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WAYFINDING SIGNAGE CRITERIA TOWARDS IMPROVING THE EFFECTIVNESS OF NAVIGATION IN ENTRANCE OF KUALA LUMPUR INTERNATIONAL AIRPORT (KLIA2)

NUR LIANA BINTI KAMAL BAHARI

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 1 August 2025 to conduct the final examination of Nur Liana binti Kamal Bahari in her Master of Art thesis entitled "Wayfinding Signage Criteria towards Improving the effectiveness of Navigation in Entrance of Kuala Lumpur International Airport (KLIA2)" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiner recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

Mumtaz Mokhtar, PhD
Associate Professor
Faculty of Art and Design
Universiti Teknologi MARA
(Chairman)

Valerie Anak Michael, PhD
Senior Lecturer
Faculty ofof Art and Design
Universiti Teknologi MARA
(Internal Examiner)

Pandu Purwandaru, PhD
Senior Lecturer
Fakultas Seni Rupa dan Desain
Universitas Sebelas Maret
(External Examiner)

PROF DR HJH ZURAEDA IBRAHIM
Dean
Institute of Postgraduates Studies
Universiti Teknologi MARA

Date: 16 March 2026

AUTHOR'S DECLARATION

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Name of Student	:	Nur Liana binti Kamal Bahari
Student ID. No.	:	2020864514
Programme	:	Master of Art and Design – AD750
Faculty	:	Art and Design
Thesis Title	:	Wayfinding Signage Criteria Towards Improving the Effectivness of Navigation in Entrance of Kuala Lumpur International Airport (KLIA2)
Signature of Student	:	
Date	:	March 2026

ABSTRACT

This research examines the criteria for effective wayfinding signage to improve navigation efficiency at entrance of Kuala Lumpur International Airport 2 (KLIA2), a complex transportation hub serving diverse local and international travelers. Ineffective signage has been linked to confusion, delays, and dissatisfaction, particularly among first-time visitors. The objectives of this study are to: (i) identify the factors that influence the ineffectiveness of wayfinding signage to convey messages clearly among visitors in KLIA2; (ii) analyse the significant factors of wayfinding signage that ineffective to convey messages clearly; and (iii) recommend the criteria to improve the effectiveness. A mixed-method approach was employed, combining quantitative data from 237 questionnaire respondents with qualitative insights from expert interviews. The study applied the Signage Pyramid Model, evaluating three key systems: information content, graphic design, and hardware. Data analysis revealed that poor content hierarchy, inadequate sign placement, limited multilingual support, visual obstruction by advertisements, and inconsistent directional continuity were major contributors to ineffectiveness. Findings indicate that effective wayfinding signage must deliver clear, concise, and continuous information, be strategically positioned, and employ high-contrast typography, universally recognized symbols, and accessible formats for all user groups, including those with disabilities. Incorporating digital and interactive wayfinding tools can further enhance navigation, especially during temporary layout changes. The study concludes with a set of design and management guidelines for KLIA2, emphasizing user-centered, inclusive, and context-specific solutions. These recommendations not only improve passenger experience and operational efficiency at KLIA2 but also provide transferable strategies for other complex public facilities.

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Abbreviations

KLIA2	Kuala Lumpur International Airport 2
MAHB	Malaysia Airports Holdings Berhad

CHAPTER 1
RESEARCH BACKGROUND

1.1 Introduction

Thousands of years ago, the Polynesians used pictorial representations as directional guides to reach their destinations. They relied on precise natural elements such as sand formations, sea debris, ice patterns, forest structures, celestial bodies, sun positioning, wind direction, and ocean waves to navigate across vast distances (Fewings, 2001; Lynch, 1960). At that time, there were no buildings, roads, or pathways to connect people from one place to another. In contrast, modern urban environments are highly structured yet complex, often making navigation challenging for individuals. According to Lynch (1960), the intricate networks of buildings, streets, and enclosed spaces in modern cities can disorient visitors, increasing their likelihood of getting lost. As cities become more dense and multifunctional, clear and efficient wayfinding systems are necessary to support navigation and ensure seamless movement within these environments.

Wayfinding is a process that begins when an individual identifies a destination and attempts to reach it from a starting point. According to Passini (1984), wayfinding involves cognitive, decision-making, and action-based components, guiding individuals from one place to another. This process is particularly significant in complex environments such as airports, where travelers must navigate through large terminals, multiple concourses, and various checkpoints. Clear, well-structured wayfinding signage is crucial in helping visitors move efficiently through an airport without unnecessary confusion or delays. Chris Calori and David Vanden-Eynden (2015) describe wayfinding as a process that relies on visual perception and spatial awareness to aid navigation. However, this perspective does not entirely account for individuals with visual, cognitive, or physical impairments. Wayfinding should be inclusive, ensuring accessibility for all individuals, including those with disabilities. Arthur and Passini (1992) emphasize that effective wayfinding systems must integrate accessibility considerations, such as tactile pathways, auditory cues, and wheelchair-friendly routes, to accommodate all users. This inclusivity is essential, as wayfinding is a routine and essential activity for individuals in their daily lives (Raubal & Egenhofer, 1998).

According to Yeh et al. (2019) and Ardi et al. (2019), wayfinding encompasses navigation, tracking, and location positioning, ensuring that individuals can efficiently travel between destinations. Lynch (1960) highlighted that wayfinding has become more manageable with the advent of modern navigational aids, including maps, street numbers, directional signs, landmarks, and public transport signage such as bus stop indicators. He further asserted that the importance of wayfinding varies based on the significance of a particular destination, whether it is a workplace, supermarket, home, restaurant, bus stop, restroom, or any indoor or outdoor location. Experience plays a significant role in wayfinding, as familiarity with an environment can significantly impact an individual's ability to navigate efficiently. Lynch (1960) suggested that the clearer an individual's memory of a space, the faster and more accurately they can reach their intended destination. Previous researchers have often associated wayfinding success with an individual's prior experience in navigating a specific area. Those familiar with an environment are less likely to experience disorientation or delays. However, in large and complex environments such as airports, reliance on experience alone is insufficient. The presence of well-designed wayfinding signage can significantly assist individuals in navigating unfamiliar spaces. Signage serves as an essential wayfinding aid, especially in expansive and intricate environments like KLIA2, where passengers must locate boarding gates, baggage claim areas, security checkpoints, and other airport facilities efficiently. To be effective, wayfinding signage must possess specific characteristics that enhance usability. Signage should incorporate clear typography, contrasting colors, universally recognized symbols, appropriate sizing, and strategic placement to ensure visibility from different angles and distances. Signage with these qualities provides accurate information and helps travelers make informed decisions while navigating an environment.

In the context of KLIA2, ineffective signage can result in increased passenger anxiety, missed flights, and congested airport pathways due to travelers frequently stopping to seek directions. This issue underscores the importance of designing a wayfinding system that prioritizes clarity, accessibility, and efficiency. The findings from this study will contribute to improving airport wayfinding strategies, ensuring that signage effectively serves its purpose for a diverse range of travelers, including first-time visitors, elderly passengers, and individuals with disabilities. By addressing these challenges, KLIA2 can enhance the overall travel experience, reduce reliance on airport staff for directional assistance, and strengthen Malaysia's global reputation for

maintaining a well-organized and user-friendly airport. This study aims to establish comprehensive guidelines for effective signage design, benefiting not only KLIA2 but also other transportation hubs, urban spaces, and public facilities that rely on wayfinding systems to facilitate smooth navigation.

1.2 Problem Statement

A well-functioning wayfinding system is essential for efficient movement within complex public spaces such as airports, where visitors must make timely and accurate navigation decisions. At Kuala Lumpur International Airport 2 (KLIA2), a recurring issue reported by travellers is the ineffectiveness of wayfinding signage, particularly in terms of placement, continuity, accuracy, and clarity. These weaknesses disrupt passenger flow, increase travel time, and contribute to heightened stress and dissatisfaction among visitors.

Poor signage placement and continuity. Signage placement and continuity are crucial for guiding passengers through complex spaces without unnecessary detours or confusion. In KLIA2, signage is often not positioned at critical decision points—such as intersections, terminal connections, or boarding gate corridors—where travellers must make immediate route choices. The absence of signs in these locations forces passengers to either backtrack or rely on verbal directions from staff and other travellers, leading to delays and inefficiency. Furthermore, a lack of continuity between one sign and the next disrupts the navigation flow, especially in transitional spaces where visitors expect sequential guidance.

Wan (2016) documented that unclear sign placement at KLIA2 resulted in prolonged walking distances for passengers, causing physical fatigue and diminished travel satisfaction. Similarly, Ika-Soegianto (2015) reported that in Jakarta's international airport, misplaced signage after the customs checkpoint incorrectly directed travellers to hotel facilities, forcing them to retrace their steps. These findings emphasize that correct placement and consistent sequencing of signs are critical to maintaining navigation accuracy and efficiency in large-scale transport hubs.

Lack of accuracy and clarity in signage. Even when signage is present, its effectiveness depends on the accuracy and clarity of its content. At KLIA2, some signs display ambiguous messages, unclear symbols, or incorrect directional arrows, leading passengers toward unintended destinations. Such errors not only waste valuable time

but also erode travellers' trust in the airport's wayfinding system, compelling them to seek alternative means of navigation. This is particularly problematic for international travellers unfamiliar with local languages or spatial layouts. Symonds (2017) found that inaccurate signage in airports frequently led to anger and dissatisfaction among passengers, with many expressing frustrations at having been misdirected to the wrong locations. In complex facilities like KLIA2, even a single misleading arrow or unclear pictogram can disrupt the entire navigation process, especially for those in time-sensitive situations such as flight transfers. Accurate and easily interpretable signage—supported by standardized icons and multilingual text—is essential to ensure passengers can reach their destinations without confusion or delay.

The two primary weaknesses in KLIA2's wayfinding signage—poor placement and continuity, and lack of accuracy and clarity—are supported by both local and international case evidence. Improper sign placement interrupts the natural flow of movement, while inaccurate or ambiguous directions actively mislead passengers. Together, these shortcomings contribute to disorientation, longer navigation times, and reduced passenger satisfaction. Addressing these issues through strategic positioning, sequential consistency, and rigorous accuracy checks is essential to improving navigation efficiency and enhancing the overall passenger experience at KLIA2.

