived customer support weakens the positive relationship between flow experience and customer engagement. Consequently, H7, which hypothesized a positive moderating effect, was not supported.

Overall, all supported hypotheses exhibit statistically significant path coefficients with t-values exceeding the critical threshold of 1.96 at the 95% confidence level.

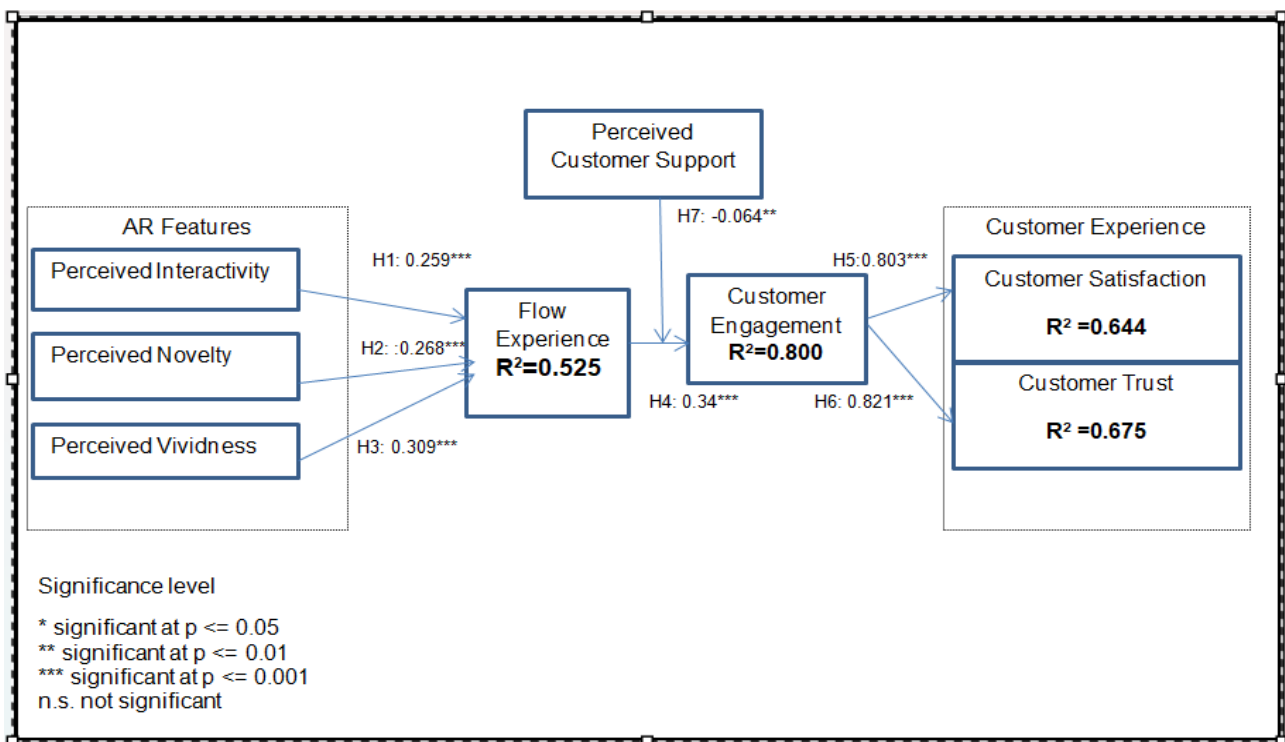


Figure 4: Path coefficients of the structural model

Table 11: Summary of Hypothesis Tests

Hypothesis	Mean	SD	T statistics	P values	Results	Support
H1: AR Perceived Interactivity -> Flow Experience	0.257	0.077	3.362	0.001	Significant	Yes
H2: AR Perceived Novelty -> Flow Experience	0.274	0.073	3.696	0.000	Significant	Yes
H3: AR Perceived Vividness -> Flow Experience	0.307	0.086	3.603	0.000	Significant	Yes
H4: Flow Experience -> Customer Engagement	0.340	0.052	6.565	0.000	Significant	Yes
H5: : Customer Engagement -> Customer Satisfaction	0.806	0.029	27.342	0.000	Significant	Yes
H6: Customer Engagement -> Customer Trust	0.821	0.027	30.065	0.000	Significant	Yes
H7: Perceived Customer Support -> Customer Engagement	-0.064	0.024	2.641	0.008	Significant	No

Notes: p-values ≤ 0.05 is significant; p-values > 0.05 not significant

Overall, the structural model demonstrates satisfactory explanatory and predictive power. The results highlight the central role of flow experience as a psychological mechanism linking augmented reality features to customer engagement, as well as the importance of customer engagement in driving customer satisfaction and customer trust. While perceived customer support significantly moderates the relationship between flow experience and customer engagement, the negative direction of this effect suggests that higher levels of support weaken, rather than strengthen, this relationship. These findings indicate that the effectiveness of immersive augmented reality experiences may depend on contextual and experiential factors, which are further discussed in Chapter Five.

Chapter 5: Discussion and Implications

5.1 Discussions of findings

This study examined how perceived augmented reality features influence the online customer experience through the lens of flow theory, with particular emphasis on customer engagement, satisfaction, and trust. By empirically testing the proposed conceptual model using PLS-SEM, the findings provide insights into the psychological mechanisms through which augmented reality-enabled shopping environments shape customer perceptions and behavioral outcomes. Overall, the results demonstrate that customers' perceptions of augmented reality features play a significant role in enhancing their experience, both directly and indirectly, through the mediating effects of flow experience and customer engagement.

The findings indicate that augmented reality technologies are not merely functional tools for product visualization but serve as experiential enablers that transform how customers interact with online retail platforms. Specifically, the results support the notion that the unique augmented reality features, including interactivity, vividness, and novelty, create immersive digital environments that foster heightened levels of cognitive and emotional involvement. This immersive quality aligns with the core assumptions of flow theory, which posits that optimal experiences occur when individuals are deeply engaged, intrinsically motivated, and fully absorbed in an activity (Csikszentmihalyi, 1975).

Consistent with prior research, the results reveal that augmented reality, which induced flow, plays a pivotal role in shaping key customer experience outcomes. Customers who experience higher levels of flow during augmented reality-enabled shopping interactions report stronger engagement with the platform, greater satisfaction with the shopping experience, and higher levels of trust in the retailer. These findings reinforce earlier studies suggesting that flow represents a critical psychological mechanism linking interactive technologies to positive consumer responses (Barhorst et al., 2021; Hoffman & Novak, 2009).

Furthermore, the results highlight the importance of customer engagement as a central outcome and mediator within augmented reality-enabled shopping contexts. Engagement emerges not only as a direct consequence of flow experience but also as a significant driver of satisfaction and trust. This suggests that while augmented reality features may attract consumers through novelty and interactivity, sustained experiential value is generated through deeper engagement processes. This finding provides empirical support for the argument that engagement serves as a bridge between immersive experiences and customer value (Bowden, 2009; Jaakkola & Alexander, 2014).

