HOW AI CHATBOT SERVICE QUALITY AFFECTS CUSTOMER SATISFACTION AND LOYALTY IN E-COMMERCE IN MALAYSIA

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HOW AI CHATBOT SERVICES QUALITY AFFECTS CUSTOMER SATISFACTION AND LOYALTY IN E-COMMERCE IN MALAYSIA

BY

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A final year project submitted in partial fulfilment of the requirement for the degree of

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I would also like to extend my appreciation to my friends and peers for their encouragement, insightful discussions, and assistance during the data collection and analysis stages. Their support and cooperation have greatly enriched my academic experience and contributed to the completion of this study.

DEDICATION

I would like to dedicate this thesis to my beloved family, whose unconditional love, support, and encouragement have formed the foundation of my academic journey. Their patience and understanding during the long hours of research and writing have been invaluable, and this work would not have been possible without them.

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LIST OF ABBREVIATIONS

A	Anthropomorphism
AVE	Average Variance Extracted
CL	Customer Loyalty
CS	Customer Satisfaction
f^2	Effect Size
H	Hypotheses
MICOM	Measurement Invariance of Composite Model
NLP	Natural Language Processing
PEU	Perceived Ease of Use
PLS-MGA	Partial Least Squares Multi-Group Analysis
PLS-SEM	Partial Least Squares Structural Equation Modeling
R^2	Coefficient of Determination
REL	Reliability
REP	Responsiveness
RO	Research Objectives
RQ	Research Questions
SERVQUAL	Services Quality
VIF	Variance Inflation Factor

Preface

This Final Year Project is undertaken in partial fulfillment of the requirements for the Bachelor of International Business (Honours) at Universiti Tunku Abdul Rahman (UTAR). The research was inspired by the rapid expansion of the e-commerce industry in Malaysia and the growing reliance on artificial intelligence (AI) chatbots as a primary customer service interface. As competition among digital platforms intensifies, businesses increasingly depend on automated service systems to manage customer interactions efficiently, making service quality a critical factor in shaping customer experience.

The selection of this research topic was driven by the author's academic interest in digital business, customer relationship management, and emerging service technologies. Through frequent interactions with Malaysian e-commerce platforms, the author observed that AI chatbots are widely implemented to respond to customer inquiries, complaints, and transaction-related issues. However, customer reactions toward these chatbots appear to vary considerably, ranging from satisfaction to frustration. These observations sparked an interest in understanding how different dimensions of chatbot service quality influence customer satisfaction and loyalty.

Furthermore, Malaysia's multicultural society presents a unique research context, as service expectations and perceptions may differ across racial groups. This motivated the author to examine whether variations exist in how chatbot service quality is evaluated among different user groups. By integrating service quality dimensions with customer satisfaction and loyalty, this study aims to contribute to a deeper understanding of AI-enabled customer service in e-commerce. It is hoped that the findings will offer valuable insights to both academics and practitioners seeking to enhance chatbot effectiveness and customer experience in Malaysia's digital marketplace.

Abstract

This study examines the impact of AI chatbot service quality on customer satisfaction and customer loyalty in the Malaysian e-commerce industry, with particular attention to differences across racial groups. As AI chatbots become increasingly prevalent as a customer service tool, understanding how users perceive their service quality is essential for sustaining competitive advantage in digital markets. Data were collected from 240 Malaysian e-commerce users through a structured questionnaire and analyzed using structural equation modeling.

The results indicate that perceived ease of use, reliability, and anthropomorphism have significant positive effects on customer satisfaction, while responsiveness exhibits a significant negative relationship. Customer satisfaction is found to have a strong positive influence on customer loyalty and plays a mediating role between chatbot service quality and loyalty. The multi-group analysis reveals notable differences across racial groups. Chinese users place the greatest emphasis on ease of use and reliability, followed by users categorized under the "Others" group, whereas Indian users tend to prioritize relational and interaction-related aspects over system performance. The relationship between satisfaction and loyalty is strongest among Chinese users and weakest among Indian users. In contrast, anthropomorphism and responsiveness are perceived consistently across all groups.

These findings highlight the importance of designing chatbots that are intuitive, reliable, and human-like, while also considering cultural diversity in user expectations. The study contributes to the literature on AI-enabled service quality and provides practical implications for e-commerce firms aiming to improve chatbot design, enhance customer satisfaction, and foster long-term customer loyalty in Malaysia's multicultural environment.

Keywords: AI chatbots, Service quality, Customer satisfaction, Customer loyalty, E-commerce

CHAPTER 1: RESEARCH OVERVIEW

1.1 Research Background

Due to rising internet penetration, smartphone usage, and changing customer behavior, Malaysia's e-commerce sector has expanded quickly in recent years. On average, 8 out of 10 Malaysians have shopped online, with 61% making purchases weekly (Payments & Commerce Market Intelligence, 2024). As competition intensifies, e-commerce companies increasingly adopt digital technologies to improve customer experience and establish enduring ties with customer.

One of the most popular customer service tools is chatbots. Chatbots are computer programs that mimic human communication with human users and assist users in completing tasks through intelligent interactive dialogue (Adamopoulou and Mouussiades, 2020). In e-commerce, chatbots aim to improve shopping experiences, foster trust, and facilitate efficient customer support before and after purchase.

Driven by Artificial Intelligence (AI) and Natural Language Processing (NLP), chatbots have become an important bridge between businesses and consumers in e-commerce platforms such as Shopee, Lazada, and Taobao. AI technology provides intelligent conversational channels for interactions between users and chatbots, while NLP enables chatbots to understand the intent embedded in spoken or written expressions within natural language, thereby achieving more efficient communication and service delivery (Meerschman and Verkeyn, 2019). Chatbots are capable of 24/7 service, responding quickly to user needs, and handling common issues such as providing product information, order inquiries, complaints, and return or refund processes without human intervention, which greatly improves customer service automation and operational efficiency (Misischia et al., 2022).
A practical example of an e-commerce chatbot can be observed on Lazada through its virtual assistant, *Lazzie*. When users initiate a chat, Lazzie introduces itself in a friendly and conversational manner, such as: “Hi there! I’m Lazzie, your friendly

shopping assistant here on Lazada. I'm here to help you find the perfect items, answer questions about products, and make your shopping experience smooth and enjoyable." (Ravimalar, 2024). This interaction illustrates how chatbots simulate human-like conversation to assist users during their shopping journey. Similarly, Shopee's Chat AI Assistant automatically responds to common customer inquiries, such as order status or refund requests by providing instant updates and step-by-step guidance, eliminating the need for human agents in routine interactions (Shopee, 2025).

However, chatbot service quality critically shapes user experience and brand perception. High-quality chatbots that accurately understand needs and provide relevant solutions enhance satisfaction (Jenneboer et al., 2022), whereas poor intent recognition or generic responses often cause frustration and dissatisfaction (Huang & Dootson, 2022). In Malaysia's multilingual and multicultural environment, consumers expect not only efficiency but also more natural, human-like communication. Repetitive or mechanised responses can create feelings of being ignored, reduce trust, and lower satisfaction and loyalty over time (Tan and Lim, 2023). Users may eventually shift to competitors offering more personalised or human-supported services.

Given these issues, understanding how various aspects of chatbot service quality influence client pleasure and loyalty is crucial. Furthermore, Malaysia's diverse racial groups, such as Malay, Chinese, Indian, and Others, may perceive chatbot interactions differently due to variations in language preference, communication norms, and service expectations. This highlights the need for a deeper empirical analysis using Multi-Group Analysis (MGA) to determine whether racial groups evaluate chatbot service quality differently and how these differences shape customer satisfaction.

1.2 Research Problem

Although the growing adoption of chatbots across Southeast Asia, research focusing specifically on the Malaysian e-commerce environment remains limited. Much of the existing literature on chatbot service quality has been conducted in countries such as China and Indonesia (Vebrianti et al., 2025; Yabes et al., 2024; Chen et al., 2023). Although these studies offer useful insights, their findings may not fully capture Malaysia's unique multicultural landscape, where differences in language, communication norms, and technology acceptance are likely to shape user perceptions and experiences with chatbots. Consequently, there is insufficient understanding of how Malaysian consumers evaluate chatbot service quality and how these evaluations affect customer happiness and loyalty.

Additionally, although previous studies have examined dimensions such as responsiveness, reliability, and usability, limited attention has been given to anthropomorphism, the human-like qualities embedded in chatbot interactions. In a culturally diverse country like Malaysia, users from different racial backgrounds may perceive anthropomorphic cues differently, yet this dimension remains underexplored.

Moreover, many studies conceptualise customer satisfaction as a direct outcome of service quality, with less emphasis on its potential mediating role in shaping customer loyalty. This omission restricts a deeper understanding of how chatbot-related service perceptions translate into behavioural outcomes like repeat purchases and good word-of-mouth.

Finally, Malaysia's multiethnic population introduces another critical factor. Customers from various racial origins, including Chinese, Indian, Malay, and others, could see and react to chatbot interactions in different ways. Research indicates that significant differences may exist between distinct subgroups, which often remain undetectable in analyses of the overall sample. Therefore, conducting group comparisons in business and marketing research holds substantial value for

understanding consumer behavior, formulating strategies, and avoiding inaccurate conclusions stemming from the neglect of demographic heterogeneity (Cheah et al., 2023). There is lack of information on how ethnic diversity affects satisfaction and loyalty results since existing research rarely use Multi-Group Analysis (MGA) to examine these inequalities. Therefore, the research problem centers on the limited understanding of how chatbot service quality influences customer happiness and loyalty in Malaysia, particularly regarding anthropomorphism, the mediating role of customer satisfaction, and variations across ethnic groups.

1.3 Research Objective

As an interpretation of the research question, this study seeks to accomplish the following goals:

RO1: To examine the effect of chatbot responsiveness on customer satisfaction in the Malaysian e-commerce sector.

RO2: To evaluate how the perceived ease of use of chatbots impact on customer satisfaction among Malaysian online shoppers.

RO3: To investigate the relationship between chatbot reliability and customer satisfaction in e-commerce platforms in Malaysia.

RO4: To determine the influence of chatbot anthropomorphism (human-like behavior) on customer satisfaction in e-commerce.

RO5: To determine whether the structural relationships between chatbot service quality (responsiveness, reliability, perceived ease of use, anthropomorphism) and customer satisfaction differ across racial groups using Multi-Group Analysis (MGA).

RO6: To assess how customer loyalty and chatbot service quality are mediated by customer satisfaction.

1.4 Research Question

RQ1: How does chatbot responsiveness affect customer satisfaction?

RQ2: How does the perceived ease of use of chatbots affect customer satisfaction?

RQ3: How does chatbot reliability impact on customer satisfaction?

RQ4: How does anthropomorphism in chatbot interaction influence customer satisfaction?

RQ5: Do different racial groups (Malay, Chinese, Indian, Others) show significant differences in the structural relationships between chatbot service quality and customer satisfaction?

RQ6: How does customer satisfaction affect customer loyalty?

1.5 Research Significance

In theory, it expands research on AI service quality by modifying the SERVQUAL model to technological contexts and providing cross-cultural evidence through Multi-Group Analysis (MGA), addressing calls for comparative studies in multicultural settings. By gathering feedback from Malaysia's ethnically and linguistically diverse e-commerce consumers, the study emphasises how cultural variations affect the connections between customer happiness, loyalty, and chatbot service quality. These findings offer methodological and practical guidance for Southeast Asia and other multicultural markets, such as the Philippines, Singapore, and Thailand.