1.3 Research Objectives

Every research study is designed to address specific questions and problems, and this study is no exception. Numerous studies have been conducted on wayfinding signage to identify the factors that contribute to its effectiveness and ineffectiveness. However, there is still a lack of detailed research that specifically examines the design characteristics of wayfinding signage at airports, particularly Kuala Lumpur International Airport 2 (KLIA2). Anuar et al. (2019) highlighted that while various studies have explored wayfinding signage, there remains an absence of in-depth evaluation focusing on the design aspects that influence navigation effectiveness at KLIA2. While past research has broadly analyzed signage efficiency in airports, none have explicitly identified the key design factors—such as typography, color schemes, iconography, and spatial placement—that contribute to the ineffectiveness of wayfinding signage. Additionally, there has been little discussion on how these elements can be optimized to create a more effective wayfinding system. Noriman and

Ismail (2018) conducted a study that assessed the visibility and readability of wayfinding signage at KLIA2 by examining elements such as fonts, colors, symbols, and sizes. However, their findings primarily focused on general visibility without providing a detailed breakdown of how each of these elements contributes to the overall effectiveness of the signage system. There remains a critical gap in research that systematically evaluates the character and functional role of these elements in enhancing user navigation at KLIA2. Given the gaps identified in previous studies, this research aims to examine the role of wayfinding signage characteristics at KLIA2 and their impact on user experience. The objectives of this study are as follows:

a) To identify the factors that influence the ineffectiveness of wayfinding signage to convey messages clearly among visitors in KLIA2.
b) To analyse the significant factors of wayfinding signage that ineffective to convey messages clearly among visitor in KLIA2.
c) To recommend the criteria to improve the effectiveness of wayfinding signage to aid in the visitor's navigation in KLIA2.

KLIA2, as a major international gateway, must ensure that its wayfinding system is both functional and aesthetically effective. Many travelers—especially first-time visitors, elderly passengers, and those unfamiliar with the layout—face challenges in navigating the airport due to issues related to signage placement, cluttered visual environments, and ineffective directional cues. These challenges can result in frustration, delays, and missed flights, ultimately affecting the overall passenger experience and operational efficiency of the airport. By achieving the outlined research objectives, this study will provide valuable insights into improving wayfinding signage design at KLIA2. Furthermore, it will contribute to the broader field of environmental graphic design by establishing clearer guidelines for the development of signage systems in complex transportation hubs. The findings of this research will not only benefit KLIA2 but can also be applied to other major airports seeking to enhance their wayfinding systems. Ultimately, effective wayfinding signage serves as a crucial element in airport design, ensuring smooth passenger movement, reducing reliance on airport staff for directions, and enhancing Malaysia's reputation as a global travel hub. Through this study, it is hoped that KLIA2 can implement signage improvements that

will set a new standard for user-friendly airport navigation while also benefiting graphic designers, travelers, and aviation stakeholders.

1.4 Scope of Study

This research is conducted within the specific context of Kuala Lumpur International Airport 2 (KLIA2), with a particular focus on the main entrance area. The study examines wayfinding signage located at and near the entrance, assessing its placement, clarity, and continuity in guiding visitors toward key facilities and destinations inside the airport. The scope is limited to the entrance zone because accessibility to other parts of the airport was restricted during the data collection period. As such, observations, measurements, and evaluations are confined to signage visible and accessible from the main entry point. While this limitation restricts the study from encompassing the entire airport layout, it provides a concentrated analysis of the signage that forms visitors' first impressions upon arrival. The target group for this study consists of Malaysian visitors who have previously been to KLIA2. This demographic was chosen to ensure participants possess prior familiarity with the airport environment, enabling them to provide informed insights into signage effectiveness, navigational flow, and potential areas for improvement. By narrowing the geographical focus to the entrance and the participant group to Malaysian visitors, this research maintains a manageable scope while delivering targeted findings relevant to signage strategy and placement at KLIA2.

1.5 Significance of Study

This study will be beneficial to various parties involved in the design, implementation, and improvement of wayfinding signage systems. The effectiveness of wayfinding signage is not limited to airport environments but also extends to other public spaces such as shopping malls, hospitals, universities, and transportation hubs. A well-designed wayfinding system plays a crucial role in enhancing user experience, reducing confusion, and improving accessibility for individuals navigating complex environments. Additionally, efficient wayfinding solutions contribute to societal progress by promoting inclusivity, operational efficiency, and positive perceptions of a country's infrastructure. The following are the key beneficiaries of this study:

1.5.1 Airport Visitor

The primary goal of wayfinding signage is to facilitate visitors' understanding of directions and help them navigate to their intended locations efficiently. Airports, being one of the most complex public spaces, require a well-structured wayfinding system to ensure a smooth flow of passengers. Unlike other public spaces, airports host a diverse range of users, including first-time visitors, frequent travelers, business professionals, elderly passengers, and individuals with disabilities. An effective wayfinding system must cater to all these groups by providing clear, intuitive, and accessible directional information. A well-designed wayfinding system is characterized by easy-to-read text, accurate arrows, bright colors, appropriate placement, and universally understood symbols. High-quality signage can significantly reduce the time passengers spend searching for key areas, such as check-in counters, security checkpoints, immigration counters, boarding gates, baggage claim areas, and transportation services. In an airport setting where punctuality is vital, a delay in navigation can lead to missed flights, increased stress, and dissatisfaction among travelers. The efficiency of a person's journey within the airport often hinges on the effectiveness of the wayfinding signage, making it a crucial aspect of airport design and management. Beyond simple navigation, wayfinding signage enhances the overall airport experience by providing travelers with a sense of confidence and control over their journey. A well-organized wayfinding system allows passengers to plan their time more effectively, enabling them to explore airport amenities such as retail stores, dining establishments, and lounges before their flights. This not only enhances passenger comfort but also contributes to the economic growth of the airport by increasing consumer spending. Airports that invest in clear and strategically placed wayfinding signage can improve operational efficiency, reduce the workload for airport staff (who would otherwise need to provide directions frequently), and enhance overall visitor satisfaction. Additionally, international airports like KLIA2 accommodate passengers from various cultural and linguistic backgrounds. This makes it essential for wayfinding signage to incorporate universally recognized symbols, multilingual text, and digital navigation aids such as interactive kiosks and mobile applications. By doing so, airports can cater to a global audience, minimizing confusion and ensuring seamless travel experiences for all passengers, regardless of their familiarity with the airport layout. Another critical aspect of wayfinding signage is its role in safety and accessibility. In

emergency situations such as fires, security threats, or medical emergencies, clear signage can guide passengers toward exits, assembly points, and emergency services swiftly and efficiently. Poorly designed or obstructed signage can lead to panic, delays, and confusion, potentially putting lives at risk. Therefore, ensuring that emergency wayfinding signs are visible, illuminated, and strategically positioned is a crucial aspect of airport safety management.

Moreover, accessibility is a key consideration in airport wayfinding. Airports must comply with universal design principles to accommodate individuals with disabilities, including those with visual impairments, hearing impairments, or mobility challenges. Tactile paving, braille signage, voice-assisted directories, and well-marked pathways for wheelchair users are some of the essential components that enhance accessibility. By implementing these features, airports can foster a more inclusive environment, ensuring that every passenger, regardless of physical ability, can navigate the space with ease. Wayfinding signage is an indispensable component of airport infrastructure, significantly impacting navigation, passenger experience, safety, and economic performance. A well-executed wayfinding system allows travelers to move efficiently within the airport, reduces stress, and enhances the overall perception of the facility. By improving navigation, airports can boost revenue through increased consumer engagement with airport amenities, reduce operational inefficiencies, and ensure the safety and accessibility of all visitors. Investing in high-quality wayfinding signage is not only beneficial to airport visitors but also to stakeholders such as airlines, airport authorities, and designers responsible for creating user-friendly public spaces.

1.5.2 Graphic Designer

This study serves as a valuable guideline for graphic designers, helping them identify the most effective designs and visual elements for wayfinding signage. The role of graphic designers in the development of wayfinding systems is crucial, as signage must not only be visually appealing but also highly functional in directing users efficiently. Wayfinding signage plays a fundamental role in reducing cognitive load, enabling users to process information quickly, and assisting in decision-making while navigating complex environments (Arthur & Passini, 1992). By investigating the necessary elements that contribute to successful wayfinding systems, this study provides insights into the critical design principles that maximize the impact of signage

on visitor navigation. The study highlights the importance of color contrast, typography, symbols, placement, and lighting in ensuring signage visibility and legibility. These findings guide graphic designers in selecting appropriate elements and creating designs that enhance the usability and effectiveness of wayfinding signage. Key Elements of Wayfinding Signage for Effective Navigation:

Typography and Readability. Typography plays a significant role in the effectiveness of wayfinding signage. Text on signage must be legible from various distances and under different lighting conditions. Sans-serif fonts such as Helvetica and Univers are commonly used in wayfinding signage due to their clarity and ease of reading (Calori & Vanden-Eynden, 2015). Font size, spacing, and boldness should be carefully considered to ensure readability for individuals with visual impairments.

Color Contrast and Visibility. The choice of color in wayfinding signage influences visibility and user comprehension. High-contrast color combinations, such as white text on a dark background or black text on a yellow background, enhance readability (Mollerup, 2013). Additionally, color coding can be used to differentiate various zones, directions, or facilities within an airport, making it easier for users to navigate large spaces. Graphic designers must ensure that colors do not blend into the surrounding environment, reducing the effectiveness of the signage.

Symbolism and Universality. International airports, such as KLIA2, serve a diverse group of travelers from different cultural and linguistic backgrounds. Therefore, the use of universally recognized pictograms and symbols is essential in wayfinding signage (ISO 7001, 2007). Icons should be simple, intuitive, and standardized to minimize language barriers. Graphic designers must focus on designing symbols that are easily recognizable at a glance, reducing dependence on text-based directions.