Another important insight from the findings is the role of trust within augmented reality-based online shopping environments. Trust is shown to be significantly influenced by experiential factors such as flow and engagement, rather than solely by technological functionality. This underscores the idea that customers' trust in augmented reality-enabled platforms is shaped by how confidently and comfortably they can interact with virtual representations of products. Such findings extend existing literature by positioning trust as an outcome of immersive experience rather than merely a prerequisite for technology adoption (Cheung & Lee, 2000; Gefen et al., 2003).

Specifically, the results show that perceived customer support negatively moderates the relationship between flow experience and customer engagement, such that higher levels of perceived support weaken the positive effect of flow on engagement. One possible interpretation of this finding is that in highly immersive augmented reality enabled shopping environments, excessive or salient support mechanisms may partially disrupt customers' sense of autonomy and absorption. Flow theory posits that optimal experiential states are characterized by uninterrupted concentration and intrinsic enjoyment. When customers perceive strong external support during such immersive experiences, their reliance on support cues may reduce the intensity with which flow translates into engagement. In contrast, when perceived support is lower, customers may rely more heavily on the immersive qualities of the augmented reality experience itself, allowing flow to exert a stronger influence on engagement outcomes.

In other words, this finding does not diminish the value of customer support in augmented reality enabled retail contexts. Rather, it highlights that support operates differently as a direct antecedent of engagement than as a moderating mechanism. Consistent with prior service research, perceived customer support remains a critical factor in encouraging customer participation and involvement (Grisseemann & Stokburger-Sauer, 2012; Hsu et al., 2021). However, its role appears to be complementary rather than synergistic with flow experience, emphasizing the need for retailers to balance immersive design with appropriately calibrated support features.

Collectively, the findings confirm that the relationship between augmented reality technology and customer experience is multifaceted and mediated by psychological processes (Arghashi & Yuksel, 2022; Rodríguez-Ardura & Meseguer-Artola, 2019; Van Noort et al., 2012). Rather than exerting a direct and uniform effect, perception of augmented reality features influences customer outcomes by shaping customers' experiential states, particularly flow and engagement. This helps explain the mixed findings reported in earlier studies, where augmented reality was found to have strong positive effects on engagement and satisfaction in some contexts, but weak, inconsistent, or non-significant effects in others, highlights the need for a more nuanced, theory-driven understanding of augmented reality-enabled customer experiences (Barhorst et al., 2021; McLean & Wilson, 2019; Nikhashemi et al., 2021).

Hence, the discussion of findings demonstrates that perception of augmented reality features enhances online customer experience by fostering immersive flow experiences that, in turn, strengthen engagement, satisfaction, and trust. Importantly, the findings also indicate that perceived customer support operates as a contextual boundary condition rather than a uniformly reinforcing factor. While support mechanisms provide reassurance and reduce uncertainty, their presence may partially weaken the strength of the relationship between flow experience and customer engagement. Together, these results provide strong empirical support for the application of flow theory within augmented reality-enabled retail contexts and offer a coherent explanation of how augmented reality technologies contribute to meaningful and sustainable customer experiences.

5.1.1 Discussion of augmented reality features and flow experience

This study examined the influence of specific augmented reality features, including interactivity, vividness, and novelty, on customers' flow experience within online shopping environments. The empirical findings indicate that these perceptions of augmented reality features play a significant role in inducing flow, thereby supporting the core assumptions of flow theory. The results confirm that when augmented reality technologies are designed to be interactive, visually rich, and novel, they are more likely to immerse customers in the shopping experience, fostering heightened levels of concentration, enjoyment, and intrinsic motivation (Csikszentmihalyi's, 2014).

Perceived interactivity emerged as an influential factor in shaping flow experience. The findings suggest that augmented reality technologies that allow consumers to actively manipulate products, control viewing angles, and explore product attributes in real time significantly enhance customers' sense of control and involvement. This aligns with flow theory, which posits that perceived control is a fundamental antecedent of flow (Csikszentmihalyi, 1975). When consumers feel that they can meaningfully interact with digital content rather than passively consume information, they are more likely to become deeply absorbed in the activity. This finding is consistent with prior studies demonstrating that interactivity enhances experiential involvement and leads to stronger immersive responses in digital environments (McLean & Wilson, 2019; Park & Yoo, 2020).

Perceived vividness also plays a crucial role in facilitating flow experience. The results indicate that augmented reality technologies with high levels of visual realism, sensory richness, and clarity enable consumers to form more accurate and vivid mental representations of products. Such perceptual richness reduces cognitive effort associated with imagining product usage or fit, allowing customers to focus more fully on the experience itself. From a flow perspective, vivid environments enhance attention focus and enjoyment, thereby increasing the likelihood of entering a flow state. This finding supports earlier research suggesting that vivid augmented reality experiences enhance immersion and experiential value by creating a stronger sense of presence within virtual environments (Hilken et al., 2018; Yim et al., 2017).

Perceived novelty was also found to significantly contribute to flow experience, highlighting the importance of innovation and perceived uniqueness in augmented reality-enabled shopping contexts. Novel augmented reality features stimulate curiosity and exploratory behavior, encouraging consumers to spend more time interacting with the application. This heightened curiosity and intrinsic interest are key components of flow, as they sustain customer engagement and motivation. However, the findings also suggest that novelty alone is insufficient to sustain flow over time. Instead, novelty must be supported by functional interactivity and vivid content to maintain prolonged immersion. This nuanced insight helps explain why some augmented reality applications experience high initial interest but fail to sustain long-term engagement, as reported in previous research (Clement, 2019).

Collectively, these findings demonstrate that flow experience in augmented reality-enabled shopping environments is not driven by a single feature but rather by the combined effect of perceived interactivity, vividness, and novelty. When these features are, effectively integrated, augmented reality technologies create optimal experiential conditions that facilitate deep cognitive and emotional immersion. This supports prior literature arguing that augmented reality's experiential value lies in its ability to blend functional utility with hedonic engagement (Barhorst et al., 2021; Arghashi & Yuksel, 2022; Hsu et al., 2021).

Importantly, the results extend existing research by empirically validating flow as a central mechanism through which perception of augmented reality features influence customer experience. While earlier studies have acknowledged the immersive potential of augmented reality, this study provides clearer evidence of how specific augmented reality attributes contribute to flow formation. By doing so, it addresses calls in the literature for more theory-driven explanations of augmented reality effects and strengthens the application of flow theory within digital retail contexts.

Therefore, the findings confirm that perception of augmented reality features significantly enhance customers' flow experiences by increasing perceived control, sensory immersion, and intrinsic motivation. These results highlight the importance of designing augmented reality technologies that go beyond technological novelty and instead focus on creating immersive, interactive, and vivid experiences that sustain customer engagement throughout the shopping journey.

5.1.2 Discussion of flow, customer engagement, satisfaction, and trust

This section discusses the relationships between flow experience, customer engagement, satisfaction, and trust within augmented reality-enabled online shopping environments. The findings reveal that flow experience plays a central role in shaping customers' attitudinal and behavioral responses, acting as a critical psychological mechanism that links augmented reality features to broader customer experience outcomes. In line with flow theory, customers who

experience deep immersion and enjoyment during augmented reality interactions exhibit higher levels of engagement, satisfaction, and trust toward the online retailer.