Practically speaking, the study provides e-commerce platforms with useful data to optimize chatbot features, including anthropomorphic tone, naturalness of interaction, and response speed, enhancing satisfaction and loyalty. High-quality chatbots can manage more service tasks, reducing reliance on human agents, lowering operational costs, and providing scalable 24/7 service. MGA results also support customer segmentation by racial preferences, enabling culturally adaptive AI service designs that improve user experience and brand value.

Socially, enhancing chatbot service quality promotes greater digital inclusion for Malaysians across different racial and linguistic groups, supporting equitable access to online services. Overall, this study advances academic understanding of AI service quality in multicultural environments, provides practical guidance for improving e-commerce chatbot systems, and contributes to more inclusive and culturally sensitive AI service research on a regional and global scale.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, the research challenge described in Chapter 1 is thoroughly reviewed and critically analyzed. It aims to examine existing theories, models, and empirical studies relevant to chatbot service quality, customer satisfaction, and customer loyalty in the e-commerce context. By synthesizing prior research, this chapter identifies key variables, theoretical frameworks, and research gaps, providing a foundation for the conceptual framework and methodology of the current study.

2.1 Summary of Empirical Literature

Empirical studies consistently show that chatbot service quality strongly influences customer satisfaction, which subsequently enhances loyalty in e-commerce settings (Surjandy and Cassandra, 2023; Carvajal, 2011; Emmanuel, 2025). Scholars generally agree that responsiveness, reliability, perceived ease of use, and anthropomorphism shape users' service experiences (Chen et al., 2023; Yabes et al., 2024; Vebrianti, 2025). However, key debates persist. For anthropomorphism, some studies find that human-like features build trust and satisfaction, whereas others argue that overly human-like chatbots may cause discomfort and reduce acceptance (Hsu and Lin, 2024; Yabes et al., 2024). Another debate contrasts automation with human support: automation improves efficiency and reduces costs, yet errors or inappropriate responses can harm satisfaction (Yun and Park, 2022; Surjandy and Cassandra, 2023). The literature also emphasises a performance–cost trade-off, requiring chatbots to balance speed, accuracy, and conversational naturalness without undermining service quality (Yabes et al., 2024; Chen et al., 2023). These conflicting results emphasize the need for more investigation, especially in multicultural e-commerce contexts like Malaysia.

2.2 Theoretical Framework

2.2.1 Theory: SERVQUAL

SERVQUAL stands for Service Quality (Wang et al., 2015) and was formally developed by Parasuraman, Zeithaml, and Berry (PZB) in 1985 to measure consumers' perceptions of service quality (Shi and Shang, 2020). The model is based on the ‘service quality perception gap’ theory, which posits that consumers evaluate service quality levels based on the gap between expected service and perceived service during service experiences, thereby influencing their satisfaction and loyalty. If perceived service exceeds expectations, consumers will provide positive evaluations of service quality, thereby enhancing satisfaction and loyalty; Conversely, if the perceived service falls short of expectations, consumers will form negative evaluations, potentially leading to customer churn. During the initial development of the model, PZB proposed 10 measurement dimensions, such as reliability, responsiveness, convenience, competence, courtesy, communication, credibility, safety, risk, and empathy, to study consumers' evaluations of the service quality provided by service providers. However, as empirical research and application of the model deepened, PZB simplified it to five core dimensions in 1988: tangibility, reliability, responsiveness, assurance, and empathy (Kulasin and Fortuny-Santos, 2005). These dimensions are not only applicable to traditional face-to-face services but can also be adapted for use in digital and automated service contexts.

Today, the SERVQUAL model is widely applied across various service industries, including retail, hospitality, banking, healthcare, and e-commerce, to evaluate service performance, identify service shortcomings, and develop improvement strategies (Shi and Shang, 2020). With the advancement of artificial intelligence, chatbots have become an essential customer service tool for e-commerce platforms, handling real-time

responses, order inquiries, after-sales support, and common issue resolution. However, consumers' opinion of chatbot service quality very different from those of traditional human customer service. In traditional human customer service environments, service quality relies more on professional competence, attitude, response speed, and emotional expression of service personnel. In chatbot environments, however, customer perception is influenced by technical performance and human-machine interaction experiences, such as information accuracy, consistency, response speed, problem-solving ability, personalised recommendations, and platform usability.

In Malaysia's e-commerce market, the consumer base is diverse and has high expectations for online shopping experiences. Because of the intense rivalry in the local market, the quality of chatbot services not only affects customer satisfaction but also has a big impact on whether or not customers will become long-term brand loyalists. High-quality chatbots can enhance shopping convenience and trust through fast, accurate, and personalised services, thereby increasing satisfaction and loyalty (Cheng et al., 2022); conversely, slow responses, inaccurate information, or a lack of humanised care may reduce satisfaction and prompt customers to reduce their purchases and switch to competitors (Ashfaq et al., 2020).

Therefore, applying the SERVQUAL model to the study of chatbot service quality not only enables a systematic evaluation of AI customer service performance across different dimensions but also shows how important each attribute is in relation to customer satisfaction and loyalty. This study will use the five core dimensions of SERVQUAL as an analytical framework to explore how chatbot service quality in Malaysian e-commerce influences customer satisfaction and drives customer loyalty, thereby providing theoretical foundations and practical references for platform optimisation of AI customer service systems.

2.2.2 Dependent Variable: Customer Loyalty

Customer loyalty is widely recognised as a key factor for sustained success in the e-commerce sector. It manifests not only through customers' consistent repeat purchases but also through their continued commitment and preference for specific brands or platforms when faced with alternative choices (Oliver, 1999). Previous studies show that loyalty building is strongly influenced by service quality, especially in Malaysian e-commerce (Kassim & Abdullah, 2008). Within Malaysia's e-commerce marketplace, high-quality service enhances trust and satisfaction, increasing repeat purchases and fostering brand attachment. In a competitive marketplace with numerous channels and brands, enterprises must consistently deliver superior service to maintain long-term loyalty.

Customer loyalty is the dependent variable in this study, which assesses how AI chatbot service quality ultimately affects consumer behavior. It is a crucial metric for determining an organization's long-term competitive advantage in addition to being the direct result of antecedent factors like customer happiness and service quality. In recent years, with the proliferation of artificial intelligence technology, AI chatbots have become a vital tool for e-commerce enterprises to enhance service experiences. Their response speed, information accuracy, and interaction quality can significantly influence customer trust and satisfaction, ultimately impacting loyalty. Therefore, establishing customer loyalty as the dependent variable facilitates a deeper exploration of how AI chatbot service quality translates into long-term brand commitment and repeat purchasing behaviour through customer experience and emotional factors.

2.2.3 Mediator: Customer Satisfaction

Singh et al. (2023) define customer satisfaction as the degree to which customers perceive their expectations to be met by the goods or services received, reflecting the sense of fulfilment or well-being generated following interactions with the organisation. As stated by Zygiaris et al. (2022, as cited by Vebrianti et al., 2025), customer satisfaction reflects the degree of alignment between a company's services and customer expectations. When a company consistently delivers high-quality services that exceed consumer demands, customers are more likely to achieve higher satisfaction levels. However, higher customer expectations elevate the standards businesses must meet; failure to meet these expectations may provoke dissatisfaction and lead to potential customer attrition. This logic equally applies in the context of AI chatbots. Chatbots that deliver high-quality experiences such as rapid responses, emotional empathy, and personalised communication can enhance customer satisfaction; conversely, inadequate performance may trigger frustration and distrust, diminishing customer loyalty. Existing research indicates that customer satisfaction serves not only as an outcome variable of service quality but also frequently functions as an intermediary or mediating variable, explaining how service quality influences customer loyalty or repeat purchase intent (Khan et al., 2022). High service quality indirectly strengthens customer loyalty by elevating satisfaction, thereby encouraging sustained relationships and repeat purchases.

2.2.4 Independent Variables:

2.2.4.1 Responsiveness:

Oktavia and Arifin (2024) explain that responsiveness refers to the ability to react rapidly and effectively to respond to changes or demands to something

or someone. Zeithaml et al. (2002), as cited in Yun and Park (2022), state that responsiveness is the willingness and ability of an organization to deliver prompt services and react when the customer faces inquiries and problems. In the context of customer service, responsiveness is associated with customer satisfaction, as it reflects the organization's attentiveness, agility, and commitment to meeting customer needs on time. A whole day of customer service support and a highly responsive chatbot can enhance the user experience by providing real-time assistance and immediate resolution. When users perceive that their inquiries are addressed promptly, they are more likely to feel valued and respected, thus resulting in increased satisfaction levels and stronger intentions to remain loyal to the brand.

2.2.4.2 Perceived ease of use

Schiopu et al. (2021), as cited in Vebrianti (2025), mention that perceived ease of use is the degree to which an information system is easy to use, straightforward, and needs minimal effort on the part of the user. This idea is especially pertinent to chatbots used in e-commerce, where interaction quality and ease of use can influence user engagement and satisfaction. As Azman et al. (2025) mention, consumers are more likely to be engaged when the chatbot becomes easy to use, intuitive, and easy to navigate. When a chatbot offers a seamless and straightforward interface, it can help users avoid feeling frustrated or confused during their interaction (Vebrianti et al., 2025). This is particularly important for new users or those with low levels of technological familiarity, such as elderly individuals or those who are not proficient in English. For example, many Malaysian e-commerce platforms, such as Shopee and Lazada, have implemented chatbots with option buttons to guide users, including "Check order", "Refund request", and "Contact customer services", among others. This allows users to access services without needing to type complex queries. This design significantly lowers the entry barrier for users, making the system more inclusive and accessible. Thus, it may improve user experience, increase consumer confidence in

using the system, and strengthen both decision-making and purchase intention.

2.2.4.3 Reliability

Within the dimension of service quality, reliability is regarded as a key factor influencing customer satisfaction and loyalty. Reliability is a capability to reliably and precisely provide services as promised (Singh et al., 2023). Past research indicates that high reliability in chatbots significantly enhances customer trust and confidence in the service process, thereby elevating perceptions of overall service quality (Yun and Park, 2022). When an AI chatbot consistently delivers accurate product information, provides swift and precise resolutions to order and logistics queries, and maintains uniform service performance across varying times and scenarios, customers perceive the enterprise as possessing high professionalism and stability. This sustained positive experience not only effectively boosted customer satisfaction but also fostered psychological dependence and commitment during prolonged interactions, thereby facilitating the formation and retention of customer loyalty.

2.2.4.4 Anthropomorphism

The term "anthropomorphism" describes the propensity to give non-human objects human features, emotions, and physical attributes (Klein and Martinez, 2022). By endowing chatbots with human-like language styles, tones, emotional responses, and even outward appearances, users are often more likely to make an emotional connection, which enhances the naturalness and intimacy of the interaction. In e-commerce environments, anthropomorphic features can compensate for the indifference in human-machine communication, enabling users to feel understanding and empathy despite the lack of human customer service. As Hsu and Lin (2023) point

out, attributing features to human entities can enhance emotional trust, improve interaction, and increase the likelihood of purchase. However, in practice, different levels of anthropomorphism may have different effects on users' cognitive, emotional, and behavioural responses. Moderate anthropomorphism can increase users' trust and acceptance of chatbots, making them more willing to interact with the system, whereas extreme anthropomorphism trigger the 'Uncanny Valley' effect, leading to discomfort or resistance (Yabes et al., 2024).