Signage Placement and Hierarchy. The location and arrangement of wayfinding signage significantly impact its effectiveness. Signs should be positioned at key decision points, such as intersections, exits, and high-traffic areas, where users are most likely to seek direction (Carpman & Grant, 2002). Additionally, a clear information hierarchy should be established, with primary directional signage prominently displayed, followed by secondary and tertiary signs guiding users to specific areas.

Lighting and Environmental Adaptation. The effectiveness of signage is also influenced by lighting conditions and environmental factors. Poorly lit signage can be difficult to read, especially in dimly lit areas such as underground parking lots or transit terminals. Illuminated signage or backlit panels enhance visibility and ensure

accessibility in various lighting conditions (Pati et al., 2015). Graphic designers must consider how signage interacts with surrounding elements, including natural and artificial light sources, to optimize readability.

Graphic designers play an integral role in achieving the objectives of wayfinding design, particularly for large-scale environments like airports. Effective wayfinding signage is not just about aesthetics—it requires a deep understanding of user behavior, cognitive mapping, and accessibility considerations. This study provides a structured approach to producing effective wayfinding systems, benefiting industries focused on environmental graphic design. Moreover, the study aids graphic designers in understanding user experience (UX) principles related to navigation. By incorporating human-centered design approaches, designers can create wayfinding signage that aligns with users' natural tendencies and expectations (Norman, 2013). This includes the strategic placement of signs at eye level, ensuring consistency in signage design throughout the environment, and using intuitive directional cues such as arrows and pathways. Additionally, the study serves as an educational resource for new graphic designers and students, equipping them with the knowledge needed to create impactful and user-friendly wayfinding signage. Understanding the psychology of navigation and visual perception allows designers to make data-driven decisions that improve the effectiveness of signage systems. In conclusion, wayfinding signage plays a critical role in enhancing navigation, reducing user confusion, and improving accessibility in complex environments such as airports. Graphic designers must consider various elements—including typography, color contrast, symbols, placement, and lighting—to create effective signage that serves diverse users. By applying research-based design principles, designers can contribute to the development of efficient wayfinding systems that facilitate smoother navigation, enhance user experience, and support the functionality of large public spaces. The insights gained from this study provide a valuable foundation for the future development of wayfinding signage, ensuring that graphic designers continue to innovate and improve navigation systems. As the demand for intuitive and user-friendly public spaces grows, the role of designers in shaping wayfinding solutions remains more important than ever.

1.5.3 Malaysia Airlines Holdings Berhad

This study is significant as it highlights the importance of effective wayfinding signage in enhancing the overall functionality of Kuala Lumpur International Airport 2 (KLIA2), which is managed by Malaysia Airports Holdings Berhad (MAHB). Given KLIA2's role as one of the busiest low-cost carrier terminals in the region, the findings of this research provide valuable insights into how wayfinding systems contribute to passenger satisfaction, operational efficiency, and Malaysia's global aviation reputation. Practical perspective, the study benefits MAHB by offering evidence-based recommendations that can support the development of more strategic and user-friendly signage systems. Improving wayfinding design reduces reliance on airport staff, alleviates congestion in high-traffic zones, and enhances the seamless movement of passengers, thereby contributing to cost efficiency and service quality.

Passenger experience perspective, this study is important because it underscores how effective signage contributes to stress-free travel, particularly for international travellers, first-time visitors, and non-English-speaking passengers. A well-designed wayfinding system ensures smoother navigation, which in turn shapes passengers' perception of Malaysia as a travel destination. At a broader level, this research strengthens Malaysia's position in the competitive aviation industry by benchmarking KLIA2 against leading global airports such as Changi, Heathrow, and Schiphol. By emphasizing the role of signage in shaping international perceptions, the study highlights how infrastructure improvements can indirectly stimulate tourism growth and increase commercial revenue within airports. Finally, from an academic perspective, the study contributes to the growing body of knowledge on airport management and passenger-centered design. It provides a framework that future researchers can build upon to explore technological innovations, such as digital and interactive wayfinding solutions, in enhancing accessibility and inclusivity for all categories of travellers. In summary, the study is significant not only for MAHB as the airport operator but also for the aviation industry, policymakers, and future scholars. It bridges the gap between passenger expectations and airport management practices, ensuring that KLIA2 remains competitive, efficient, and aligned with international standards.

1.6 Summary

This chapter has outlined the foundation of the study by presenting the background, problem statement, research objectives, scope, and significance. The discussion began by highlighting the importance of wayfinding as a fundamental human activity, emphasizing its relevance in modern complex environments such as airports. The review of past studies demonstrated that ineffective signage—particularly issues of placement, continuity, clarity, and accuracy—has been a recurring challenge in Kuala Lumpur International Airport 2 (KLIA2), often resulting in disorientation, congestion, and passenger dissatisfaction.

The problem statement identified the critical gaps in the current wayfinding system at KLIA2, providing justification for the present study. To address these issues, the study formulated three main objectives: (a) to identify factors that contribute to the ineffectiveness of wayfinding signage, (b) to analyze the significant design elements that affect message clarity, and (c) to recommend criteria for improving signage effectiveness in aiding navigation. The scope of this research is focused on the main entrance area of KLIA2, with participants limited to Malaysian visitors who have prior experience at the airport, thereby ensuring targeted insights into signage performance.

The significance of this study was also discussed, emphasizing its practical, academic, and societal contributions. For airport visitors, effective signage enhances navigation, safety, accessibility, and the overall travel experience. For graphic designers, the study provides evidence-based guidelines on typography, color, symbolism, placement, and environmental adaptation, strengthening professional practice in environmental graphic design. For Malaysia Airports Holdings Berhad (MAHB), the research offers recommendations that can improve operational efficiency, reduce congestion, and reinforce Malaysia's global aviation reputation. More broadly, the study also contributes to the literature on passenger-centered design, offering a framework for future research and practical applications in transportation hubs and other complex public environments.

In conclusion, chapter one has established the rationale and direction of this research. It has demonstrated that ineffective wayfinding signage remains a pressing issue at KLIA2 and that addressing this problem is essential for enhancing passenger satisfaction, operational efficiency, and Malaysia's standing in the global aviation industry. The subsequent chapter will review relevant literature on wayfinding, signage

design, and airport navigation to provide the theoretical and conceptual foundation for this study.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Wayfinding has long been a central element of human navigation, evolving from reliance on natural cues by ancient civilizations to complex visual communication systems within modern built environments (Fewings, 2001; Lynch, 1960). In contemporary contexts, airports represent some of the most challenging spaces to navigate due to their scale, multifunctional character, and diverse user populations. Within such environments, effective wayfinding systems—particularly signage—play a crucial role in ensuring smooth passenger flow, safety, and satisfaction. This chapter presents a critical review of literature relevant to this study. The review is structured around the research objectives to provide coherence and clarity: (i) definitions and conceptualizations of wayfinding signage, (ii) theoretical models and frameworks guiding wayfinding studies, (iii) challenges and ineffectiveness of signage in airport environments, (iv) characteristics of effective wayfinding signage, and (v) the integrated theoretical framework adopted for this study. In addition, this chapter discusses the delimitation of the literature and empirical sources reviewed, highlighting the years and context of data collection. The chapter concludes with a summary that synthesizes the literature and identifies gaps to be addressed.

Wayfinding has been an essential aspect of human navigation for centuries. According to Fewings (2001), ancient civilizations relied entirely on natural elements such as the position of the sun, wind direction, and ocean currents for navigation, as they lacked modern tools like maps, clocks, and satellite-based systems. Early humans also used drawings on surfaces such as caves and rocks to communicate messages, directions, and other important information. This practice aligns closely with the concept of graphic communication, demonstrating that visual aids have long been a fundamental tool for wayfinding (Chris Calori & David Vanden-Eynden, 2015).

Wayfinding systems today have evolved into two primary forms: digital and physical signage. Digital wayfinding, enabled through satellite transmission, allows users to navigate through GPS-enabled devices, such as smartphones, with internet access. This technology has significantly improved navigation efficiency in outdoor

environments. However, digital wayfinding systems have limitations, particularly in enclosed spaces where satellite signals may not penetrate effectively. Physical wayfinding signage, also referred to as static signage, remains relevant in the modern era despite advancements in digital navigation tools. These signs are crucial for guiding users in environments such as roads, bike paths, sidewalks, urban areas, and complex indoor spaces where digital signals may be unreliable. The continued necessity of static wayfinding signage highlights its significance, even in technologically advanced settings. Designing effective wayfinding signage presents various challenges, particularly when catering to diverse user needs. Certain groups, such as individuals with dementia, may struggle with memory and spatial orientation, making it difficult for them to navigate unfamiliar environments. Similarly, visually impaired individuals require specialized navigation tools, including tactile pathways and braille-enhanced signage, to facilitate movement within public spaces.

Moreover, even in standard environments, ineffective wayfinding signage can create challenges. Large and complex buildings, such as airports, shopping malls, and hospitals, often pose navigational difficulties due to their size and structural intricacies. Poorly designed signage can lead to confusion, increased travel time, and a negative user experience. According to Jeffrey (2017), although various studies have explored wayfinding signage in complex environments, there are still no standardized guidelines for designing effective wayfinding systems in large-scale buildings.

Airports are among the most complex environments that require well-structured wayfinding systems. Kuala Lumpur International Airport 2 (KLIA2), a major low-cost carrier terminal in Malaysia, exemplifies the challenges associated with wayfinding in large-scale infrastructures. KLIA2 was developed with a "shopping paradise" concept, integrating retail stores, restaurants, and entertainment facilities alongside traditional airport functions. The presence of various types of signage, including commercial advertisements and directional signs, creates a visually dense environment, potentially leading to wayfinding difficulties. According to Malaysia Airports Statistics (2020), KLIA2 recorded a 44.9% decline in passenger movement between 2019 and 2020, with an even more dramatic drop of 94.7% in August 2020 compared to the same period in the previous year. While these figures were primarily influenced by cross-border and state travel restrictions due to the COVID-19 pandemic, they underscore the importance of enhancing airport infrastructure, including wayfinding systems, to improve passenger experience and operational efficiency.