The results demonstrate that flow experience significantly enhances customer engagement. When consumers enter a flow state, they become fully absorbed in the shopping activity, leading to sustained attention, increased interaction, and a stronger psychological connection with the platform. This finding supports prior research suggesting that flow fosters active participation and deeper involvement in digital environments (Barhorst et al., 2021; Hoffman & Novak, 2009). In augmented reality-enabled contexts, flow transforms the shopping process from a transactional task into an experiential activity, encouraging consumers to explore products more extensively and interact with the platform in meaningful ways.

Customer engagement, in turn, was found to significantly influence both satisfaction and trust. Highly engaged customers are more likely to perceive the shopping experience as enjoyable, valuable, and fulfilling, which enhances overall satisfaction. This aligns with existing literature that positions engagement as a key determinant of positive customer evaluations and long-term relational outcomes (Bowden, 2009; Jaakkola & Alexander, 2014). In augmented reality-based shopping environments, engagement reflects not only behavioral interaction but also emotional and cognitive investment, thereby amplifying customers' positive responses to the experience.

The findings further indicate that flow experience has a direct positive effect on customer satisfaction. When consumers experience enjoyment, concentration, and intrinsic motivation during augmented reality interactions, they are more likely to evaluate the overall shopping experience favorably. This suggests that satisfaction in augmented reality-enabled contexts extends beyond functional outcomes, such as product information or convenience, and is strongly influenced by experiential quality. These results are consistent with prior studies highlighting the role of hedonic and experiential factors in shaping customer satisfaction within immersive digital environments (Chung et al., 2015; Poushneh & Vasquez-Parraga, 2017).

Trust also emerged as a significant outcome of flow experience and customer engagement. The findings suggest that immersive and engaging augmented reality experiences foster a sense of confidence and psychological comfort, which strengthens customers' trust in the retailer and the underlying technology. When consumers feel in control and fully immersed during augmented reality interactions, they are more likely to perceive the platform as reliable and credible. This extends existing trust literature by demonstrating that trust in augmented reality-enabled shopping environments is not solely driven by system reliability or information quality but is also shaped by experiential and emotional factors (Sheikh et al., 2019; Shen et al., 2020; Chung et al., 2000).

Moreover, the mediating roles of flow experience and customer engagement provide important insights into the indirect pathways through which perception of augmented reality features influence satisfaction and trust. The findings indicate that perception of augmented reality features

enhance customer outcomes primarily by creating immersive experiences that foster flow, which subsequently leads to higher engagement and evaluations that are more positive. This mediated relationship helps explain why previous studies have inconsistent evidence regarding whether augmented reality features exert direct effects on satisfaction and trust. Without considering psychological mechanisms such as flow and engagement, the impact of augmented reality features may appear inconsistent or context-dependent.

Overall, the findings underscore the interconnected nature of flow, engagement, satisfaction, and trust in augmented reality-enabled online shopping environments. Flow experience serves as the foundational experiential state that initiates deeper engagement, which in turn reinforces satisfaction and trust. This integrated perspective contributes to a more comprehensive understanding of how augmented reality technologies influence customer experience and highlights the importance of designing augmented reality technologies that support immersive and engaging customer experiences rather than focusing solely on technological functionality.

Thus, the findings suggest that flow experience and customer engagement are central mechanisms through which perception of augmented reality features shape customer satisfaction and trust. By fostering immersive and enjoyable experiences, augmented reality-enabled shopping platforms can strengthen customers' emotional and cognitive connections with the retailer, ultimately enhancing overall customer experience outcomes.

5.1.3 Role of perceived customer support

Perceived customer support functions as an important contextual factor that shapes how customers interpret and evaluate their augmented reality experiences. When consumers perceive that assistance is readily available, such as guidance during augmented reality usage, responsive customer service, or reassurance in case of technical difficulties, they are more likely to feel confident and comfortable engaging with augmented reality technologies (Hsu et al., 2021). This sense of support reduces uncertainty and perceived risk, is associated with higher levels of customer engagement and fostering evaluations that are more positive in the shopping experience. Conversely, when perceived customer support is low, customers may experience greater uncertainty or hesitation during augmented reality interactions, which can negatively affect their engagement and overall evaluations. The significant but negative moderating effect of perceived customer support provides insight into previously reported mixed findings in augmented reality research (Grissemann & Stokburger-Sauer, 2012; Hsu et al., 2021). Differences in the availability, visibility, or intrusiveness of customer support mechanisms may help explain why some augmented reality technologies succeed in enhancing satisfaction and trust, while others fail to sustain positive customer experiences.

Overall, the findings confirm that perceived customer support plays a crucial direct role in enhancing customer engagement and contributes to satisfaction and trust, while simultaneously

weakening the extent to which flow experience translates into engagement. By carefully integrating adaptive and context-sensitive support structures with immersive augmented reality features, retailers can maximize the experiential and relational value of augmented reality-enabled shopping environments without disrupting customers' flow experiences.

5.2 Implications

The findings of this study offer important implications for both theory and practice by providing a deeper understanding of how perception of augmented reality features influence customer experience through psychological and contextual mechanisms. By empirically validating the roles of flow experience, customer engagement, and perceived customer support, this research contributes to a more comprehensive explanation of how augmented reality-enabled shopping environments shape satisfaction and trust. Drawing on the study's empirical findings, this section outlines implications that directly address the gaps identified in prior literature.

Overall, the results demonstrate that the effectiveness of augmented reality in online retail extends beyond technological novelty or functional utility. Instead, customer experience outcomes are shaped by a combination of immersive experiential states (flow), relational processes (engagement and trust), and contextual support mechanisms (perceived customer support). This integrated perspective underscores the importance of adopting a holistic approach when examining and implementing augmented reality technologies in online shopping contexts.

The findings suggest that perception of augmented reality features influence customer experience through both direct and indirect pathways, reinforcing the argument that psychological processes play a central role in technology-enabled consumption experiences. Specifically, flow experience and customer engagement act as key mediators that translate perception of augmented reality features into meaningful customer outcomes, while perceived customer support serves as a critical boundary condition that shapes these relationships. These insights offer a nuanced understanding of why some augmented reality implementations succeed in enhancing customer experience, while others fail to deliver sustained value.

The implications of these findings are discussed in two broad categories: theoretical implications and practical implications. The theoretical implications highlight how this study advances existing knowledge and extends established theories within the context of augmented reality-enabled retail. The managerial implications focus on how retailers and practitioners can apply these insights to design more effective augmented reality-based shopping experiences that foster higher levels of engagement, satisfaction, and trust.

5.2.1 Theoretical implications

This study makes several important theoretical contributions to the literature on augmented reality, customer experience, and technology-enabled consumer behavior. By integrating flow theory with augmented reality-enabled online retail contexts, the research advances existing theoretical frameworks and responds directly to calls for more theory-driven investigations of augmented reality technologies.