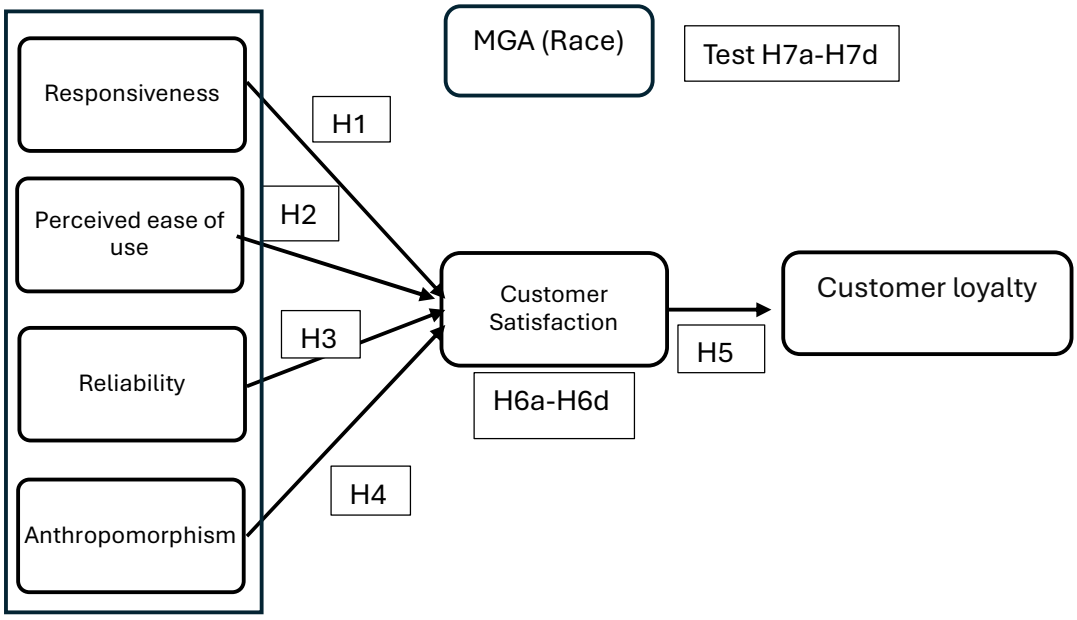
2.2.5 Grouping Variable in Multi-Group Analysis (MGA) as Moderator: Races

Malaysia is a distinctly multi-ethnic nation, primarily composed of Malays, Chinese, Indians, and other minority groups. Research has demonstrated that ethnic differences can lead to systematic variations in consumption preferences, values, and service expectations (Trinh et al., 2020). Within this multicultural context, customers interacting with AI chatbots may perceive and evaluate service quality differently based on their ethnic identity. In e-commerce environments, such ethnic differences may significantly moderate the relationship between chatbot service quality and customer satisfaction. For example, Malay consumers tend to prioritise politeness, respect, and alignment with religious values in communication traits consistent with high-context cultural interaction characteristics; while Chinese consumers may emphasise efficiency, accuracy, and practicality; and Indian consumers may prioritise interpersonal interaction and emotional engagement (Rizal et al., 2016). Consequently, the same chatbot service features may elicit varying levels of satisfaction and trust across different ethnic groups. Furthermore, ethnic differences may also shape how customer satisfaction translates into customer loyalty, as different groups may exhibit distinct levels of repurchase intention and brand stickiness once

they perceive satisfaction. Therefore, race is a key moderating variable to explore using Multi-Group Analysis.

2.3 Research Framework

Figure 1: Conceptual Framework



Notes: Multi-Group Analysis (MGA) will be applied to test whether structural relationships differ across ethnic groups.

2.4 Hypotheses

H1: Responsiveness of chatbots positively affects customer satisfaction.

H2: Perceived ease of use of chatbots positively affects customer satisfaction.

H3: Reliability of chatbot responses positively affects customer satisfaction.

H4: Anthropomorphism (human-like behavior) in chatbot communication positively affects customer satisfaction.

H5: Customer satisfaction mediates the relationship between chatbot service quality and customer loyalty.

H6a: Customer satisfaction mediates the relationship between chatbot responsiveness and customer loyalty.

H6b: Customer satisfaction mediates the relationship between perceived ease of use and customer loyalty.

H6c: Customer satisfaction mediates the relationship between reliability and customer loyalty.

H6d: Customer satisfaction mediates the relationship between anthropomorphism and customer loyalty.

H7a: The relationship between chatbot responsiveness and customer satisfaction differs across racial groups (Malay, Chinese, Indian, and Others).

H7b: The relationship between perceived ease of use and customer satisfaction differs across racial groups.

H7c: The relationship between reliability and customer satisfaction differs across racial groups.

H7d: The relationship between anthropomorphism and customer satisfaction differs across racial groups.

2.5 Research Gaps

Although chatbot-related research has expanded internationally, several gaps remain in academic literature. First, studies specifically examining chatbot service quality in Malaysian e-commerce are scarce, reducing the relevance of foreign findings to Malaysia's multicultural context. Second, few studies incorporate multiple chatbot service quality dimensions, including responsiveness, reliability, perceived ease of use, and anthropomorphism within a single integrative model. Third, anthropomorphism remains underexamined in real e-commerce settings, especially in culturally diverse societies. Fourth, the mediating role of customer satisfaction between chatbot service quality and customer loyalty has not been extensively tested. Finally, existing studies seldom apply Multi-Group Analysis (MGA) to explore racial or cultural differences, despite their potential influence on consumer perceptions. This study addresses these gaps by integrating multiple chatbot service quality constructs, testing satisfaction as a mediator, and comparing racial groups within the Malaysian e-commerce context.

CHAPTER 3: METHODOLOGY

3.1 Research Design

Causal research is use to investigate causal links between variables, typically involving one or more independent variables and their effects on one or more dependent variables. As noted by Pribesh and Gregory (2018), causal research systematically links causes to effects, thereby revealing the actual impact of independent variable changes on dependent variables. This study uses a causal research design to assess how chatbot service quality influences customer satisfaction within Malaysia's e-commerce environment and further affects customer loyalty. The causality research design is appropriate because its primary objective extends beyond merely describing customers' perceptions of chatbot services. It seeks to validate the causal relationships among service quality dimensions, customer satisfaction, and loyalty. Through this approach, we can determine whether changes in chatbot reliability, responsiveness, usability, or personification greatly impact client satisfaction, which in turn affects loyalty. When evaluating products, services, and brands, customers often mentally compare their expectations against actual performance (Garcia and Caro, 2008). Causal research offers a more scientific explanation of how this gap between expectations and reality translates into satisfaction or dissatisfaction, ultimately influencing whether customers are willing to repurchase or recommend the brand.

3.2 Sampling Design

The study's target group consists of Malaysian online customers who have previously dealt with AI chatbots on e-commerce sites like Shopee, Lazada, Zalora, and other online retailers (Afrina et al., 2025). These individuals are considered relevant respondents because they are directly exposed to chatbot services and are thus able to evaluate chatbot service quality, satisfaction, and loyalty based on their

personal experiences. The elements of the study are individual consumers, as perceptions and behavioral responses toward chatbot interactions are inherently subjective and vary across individuals. The sampling units are defined as Malaysian e-commerce users who have engaged with AI chatbots at least once during their shopping journey.

To reach this population, the sampling frame will include online communities, social media groups, and customer networks where e-commerce users are active, such as Facebook groups, online forums, and platform-specific communities. Given the broad and diverse nature of Malaysia's online shoppers, a non-probability approach, specifically purposive sampling, will be employed. As Rahman (2023) notes, non-probability sampling generally requires less time and resources than probability-based techniques. Purposive sampling, or judgmental sampling, selects participants with specific key characteristics and is effective when eligible subjects are limited (Vehovar et al., 2016). To enhance representativeness, selection criteria will be based on research objectives, including transaction frequency, platform experience, and familiarity with online shopping. This increases the validity and reliability of the results by ensuring that only respondents who have actually interacted with chatbots are included.

According to Lakens (2022), a larger sample size enables researchers to obtain more precise, stable, and meaningful statistical estimates. Additionally, Rahman (2023) recommends that for basic research models with regularly distributed data, a sample size of 100–200 respondents is sufficient.

This study initially used G*Power to do an a priori power analysis in order to ascertain the minimal necessary sample size. According to G*Power, a minimum of 116 respondents are required for a model with five variables in order to have sufficient statistical power. This guarantees that there is enough statistical power to identify medium effect sizes. Beyond G*Power, this study also follows the 10-times rule commonly applied in PLS-SEM, which states that the minimum sample size needed should be ten times the maximum number of indicators used to quantify a single construct (Hair et al., 2011, as cited by Kock and Hadaya, 2018). As the

measurement model in this study includes 24 items, the minimum recommended sample size under this rule is 240 respondents. To ensure robustness, reliability, and the stability of the PLS-SEM results, the study successfully collected 240 valid responses, meeting and exceeding the methodological requirements.

3.3 Data Collection Methods

This study utilize a quantitative research method, and data collection for this project primarily through a self-administered online questionnaire distributed via Google Form. Google Forms was selected as the primary distribution tool because of its accessibility, cost-effectiveness, and efficiency in reaching a large pool of respondents within a short time frame (Hasan and Bakar, 2022). Especially in the Malaysian e-commerce context, where internet usage is widespread.

3.4 Research Instrument

A multi-section structured questionnaire serves as the research tool. In the first portion, demographic data is gathered on a nominal scale, including age, gender, education, and experience purchasing online. Nominal scales categorise data into distinct groups without any inherent order, making them suitable for variables like gender, education level, and online shopping experience, where the categories are mutually exclusive but not ordered (Margolis, 1998). The subsequent sections measure the key constructs of the study, including chatbot service quality, customer satisfaction, and customer loyalty, using established Likert-scale items adapted from prior research. According to Taherdoost (2019), a Likert scale is an assessment technique where participants indicate how much they agree or disagree with a set of statements about a certain attitude, item, person, or event. The Likert scale is chosen because it allows for standardised, quantifiable responses, facilitating statistical analysis and comparison across participants while capturing the intensity of their attitudes and perceptions. Therefore, a 7-point Likert scale ranging from

"strongly disagree" to "strongly agree" is employed in the research to capture respondents' perceptions.

3.4.1 Demographic Information

The demographic section collected information on respondents' background, including:

Table 3.4.1: Demographic Questions

Demographic	**Instrument**
Gender	• Male • Female • Prefer not to say
Age	• 20 and below • 21-28 (Gen Z) • 29-44 (Gen Y) • 45-60 (Gen X) • Above 60
Race	• Chinese • Malay • Indian • others
Level of education	• SPM or below • Diploma • Bachelor's Degree • Master's Degree • others

E-commerce platform usage frequency	• Everyday • Several times a week • Once a week • 2-3 times a month • Once a month • Less than once a month • Never use
How often do you use customer service chatbots on an e-commerce platform	• Rarely to very often

Source: Developed for research

These variables were included to profile respondents and ensure the sample represented Malaysia's multicultural consumer base.