Wayfinding signage plays a crucial role in ensuring smooth navigation within both outdoor and indoor environments. While digital wayfinding has improved accessibility in open spaces, physical signage remains essential, particularly in large and enclosed areas such as airports. Despite advancements in wayfinding research, there is still a lack of standardized guidelines for designing signage in complex buildings. As airports continue to expand and incorporate commercial elements, it is essential to develop effective, user-friendly wayfinding solutions to enhance passenger experience and optimize movement within these high-traffic environments.

2.2 Definition of Wayfinding Signage

Wayfinding has been defined as the process of determining and following a path between an origin and a destination (Passini, 1984). Lynch (1960) emphasized its importance within complex urban environments, where buildings, streets, and enclosed spaces can create disorientation. Wayfinding is supported by tools such as maps, street names, directional arrows, and signage (Yeh et al., 2019; Ardi et al., 2019). In the airport context, signage functions as a primary tool for aiding navigation. Chris Calori and David Vanden-Eynden (2015) described wayfinding as a visual perception process relying on spatial cues, whereas Arthur and Passini (1992) argued that effective wayfinding systems must also accommodate individuals with visual, cognitive, or physical impairments. For this reason, inclusivity has emerged as a critical requirement for signage systems, incorporating tactile pathways, auditory guidance, braille, and wheelchair-accessible routes (Raubal & Egenhofer, 1998). In this study, the term *ineffectiveness* is used to describe signage that fails to meet its navigational purpose due to weaknesses in design, placement, clarity, or continuity. This interpretation aligns with Noriman and Ismail (2018), who identified poor typography, inappropriate color schemes, unclear symbols, and inadequate sizing as common sources of user confusion. Clarifying this terminology is necessary to distinguish between signage that is entirely absent and signage that exists but underperforms due to design deficiencies.

Table 2.1
Authors Definition of Wayfinding

Author	Definition of Wayfinding
(Ardi et al., 2019)	Wayfinding is a process of movement from one location to the next destination in either professed or unfamiliar environmental condition.
(Lynch, 1960)	describes wayfinding as a process requiring vision and mindfulness of an area to navigate effectively
(Chris Calori & David Vanden-Eynden, 2015)	wayfinding is a process that requires the ability of vision and mindfulness of an area for the purpose of navigation
(Zuhudi et al., 2017)	Way finding or road sign or also can be known as signage can be referred as information systems in order to guide consumer through physical environment. By using way finding, it can enhance. consumer understanding and experience of the place or location, especially in complex-built environments such as urban centre, health care, educational campuses, and transportation facilities.
(Dubey et al., 2019)	Wayfinding and orientation in built environments are essential aspects of people's daily lives. Many of these environments are unfamiliar and thus require wayfinding assistance.

2.2.1 Narrative Content

Ardi et al. (2019) define wayfinding as the process of moving from one location to the next in either familiar or unfamiliar environmental conditions. This definition emphasizes the movement aspect and the environmental context, highlighting the importance of navigation regardless of the individual's familiarity with the area. Lynch (1960) describes wayfinding as a process requiring vision and mindfulness of an area to navigate effectively. This definition underscores the cognitive and perceptual skills necessary for successful navigation, implying that wayfinding is not only about physical movement but also about mental awareness and visual perception. Chris Calori and David Vanden-Eynden (2015) provide a similar definition, stating that wayfinding involves the ability to see and understand the surroundings for navigation purposes. Their work emphasizes the design aspects that facilitate wayfinding, such as clear signage and intuitive layouts. Zuhudi et al. (2017) expand the definition by referring to wayfinding as information systems designed to guide individuals through physical environments. This definition highlights the informational role of wayfinding systems, which enhance user understanding and experience, particularly in complex

environments like urban centers, healthcare facilities, educational campuses, and transportation hubs. Dubey et al. (2019) emphasize the essential nature of wayfinding and orientation in built environments, noting that many of these environments are unfamiliar and require wayfinding assistance. This definition points to the necessity of wayfinding systems in helping individuals navigate daily life in complex and often unfamiliar settings.

2.2.2 Similarities in Definitions

The definitions provided by Ardi et al. (2019), Lynch (1960), Chris Calori and David Vanden-Eynden (2015), Zuhudi et al. (2017), and Dubey et al. (2019) share several similarities:

Navigation Process: All definitions agree that wayfinding involves navigating from one location to another.

Environmental Context: They acknowledge the role of the environment, whether familiar or unfamiliar, in the wayfinding process.

Cognitive and Perceptual Skills: The necessity of vision, mindfulness, and understanding of surroundings is a common theme.

Informational Role: Zuhudi et al. (2017) and Dubey et al. (2019) specifically mention the informational aspect of wayfinding systems, which is implied in other definitions as well.

2.2.3 Differences in Definitions

Despite the commonalities, there are notable differences in how each author defines wayfinding. *Scope of Definition*: Ardi et al. (2019) focus more on the movement aspect, while Lynch (1960) and Chris Calori & David Vanden-Eynden (2015) emphasize cognitive skills and visual perception. *Design Focus*: Chris Calori and David Vanden-Eynden (2015) highlight the design elements that facilitate wayfinding, whereas others do not explicitly mention this. *Contextual Application*: Zuhudi et al. (2017) provide a broader application of wayfinding to various complex environments, whereas Dubey et al. (2019) emphasize its necessity in unfamiliar settings. In conclusion, wayfinding is a critical process that involves navigating from one location to another, requiring cognitive and perceptual skills, particularly in complex and

unfamiliar environments. Effective wayfinding systems, as described by these authors, are essential for enhancing user experience and understanding in various settings, including urban areas, healthcare facilities, educational campuses, and transportation hubs. The definitions collectively underscore the importance of clear and intuitive design in wayfinding systems to support seamless navigation and orientation in built environments.

2.3 Wayfindings Theories

The analysis of wayfinding signage in this study was grounded in established theoretical models that provide structured frameworks for evaluating design effectiveness. Two models were particularly relevant:

2.3.1 Signage Pyramid Model

The Signage Pyramid Model (Calori & Vanden-Eynden, 2015) conceptualized signage within three hierarchical dimensions: the information content system, the graphic system, and the hardware system. The information content system concerned accuracy, clarity, and continuity of directional information. The graphic system included typography, color, symbols, arrows, and layout, while the hardware system encompassed material durability, lighting, and placement. This model offered a comprehensive structure for analyzing signage both as visual communication and as physical infrastructure.

2.3.2 Elements and Principle of Design

The Elements and Principles of Design (Jafari, 2014; Mishler & Neider, 2017) provided further insights into the visual and perceptual qualities of signage. These principles emphasized balance, contrast, readability, simplicity, and accessibility. While the Signage Pyramid emphasized systematic categorization, the design principles highlighted aesthetic and user-centered considerations, ensuring signage functioned effectively across diverse passenger groups.

2.3.3 Connections of the Models

The integration of the Signage Pyramid Model with the Elements and Principles of Design allowed for a holistic analysis. The models were complementary: the pyramid ensured structural evaluation across three tiers, while the design principles provided depth to the assessment of graphical and perceptual quality. Together, they established a coherent framework that was aligned with the research objectives of identifying, analyzing, and recommending improvements to wayfinding signage at KLIA2.

2.4 Ineffectiveness of Wayfinding Signage in Airports

Airports, due to their complexity and passenger diversity, are highly susceptible to navigational challenges. Numerous studies documented cases of signage ineffectiveness. For instance, Wan (2016) reported that misplaced signage in KLIA2 led to prolonged walking distances, causing fatigue and reduced satisfaction. Similarly, Symonds (2017) found that ambiguous messages and inaccurate arrows misdirected passengers, leading to frustration and missed flights. Ika-Soegianto (2015) noted that in Jakarta International Airport, poor placement after customs checkpoints forced passengers to retrace steps, disrupting flow.

Comparative studies highlighted multiple causes of ineffectiveness. Anuar et al. (2019) observed that cluttered advertising near signage reduced visibility, while Woo and Riget (2020) stressed the lack of multilingual inclusivity. Zuhudi et al. (2017) emphasized insufficient spatial cues, such as landmarks, as compounding the problem. Despite these contributions, most studies did not systematically evaluate the design criteria of signage itself. This gap provided justification for the present study, which directly examined signage design characteristics in KLIA2. This section explores the issues related to wayfinding as discussed by various authors, including Anuar et al. (2019), Woo & Nora Riget (2020), and Zuhudi et al. (2017). The discussion is categorized into narrative content, similarities in issues, differences in issues, and a concluding summary.

Table 2.2
Issue of Wayfinding Signage

Author	Issue of Wayfinding Signage
(Anuar et al., 2019)	Airport traveller wayfinding behaviour at KLIA2
(Woo & Nora Riget, 2020)	Linguistic landscape in KLIA2 (penggunaan Bahasa pada signage)
(Zuhudi et al., 2017)	To make wayfinding works and easier for consumer, do not forget about these characteristics; landmarks, orientation, navigation.

2.4.1 Narrative Content

Anuar et al. (2019) focus on the impact of wayfinding design at KLIA2 on traveler behavior. Their study examines factors that disrupt the wayfinding process, such as advertisements, lighting, and the structure/layout of the terminal. This study does not specifically focus on the criteria and design of wayfinding signage but rather on the environmental aspects that affect navigation. Woo & Nora Riget (2020) address the linguistic landscape of wayfinding signage at KLIA2. They highlight the issue of language use on signage, suggesting the inclusion of Tamil in addition to the existing languages to improve clarity and accessibility for Tamil-speaking travellers. Zuhudi et al. (2017) emphasize the characteristics essential for effective wayfinding, such as landmarks, orientation, and navigation. Their study focuses on the elements that make wayfinding easier for consumers, ensuring that these features are incorporated into wayfinding systems to enhance user experience.

2.4.2 Similarities in Issues

The issues discussed by Anuar et al. (2019), Woo & Nora Riget (2020), and Zuhudi et al. (2017) share several commonalities. *Impact on Traveller Experience*: All studies recognize that wayfinding significantly impacts traveller experience and behaviour. *Environmental and Design Factors*: The studies acknowledge the importance of environmental and design factors in effective wayfinding, whether it is the physical environment, language use, or essential wayfinding characteristics. *Need for Improvement*: Each study suggests areas for improvement in wayfinding systems to enhance user experience and navigation efficiency.