First, this study extends flow theory by empirically validating its applicability within augmented reality-enabled online shopping environments. Although flow theory has been widely applied in areas such as online browsing, gaming, and digital media consumption (Hoffman & Novak, 1996; 2009), its application to augmented reality-based retail contexts has received comparatively limited empirical attention. The findings demonstrate that perception of augmented reality features such as interactivity, vividness, and novelty create optimal experiential conditions that facilitate flow, characterized by deep immersion, enjoyment, and focused attention. This extends flow theory beyond traditional digital platforms by illustrating how immersive technologies facilitate flow through sensory-rich and interactive design elements.

Second, the study contributes to the augmented reality literature by offering a mechanism-based explanation for how perception of augmented reality features influences customer experience outcomes. Rather than treating augmented reality as a monolithic technology, this research decomposes augmented reality into specific features and empirically examines their effects through psychological processes such as flow and engagement. In doing so, the study addresses longstanding inconsistencies in prior findings regarding the effectiveness of augmented reality in enhancing customer experience. The results suggest that the impact of augmented reality features is largely indirect and contingent upon the extent to which these features successfully induce flow and foster engagement. This nuanced perspective advances theoretical understanding by moving beyond simplistic direct-effect models.

Third, the study contributes to customer engagement theory by empirically positioning engagement as both an outcome of flow experience and a mediator between immersive experiences and relational outcomes such as satisfaction and trust. While prior research has acknowledged engagement as a central construct in customer–brand relationships (Bowden, 2009; Jaakkola & Alexander, 2014), limited attention has been given to its role within immersive technology contexts. The findings demonstrate that engagement in augmented reality-enabled shopping environments is not solely behavioural but also cognitive and emotional, reinforcing the multidimensional nature of engagement and extending its theoretical relevance to emerging digital technologies.

Fourth, this research advances understanding of trust formation in augmented reality-enabled environments. Existing trust literature in e-commerce has primarily focused on factors such as website quality, information credibility, and perceived risk (Cheung & Lee, 2000; Gefen et al.,

2003). The present study extends this body of work by demonstrating that trust can emerge as an experiential outcome shaped by flow and engagement, rather than solely as a prerequisite for technology adoption. This theoretical extension highlights the role of immersive experiences in reducing uncertainty and enhancing consumers' confidence in digital retail platforms.

Finally, the study contributes to theory by introducing perceived customer support as a moderating variable within augmented reality-enabled shopping contexts. The findings demonstrate that perceived customer support plays a complex and context-dependent role in augmented reality-enabled shopping environments by shaping how immersive experiences translate into customer outcomes. Rather than functioning as a uniform enhancer of engagement, perceived customer support operates as a boundary condition that alters the strength of the relationship between flow experience and engagement. Specifically, the negative moderating effect observed in this study indicates that higher levels of perceived support weaken the extent to which flow experience translates into engagement. This finding extends prior service and technology research by suggesting that supportive service cues do not always amplify immersive psychological states, particularly in highly engaging digital environments.

From a theoretical perspective, this result challenges the implicit assumption in both service-dominant logic and technology-enabled experience research that greater support uniformly enhances customer responses. While prior studies have emphasized the positive role of support in reducing uncertainty and facilitating technology use (Bettencourt, 1997; Gefen et al., 2003; Grisseman & Stokburger-Sauer, 2012), the present findings suggest that in immersive augmented reality contexts, highly salient or intrusive support cues may interfere with customers' sense of autonomy and absorption. Accordingly, perceived customer support should be conceptualized not only as a facilitative resource but also as a contextual factor whose effectiveness depends on the experiential intensity of the technology-mediated interaction.

5.2.2 Practical implications

The findings of this study offer several important practical implications for online retailers, technology developers, and online shopping platforms seeking to leverage augmented reality to enhance customer experience. By identifying the mechanisms through which perception of augmented reality features influences engagement, satisfaction, and trust, the study provides actionable insights for the effective design and implementation of augmented reality-enabled shopping environments.

First, the results emphasize that successful augmented reality implementation extends beyond mere technological novelty. While novelty initially attracts customers, the findings indicate that long-term customer value is achieved only when augmented reality technologies are designed to foster meaningful interaction and immersive experiences. Retailers should therefore prioritize the development of augmented reality features that allow consumers to actively manipulate products,

personalize views, and explore alternatives in real time. Enhancing interactivity not only increases customers' sense of control but also contributes to deeper flow experiences, which are essential for sustained engagement and positive customer outcomes.

Second, vividness and realism emerge as critical design considerations. Retailers should invest in high-quality visual rendering, accurate scaling, and realistic product representations to reduce uncertainty and enhance decision confidence. Augmented reality experiences that closely replicate real-world interactions enable consumers to better evaluate products, leading to higher satisfaction and trust. For example, in fashion and beauty retail, accurate color matching and realistic texture simulation can significantly improve consumers' confidence in purchase decisions. In furniture and home décor retail, spatial accuracy and environmental integration are essential for delivering experiential value.

Third, the study highlights the importance of flow experience as a strategic objective rather than an incidental outcome. Managers should design augmented reality technologies that minimize cognitive friction and maximize ease of use to support uninterrupted immersion. This includes intuitive navigation, fast system responsiveness, and seamless integration with existing shopping interfaces. By reducing technical complexity and system delays, retailers can increase the likelihood that customers enter a state of flow, which in turn strengthens engagement, satisfaction, and trust.

Fourth, the findings underscore the central role of customer engagement as a bridge between immersive experiences and relational outcomes. Retailers should view engagement as a multi-dimensional construct encompassing emotional involvement, cognitive investment, and behavioral interaction. To foster engagement, managers can incorporate gamified elements, interactive storytelling, or personalized recommendations within augmented reality experiences. However, such elements should be carefully aligned with consumers' shopping goals to avoid overstimulation or distraction.

Importantly, this study demonstrates that perceived customer support plays a significant but nuanced role in shaping the effectiveness of augmented reality experiences. Even highly immersive augmented reality technologies may fail to generate positive outcomes if consumers feel unsupported during the shopping process. Retailers should therefore integrate visible and accessible support mechanisms, such as live chat, AI-driven virtual assistants, or contextual help features within augmented reality platforms. These support cues reassure consumers, reduce uncertainty, and fostering customer engagement and more favorable evaluations, even though they may weaken the extent to which flow translates into engagement.

Furthermore, the role of perceived customer support suggests that augmented reality should not be implemented in isolation but as part of a broader service ecosystem. Managers should therefore integrate visible but adaptive and context-sensitive support mechanisms to ensure consistency

between augmented reality experiences and overall service quality across touch points, including customer service, delivery, and post-purchase support. This integrated approach enhances relational continuity and reinforces trust in the brand.

From a strategic perspective, the findings suggest that augmented reality can serve as a differentiation tool in competitive online retail markets. However, its effectiveness depends on aligning technological investments with experiential design and service support. Retailers should adopt a customer-centric mindset when deploying augmented reality, focusing on how specific features enhance value rather than merely showcasing technological capabilities.