3.4.2 Measurement of Variables

The constructs used in this study were adopted directly from Chen et al. (2021) without modification to ensure validity and reliability. These constructs are summarised in **Table 3.4.2** below.

Table 3.4.2 Construct Items

Construct	**Dimension**	**Indicators**	**Literature source**
Chatbot Services Quality	Responsiveness	(1) This AI chatbot is available at 7 days x 24 h. (2) I can get the AI chatbot service at any time. (3) This AI chatbot is always online. (4) I can always find the AI chatbot online.	Venkatesh et al. (2011)

		(5) This AI chatbot will respond to me at any time. (6) I can get this AI chatbot at any time throughout the day.	
	Reliability	(1) This AI chatbot can accurately understand what I say. (2) The response from this AI chatbot is accurate. (3) The answer of this AI chatbot corresponds to the question I asked. (4) The answer from this AI chatbot meets my expectations.	Mayer and Davis (1999)
	Ease of use	(1) It is easy to become skillful at using the AI chatbot. (2) Learning to interact with the AI chatbot is easy. (3) The AI chatbot is flexible to interact with. (4) My interaction with the AI chatbot is clear and understandable.	Gefen et al. (2003)
	Anthropomorphism	(1) I feel that this AI chatbot puts my interests first. (2) I feel that this AI chatbot is serving me attentively. (3) This AI chatbot makes me feel concerned.	Pitt et al. (1995)
Customer Satisfaction		(1) Overall, I feel extremely satisfied with this AI chatbot.	Fang et al. (2014)

		(2) Overall, I feel extremely pleased with this AI chatbot. (3) My expectations of this AI chatbot is achieved. (4) I would recommend this AI chatbot to friends.	
Customer loyalty		(1) I will suggest this organizations' products or services to other customers. (2) I intend to keep purchasing products or services from this organization. (3) I will recommend this organizations' products or services to others.	Fang (2019)

Adopted from: Chen, Q., Lu, Y., Gong, Y., & Xiong, J. (2023). Can AI chatbots help retain customers? Impact of AI service quality on customer loyalty. Internet Research, 33(6), 2205–2243. https://doi.org/10.1108/intr-09-2021-0686

3.5 Validity and Reliability

Table 3.5.1: Fornell-Larcker criterion (Pilot Test)

	A	CL	CS	PEU	RL	RP
A	0.913					
CL	0.745	0.945				
CS	0.731	0.861	0.934			
PEU	0.79	0.887	0.759	0.898		
RL	0.626	0.768	0.846	0.772	0.934	
RP	0.743	0.762	0.583	0.834	0.57	0.944

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Table 3.5.2: Reliability and Validity (Pilot Test)

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
A	0.9	0.907	0.938	0.834
CL	0.94	0.942	0.962	0.893
CS	0.95	0.951	0.965	0.872
PEU	0.92	0.923	0.943	0.806
REL	0.95	0.956	0.964	0.872
REP	0.975	0.978	0.98	0.891

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Before the main survey, a pilot test was carried out to guarantee the validity and reliability of the data obtained. The pilot test involved a small group of respondents (n = 30) who shared similar characteristics with the target population. The pilot test's objective was to assess the clarity of the questionnaire items, identify potential ambiguities, and ensure that the constructs measured were appropriate for the Malaysian e-commerce context. Feedback from the pilot test was used to refine the wording of questions and improve the overall structure of the instrument.

3.6 Data Analysis Techniques

The structured data collection approach ensures standardised responses suitable for statistical analysis. Two primary tools will be used: Microsoft Excel and SmartPLS 4.0. Microsoft Excel will support descriptive analysis of demographic data through frequencies and percentages to summarise respondent profiles. SmartPLS 4.0 will be used to analyse the main constructs using Structural Equation Modeling (SEM), enabling simultaneous testing of multiple relationships and validation of both measurement and structural models. In addition, Multi-Group Analysis will assess the moderating effect of race by comparing structural paths across Malays, Chinese, Indians, and other minority groups. This method offers an extensive overview of how customer happiness and loyalty are impacted by chatbot service quality across Malaysia's various ethnic groups.

3.7 Ethical Consideration

To safeguard the rights and welfare of participants, this study complies with accepted ethical research guidelines. Respondents were informed of the goal of the study prior to giving their assent, and participation was entirely voluntary. Anonymity and confidentiality are guaranteed, as no identifying personal information will be collected or disclosed. All responses will be only used for academic purposes, stored securely, and reported in aggregate form. Furthermore,

this research has obtained formal ethical clearance from the UTAR Scientific and Ethical Review Committee (SERC). The survey questionnaire, research procedures, and data management protocols were reviewed and approved by the committee to ensure compliance with institutional ethical guidelines. This approval confirms compliance with institutional ethical guidelines, including participant protection, transparency, and responsible handling of research data.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter presents the data analysis and discusses the findings in relation to the research objectives and hypotheses. The study investigates how AI chatbot service quality influences customer satisfaction and loyalty within the e-commerce context. PLS-SEM was used to assess both the measurement model, which evaluates reliability and validity, and the structural model, which tests the hypothesised relationships. A Multi-Group Analysis (MGA) was also conducted to examine differences across racial groups (Chinese, Malay, Indian, and Others). This approach identifies how cultural backgrounds may shape perceptions of chatbot service quality and subsequently influence satisfaction and loyalty. Variations in cultural values and expectations can affect how users interpret dimensions such as reliability, responsiveness, and anthropomorphism. The results presented in this chapter provide an overview of the measurement properties, structural relationships, mediation effects, and group-level differences, highlighting both the overall model and the moderating role of race in shaping customer experiences.

4.1 Measurement and data collection

A total of **240 respondents** participated in this study. The demographic distribution provides useful insights into the characteristics of the sample and helps contextualise the study's findings. The demographic results are summarised and interpreted as follows.

Table 4.1.1: Summary of Respondents' Demographics

Measure	Item	Frequency	Percentage (%)
Gender	Female	131	54.6
	Male	73	30.4
	Prefer not to say	36	15.0
Age	20 and below	50	20.8
	21-28 (Gen Z)	97	40.4
	29-44 (Gen Y)	44	18.3
	46-60 (Gen X)	46	19.2
	above 60	3	1.3
Race	Chinese	95	39.6
	Malay	42	17.5
	Indian	52	21.7
	others	51	21.3
Level of education	SPM or below	96	40
	Diploma	29	12.1
	Bachelor's degree	94	39.2
	Master's degree	16	6.7
	Others	5	2.1
E-commerce platform usage frequency	Everyday	50	20.8
	Several times a week	49	20.4
	Once a week	34	14.2
	2-3 times a month	37	15.4
	Once a month	21	8.8
	Less than once a month	49	20.4
	Never use	0	0
How often do you use customer service chatbots on e-commerce platforms	1 (Rarely)	31	12.9
	2	38	15.8

	3	25	10.4
	4	89	37.1
	5 (Very Often)	57	23.8

Source: Developed from the research.

The sample consists of 54.6% females (n = 131), 30.4% males (n = 73), and 15.0% (n = 36) who did not disclose their gender, indicating a female majority. Younger age groups dominate, with Generation Z (21–28 years) at 40.4% (n = 97) and those 20 and below at 20.8%. Gen Y (29–44 years) represents 18.3%, Gen X (46–60 years) 19.2%, and only 1.3% are above 60, reflecting a sample largely composed of digitally active consumers. Racially, participants include 39.6% Chinese, 17.5% Malay, 21.7% Indian, and 21.3% from other ethnic groups, providing diverse representation. Educationally, 40% hold SPM or below, 12.1% a Diploma, 39.2% a Bachelor's degree, 6.7% a Master's degree, and 2.1% other qualifications.

Regarding e-commerce engagement, 20.8% use platforms daily, 20.4% several times a week, 14.2% weekly, and 8.8% monthly, with none reporting no usage. For chatbot usage, 60.9% frequently use these services (ratings 4–5), indicating strong familiarity. Overall, the sample reflects digitally active consumers well-suited for examining chatbot service quality, customer satisfaction, and loyalty in Malaysia's e-commerce context.

4.2 Measurement Model Assessment

Table 4.2.1: Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
A	0.832	0.832	0.899	0.749
CL	0.92	0.92	0.949	0.862
CS	0.951	0.951	0.965	0.872
PEU	0.931	0.931	0.951	0.828
REL	0.925	0.926	0.947	0.817
REP	0.865	0.872	0.898	0.594

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Cronbach's alpha, composite reliability rho_a and rho_c, and Average Variance Extracted were used to evaluate the measurement model's reliability and convergent validity (Hair, 2018). With Cronbach's alpha values between 0.832 and 0.951, rho_a between 0.832 and 0.926, and rho_c between 0.898 and 0.965, all constructs showed good internal consistency, above the suggested criterion of 0.70 (Hair et al., 2021). Convergent validity was also established, as AVE values ranged from 0.594 to 0.872 and met the minimum criterion of 0.50. **CS** and **CL** showed the highest reliability and convergent validity, while **REP** recorded a lower AVE but remained within acceptable limits. Overall, the results confirm that the constructs are measured properly and dependably, supporting further structural model analysis.

Table 4.2.2: Fornell-Larcker criterion

	A	CL	CS	PEU	REL	REP
A	0.865					
CL	0.562	0.929				
CS	0.619	0.917	0.934			
PEU	0.551	0.877	0.873	0.91		
REL	0.487	0.844	0.884	0.794	0.904	
REP	0.375	0.367	0.324	0.42	0.367	0.771

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Cross-loadings and the Fornell-Larcker criterion were used to evaluate discriminant validity. The square root of each construct's AVE should be higher than its correlations with other constructs in accordance with the Fornell-Larcker criteria (Hair et al., 2021). In this study, all constructs satisfy this requirement. For instance, each construct shares more variance with its own indicators than with other constructs, as seen by the square roots of AVE for **A** (0.865), **CL** (0.929), **CS** (0.934), **PEU** (0.910), **REL** (0.904), and **REP** (0.771) being greater than their corresponding inter-construct correlations.

Table 4.2.3 Cross Loading

	A	CL	CS	PEU	REL	REP
A1	0.883	0.482	0.529	0.507	0.433	0.353
A2	0.857	0.492	0.541	0.509	0.439	0.397
A3	0.856	0.484	0.537	0.415	0.393	0.223
CL1	0.478	0.931	0.832	0.815	0.766	0.347
CL2	0.54	0.923	0.862	0.8	0.786	0.328
CL3	0.546	0.932	0.859	0.826	0.797	0.349
CS1	0.571	0.824	0.924	0.821	0.814	0.319
CS2	0.571	0.885	0.94	0.819	0.842	0.294
CS3	0.582	0.861	0.948	0.813	0.837	0.274
CS4	0.589	0.853	0.924	0.808	0.808	0.324
PEU1	0.475	0.829	0.81	0.915	0.725	0.383
PEU2	0.487	0.8	0.791	0.894	0.707	0.381
PEU3	0.536	0.797	0.786	0.917	0.743	0.385
PEU4	0.51	0.764	0.79	0.913	0.714	0.378
REL1	0.405	0.75	0.763	0.729	0.886	0.368
REL2	0.461	0.78	0.816	0.724	0.909	0.298
REL3	0.436	0.742	0.788	0.716	0.912	0.349
REL4	0.457	0.778	0.826	0.703	0.909	0.314
REP1	0.287	0.281	0.282	0.32	0.304	0.767
REP2	0.325	0.283	0.264	0.344	0.311	0.772
REP3	0.193	0.209	0.157	0.258	0.192	0.746
REP4	0.312	0.314	0.283	0.35	0.31	0.797
REP5	0.339	0.281	0.238	0.356	0.267	0.762
REP6	0.242	0.306	0.232	0.29	0.274	0.78

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Cross-loading analysis further supports discriminant validity. Each indicator shows the highest loading on its associated construct compared to all other constructs. For example, all **CS** indicators load above 0.924 on **CS**, which is higher than their loadings on other constructs, while **PEU** indicators, such as **PEU1–PEU4**, load above 0.894 on **PEU** and lower on other constructs. Although some constructs, such as **REL** and **CL**, show moderate cross-loadings with related constructs, their highest loadings remain with their respective constructs, confirming discriminant validity.