2.4.3 Differences in Issues

Despite the commonalities, each study addresses unique aspects of wayfinding issues. *Focus on Environmental Disruptions*: Anuar et al. (2019) emphasize the environmental factors such as advertisements, lighting, and terminal layout that disrupt wayfinding, rather than focusing on the signage itself. *Linguistic Landscape*: Woo & Nora Riget (2020) concentrate on the language used on wayfinding signage, advocating for the inclusion of Tamil to better serve Tamil-speaking travelers. *Essential Wayfinding Characteristics*: Zuhudi et al. (2017) focus on the critical elements of wayfinding systems—landmarks, orientation, and navigation—necessary for effective consumer navigation.

In conclusion, wayfinding issues encompass a range of factors that impact traveler experience and navigation efficiency. Anuar et al. (2019), Woo & Nora Riget (2020), and Zuhudi et al. (2017) highlight different aspects of these issues, from environmental disruptions and linguistic landscape to essential wayfinding characteristics. Despite their differences, these studies collectively emphasize the need for improved wayfinding systems that address environmental factors, language accessibility, and critical wayfinding elements to enhance the overall navigation experience for travelers.

2.5 Characteristic of Effective Wayfinding Signage

This study applies the elements and principles of design as a basis in strengthening this research. The elements in question are components or criteria in the wayfinding signage such as fonts, linguistics, colors, shapes, layouts, sizes, ergonomics, pictograms or symbols produced by graphic designers, in which they are very important in enhancing the effectiveness of the wayfinding signage (Jafari, 2014; Tezcan & Hiemstra-van Mastrigt, 2019). In addition, Noriman and Ismail (2018) also measures the level of ineffectiveness of wayfinding signage at KLIA2 with these four elements, namely font, color, symbols and size.

According to Mishler and Neider (2017), wayfinding signage must contain design principles that display simple images or symbols, consistent locations, features, specialties, as well as clear and precise markers, in order to convey an effective message. There is a theory used to ensure the presentation and design of this study is

more organized and has an impact on those who read it. This model was produced by an expert in the field of signage design and has also proven its effectiveness in several previous studies. The model in question is the Pyramid Signage produced by Chris Calori. Signage consists of several types such as directional signs, identification signs, informational sings, regulatory signs, and commercial signs and it is commonly used at the airport (Symonds, 2017). Furthermore, electronic or static wayfinding is very important in helping visitor in navigating in the use of space and area instead of assistance from people. Chris Calori and David Vanden-Eynden (2015) have stated that many people are more likely to ask around for directions than to use signage or a map. This study involves wayfinding in buildings and focuses on signage in improving its functions for users. Chris Calori and David Vanden-Eynden (2015) added that signage can guide people from one destination to the other without the help from surrounding people.

The Kuala Lumpur International Airport (KLIA2) was chosen due to its large and complex design. Lynch (1960) mentioned a complex area usually involves focusing on something that can be a sign in wayfinding, or a division of space that has boundaries and may be a route that is familiar to visitors. Lynch (1960) has also added that a place can be visited by the same group of people of different cultures, religions, occupations, ages, genders, and familiarity. The use of wayfinding signage at KLIA2 is relevant and is the main navigation tool to guide visitors to their destinations. Chris Calori and David Vanden-Eynden (2015) has said that the static signage wayfinding is very useful and important in unavoidable situations where the digital system is unusable or vice versa. The visitor route at the airport is the route through the lobby or corridor from various directions and destinations (Garcia-Castro, 2007). Visitors who come to the airport are also those who will board the plane, to get off from the flight, to pick up or send relatives in the allocated time and safe conditions (Symonds, 2017). The quality of wayfinding signage at an airport is also determined by the design of the building (Garcia-Castro, 2007).

The wayfinding signage helps visitors find directions especially buildings that have intricate floor plans (O'Neill, 1991). A person's response to an environment that successfully moves from one place to another reflects the effectiveness of a wayfinding signage (Farr et al., 2014). Wang (2005) said that an effective wayfinding signage makes the trip more enjoyable, pleasurable, and most importantly contributes to a positive experience that makes visitors feel confident to travel again. To further

strengthen this study, the Signage Pyramid model from Chris Calori and David Vanden-Eynden (2015), is used as a guide in achieving the research objectives. Calori has proven that the effectiveness of the Signage Pyramid model through its adoption by past researchers in the previous studies. According to Marques and Cardoso (2012), the Signage Pyramid model provides a complete and clear guide in terms of information mastery, production of creative and orderly design as well as its physical efficacy and impactful delivery. Simultaneously, the Signage Pyramid model creates a signage character that answers the research question. The model is very suitable to be used for this study to produce the signage character that could aid in improving its effectiveness. The Signage Pyramid model includes three fractions that complement the wayfinding signage, namely Information Content System, Graphic System, and Hardware System. According to Chris Calori and David Vanden-Eynden (2015), signage aims to convey information about the environment to users through a graphic display on a physical object or hardware. She added that it helps to manage the workflow with a full systematic process and strategy, especially in the face of complex problems in producing wayfinding signage.

Effective signage requires the integration of design elements that support usability, readability, and accessibility. The literature highlighted three key dimensions, consistent with the Signage Pyramid Model:

Information Content System – Studies underscored the importance of continuity in signage sequencing (Wan, 2016), multilingual inclusivity (Woo & Riget, 2020), and clear directional cues (Symonds, 2017). Accurate, consistent information reduced reliance on airport staff and improved passenger independence.

Graphic System – Readability was significantly influenced by typography and contrast. Garvey et al. (2016) showed that sans-serif fonts improved legibility, while high-contrast color schemes enhanced visibility. However, Noriman and Ismail (2018) cautioned that excessive variation in fonts and colors undermined consistency. Symbols and arrows were universally recognized aids (ISO 7001, 2007), yet their effectiveness depended on simplicity and standardization.

Hardware System – Physical characteristics such as material durability, lighting, and placement determined the functionality of signage in diverse conditions (Pati et al., 2015). Poorly illuminated signage was often ineffective in dim areas, while inappropriate placement at non-decision points disrupted navigational flow (Carpman & Grant, 2002).

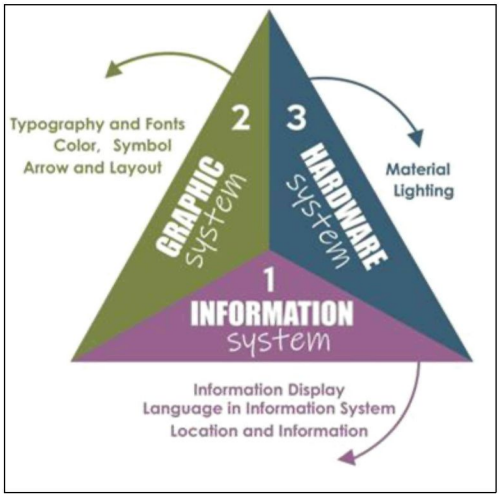

Plate 2.1 Signage Pyramid Model by Chris Calori and David Vanden-Endean (2015)

2.5.1 The Information Content System

This refers to the content and messaging on signs, including how information is organized and communicated to users. Effective information systems prioritize clarity, conciseness, and relevance, ensuring that passengers receive the right information at the right time (Calori, 2007). Based on the information content system provided in the Signage Pyramid by Chris Calori and David Vanden-Eynden (2015), it is the starting and most important component. According to Jeffrey (2017) all the authors have the same opinion that the information available on wayfinding signage is the key factor driving its effectiveness. This is because the information content of this system could affect the graphic and the hardware system. It is best that this information content system should be obtained in detail first. The crucial things that need to be emphasized in the title of this information content system are information or messages displayed, the language used, location and information, and the continuity of information or messages in one location to the next location.

2.5.1.1 Information Display

The signage at the airport contains messages that are different from other public places. It involves things or activities at the airport such as arrival, departure, baggage reclaims, border gates and so on. Anuar et al. (2019) said the information included in a signage must be accurate and appropriate to the location to ensure visitors find directions easily and clearly. In addition, determining the appropriate and accurate

information is very important so that the wayfinding signage is not too dense with information that causes confusion to visitors. According to Anuar et al. (2019), the difficulty of visitors in making quick decisions due to too many choices of information will cause problems such as time constraints, demoralizing visitors, stress and will lead to various unwanted incidents. Important things such as the information contained on the wayfinding signage should be highlighted in the corners of the complex building to make it easier for visitors to identify its existence. However, according to Symonds (2017), in order to generate profit after making a large investment such as at the airport, advertising signage becomes a large number in the collection as well as overcoming and preventing wayfinding signage from being seen by visitors.

2.5.1.2 Language

An airport is a place where people come and go from all over the world. The use of intermediate language is important to ensure the comprehension of people of different linguistic backgrounds. Sutthinaraphan (2016) explained that in an era of globalization, distant parts of the world become interconnected, and English has become the lingua franca used to communicate with people of dissimilar backgrounds. Referring to Woo and Nora Riget (2020), the sole national and official language of the country is displayed in the dominant position in all the multilingual signage. This can be proven by referring to the KLIA2 wayfinding signage, where Malay is the main language displayed with a bigger font size and followed by English language located at the bottom of the signage. This shows that English acts as the second language after Malay, apart from being the international language for communication. However, with concerns regarding foreign visitors at the airport, Malaysia Airlines Holdings Berhad (MAHB) has placed three more languages in the wayfinding signage at KLIA2 which are Chinese, Arabic and Japanese, with each have smaller fonts, respectively. However, this type of signage can only be found at the main area. Most of the airport users agreed that a combination of Malay and English should be used on the signage in Malaysian airports and are happy with the multilingual approach. However, some locals strongly feel that Tamil should be added into the signage (Woo & Nora Riget, 2020). According to Rahman and Mehta (2020), types and fonts have personalities, traits, and specific qualities to convey messages beyond what is expressed within the text of the sign. According to Symonds (2017), inserting too much language in a signage and not

distinguishing through color or font type or size brings problems when it makes it difficult for users to read it. This should be considered by graphic designers to ensure that the use of various types of language does not make it difficult for users. It should be distinguished by size, color and font type but retain the family nature and unity of the signage.