Hence, the practical implications of this study highlight that augmented reality-driven customer experience is shaped by the interaction between immersive technology, psychological engagement, and supportive service environments. By strategically designing augmented reality features, facilitating flow, fostering engagement, and carefully calibrating customer support, retailers can maximize the return on augmented reality investments and build stronger, more trusted relationships with online consumers.

5.3 Limitations and future research directions

While the current research makes several important contributions to understanding how augmented reality influences customer experience through flow and engagement, certain limitations should be acknowledged. These limitations also open valuable avenues for future research.

One of the primary limitations of this study is the geographical generalization of the data. The data were gathered through an online survey that was not tailored to a specific country, culture, or region. While this approach facilitated broader participation, it may have neglected significant cultural variations in how consumers perceive and experience augmented reality technology. Cultural factors such as uncertainty avoidance, power distance, or technological (Jan et al., 2024) readiness may impact how customers interact with augmented reality and develop trust in online retailers. For example, consumers in technologically sophisticated economies like South Korea or Japan may view augmented reality features as natural extensions of digital shopping, whereas consumers in emerging economies may still find them innovative or even daunting. Therefore, future research could undertake country-specific or region-specific studies to investigate how cultural and social factors moderate the relationships among augmented reality features, flow, engagement, satisfaction, and trust. Comparative cross-country studies could also help refine the conceptual model by identifying cultural convergences and divergences (Schoefer et al., 2025) in augmented reality adoption and customer experience outcomes.

This study employed an online questionnaire survey to gather quantitative data, which allowed for efficient data collection from a diverse set of participants. However, the reliance on self-reported

responses limits the depth of understanding about the underlying cognitive and emotional processes behind consumers' experiences. While statistical testing of relationships provides strong quantitative validation, it may not fully capture the nuanced psychological or contextual factors that influence flow and engagement in augmented reality-based shopping. To address this limitation, future studies could adopt mixed-method approaches that combine quantitative surveys with qualitative interviews, focus groups, or ethnographic observations. Such methods would allow researchers to explore deeper insights into how consumers interpret and emotionally connect with augmented reality shopping environments. As suggested by Hsu et al. (2021), combining survey data with qualitative narratives can reveal the reasoning and motivations behind consumer behaviour that structured questionnaires often miss. This approach would lead to a more holistic understanding of how augmented reality experiences are perceived and valued.

Another limitation is that the study did not concentrate on a specific brand or industry. While the findings provide a broad framework applicable to online retailing, consumer perceptions of augmented reality can differ substantially across industries such as fashion, real estate, beauty, or automotive. For instance, in fashion retail, augmented reality try-on tools may directly impact satisfaction through visual fidelity and fit precision, whereas in real estate, augmented reality may influence trust through spatial representation and authenticity. Therefore, future research could focus on specific industries or brand contexts to investigate whether the relationships observed in this study are consistent across different product categories. Brand-specific studies could also assess how brand familiarity, reputation, or perceived quality moderate the impact of augmented reality on customer experience outcomes. Longitudinal brand-based studies may further uncover how repeated augmented reality exposure enhances engagement, trust, and loyalty over time.

This research treated augmented reality as a single construct; however, augmented reality technologies can differ in their level of immersion, interactivity, and sensory richness. McLean (2019) suggested that augmented reality can be categorized into low-level (basic visualization), medium-level (interactive features), and high-level (fully immersive experiences). The current study did not distinguish between these levels, which may influence the intensity of flow and engagement. Future research should examine how different levels of augmented reality sophistication influence customer responses. For instance, does a simple 3D product viewer evoke the same psychological flow as a fully immersive augmented reality fitting room? Additionally, studies could test whether higher levels of involvement (Van Noort et al., 2012) lead to stronger trust formation or, conversely, cause cognitive overload that reduces satisfaction. Understanding these nuances will help refine theoretical models and guide practitioners in selecting the most effective augmented reality design strategies for their target markets.

Another limitation is the cross-sectional nature of the data, which captures consumer perceptions at a single point in time. Customer engagement and trust, however, are evolving constructs that develop through repeated interactions and accumulated experiences. Consequently, longitudinal

research could provide more nuanced insights into how ongoing augmented reality interactions influence engagement, satisfaction, and trust over time. A further limitation of this study is its reliance on cross-sectional data, which provides a static snapshot of consumer perceptions at a single point in time. Given that customer engagement and trust are dynamic constructs that evolve through repeated interactions and accumulated experiences, a longitudinal research design would offer more nuanced insights into the temporal dynamics of augmented reality interactions, including their influence on engagement, satisfaction, and trust (Hsu et al., 2021).

Future studies could also expand this model to include loyalty, repurchase intention, or advocacy as additional outcome variables. By examining these long-term effects, researchers can determine whether the initial flow and engagement generated by augmented reality experiences lead to lasting customer relationships or fade after the novelty effect subsides. Future studies could also expand this model to include loyalty (Hsu et al., 2021), repurchase intention, or advocacy (Ngo et al., 2025) as additional outcome variables. By examining these long-term effects, researchers can determine whether the initial flow and engagement generated by augmented reality experiences lead to lasting customer relationships or fade after the novelty effect subsides.

Finally, as augmented reality continues to advance its integration with other immersive and intelligent technologies, such as Mixed Reality (MR), Virtual Reality (VR), or Artificial Intelligence (AI)-enhanced augmented reality and offer new possibilities for research. These technologies may deepen immersion, personalize experiences, and enhance decision-making, potentially transforming customer engagement models. Future studies could explore how such hybrid technologies influence flow, trust, and satisfaction differently from traditional augmented reality. For example, AI-enhanced augmented reality could analyze customer preferences in real time to recommend products that align with individual tastes, creating personalized shopping experiences that further reinforce flow and engagement. Understanding these technological synergies will contribute to both theoretical advancement and practical innovation in digital customer experience research.

Chapter 6: Conclusion

This study sets out to explore how perception of augmented reality features impacts customer experience outcomes, particularly satisfaction and trust, within the context of online shopping. Grounded in flow theory, the research further examined the mediating role of flow experience and customer engagement, as well as the moderating influence of perceived customer support. The findings provide robust empirical and conceptual support for the proposed model, offering novel insights into how augmented reality transforms the digital shopping journey into an immersive, captivating, and trustworthy experience.

The results reveal that customer perceptions of augmented reality features such as interactivity, vividness, and novelty act as psychological catalysts that enhance customer immersion and create a state of flow. This flow experience serves as a bridge between technological design and emotional response, ultimately improving satisfaction with the shopping process. When customers experience flow, they become more deeply invested, devoting greater time, attention, and emotional energy to their interactions. This engagement, in turn, strengthens their trust in the retailer and shapes long-term relationship intentions.

From a theoretical perspective, this research expands the existing model by integrating Flow Theory, into a unified augmented reality – customer experience model. The findings broaden Flow Theory's applicability to digital commerce, showing how technological immersion leads to psychological flow and engagement. It also demonstrates how engagement functions as a behavioural manifestation of flow. Together, these contributions provide a strong theoretical foundation for understanding augmented reality's role in creating satisfactory and trustworthy customer experiences while recognizing the contingent role of contextual support mechanisms.