Overall, the Fornell-Larcker criterion and cross-loading analysis show that the study's constructs have sufficient discriminant validity, meaning that each construct is empirically unique and assesses distinct facets of customer satisfaction, customer loyalty, and AI chatbot service quality (Hair, 2021).

Table 4.2.4: Variance Inflation Factor (VIF)

	VIF
A1	2.152
A2	1.85
A3	1.852
CL1	3.524
CL2	3.116
CL3	3.492
CS1	4.095
CS2	4.819
CS3	5.509
CS4	4.055
PEU1	3.513
PEU2	2.921
PEU3	3.695
PEU4	3.493
REL1	2.795
REL2	3.275
REL3	3.425
REL4	3.244
REP1	1.695
REP2	1.802
REP3	1.853
REP4	1.864
REP5	1.794
REP6	1.891

To evaluate any multicollinearity among the constructions' indicators, the VIF was looked at. All indicators' VIF values fell between 1.695 and 5.509, suggesting that multicollinearity is often within acceptable bounds. Specifically, the **A** indicators ranged from 1.850 to 2.152, showing low multicollinearity. **CL** indicators ranged from 3.116 to 3.524, and **CS** indicators ranged from 4.055 to 5.509, indicating moderate collinearity; **CS3**, in particular, approached the higher threshold of 5, suggesting some shared variance among satisfaction items. **PEU** indicators ranged from 2.921 to 3.695, and **REL** indicators ranged from 2.795 to 3.425, reflecting moderate but acceptable multicollinearity. **REP** indicators displayed the lowest VIF values, ranging from 1.695 to 1.891, indicating that the items are distinct and independent. Overall, the VIF results show that the measurement model is not seriously threatened by multicollinearity, and the indicators can reliably contribute to the assessment of their respective constructs.

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

4.3 Structural Model Assessment

Table 4.3.1: Direct Relationships

Hypotheses	Beta(β)	T statistics	P values	Result
A -> CS	0.184	4.533	0	Supported
CS -> CL	0.917	58.202	0	Supported
PEU -> CS	0.418	6.254	0	Supported
REL -> CS	0.5	7.089	0	Supported
REP -> CS	-0.104	3.38	0	Supported

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness. *Relationships are significant at P<0.05.

Source: Result from SmartPLS software

The findings show that **A** significantly and favorably affects **CS** ($\beta = 0.184$, $t = 4.533$, $p < 0.001$), indicating that consumers who think AI is more human-like are more likely to be satisfied. Additionally, **PEU** has a favorable impact on **CS** ($\beta = 0.418$, $t = 6.254$, $p < 0.001$), highlighting the importance of usability in increasing satisfaction. Another significant predictor of **CS** is **REL** ($\beta = 0.500$, $t = 7.089$, $p < 0.001$), demonstrating that reliable and consistent service boosts pleasure.

Interestingly, **REP** exhibits a negative but significant effect on **CS** ($\beta = -0.104$, $t = 3.380$, $p < 0.001$), suggesting that higher responsiveness may slightly reduce satisfaction, which could reflect customer perceptions of response quantity over quality. Finally, **CS** has a very strong positive effect on **CL** ($\beta = 0.917$, $t = 58.202$, $p < 0.001$), suggesting that happy consumers are quite likely to stick around. All things considered, **A, PEU**, and **REL** are major factors that influence **CS**, which is the primary factor that determines customer loyalty, while **REP** requires further interpretation due to its unexpected negative effect.

Table 4.3.2: Mediation Analysis

Hypotheses	Beta(β)	T statistics	P values	Result
PEU -> CS -> CL	0.383	6.077	0	Supported
REL -> CS -> CL	0.459	7.205	0	Supported
REP -> CS -> CL	-0.095	3.435	0	Supported
A -> CS -> CL	0.168	4.564	0	Supported

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness. *Relationships are significant at P<0.05

Source: Result from SmartPLS software

Mediation analysis was conducted to assess the indirect effects of **A, PEU, REL, and REP** on **CL** through **CS**. The results show that **CS** significantly mediates all four relationships. Specifically, **PEU** has a positive mediating effect on **CL** through CS ($\beta = 0.383$, $t = 6.077$, $p < 0.001$), indicating that ease of use enhances satisfaction, which, in turn, strengthens loyalty. **REL** also demonstrates a strong positive mediated effect ($\beta = 0.459$, $t = 7.205$, $p < 0.001$), confirming that reliability fosters loyalty via satisfaction. **A** similarly shows a significant positive mediation effect ($\beta = 0.168$, $t = 4.564$, $p < 0.001$). In contrast, **REP** exhibits a negative but significant mediated effect ($\beta = -0.095$, $t = 3.435$, $p < 0.001$), suggesting that higher responsiveness may slightly reduce satisfaction, which subsequently affects loyalty. These results demonstrate the critical function of **CS** as a mediator in converting customer perceptions and service quality into loyalty outcomes.

Table 4.3.3: Coefficient of Determination

	R-square	R-square adjusted
CL	0.84	0.839
CS	0.887	0.885

Note(s): A: CL: Customer Loyalty; CS: Customer Satisfaction

Source: Result from SmartPLS software

The model demonstrates strong predictive power, as indicated by the R^2 values of the endogenous constructs. **CS** has an R^2 of 0.887 (adjusted R^2 = 0.885), meaning that approximately 88.7% of the variance in **CS** is explained by **A**, **PEU, REL,** and **REP**. According to Hair et al. (2013), R^2 values of 0.75, 0.50, and 0.25 can be interpreted as substantial, moderate, and poor predictive accuracy, respectively. Therefore, the R^2 value of **CS** indicates substantial predictive accuracy. **CL** has an R^2 of 0.840 (adjusted R^2 = 0.839), which also falls within the substantial range, indicating that 84% of the variance in **CL** is explained by **CS**.

Table 4.3.4: Effect Size

	f-square
A -> CS	0.2
CS -> CL	5.255
PEU -> CS	0.504
REL -> CS	0.811
REP -> CS	0.076

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

The effect size (f^2) analysis provides further insight into how each predictor affects the endogenous constructs. Based on Hair et al. (2013) guidelines, values of 0.02, 0.15, and 0.35 represent small, medium, and large effects. The result shows that **REL** has a very large effect on **CS** (f^2 = 0.811). **PEU** also exerts a large effect (f^2 =

0.504). **A** show a medium effect ($f^2 = 0.200$), whereas **REP** demonstrates a small effect ($f^2 = 0.076$). Additionally, **CS** has an exceptionally large effect on **CL** ($f^2 = 5.255$), far exceeding the conventional thresholds and confirming its critical role in driving loyalty.

Overall, these results indicate that **REL** and **PEU** are the strongest predictors of **CS**, **A** has a moderate influence, and **REP** provides only a minor contribution. Meanwhile, **CS** overwhelmingly determines **CL**, emphasizing its central mediating role in the model and supporting the robustness of structural relationships.

4.4 Multi-Group Analysis (MGA)

Table 4.4.1: Measurement Invariance of Composite Models (MICOM)

Group Comparison	Construct	Original Correlation	5% Quantile	Permutation p-value	Compositional Invariance	Step 3: Equal Means & Variances
Chinese vs Malay	A	0.999	0.991	0.612	Yes	Yes
	CL	1	1	0.871	Yes	Yes
	CS	1	1	0.853	Yes	Yes
	PEU	1	1	0.968	Yes	Yes
	REL	1	1	0.277	Yes	Yes
	REP	0.999	0.95	0.881	Yes	Yes
Chinese vs Indian	A	0.999	0.988	0.692	Yes	Yes
	CL	0.365	1	0	No	No
	CS	0.995	1	0	No	No
	PEU	0.997	0.999	0.001	No	No
	REL	0.979	1	0	No	No
	REP	0.99	0.976	0.232	Yes	Yes
Chinese vs Other	A	0.994	0.988	0.224	Yes	Yes

	CL	1	1	0.152	Yes	Yes
	CS	1	1	0.039	No	No
	PEU	1	1	0.737	Yes	Yes
	REL	0.999	1	0.009	No	No
	REP	-0.029	0.956	0	No	No
Malay vs Indian	A	0.998	-0.424	0.518	Yes	Yes
	CL	0.197	-0.928	0.099	Yes	Yes
	CS	0.982	0.031	0.483	Yes	Yes
	PEU	0.986	-0.332	0.73	Yes	Yes
	REL	0.915	-0.598	0.59	Yes	Yes
	REP	0.98	-0.336	0.804	Yes	Yes
Malay vs Other	A	0.999	0.985	0.65	Yes	Yes
	CL	1	0.999	0.251	Yes	Yes
	CS	1	1	0.466	Yes	Yes
	PEU	1	0.98	0.962	Yes	Yes
	REL	0.998	0.99	0.33	Yes	Yes
	REP	0.065	0.47	0.009	No	No
Indian vs Other	A	0.992	0.952	0.507	Yes	Yes
	CL	0.253	0.989	0.003	No	No
	CS	0.988	0.996	0.023	No	No
	PEU	0.978	0.779	0.345	Yes	Yes
	REL	0.932	0.96	0.025	No	No
	REP	-0.17	-0.607	0.249	Yes	Yes

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Before conducting the MGA, the MICOM procedure was carried out to ensure that the constructs were measured equivalently across the four racial groups (Chinese, Malay, Indian, Others). Following the three-step MICOM procedure proposed by Henseler et al. (2016), results show that Step 1: Configural invariance was established, as all groups used identical indicators, data treatment procedures, and algorithm settings.

For Step 2: Compositional invariance, the permutation tests revealed that the majority of constructs achieved compositional invariance across most group comparisons, as the original correlations were not significantly different from the distribution of permuted correlations ($p > 0.05$). This indicates that the composites were formed in a similar way across groups, satisfying the minimum requirement for measurement invariance.

In Step 3: Equality of means and variances, some constructs showed significant differences between certain racial groups (e.g., Chinese vs Indian, Indian vs Others), indicating that full measurement invariance was not achieved. However, according to Henseler et al. (2016), partial measurement invariance is sufficient to proceed with MGA, as Steps 1 and 2 were satisfied. Therefore, the MGA results remain valid and interpretable.