2.5.1.3 Location and Information

The location and information in the content system provide a message regarding the destination with the directions displayed. They also provide accuracy in terms of information, where the signage is located, directional markers, and the location displayed. The location of the signage is important as this will guide visitors from one destination to the other. The location of each signage must be easy to see and continuously from the one before. Bae et al., (2020) mentioned, many studies that have successfully overcome the problems related to the ineffectiveness of wayfinding did not emphasize on the location factor between the signage and the user's appropriate level of view. According to Anuar et al. (2019) it is very important for wayfinding signage that provides navigation information to users to have a suitable design and placed in the right place to make it easier for visitors to see, read and understand it accurately. The existence of wayfinding signage for users to find directions will certainly be placed in the right place. Graphic designers and certain parties ensure the matter through the floor plan before each signage is installed. However, the existence of wayfinding signage in the right place is sometimes obstructed or obscured by advertising signage that confuses visitors and increases the problem in finding directions (Anuar et al., 2019). There is no doubt that advertising signage is also important in generating income for the airport although it weakens the user's ability in navigation (Noriman & Ismail, 2018). Therefore, to overcome the problem, Symonds (2017) suggested that advertising signage be placed in a specific area where it cannot be placed in the path of visitors where there is wayfinding signage.

2.5.2 The Graphic System

The design of the signs, including typography, color schemes, and symbology, falls under the graphic system. A well-designed graphic system improves readability

and visual recognition, making signs easier to understand from a distance or in crowded environments. Consistency in design across different signs helps to maintain a cohesive wayfinding experience (Calori, 2007). This graphic system is a mover or translator of information content system in a visual form. It is a two-dimensional element consisting of typography, symbols, arrows, and colors that are applied to further emphasize the conveyed messages (Chris Calori & David Vanden-Eynden, 2015). She added that the elements must be laid out to produce a layout that still maintains the priority of the information and creates the identity of the signage itself. Next, the importance of this graphic is adapted to the signage in order to facilitate user's acceptance. According to Symonds (2017) wayfinding signage in airport should designed and presented in family group of signage where it is in the seamless character of fonts, symbols, color, arrows and layout.

2.5.2.1 Typography and Fonts

Typography and fonts are one of the important elements in aiding the effectiveness of conveying a message. It is also closely related to the language used which needs to be appropriate to the people in the area. According to Garvey et al. (2016), a layout or design can be very creative with the use of large font size. Typography is clearly designed to promote a culture of reading but there is evidence where the text is difficult to read and has low clarity (Thiessen et al., 2020). For the use of fonts in signage, especially in wayfinding signage, the selection of fonts must be clear and not too complex so that the fonts be easily seen by the community of all ages and the size should also be appropriate based on the distance between the visitors and the texts. An example given by Symonds (2017) is signage located on high building columns allowing the use of large fonts as well as contrasting with background colour.

Referring to the MAHB Sub-Contract Document, KLIA2 is using the Frutiger Bold 65 as the primary font and Frutiger 55 Roman as the secondary font. According to Bullough (2017), the size or space of the signage affects the number of words and symbols that can be included in a text. Bullough (2017) added that there is a guideline where the signage space cannot be filled with too many letters or symbols to avoid overcrowding of information that leads to difficulty in reading the signage. This statement is supported because every signage, especially wayfinding signage, must have a spacing and gap between each word to make it easier to be read by visitors. Shrinking

the font will only aggravate the situation because there will be significant differences between one signage with another that could also impact the clarity of reading even from a short distance. Symonds (2017) suggested to differentiate each word with a different font size and could also include a line element as a divider to each information. If the information is too much or too long, it is better to shorten the word, so the signage can be easily understood. The amount of information on the signage can also be related to the size of the signage itself. According to Noriman and Ismail (2018) visitors will only receive information only at a certain density rate during the navigation process. Symonds (2017) mentioned the situation would be more difficult when the use of different font types among signage and did not show unity in the wayfinding signage system.

2.5.2.2 Symbol

Symbols, pictograms, or visual signs are another essential element applied in the signage to convey message. Symonds (2017) suggests the use of standard symbols or pictograms used in most countries is very important because this is to ensure that users from all over the world understand the message. He added that using symbols or pictograms is better than using two words from different languages such as "washroom/ladies". People with dementia may no longer be able to read, and some researchers have suggested that pictograms should be implemented in signage to convey directional information (Marques & Cardoso, 2012).

2.5.2.3 Color

According to Helvacıoğlu and Olguntürk (2010), color can be an immensely powerful element that aids the navigation within a building. He added, to determine the effectiveness of wayfinding, visitors must identify the layout of the building as well as the levels inside the building. The division of space in the building can be marked with different colors, with an inclusion of wayfinding signage to make it easier for visitors to identify the structure of the building and navigate to their destination. However, the choice of color in the wayfinding signage should be inspected carefully because there are some visitors who have color blindness and are not able to distinguish different

groups of colors. Precautionary steps should be considered by referring to experts regarding the use of colors in the wayfinding signage.

2.5.2.4 Arrow and Layout

Aiyegbusi (2016) has stated that the information in static wayfinding signage is difficult to upgrade as compared to the electronic wayfinding signage, which only uses the Internet to update the information. Aiyegbusi (2016) added that the static wayfinding signage has a limited space to include more location-related information at the airport. Another main element of a wayfinding signage is an arrow. An arrow is important to a wayfinding signage as it is used a directional sign to help with the visitor's navigation. From the starting point to the destination, the arrow is responsible in guising people to get to their destination. To convey effective messages, the layout or placement of an arrow must be precise and clear.

2.5.3 The Hardware System

This involves the physical elements of signage, such as material selection, positioning, and durability. Hardware systems ensure that signs are visible, properly installed, and withstand environmental conditions such as lighting, wear and tear, and weather. Well-placed and maintained signs are essential for creating a seamless wayfinding experience (Calori, 2007). By applying the Signage Pyramid Model, this thesis aims to identify the specific criteria that contribute to effective wayfinding signage in airports, with a focus on improving navigation at KLIA2. This is the third part of the Signage Pyramid model where it is a three -dimensional physical sign that carries the content information in a graphic form. The size and shape are also greatly influenced by the density of the graphic system. After all the information and graphics system have been loaded, the hardware of this system must be installed or attached within the building (i.e., hanging signage, wall-mounted signage, and standing signage). According to Chris Calori and David Vanden-Eynden (2015) to attract the attention of users, the condition of the signage must be attractive depending on the materials, lighting and coating used. It must also have an identity, similarity, and likeness of one group to another signage as well as the environment.

2.5.3.1 Material

Symonds (2017) in his study suggested that wayfinding signage in large and complex places such as airports should be seen as an environmentally friendly system, a system that is organized and constantly audited to maintain the quality of its existence. The suitability and durability of a signage must be ensured because it is closely related to the environment and to prevent harmful things from happening to visitors. Therefore, Calori and Eynden (2015) mentioned that there are various types of materials of various price range that can be used to create wayfinding signage such as acrylic, aluminium, stainless steel, stickers and so on. It depends on the budget and how the signage is presented.

2.5.3.2 Lighting

According to Petek and Suzanne (2019), the static wayfinding signage is a bit outdated and no longer suitable to be used in the current era. Petek and Suzanne (2019) added that the new era now requires animated wayfinding signage such as lighting projection to increase the level of effectiveness as well as to reduce stress among visitors for a sufficient amount of lighting is important to help older adults to see and interpret their environment. There is an evidence that ambient light should be set for at least 500 lx, and the lighting supply should be within 2000 lx, as suggested for areas where activities would occur (Marquardt, 2011). With respect to the general impact of lighting, it is believed that with an appropriate and specifically bright lighting, the wayfinding process will be more successful (Gharaveis et al., 2016). Hidayetoglu et al. (2012) mentioned that bright lighting is perceived to be more navigable than low or medium lighting. Gharaveis et al. (2016) also found that daylighting is an important environmental factor that supports older adults' activities, including their navigation through buildings.

To achieve the objectives of this study, a theoretical framework has been proposed. This method involves an online questionnaire that will be distributed to Malaysian citizens who have been to KLIA2. The questionnaire includes items related to the effectiveness of wayfinding signage such as design, language, location, installation techniques, continuity and so on. This phase will be able to answer the second research question. After collecting and analyzing the data for the first and second

research questions, the process to answer the third research question will be carried out. The guidelines or criteria will be established to improve the effectiveness of wayfinding signage in KLIA2. Hence, the third phase focuses on improving the effectiveness of wayfinding signage as it is especially beneficial to airport users. Apart from that, KLIA2 and the graphic designers will also benefit from this study, as both parties are able to produce an effective wayfinding signage in the future.

Wayfinding is a crucial aspect of airport operations, as it ensures that passengers can navigate the terminal efficiently. At Kuala Lumpur International Airport 2 (KLIA2), issues with the effectiveness of signage have been reported. Passengers often face challenges locating key facilities, leading to confusion, stress, and even delays. This presents a significant problem as airports are highly dynamic environments that require clear, effective signage systems to support smooth passenger flow. The challenges at KLIA2 highlight the need for better wayfinding strategies to improve passenger experience, reduce congestion, and enhance overall airport efficiency.

The theoretical framework for this thesis will draw upon the Signage Pyramid Model developed by Chris Calori, a leading expert in the field of wayfinding and environmental graphic design. The purpose of this theoretical framework is to provide a structured approach to evaluating the current signage at KLIA2 and to propose improvements based on established wayfinding principles. The framework will guide the analysis of existing signage systems by examining their informational, graphical, and hardware components. Additionally, it will help to develop criteria for designing more effective wayfinding systems that enhance user navigation and satisfaction in airport settings. By integrating the insights from Calori's model, the research will contribute to the broader understanding of how signage can influence passenger behavior and airport efficiency, ultimately offering practical recommendations for improving wayfinding at KLIA2 and similar airport environments.

These findings demonstrated that effective wayfinding signage was multi-dimensional, requiring balance between visual clarity, structural positioning, and inclusivity.