From a practical standpoint, the findings suggest that the success of augmented reality in online shopping depends on both technological quality and experiential design. Retailers and augmented reality developers should prioritize creating intuitive, interactive, and emotionally rewarding interfaces that promote flow and engagement. In addition, effective customer support mechanisms should accompany augmented reality in a calibrated and context-sensitive manner to ensure customers feel guided and secure without disrupting immersive engagement. By aligning augmented reality design with customer-centric values and carefully calibrated service responsiveness, businesses can enhance satisfaction and trust as key customer experience outcomes.

A surprising finding of this study lies in its identification of the counterintuitive moderating role of perceived customer support within augmented reality-enabled shopping environments. While prior research generally assumes that service support uniformly enhances technology-driven

experiences, the findings of this study demonstrate that perceived customer support can weaken the extent to which flow experience translates into customer engagement. This insight advances existing theory by revealing that immersive psychological states such as flow may be most effective when customers experience a sense of autonomy and uninterrupted immersion, thereby positioning perceived customer support as a contextual boundary condition rather than a universally reinforcing factor. In conclusion, this research demonstrates that augmented reality is not merely a technological innovation but a psychological and experiential catalyst that transforms how customers perceive, evaluate, and engage with online retailers. By fostering flow, deepening engagement, and building satisfaction, trust through immersive design and carefully managed support mechanisms. By revealing that highly salient customer, support mechanisms can disrupt immersive engagement by weakening the translation of flow experience into customer engagement; this study challenges prevailing assumptions in augmented reality and service research and opens new avenues for future investigation.

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Appendices

Appendix A – Ethics approval



AUT
TE WĀNANGA ARONGI
O TĀMĀKI MĀKAU RAU

**Auckland University of Technology Ethics Committee
(AUTEC)**

31 July 2025
Thuy Tien Nguyen
Faculty of Business Economics and Law

Dear Thuy Tien

Re Ethics Application: **25/237 Influence of Augmented Reality (AR) Technology on Customer Experience in Online Shopping**

Thank you for your responses to AUTEC's conditions.
Your ethics application has been approved for three years until 31 July 2028.

Non-Standard Conditions of Approval

- Changes to the Information Sheet:
 - Proofread to remove prompts and repetition.
 - Remove the offer for participants to contact the research for results, just keep the link to the supervisor's profile page.

Non-standard conditions do not need to be submitted to or reviewed by AUTEC unless requested but must be completed before commencing your study.

Standard Conditions of Approval

- The research is to be undertaken in accordance with the [Auckland University of Technology Code of Conduct for Research](#) and as approved by AUTEC.
- All public facing documents must have the AUTEC approval number and be of a high standard of spelling and grammar. Dates on the Information Sheet(s) and Consent Form(s) must be consistent.
- Any amendments to the project must be approved by AUTEC prior to being implemented.
- A progress report is due annually on the anniversary of the approval date.
- A final report is due at the expiration of the approval period, or, upon completion of project.
- Any serious or adverse events must be reported to AUTEC, this includes unforeseen issues that might affect continued ethical acceptability of the project.
- AUTEC grants ethical approval only. You are responsible for obtaining management permission for access from any institution or organisation at which your research is being conducted and you need to meet all ethical, legal, public health, and locality obligations or requirements for the jurisdictions in which the research is being undertaken.

The application number and title need to be referenced on all correspondence related to this project.


All forms are available online <http://www.aut.ac.nz/research/researchethics>

For any enquiries, please contact the Secretariat at ethics@aut.ac.nz
(This is a computer generated letter for which no signature is required)

The AUTEC Secretariat
Auckland University of Technology Ethics Committee
Cc: khm0016@aut.ac.nz; angeara@aut.ac.nz

Auckland University of Technology, D-80, Private Bag 92006, Auckland 1142, New Zealand.
T: +64 9 921 9999 ext. 8316; F: ethics@aut.ac.nz; www.aut.ac.nz/researchethics

Appendix B – Participant information sheet



TE WĀNANGA APOHURI
O TĀMAKI MAKAU RAU

15 August 2025

Influence of Augmented Reality (AR) Technology on Customer Experience in Online Shopping

Over the last decade, Augmented Reality (AR) has become a powerful feature in online shopping experiences. AR technology allows users to visualize products in real-time through their smartphones, tablets, or computers by overlaying digital elements onto their real environment. For example, you might have used AR to:

- Try on clothes or accessories virtually
- Place 3D furniture in your room to see how it fits
- Preview makeup or hair colors on your face
- See how home décor would look in your space

These features are designed to make shopping online feel more like shopping in a physical store. We are interested in your experience and perceptions of using AR features while shopping online.

This is student research being undertaken at AUT to understand how AR features in online shopping platforms influence your experiences, such as engagement, satisfaction, and trust towards an online retail/shopping platform. This study aims to investigate which AR features contribute to greater satisfaction and trust in online shopping. As someone who may have experienced AR in online shopping, your input would be extremely valuable to this study.

This study is being conducted by Anindita ~~Debnath~~, Student of Master of Business, from Auckland University of Technology (AUT), New Zealand (NZ) with the project supervisors - Dr ~~Thuy Tien~~ Nguyen, Lecturer and Dr ~~Angana Techarassanasontara~~, Professor in the Department of Management, Technology and Organisation (MTO) in the Faculty of Business, Economics and Law at AUT, NZ. The study is being carried out as a requirement for the Master of Business.

Participation is optional and anonymous. Your responses cannot be linked to you. Further, no identifying information will be gathered.

The survey takes approximately 10-15 minutes and can be completed on any device. For more information, please see below.

What is the purpose of this research?

The researchers will be gathering data on the features of AR technology that create a positive and engaging shopping experience. In addition, they will evaluate your perception of AR features in order to contribute to enhanced satisfaction and trust in an online shopping platform.

The findings of this research may be shared in academic publications and presentations. All information will be ~~anonymous~~.

How was I identified and why am I being invited to participate in this research?

To be included in this research, you must be a user of online shopping platforms, have experience with AR features such as virtual try-ons or 3D product views, and be at least 18 years of age.

How do I agree to participate in this research?

Completing the online survey will be taken as consent to participate. Your participation in this research is voluntary (it is your choice), and whether you choose to participate will neither advantage nor disadvantage you.

15 January 2025 page 1 of 3 This version was edited November 2024

Where information cannot be traced to an individual (e.g., when provided anonymously), it cannot be withdrawn, and this should be clearly stated.

You are free to withdraw at any time. To do this, simply close your browser window or the application (App) in which the survey is presented. Any information you have entered up to that point will be deleted from the dataset. As this is an anonymous survey, it will not be possible to withdraw your information after you have completed the survey. Submission of completed questionnaires will be taken as consent and an agreement to participate.

What will my participation involve?

The survey will take approximately 10-15 minutes to complete. You may complete the survey at a time and place that is convenient to you. If you wish, you may stop completing the survey at any time.

What are the benefits?

Participants on Prolific are always informed about the monetary compensation they will receive for a study before they choose to participate.

What are the costs?