Overall, the MICOM analysis confirms partial measurement invariance, enabling meaningful comparison of path coefficients across racial groups in subsequent MGA analyses.

Table 4.4.2: Multi-Group Analysis (MGA) Result

Hypotheses	Difference (Chinese - Indian)	P-Value	Result	Difference (Chinese - Malay)	P-Value	Result	Difference (Chinese - Others)	P-Value	Result
A -> CS	-0.373	0.149	Not Supported	-0.344	0.089	Not Supported	0.011	0.903	Not Supported
CS -> CL	0.709	0	Supported	0.002	0.585	Not Supported	0.003	0.902	Not Supported
PEU -> CS	0.463	0.04	Supported	0.031	0.982	Not Supported	0.165	0.278	Not Supported
REL -> CS	0.657	0.022	Supported	0.489	0.011	Supported	-0.128	0.414	Not Supported
REP -> CS	-0.386	0.318	Not Supported	-0.132	0.424	Not Supported	-0.011	0.902	Not Supported

Hypotheses	Difference (Indian - Malay)	P-Value	Result	Difference (Indian - Others)	P-Value	Result	Difference (Malay - Others)	P-Value	Result
A -> CS	0.029	0.9	Not Supported	0.383	0.159	Not Supported	0.354	0.104	Not Supported
CS -> CL	-0.708	0.103	Not Supported	-0.707	0.003	Supported	0.001	0.582	Not Supported
PEU -> CS	-0.432	0.149	Not Supported	-0.298	0.264	Not Supported	0.134	0.467	Not Supported
REL -> CS	-0.169	0.57	Not Supported	-0.785	0.011	Supported	-0.616	0.006	Supported
REP -> CS	0.254	0.476	Not Supported	0.375	0.332	Not Supported	0.121	0.478	Not Supported

Note(s): A: Anthropomorphism; CL: Customer Loyalty; CS: Customer Satisfaction; PEU: Perceived Ease of Use; REL: Reliability; REP: Responsiveness

Source: Result from SmartPLS software

Multi-group analysis was conducted to examine whether the structural relationships differ across racial groups, namely Chinese, Indian, Malay, and Others. The results indicate that the effect of **A** on **CS** and **REP** on **CS** showed no significant differences across any of the racial groups (all p-values > 0.05), suggesting that these relationships are consistent regardless of race. In contrast, the relationship between **CS** and **CL** differed significantly between Chinese and Indian respondents (difference = 0.709, p = 0.000) and between Indian and Others (difference = -0.707, p = 0.003), while no significant differences were found between Chinese and Malay, Chinese and Others, or Malay and Others. This indicates that the satisfaction-loyalty link is stronger for Chinese respondents compared to Indian respondents and also differs between Indian and Other respondents.

For **PEU** on **CS**, a significant difference was observed only between Chinese and Indian respondents (difference = 0.463, p = 0.040), indicating that ease of use has a stronger impact on satisfaction for Chinese respondents, while the effect remains consistent across other racial comparisons. **REL** on **CS** showed multiple significant differences: Chinese respondents were more influenced by **REL** than Indian respondents (difference = 0.657, p = 0.022) and Malay respondents (difference = 0.489, p = 0.011). Significant differences were also found between Indian and Others (difference = -0.785, p = 0.011) and between Malays and Others (difference = -0.616, p = 0.006), indicating that the influence of reliability on satisfaction varies substantially across racial groups.

Overall, these results suggest that while **A** and **REP** operate similarly across all racial groups, the effects of **CS**, **PEU,** and **REL** on satisfaction and loyalty are moderated by race. This highlights the importance of considering racial or cultural differences when evaluating customer perceptions and loyalty outcomes, as some service quality dimensions may resonate differently with different demographic groups.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATION

5.0 Discussion of Findings

This study aimed to examine how AI chatbot service quality influences customer satisfaction and, subsequently, customer loyalty in the Malaysian e-commerce sector. The results provide several theoretical insights and practical observations.

5.1 Discussion of Findings Based on Research Objectives

RO1: To examine the effect of chatbot responsiveness on customer satisfaction in the Malaysian e-commerce sector.

Responsiveness shows a significant but negative effect on customer satisfaction. Although responsiveness is traditionally associated with higher satisfaction (Zeithaml et al., 2002), the negative coefficient suggests that Malaysian users may perceive rapid or automated replies as generic, impersonal, or unhelpful. This aligns with Huang and Dootson (2022), who argue that fast responses without meaningful content may frustrate users. Similarly, Ashfaq et al. (2020) found that repeated and template-like messages reduce perceived service quality. These findings indicate that while responsiveness remains important, customers prioritise response quality over speed, especially when interacting with AI-driven systems. Therefore, RO1 is achieved and reveals a counterintuitive relationship that challenges traditional assumptions about service speed.

RO2: To evaluate how the perceived ease of use of chatbots impact on customer satisfaction among Malaysian online shoppers.

Perceived ease of use shows a strong positive influence on satisfaction, supporting TAM-based research that enhances the usability of perceived service value (Schiopu et al., 2021). When chatbots are intuitive and easy to navigate, customers feel more confident and less mentally burdened, which is consistent with findings by Azman et al. (2025) and Vebrianti et al. (2025). Malaysian users, therefore, appear to value simple interfaces, clear instructions, and minimal effort during chatbot interactions. RO2 is fully met, confirming the importance of usability in AI service systems.

RO3: To investigate the relationship between chatbot reliability and customer satisfaction in e-commerce platforms in Malaysia.

Reliability emerges as the strongest predictor of customer satisfaction, reinforcing earlier studies emphasising the importance of correctness and accuracy in AI-driven services (Yun & Park, 2022; Jenneboer et al., 2022). Malaysian customers rely on chatbots for order updates, issue resolution, and accurate product information; thus, inconsistent or incorrect responses significantly weaken trust. The results demonstrate that online shoppers in Malaysia highly prioritise trustworthiness, accuracy, and problem-solving capability in chatbot interactions. RO3 is fully achieved.

RO4: To determine the influence of chatbot anthropomorphism (human-like behavior) on customer satisfaction in e-commerce.

Anthropomorphism has a positive and significant influence on customer satisfaction. Human-like qualities, such as friendly tone, natural conversational flow, and perceived empathy, make interactions more pleasant and engaging. This finding supports Hsu and Lin (2023), who showed that anthropomorphic characteristics enhance emotional connection and trust. Although some studies warn that excessive

human-likeness can cause discomfort (Yabes et al., 2024), the moderate level used by chatbots in this study strengthens the user experience. Malaysian consumers respond favourably to chatbots that feel personable without being overly human. RO4 is thus achieved.

RO5: To determine whether the structural relationships between chatbot service quality (responsiveness, reliability, perceived ease of use, anthropomorphism) and customer satisfaction differ across racial groups using Multi-Group Analysis (MGA).

The Multi-Group Analysis reveals meaningful racial differences in how chatbot service quality influences satisfaction and loyalty. While responsiveness and anthropomorphism show consistent effects across all groups, significant differences appear in perceived ease of use, reliability, and the satisfaction–loyalty relationship.

Chinese respondents place the highest importance on ease of use and reliability. The effect of ease of use on satisfaction is significantly stronger among Chinese users compared to Indian users, and reliability has a stronger effect among Chinese respondents than among both Malay and Indian groups. This is consistent with research showing that Chinese consumers emphasise efficiency, usability, and accuracy in digital interactions (Rizal et al., 2016). Malay users show moderate sensitivity to reliability, reflecting balanced expectations regarding stability, politeness, and clarity. Indian respondents rely less on ease of use and reliability, aligning with Trinh et al. (2020), who suggest that Indian consumers place greater value on interpersonal warmth and relational cues during service encounters.

The satisfaction–loyalty relationship also varies significantly. Chinese respondents exhibit the strongest satisfaction–loyalty linkage, suggesting that they are more likely to translate satisfaction directly into long-term loyalty. Conversely, Indian respondents show a weaker linkage, indicating that additional relational or emotional engagement may be needed before satisfaction leads to loyalty.

Overall, RO5 is achieved, confirming that racial differences meaningfully influence how Malaysian consumers evaluate chatbot service quality and its outcomes.

RO6: To assess how customer loyalty and chatbot service quality are mediated by customer satisfaction.

Customer satisfaction has a strong and significant effect on loyalty, confirming that it is the primary driver of repeat usage and commitment. This aligns with Oliver's (1999) expectation-confirmation theory and prior research in Malaysian e-commerce (Kassim & Abdullah, 2008; Surjandy & Cassandra, 2023). The strength of this relationship indicates that consumers are more likely to return, make more purchases, and refer others to the platform when they are happy with their experiences with chatbots. RO6 is fully achieved.

5.2 Discussion of Findings Based on Hypotheses

H1: Responsiveness positively affects customer satisfaction.

H1 is supported, indicating that responsiveness significantly influences customer satisfaction. However, the findings suggest that responsiveness enhances satisfaction only when responses are perceived as useful and relevant**.** While prompt replies are generally valued by users, overly automated or repetitive responses may weaken the positive impact of responsiveness. This indicates that customers interpret responsiveness not merely as speed, but as the ability of the chatbot to provide timely and meaningful assistance. Consistent with prior studies, responsiveness contributes positively to satisfaction when it is aligned with response accuracy and problem resolution rather than speed alone.

H2: Perceived ease of use positively affects customer satisfaction.

H2 is supported. The findings confirm that chatbots that are easy to understand and navigate enhance customer satisfaction. This result aligns with technology acceptance theories, which emphasize that simple and intuitive systems improve user experiences. In the Malaysian e-commerce context, ease of use is particularly important due to linguistic diversity and varying levels of digital literacy.

H3: Reliability positively affects customer satisfaction.

H3 is supported, with reliability emerging as the most influential factor in shaping customer satisfaction. This indicates that customers place high importance on chatbots that provide accurate, consistent, and dependable responses. Reliable performance reduces uncertainty and frustration, especially for transactional inquiries, thereby strengthening user trust and satisfaction.

H4: Anthropomorphism positively affects customer satisfaction.

Supported. Human-like features, such as friendly language and conversational tone, contribute positively to customer satisfaction by enhancing emotional comfort and engagement. Although its impact is weaker than reliability and ease of use, anthropomorphism still plays a meaningful role in creating a more pleasant chatbot interaction experience.

H5: Customer satisfaction positively affects customer loyalty.

H5 is strongly supported**.** Customer loyalty is significantly impacted by customer happiness, meaning that happy customers are more likely to stick with and utilize the e-commerce platform. This result confirms that in AI-enabled service environments, customer happiness is a major factor in fostering loyalty.

H6a–H6d: Customer satisfaction mediates the relationships between service quality dimensions and customer loyalty.

All mediation hypotheses are supported. Customer satisfaction significantly mediates the relationships between chatbot service quality dimensions and customer loyalty. This confirms that improvements in chatbot performance influence loyalty primarily by enhancing customer satisfaction, highlighting satisfaction as a critical pathway linking chatbot service quality to long-term customer commitment.

H7a–H7d: Structural relationships differ across racial groups.

The findings for H7 indicate that the hypothesis is only partially supported. The impacts of anthropomorphism and responsiveness on customer satisfaction do not significantly differ by race, indicating that these correlations hold true for all populations. Nonetheless, notable variations were discovered in the link between customer happiness and customer loyalty as well as the effect of perceived dependability and simplicity of use on consumer satisfaction. This indicates that while certain chatbot qualities are seen similarly across racial groups, others are rated differently.