2.6 Methodology Approaches in Previous Studies

Understanding the methodological approaches employed by various authors in their studies provides insights into how data collection and analysis are tailored to specific research objectives. This essay compares the research methods used by Anuar et al. (2019), Creswell (1999), and Halcomb & Hickman (2015), highlighting their unique characteristics and applications. Anuar et al. (2019) adopted a quantitative approach, focusing on collecting numerical data to analyze traveler experiences at KLIA2. They conducted a survey involving 200 respondents, emphasizing statistical accuracy and generalizability of the findings. This approach is particularly suitable for studies aiming to identify trends and patterns within large populations.

Creswell (1999), in contrast, proposed a mixed method research approach, which combines both quantitative and qualitative methods. His work introduced three distinct mixed-method models: the Convergence Model, which integrates quantitative and qualitative data simultaneously; the Sequential Model, which collects one type of data first, followed by the other; and the Instrument Building Model, where qualitative findings are used to inform quantitative measures. This approach is ideal for addressing complex research questions requiring both numerical data and in-depth contextual understanding. Halcomb & Hickman (2015) further refined mixed method approaches by applying them to nursing studies. They outlined four specific characteristics: the Convergent Parallel Model, which collects and analyzes data concurrently; the Sequential Explanatory Model, which starts with quantitative data followed by qualitative exploration; the Sequential Exploratory Model, reversing the sequence; and the Embedded/Nested Model, which incorporates one method within another. Their framework, adapted from Creswell and Plano Clark, underscores the flexibility and depth of mixed-method research.

In summary, the research methods used by these authors reflect a progression from quantitative precision to the comprehensive integration of mixed-method designs. Anuar et al. (2019) prioritized simplicity and statistical reliability, Creswell (1999) emphasized methodological versatility, and Halcomb & Hickman (2015) demonstrated the adaptability of these approaches in specialized fields. Together, these methods offer valuable tools for researchers aiming to address diverse and multifaceted research questions.

Table 2.3
Authors Method Approach

Author	Method Approach	Remarks
(Anuar et al., 2019)	Quantitative – 200 respondents from KLIA2 travellers	
(Creswell, 1999)	Mixed Method research	Mixed method model: 1-convergence model 2- sequential Model 3- Instrument Building Model
(Halcomb & Hickman, 2015)	4 Mixed method characteristics Adopted from Creswell and Plano Clark in nursing study	1- convergent parallel (concurrent) 2- sequential explanatory (quant to qual) 3- sequential exploratory (qual to quant) 4. embedded / nested

2.7 Theoretical Framework

The theoretical framework of this study was constructed by integrating the Signage Pyramid Model proposed by Calori (2015) with the Elements and Principles of Design (Petek & Suzanne, 2019; Jafari, 2014; Mishler & Neider, 2016). This integration provides a structured lens for examining the ineffectiveness of wayfinding signage at Kuala Lumpur International Airport 2 (KLIA2), particularly at its main entrance. By combining theoretical models of signage systems with design-based perspectives, this framework ensures that both functional and aesthetic dimensions of signage are critically evaluated. The central issue underpinning this research is the ineffectiveness of wayfinding signage. In this study, ineffectiveness is defined as the failure of signage to facilitate efficient navigation due to weaknesses in placement, continuity, accuracy, or visual design. Such weaknesses are particularly problematic in airport environments, where passengers must make rapid and accurate decisions under time constraints. At the core of this framework lies the Signage Pyramid Model. Calori (2015) emphasized that a successful wayfinding system relies on the integration of three interconnected systems: the information system, the graphic system, and the hardware system. The information system concerns the accuracy, clarity, and continuity of directional content presented to users. The graphic system translates this information visually, through elements such as typography, color schemes, arrows, and pictograms. The hardware system refers to the material and structural qualities of signage, ensuring durability, ergonomics, and visibility within the built environment. These three systems collectively establish the functional foundation of wayfinding signage and provide

categories through which ineffectiveness may be systematically identified and analyzed.

To complement this functional model, the Elements and Principles of Design were incorporated into the framework. The elements of design—such as fonts, colors, shapes, layouts, sizes, pictograms, and ergonomic considerations—represent the building blocks that influence how signage is perceived and understood. The principles of design, which include clarity, consistency, simplicity, precision, and effectiveness in message delivery, determine whether these elements achieve their intended communicative purpose. By combining these two perspectives, the study ensured that signage evaluation addressed both its structural role as a navigational aid and its aesthetic and perceptual impact on users.

The framework therefore operationalized several key variables for assessment, including typographic clarity, linguistic accessibility, the use of universally recognized pictograms, strategic placement, size and proportion, and color contrast. When these variables were poorly executed, signage became ineffective, leading to passenger disorientation, congestion, and heightened stress. Conversely, when these variables were well-designed, they contributed positively to navigation efficiency and user satisfaction.

A key strength of this framework lies in its alignment with the research objectives. The first research objective, which seeks to identify the factors contributing to signage ineffectiveness, is directly supported by the Signage Pyramid Model, as its three systems provide a clear basis for classification. The second objective, which involves analyzing the significant factors of ineffectiveness, is facilitated by the integration of the elements and principles of design, as these criteria allow for deeper exploration of the specific characteristics that hinder effective communication. The third objective, which aims to recommend criteria for signage improvement, is achieved by synthesizing insights from both models, ensuring that the recommendations are grounded in established theoretical perspectives as well as empirical findings. This framework was applied in the case study of KLIA2 entrance signage, with photographic documentation collected during 2022–2023 on the main entrance floor. The entrance was selected as the primary site because it represents passengers' initial interaction with the airport environment and therefore plays a critical role in shaping first impressions of navigational ease. The application of this framework to the entrance context ensured that the study was both contextually grounded and methodologically robust. The

theoretical framework of this study integrated the Signage Pyramid Model and the Elements and Principles of Design. This framework guided the analysis in alignment with the research objectives. First objective is to identify factors influencing ineffectiveness – informed by the identification of weaknesses across the three pyramid dimensions (information, graphics, hardware). Second objective is to analyze significant factors – supported by the hierarchical structure of the Signage Pyramid, enabling prioritization of critical elements. Objective number three is to recommend criteria for improvement – developed through the synthesis of design principles and empirical findings, offering evidence-based guidelines for signage enhancement. The framework thus provided both structural rigor and design sensitivity, ensuring practical and academic contributions.

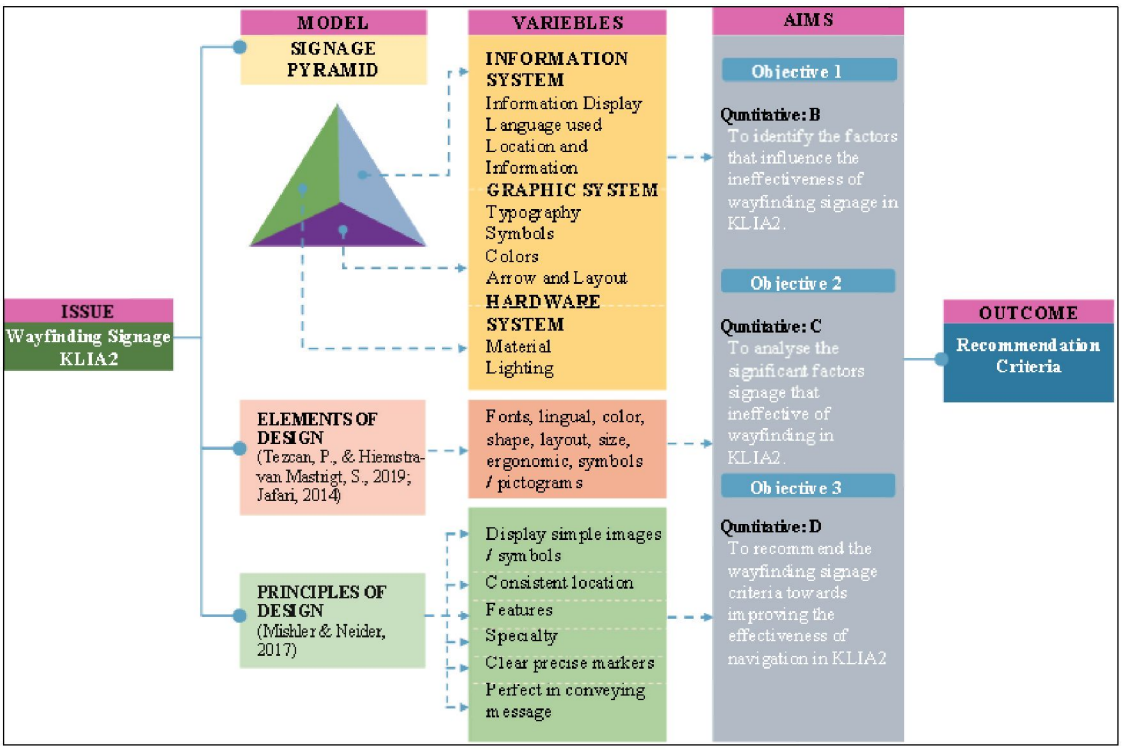

Plate 2.2 Theoretical Framework

In conclusion, the theoretical framework of this study provided a comprehensive and multidimensional structure for analyzing wayfinding signage. By integrating the Signage Pyramid with the elements and principles of design, the framework allowed for both structural and visual evaluation of signage. It also established a direct connection between theoretical concepts and research objectives, thereby bridging the gap between academic theory and practical airport management. This dual focus strengthened the

contribution of the study, offering insights not only for KLIA2 but also for broader discussions on wayfinding design in complex public environments.

2.8 Delimitation of the Study

This literature review was delimited to scholarly works published between 2015 and 2023, focusing on wayfinding signage in airports and other large-scale public infrastructures. Empirical data in the form of images were collected at KLIA2 during 2022 and 2023, specifically on the main entrance floor. These images captured the signage most visible to arriving passengers, serving as contextual evidence for analysis. The delimitation ensured relevance, currency, and feasibility within the study's scope.