There are no direct costs to you associated with this research. The survey will take approximately 10 minutes to complete. If you have decided to participate and change your mind, you can stop at any time. However, once your survey is submitted within Qualtrics, it is anonymised, so it cannot be withdrawn.

What will happen to information about me?

Responses to the survey are anonymous; data will be stored in the AUT's OneDrive or equivalent once analysis is completed under the control of the applicant/ supervisors.

At the end of the six-year retention period, all data from participants' responses will be permanently destroyed in accordance with the university's Research Data Management Guidelines.

What opportunity do I have to consider this invitation?

You will have 2 weeks to complete the survey.

Will I receive feedback on the results of this research?

While individual feedback will not be provided, the findings from this research may be published in an academic journal. If published, a link to the publication will be made available on the researcher's academic profile page on the AUT website of [Dr. Nguyen's AUT Profile Link](#) and [Prof. Techatassanasontorn's AUT Profile Link](#).

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr ~~Thuy Tien~~ Nguyen, thuy.tien.nguyen@aut.ac.nz

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTECH, ethics@aut.ac.nz, (+649) 921 9999 ext. 6038.

Who do I contact for further information about this research?

Please keep this Information Sheet for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Anindita Bhowal-khm6914@autuni.ac.nz

Project Supervisors Contact Details:

Dr ~~Thuy Tien~~ Nguyen- thuy.tien.nguyen@aut.ac.nz

Prof. ~~Angsana Techatassanasontorn~~ - angsana@aut.ac.nz

Approved by the Auckland University of Technology Ethics Committee on **31/07/2025**, AUTECH Reference number 25/237.

Appendix C– Survey questionnaire

Qualtrics survey

Default Question Block

Influence of Augmented Reality (AR) Technology on Customer Experience in Online Shopping

In recent years, Augmented Reality (AR) has become a powerful feature in online shopping experiences. AR technology allows users to visualize products in real-time through their smartphones, tablets, or computers by overlaying digital elements onto their real environment. For example, you might have used AR to:

- Try on clothes or accessories virtually
- Place 3D furniture in your room to see how it fits
- Preview makeup or hair colors on your face
- See how home décor would look in your space

These features are designed to make shopping online feel more like shopping in a physical store. We're interested in your experience and perceptions of using AR features while shopping online.

This is student research undertaken at AUT to understand how Augmented Reality (AR) features in online shopping platforms influence your experiences such as engagement, satisfaction and trust towards an online retail/shopping platform. This study aims to investigate which AR feature contribute to a more satisfaction and trust in online shopping. As someone who may have experienced AR in online shopping, your input would be extremely valuable to this study.

This study is being conducted by Anindita Bhowal, Student of Master of Business, from Auckland University of Technology (AUT), New Zealand (NZ) with the project supervisors - Dr Thuy Tien Nguyen, Lecturer and Dr Angsana Techatassanasoontorn, Professor in the Department of Management, Technology and Organization (MTO) in the Faculty of Business, Economics and Law at AUT, NZ. The study is being carried out as a requirement for Master of Business.

Participation is optional and anonymous. Your responses cannot be linked to you. Further, no identifying information will be gathered.

The survey takes approximately 10-15 minutes and can be completed on any device.

For more information, please see below.

What is the purpose of this research?

The researchers will be gathering data on the features of AR technology that are creating a positive and engaging shopping experiences. In addition, they will evaluate your perception of AR features as to contribute enhanced satisfaction and trust in an online shopping platform. The findings of this research may be shared in academic publications and presentations. All information will be anonymised.

How was I identified and why am I being invited to participate in this research?

To be included in this research, you need to be a user of online shopping platforms and may have experience with AR features such as virtual try-ons or 3D product views and 18 years of age or above. Participants who don't meet the inclusion criteria will be excluded for this study.

How do I agree to participate in this research?

Completing the online survey will be taken as consent to participate. Your participation in this research is voluntary (it is your choice) and whether you choose to participate will neither advantage nor disadvantage you. Where information cannot be traced to an individual (e.g., when provided anonymously) it cannot be withdrawn, and this should be clearly stated. You are free to withdraw at any time. To do this, simply close your browser window or the application (App) the survey is presented on. Any information you have entered up to that point will be deleted from the data set. As this is an anonymous survey it will not be possible to withdraw your information after you have completed the survey. Submission of completed questionnaires will be taken as consent and agreement to participate.

What will my participation involve?

The survey will take approximately 10-15 minutes to complete. You may complete the survey at a time and place that is convenient to you. If you wish, you may stop completing the survey at any time.

What are the benefits?

Participants on Prolific are always informed about the compensation they will receive for a study before they choose to participate. Platforms like Prolific are compensated, typically around NZ\$ 3-5 per completed survey.

What are the costs?

There are no direct costs to you associated with this research. The survey will take approximately 10-15 minutes to complete. If you have decided to participate and change your mind, you can stop at any time. However, once your survey is submitted within Qualtrics, it is anonymised, so it cannot be withdrawn.

What will happen to information about me?

Responses to the survey are anonymous; data will be stored to AUT one drive or equivalent, once analysis is completed under the control of the applicant/ supervisors. At the end of the six-year retention period, all research data will be permanently destroyed in accordance with the university's Research Data Management Guidelines.

What opportunity do I have to consider this invitation?

You will have 2 weeks to complete the survey.

Will I receive feedback on the results of this research?

An url link to the summary of the findings will be made available if you request, once the research is completed.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, Dr Thuy

Tien Nguyen, thuy.tien.nguyen@aut.ac.nz

Concerns regarding the conduct of the research should be notified to the Executive Secretary of AUTEC,
ethics@aut.ac.nz, (+649) 921 9999 ext 6038.

Who do I contact for further information about this research?

Please keep this Information Sheet for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details: Anindita Bhowal-khm8@14@aut.ac.nz Project Supervisors Contact Details: Dr Thuy Tien

Nguyen- thuy.tien.nguyen@aut.ac.nz

Prof. Angsana Techatassanasoontorn- angkana.techatassanasoontorn@aut.ac.nz

Approved by the Auckland University of Technology Ethics Committee on, AUTEK Reference number 25/237

With thanks,

Anindita Bhowal

Thuy Tien Nguyen

Angsana Techatassanasoontorn

Auckland University of Technology (AUT)

To begin the survey, please click >> below

Q1.2. What is your age?

- below 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55 and above

Q1.1. What is your gender?

- Male
- Female
- Non-binary / third gender
- Prefer not to say

Q1.3. What is your highest level of education completed?

- High School
- University and college
- Post graduate and above

Q1.4. What is your current occupational status?

- Under 1 year
- 1- 3 years

- >3 – 5 years
- >5 – 8 years
- >8 – 15 years
- more than 15 years

Q1.5. How frequently do you shop online?

- Less than a week
- Weekly
- Biweekly
- Once in a month
- Every three months and above

Q1.6. Have you ever used AR technology while shopping online (e.g., Virtual try-ons, 3D product views)?