5.3 Implication

5.3.1 Practical Implications

The findings of this study carry meaningful practical implications for e-commerce businesses in Malaysia. First, the results indicate that reliability, anthropomorphism, and perceived ease of use strongly influence satisfaction, suggesting that companies should enhance the accuracy of

chatbot responses, simplify interface design, and incorporate moderate human-like communication, such as friendly tone and conversational warmth, to enhance user engagement. Importantly, since responsiveness has a negative effect, companies should focus on meaningful and helpful responses rather than focusing solely on speed, clarity and problem-solving over automated speed. Furthermore, the study's insights into racial differences imply that businesses may benefit from culturally adaptive chatbot scripts, where language styles, response patterns, or conversational cues are tailored to different user groups. This approach would make AI customer service more inclusive and aligned with Malaysia's diverse consumer expectations. By implementing these improvements, e-commerce companies can enhance service effectiveness, increase satisfaction, and ultimately strengthen customer loyalty.

5.3.2 Theoretical Implication

This study offers several key theoretical contributions. First, it extends the SERVQUAL framework to AI-driven e-commerce by integrating constructs such as anthropomorphism and perceived ease of use, which are increasingly relevant in human–machine interactions. This broadens the traditional understanding of service quality beyond human-delivered services and shows how technological attributes influence consumer perceptions in digital environments. Second, the findings provide empirical evidence that customer satisfaction serves as a central mechanism linking chatbot service quality to loyalty, reinforcing satisfaction as a vital mediator in technology-based service encounters, consistent with prior literature. Third, the study offers comparative insight by examining racial differences in consumer perceptions within Malaysia's multicultural context. This emphasizes the role of cultural and social diversity in shaping service evaluations and suggests that AI service models may not operate uniformly across demographic groups. Collectively, these contributions enrich theory

by incorporating cultural, technological, and psychological dimensions into the evaluation of AI-based service quality.

5.4 Limitations and Recommendations for Future Research

Although this study has yielded valuable insights, several limitations exist that warrant consideration.

5.4.1 Limitations Related to Measurement Invariance

Although the MICOM procedure confirmed partial measurement invariance, full measurement invariance was not achieved across all racial groups. Specifically, Step 3 of the MICOM procedure, which tests the equality of composite means and variances, was not supported for several constructs in certain group comparisons. This suggests that respondents from different racial backgrounds may interpret some constructs differently, highlighting the potential influence of cultural or demographic factors on construct perceptions. While partial measurement invariance is considered sufficient for conducting multi-group comparisons in PLS-SEM (Henseler et al., 2016; Hair et al., 2021), the absence of full invariance implies that observed differences in path coefficients should be interpreted with caution. Future research could enhance measurement equivalence by refining indicators, improving the cross-cultural neutrality of wording, or increasing and balancing sample sizes across racial groups.

5.4.2 Unequal sample size for each race

Although respondents from multiple racial groups were included, the distribution was uneven. For instance, the Chinese group comprised 90 respondents, whereas the Malay group included only 40 respondents. Such disparities may reduce the statistical power of multi-group analyses and limit the generalizability of the findings across all racial categories. Ensuring more balanced sample sizes in future research would strengthen the reliability of group-specific path estimates and enhance the robustness of comparative analyses.

5.5 Conclusion

This study examined how chatbot service quality influences customer satisfaction and loyalty in the Malaysian e-commerce sector, with race included as a moderating factor. The findings show that reliability, perceived ease of use, and anthropomorphism significantly enhance customer satisfaction, while responsiveness unexpectedly reduces it. This result suggests that users value meaningful and helpful responses more than fast replies. Customer satisfaction strongly predicts loyalty and also mediates all service quality effects, confirming its central role in shaping long-term commitment.

The moderating analysis indicates that racial groups differ in how they evaluate ease of use, reliability, and the satisfaction-to-loyalty relationship, which reflects important cultural differences. Overall, the study contributes to a better understanding of artificial intelligence-based service interactions and offers practical guidance for designing more effective chatbots. By focusing on improving accuracy, usability, thoughtful response design, and cultural diversity, organisations can improve satisfaction and strengthen customer loyalty.

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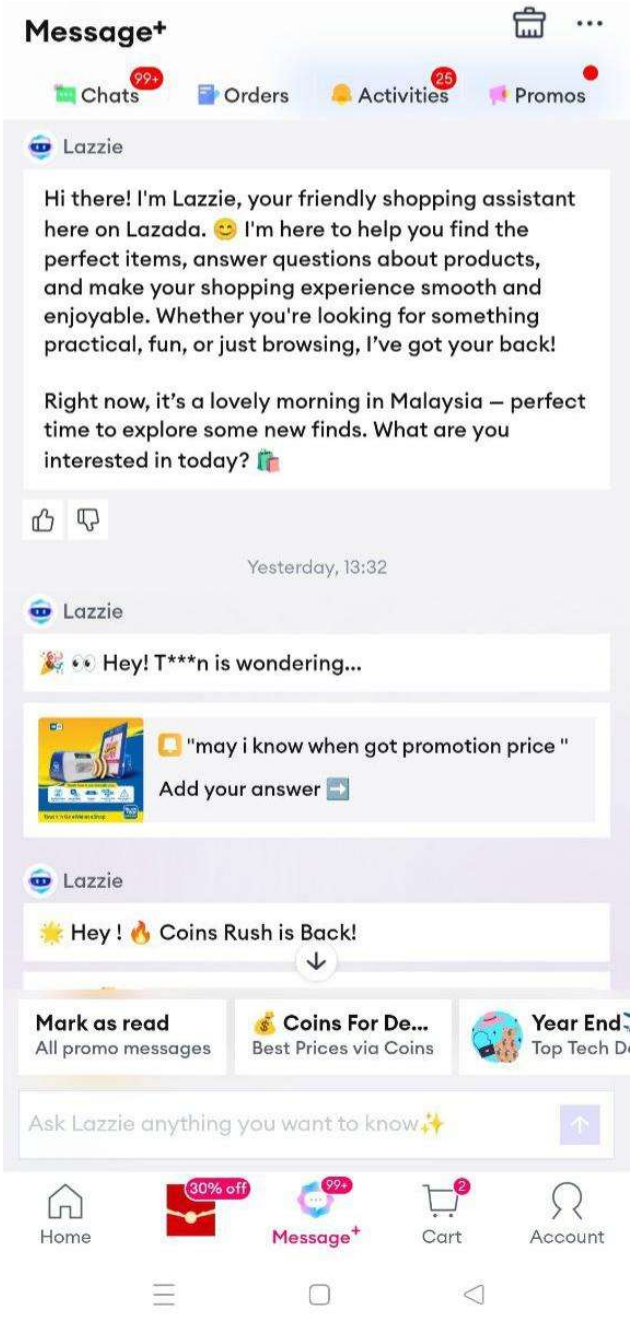
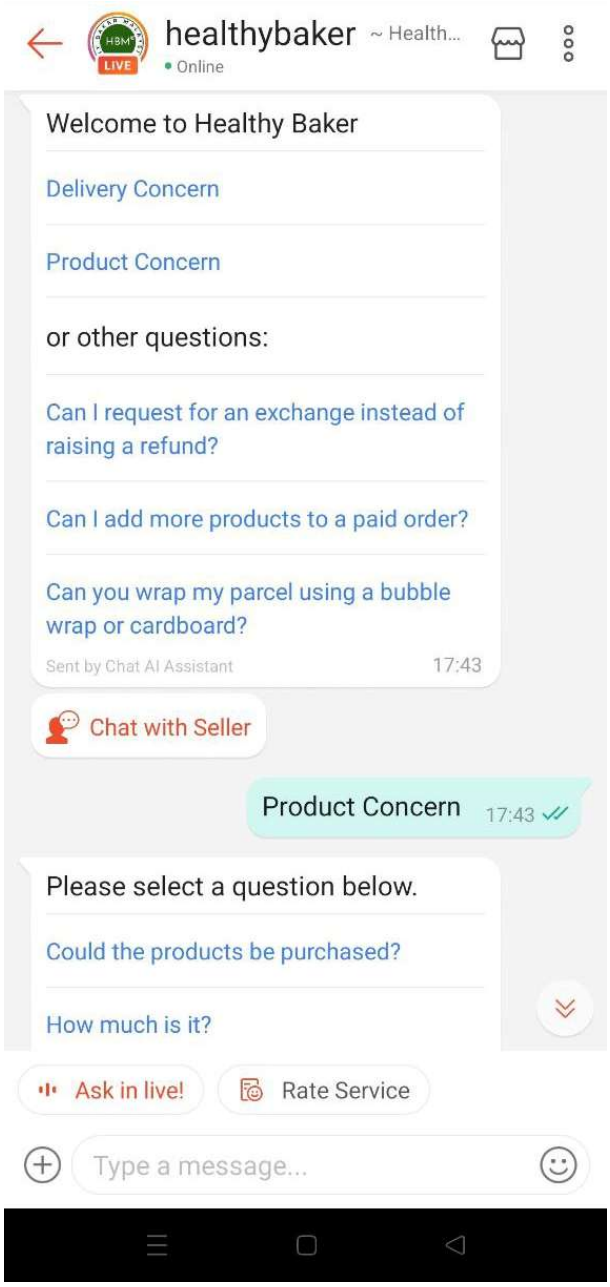
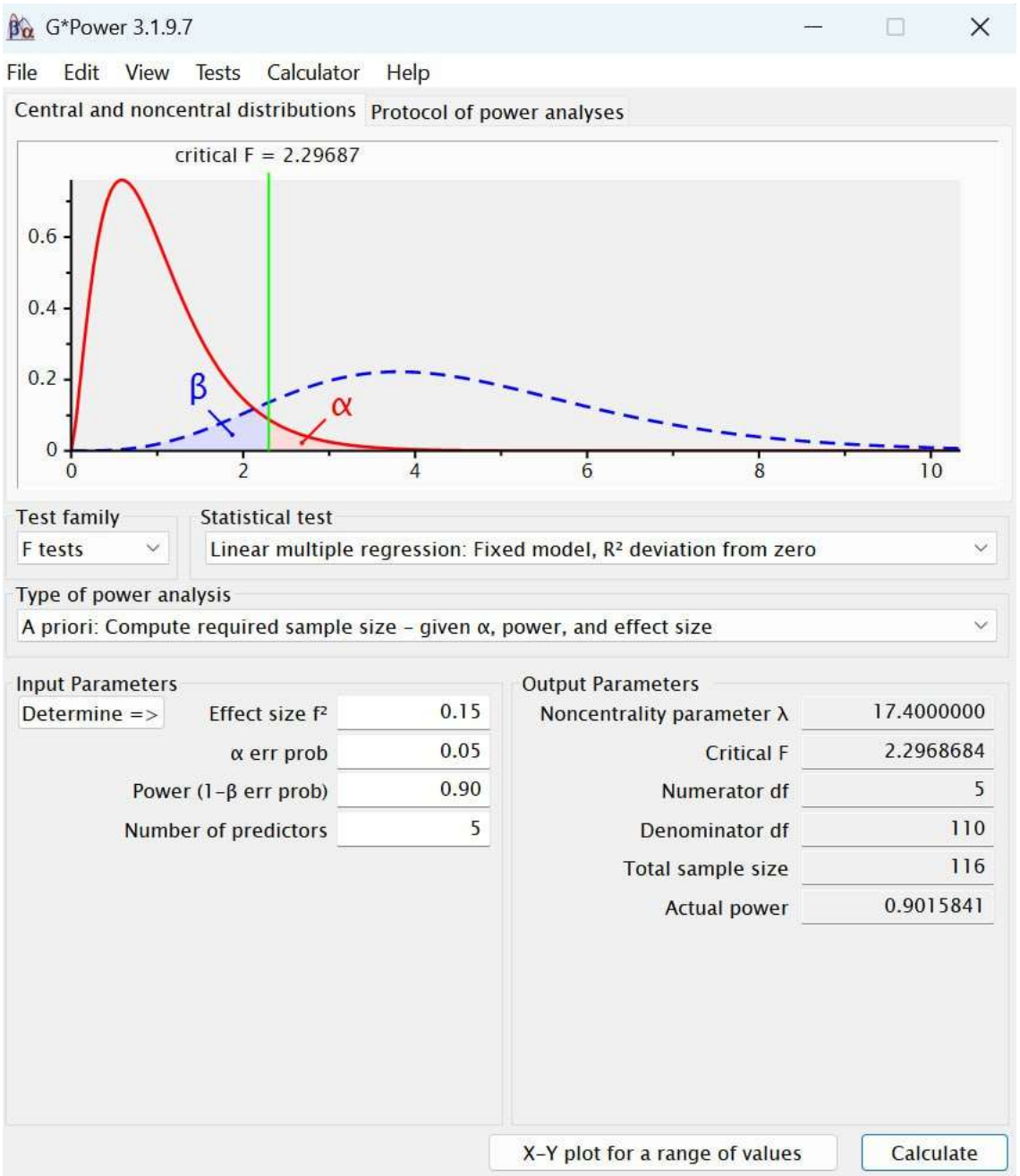
APPENDECES

Appendix 1.1 Example Chatbot Reply





Appendix 3.1 G*Power



Appendix 3.2 Questionnaire

How Chatbot Service Quality Affects Customer Satisfaction and Loyalty in E-commerce in Malaysia

Dear Esteemed Respondents

This study aims to explore how online shoppers perceive AI chatbot services and how these perceptions influence their satisfaction and loyalty toward e-commerce platforms. The findings will provide valuable insights into the role of chatbot service quality in shaping customer experiences, helping businesses enhance their digital customer service strategies and strengthen customer relationships. Your responses will contribute to a better understanding of how features such as ease of use, responsiveness, reliability, personalization, and human-like interaction impact user satisfaction and brand loyalty.

There are no anticipated risk associated with responding to the questionnaire. Additionally, no personal details will be collected, and the confidentiality of all respondents will be assured. We humbly request your voluntary participation in this study. The survey will only take 15-20 minutes to complete. Your confidentiality is assured. The data collected is meant for academic purposes, and the information will be aggregated.

PERSONAL DATA PROTECTION NOTICE

Please be informed that in accordance with Personal Data Protection Act 2010 ("PDPA") which came into force on 15 November 2013, Universiti Tunku Abdul Rahman ("UTAR") is hereby bound to make notice and require consent in relation to collection, recording, storage, usage, and retention of personal information.

1. Personal data refers to any information which may directly or indirectly identify a person which could include sensitive personal data and expression of opinion, such as name, IC number, phone number, or address.

The data collected includes only:

a) Education level

b) Gender

c) Race

d) Age

e) Online shopping experience

f) Responses to statements regarding how services quality of AI Chatbot such as responsiveness, reliability, perceived ease of use, and anthropomorphism influence customer satisfaction and loyalty

2. The purposes for which your personal data may be used are inclusive but not limited to:

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a) For assessment of any application to UTAR
b) For processing any benefits and services
c) For communication purposes
d) For advertorial and news
e) For general administration and record purposes
f) For enhancing the value of education
g) For educational and related purposes consequential to UTAR
h) For replying any responds to complaints and enquiries
i) For the purpose of our corporate governance
j) For the purposes of conducting research/ collaboration

2. Your personal data may be transferred and/or disclosed to third party and/or UTAR collaborative partners including but not limited to the respective and appointed outsourcing agents for purpose of fulfilling our obligations to you in respect of the purposes and all such other purposes that are related to the purposes and also in providing integrated services, maintaining and storing records. Your data may be shared when required by laws and when disclosure is necessary to comply with applicable laws.

3. Any personal information retained by UTAR shall be destroyed and/or deleted in accordance with our retention policy applicable for us in the event such information is no longer required.

4. UTAR is committed in ensuring the confidentiality, protection, security and accuracy of your personal information made available to us and it has been our ongoing strict policy to ensure that your personal information is accurate, complete, not misleading and updated. UTAR would also ensure that your personal data shall not be used for political and commercial purposes.

Consent:

5. By submitting or providing your personal data to UTAR, you had consented and agreed for your personal data to be used in accordance to the terms and conditions in the Notice and our relevant policy.

6. If you do not consent or subsequently withdraw your consent to the processing and disclosure of your personal data, UTAR will not be able to fulfill our obligations or to contact you or to assist you in respect of the purposes and/or for any other purposes related to the purpose.

If you have any questions about this study at any time, please feel free to contact us.

Your sincerely,

Lai Jing Lu (laijinglu1008@1utar.my) &

Ms. Chin Wai Yin (chinwy@utar.edu.my),

Faculty of Accountancy and Management,

University of Tunku Abdul Rahman.

* Indicates required question

1. Email *

2. Acknowledgment of Notice *

Mark only one oval.

- ◯ I have been notified and that I hereby understood, consented and agreed per UTAR above notice *Skip to question 3*
- ◯ I disagree, my personal data will not be processed *Skip to section 4 ()*

Demographic

3. Gender *

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say

4. Age *

Mark only one oval.

- ◯ 20 and below
- ◯ 21-28 (Gen Z)
- ◯ 29-44 (Gen Y)
- ◯ 45-60 (Gen X)
- ◯ above 60

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5. Race *

Mark only one oval.

- Chinese
- Malay
- Indian
- others

6. Level of education *

Mark only one oval.

- SPM or below
- Diploma
- Bachelor Degree
- Master Degree
- Others

7. E-commerce platform usage frequency *

Mark only one oval.

- Everyday
- Several times a week
- Once a week
- 2–3 times a month
- Once a month
- Less than once a month
- Never use

8. How often do you use customer service chatbots on e-commerce platforms *

Mark only one oval.

	1	2	3	4	5	
Rare	◯	◯	◯	◯	◯	Very Often

Chatbot Services Quality

Strongly disagree ⟷ Strongly agree

9. Responsiveness *

Mark only one oval per row.

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
This AI chatbot is available at 7 days x 24 h	◯	◯	◯	◯	◯	◯	◯
I can get the AI chatbot services at any time	◯	◯	◯	◯	◯	◯	◯
This AI chatbot is always online	◯	◯	◯	◯	◯	◯	◯
I can always find the AI chatbot online	◯	◯	◯	◯	◯	◯	◯
This AI chatbot will respond to me at any time	◯	◯	◯	◯	◯	◯	◯
I can get this AI chatbot at any time throughout the days	◯	◯	◯	◯	◯	◯	◯

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10. Reliability *

Mark only one oval per row.

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
This AI chatbot can accurately understand what I say	◯	◯	◯	◯	◯	◯	◯
The response from this AI chatbot is accurate	◯	◯	◯	◯	◯	◯	◯
The answer of this AI chatbot corresponds to the question I asked	◯	◯	◯	◯	◯	◯	◯
The answer from this AI chatbot meets my expectation	◯	◯	◯	◯	◯	◯	◯

11. Perceived Ease of Use *

Mark only one oval per row.

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
It is easy to become skillful at using the AI chatbot	◯	◯	◯	◯	◯	◯	◯
Learning to interact with the AI chatbot is easy	◯	◯	◯	◯	◯	◯	◯
The AI chatbot is flexible to interact with	◯	◯	◯	◯	◯	◯	◯
My interaction with the AI chatbot is clear and understandable	◯	◯	◯	◯	◯	◯	◯

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12. Anthropomorphism *

Mark only one oval per row.

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
I feel that this AI chatbot puts my interest first	◯	◯	◯	◯	◯	◯	◯
I feel that this AI chatbot is serving me attentively	◯	◯	◯	◯	◯	◯	◯
This AI chatbot makes me feel concerned	◯	◯	◯	◯	◯	◯	◯

13. Satisfaction *

Mark only one oval per row.

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
Overall, I feel extremely satisfied with this AI chatbot	◯	◯	◯	◯	◯	◯	◯
Overall, I feel extremely pleased with this AI chatbot	◯	◯	◯	◯	◯	◯	◯
My expectations of this AI chatbot is achieved	◯	◯	◯	◯	◯	◯	◯
I would recommend this AI chatbot to a friend	◯	◯	◯	◯	◯	◯	◯

14. Customer loyalty *

Mark only one oval per row.

	Strongly Disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
I will suggest this organization's products or services to other customer	◯	◯	◯	◯	◯	◯	◯
I intend to keep purchasing products or service from this organization	◯	◯	◯	◯	◯	◯	◯
I will recommend this organization's products or services to other	◯	◯	◯	◯	◯	◯	◯

Thank you for your time! Your responses are greatly appreciated.

Appendix 3.3 Ethical Clearance- Approval Letter

UNIVERSITI TUNKU ABDUL RAHMAN DU012(A)
Wholly owned by UTAR Education Foundation Co. No. 578227-M

Re: U/SERC/78-650/2025

17 November 2025

Dr Fitriya Binti Abdul Rahim
Head, Department of International Business
Faculty of Accountancy and Management
Universiti Tunku Abdul Rahman
Jalan Sungai Long
Bandar Sungai Long
43000 Kajang, Selangor

Dear Dr Fitriya,

Ethical Approval For Research Project/Protocol

We refer to your application for ethical approval for your student's research project from Bachelor of International Business (Honours) programme enrolled in course UKMZ3016. We are pleased to inform you that the application has been approved under Expedited Review.

The details of the research projects are as follows:

No.	Research Title	Student's Name	Supervisor's Name	Approval Validity
1.	How Chatbot Service Quality Affects Customer Satisfaction and Loyalty in E-commerce in Malaysia	Lai Jing Lu	Ms Chin Wai Yin	17 November 2025 – 16 November 2026

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

(4) Written consent be obtained from the institution(s)/company(ies) in which the physical or/and online survey will be carried out, prior to the commencement of the research.

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
Tel: (605) 468 8888 Fax: (605) 466 1313
Sungai Long Campus : Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor Darul Ehsan, Malaysia
Tel: (603) 9086 0288 Fax: (603) 9019 8868
Website: www.utar.edu.my

Should the students collect personal data of participants in their studies, please have the participants sign the attached Personal Data Protection Statement for records.

Thank you.

Yours sincerely,

Professor Dr Zuraidah Abd Manaf
Chairman
UTAR Scientific and Ethical Review Committee

c.c Dean, Faculty of Accountancy and Management
Director, Institute of Postgraduate Studies and Research

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
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