- Yes
- No

Q2. Augmented Realty features

Q2.1. Thinking about the features of augmented reality technology which allowing users to engage in real-

time, while doing online shopping, please indicate the extent you agree or disagree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I was in control of my navigation through the augmented reality technology.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had some control of the augmented reality technology that I wanted to see.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The augmented reality technology had the ability to respond to my specific needs quickly and efficiently.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2.2. Thinking about the features of augmented reality technology that bringing digital elements to life with

stunning details, while doing online shopping, please indicate the extent you agree or disagree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Using the augmented reality feature offers something new each time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the augmented reality feature offers unique information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the augmented reality features is something different each time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the augmented reality feature offers specific content.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2.3. Thinking about the feature of augmented reality technology, which offers fresh and surprising interactions, while doing online shopping, please indicate the extent you agree or disagree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The visual display through the AR technology was clear.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The visual display through the AR technology was detailed.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The visual display through the AR technology was vague.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The visual display through the AR technology was sharp.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Strongly disagree Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree Strongly agree

The visual display through the AR technology was well-defined.

Q3. Flow experience

The word “flow” is used to describe a state of mind sometimes experienced by people who are deeply involved in an activity. When you are in flow state, time may seem to stand still and nothing else seems to matter.

Typically, flow is described as a pleasurable online shopping with AR experience. Please think your experience of using the AR enabled online shopping platform and answer the following:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I have experienced "flow" on this shopping platform.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have experienced "flow" on this shopping platform.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While using the AR enabled online shopping platform, I undergo a 'flow'.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q 4. Engagement

Please think your experience of using the AR enabled online shopping platform and answer the following:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree	Click to write Scale Point 6
Using the AR feature get me thinking about the retailer's online platform.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think about the a lot when using the AR feature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the AR feature stimulates my interest in online shopping.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel positive when I use AR feature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel good when I use the AR feature.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using the AR feature makes me happy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

				Neither agree nor disagree				Click to write Scale Point 6
	Strongly disagree	Disagree	Somewhat disagree		Somewhat agree	Agree	Strongly agree	

I spend a lot of time using the AR feature of online shopping platform compared to non-AR feature.

Whenever I am using the internet, I often interact with AR feature.

Q 5. Customer experience

Q 5. 1. Thinking about your satisfaction towards augmented reality technology while doing online shopping, please indicate the extent you agree or disagree with the following statements.

				Neither agree nor disagree			
	Strongly disagree	Disagree	Somewhat disagree		Somewhat agree	Agree	Strongly agree

I am satisfied with for online shopping with AR experience

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Online shopping with AR experience is exactly what I needed.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Online shopping with AR experience hasn't worked out as well as I thought it would.

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Q 5. 2. Thinking about your trust towards augmented reality technology while doing online shopping , please indicate the extent you agree or disagree with the following statements.

Strongly disagree Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree Strongly agree

The AR technology in online shopping platform meets my expectations.

I can trust the AR technology enabled online shopping platform performance.

The AR technology is reliable for trying online shopping.

Q 6. Customer support

Thinking about your customer support received while doing online shopping with AR technology, please indicate the extent you agree or disagree with the following statements.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The AR enabled online shopping platform considers my needs and wants.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AR enabled online shopping platform cares about my opinions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AR enabled online shopping platform cares about my opinions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The AR enabled online shopping platform explains how to use it via step-by - step instructions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Strongly disagree Disagree Somewhat disagree Neither agree nor disagree Somewhat agree Agree Strongly agree

The AR enabled online shopping platform explains how to use it via step-by-step instructions.

Q7. On which platform(s) have you used AR technology for online shopping?

- Mobile app (e.g., retailer's app)
- Mobile web browser
- Desktop/laptop website
- In-store AR device
- Social media platform (e.g., Instagram, Snapchat, TikTok)
- Other (please specify): _____

8. Which brand(s) have you used augmented reality (AR) features with while shopping online? Please list the brand

names you remember.

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Appendix D – Artificial intelligence declaration template

ARTIFICIAL INTELLIGENCE DECLARATION TEMPLATE

Artificial Intelligence Guidelines:

Artificial Intelligence (AI) tools, including generative AI tools approved for use by AUT ([AI Tool Register](#)), can be used as learning tools when preparing to write your research proposal or research component. AI tools also have capability to assist with data modelling, data analysis and data visualisation. However, the research component you submit for examination must be substantively your own work. AI tools cannot solely be used to generate content when writing or creating an artwork/artefact, as this constitutes plagiarism. The formal guidelines for appropriate use of AI on the [AI Hub](#) must be followed. Also refer to the [Using Artificial Intelligence in your Research: Self-Assessments, Checklists, and Sample Text](#), for examples and sample text.

If you do plan to use AI tools, this declaration should be submitted with the initial research proposal, Confirmation of Candidature, and when you submit your research component for examination. You must complete the template below for each AI output used detailing the following:

- **Chapters where AI was used in any way**
- **Purpose of AI Use**
- **AI Tool(s) Used**
- **Prompts Used**
- **Post-AI Processing Methods**

Specify the chapter number(s) in your research proposal/research component where AI was used.

Chapter number(s): 1,2,3,4 ,5 and 6

Briefly explain why the AI tool was used (e.g., idea generation, summarization, data analysis, image creation, etc.).

Purpose of AI Use: To reorganize my ideas and logical flow of the content when required in accordance with Postgraduate Handbook page 95-98.

Clearly state the AI tools used.

AI Tool(s) Used: ChatGPT

Exact prompts or queries entered into the AI tool. Include all relevant variations.

Prompts Used: preferred to articulate below, the purpose for which the prompt was used, rather than stating what prompt were used.

A summary or description of the AI-generated output. (Optional: attach output in an appendix.)

Output Received: The AI output provided language-level suggestions aimed at improving clarity, coherence, and writing quality, such as minor rewording and sentence restructuring. The output did not include original analysis, arguments, or conclusions.

Describe how the AI output was used, edited, or transformed.

Post-AI Processing Methods: The AI-generated output was used solely to improve the logical flow, clarity, and overall writing quality of the content, including sentence structure, coherence, and consistency of arguments. All suggestions provided by the AI were carefully reviewed line by line. I manually edited, refined, or rejected the suggestions where necessary to ensure accuracy, originality, and alignment with my intended meaning. The content was critically evaluated to confirm that the arguments, analysis, interpretation of results, and conclusions were not altered. The use of AI was limited strictly to language polishing and structural refinement, and the final text remains entirely my own work.

You may use this free text box to explain the intent for the use of the AI generated content. For example, rather than stating what prompt(s) were used, you may articulate the purpose for which the prompt was used (supported by examples) here:

I declare that artificial intelligence tools were used to assist with (1) *the logical flow of the content*, (2) *consistency, coherence, and writing quality* of this research. All AI-generated content has been

verified, and the analysis and conclusions remain my original work. AI assistance has been used in accordance with AUT guidelines and with supervisor approval.

STUDENT DECLARATION

By signing, you are confirming that the AI use stated in the table(s) above are accurate and follow AUT's recommended guidelines detailed in the AI Hub and Postgraduate Handbook.

Student Name: Anindita Bhowal

Signature:



Date:

19 February 2026