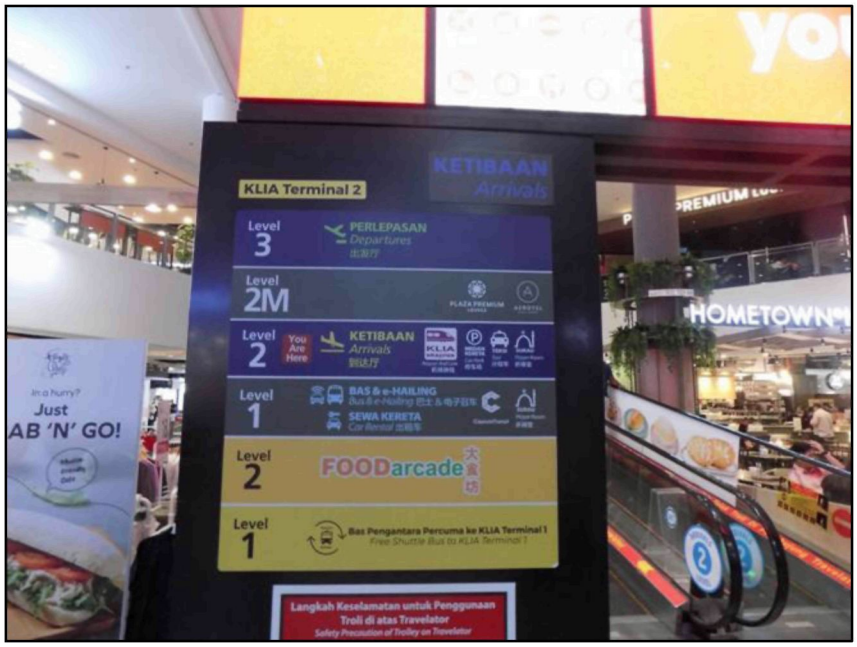

Plate 2.3 Font's Size, Colour, Pictogram, Lighting (Taken at KLIA2 in 2024)

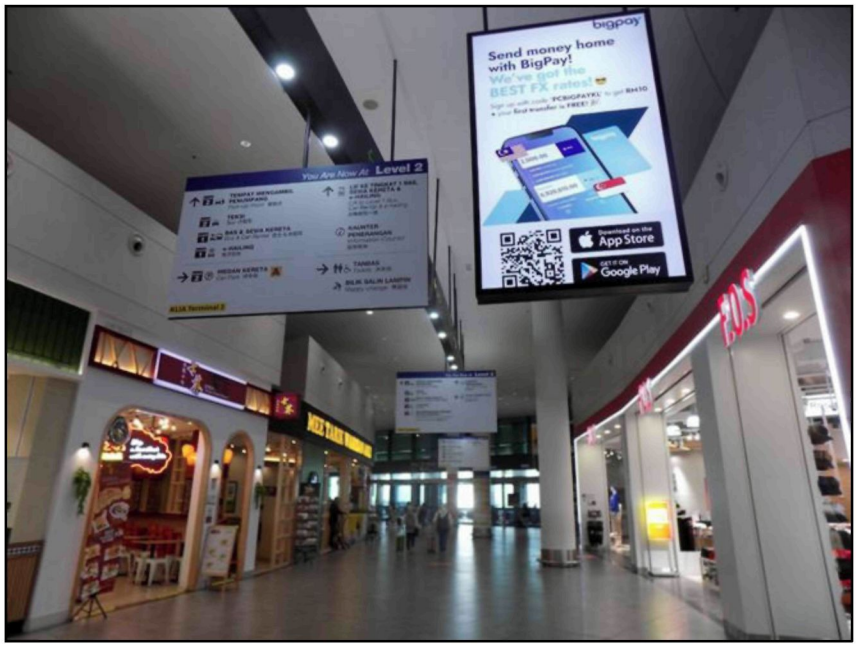

Plate 2.4 The Continuity, Layout of Wayfinding Signage at KLIA2 (Taken at KLIA2 in 2024)

Plate 2.5 The Hidden of Wayfinding Signage at KLIA2 (Taken at KLIA2 in 2024)

Plate 2.6 The Hidden of Wayfinding Signage at KLIA2 (Taken at KLIA2 in 2024)

Plate 2.7 Advertising Sign Brighter Up (Taken at KLIA2 in 2024)

Plate 2.8 Confusing Wayfinding Signage (Taken at KLIA2 in 2024)

2.9 Summary

This chapter critically reviewed literature related to wayfinding signage. The discussion covered definitions and conceptualizations, theoretical models, challenges of ineffectiveness, characteristics of effective signage, and methodological approaches. The review established that while many studies examined environmental and linguistic factors, there remained a lack of systematic evaluation of signage design elements in airports, particularly at KLIA2.

The Signage Pyramid Model and the Elements and Principles of Design were identified as appropriate frameworks, offering complementary perspectives on the structural and perceptual dimensions of signage. Furthermore, the chapter clarified the terminology of ineffectiveness, established the connection between models, and defined the delimitation of the study.

In summary, this literature review highlighted both theoretical foundations and practical gaps, justifying the present research. The next chapter presents the research methodology, outlining the design, data collection, and analytical strategies employed to address the research objectives.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is the most important chapter in each research. In this chapter, researcher was planned the process of how to achieve the objective and answer the research question of the study. In the literature review, this study consists of reading eBooks, journals, articles, and documents to find information and problems that arise regarding wayfinding signage, whether in or outside of the country. This stage is important to get familiar with wayfinding signage character, to know how complex of the building such as an airport, and to find out theory that related to this research (Noriman & Ismail, 2018). However, further investigation planed with mixed method approach to obtain data and information.

According to Creswell (1999), for studies that use a mixed method approach, there are eight basic procedures that must be followed to ensure the effectiveness of its use. Firstly, to ensure that the problems in the study can be investigated through a mixed method approach, Creswell insinuates that researcher are able to obtain more quality data rather than using a single method approach. He added that from one method, the result will grow into the use of two methods regardless of whether it starts with qualitative or quantitative. Secondly, Creswell has mentioned that the researcher must ensure that the mixed method approach can be implemented because it involves cost and time to complete the study. Third, create research questions to identify the method that will be used, which is either qualitative or quantitative. Fourth, examine and then against both methods. The quantitative approach includes observing and interviewing through a mediator such as a form that contains questions related to the study of the groups involved. The findings for this quantitative approach will be in the form of numerals and aggregates. As for the qualitative approach, it includes observation, interviews, documents, and audio-visual interviews. Fifth, evaluate each method strategy in terms of its implementation. Discuss each of these methods according to the objectives of the study. Six, translate the method pattern strategy into a visual form to make it easier for the people to understand. Seven, determine how the data obtained will

be analysed and eight is assess the extent to which the quality of the study can be determined.

3.2 Mixed Method

This study adopted a mixed-method approach, which integrated both quantitative and qualitative strategies. The justification for this approach was grounded in the need to obtain not only numerical data that could be statistically tested but also richer insights that could only be derived from expert interpretation. According to Creswell and Plano Clark (2011), the combination of quantitative surveys and qualitative interviews enhances the depth and breadth of understanding while ensuring triangulation of findings.

The quantitative component involved a structured questionnaire administered to 237 respondents who had prior experience navigating KLIA2. This survey provided measurable data regarding user perceptions of signage clarity, placement, language accessibility, and design consistency. The qualitative component consisted of semi-structured interviews with professionals in environmental graphic design, airport operations, and wayfinding system development. These interviews allowed the researcher to capture expert perspectives, identify subtle design weaknesses, and gather practical recommendations. The integration of both approaches ensured that limitations in one method were compensated by strengths in the other, thus enhancing overall validity.

To further illustrate the methodological orientation, this study adopted Creswell's Sequential Explanatory Model of mixed-method research (1999). The model is designed to first collect and analyze quantitative data, followed by qualitative data to explain, or expand upon the statistical results. This sequence aligned with the structure of the present research, where questionnaires provided measurable findings regarding signage effectiveness and subsequent expert interviews offered deeper contextual insights. The integration of both phases enhanced the robustness of the findings and ensured triangulation of results. The adopted model is illustrated in

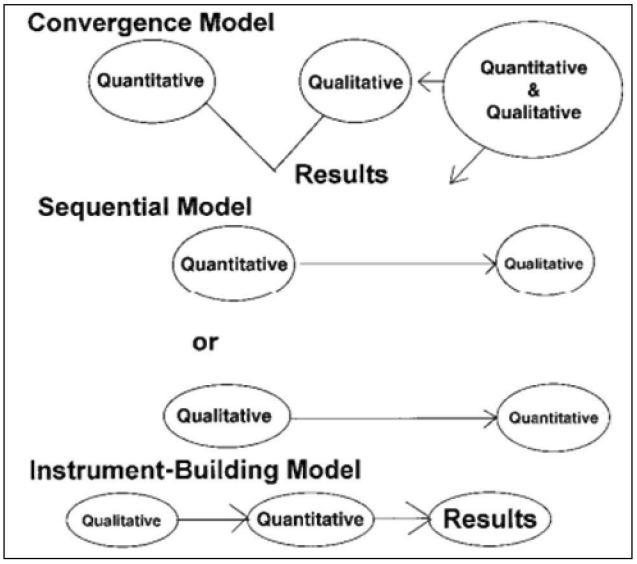

Figure 3.1 Three Model of Mixed Method for Social Sciences by Creswell

In order to strengthen the justification for selecting the Sequential Explanatory Model, it was important to differentiate it from the Sequential Exploratory Model. While both approaches employ sequential data collection, their order of priority and emphasis differ significantly. The explanatory model prioritizes quantitative data followed by qualitative exploration, whereas the exploratory model begins with qualitative insights before moving into quantitative testing. The distinction is presented in Table 3.2 below.

Table 3.1
Sequential Explanatory and Sequential Exploratory by Creswell

Research Design	Process	Purpose	Level of Interaction	Level of Priority
Sequential Explanatory	QUANTITATIVE ↓ qualitative	Qualitative data are collected to explain the quantitative findings	Quantitative data frames qualitative data collection	Quantitative dominant
Sequential Exploratory	QUALITATIVE ↓ quantitative	Quantitative data builds on qualitative findings to provides generalizability	Qualitative data frames quantitative data collection	Qualitative dominant

3.3 Research Phase

The research process was structured into four distinct phases, in line with the Sequential Explanatory Model of mixed-method research. This design allowed the study to first generate broad statistical findings and subsequently explain them in greater

depth through qualitative inquiry. The phased approach ensured coherence, credibility, and systematic progression from theory to evidence.

3.3.1 Phase One: Development of the Research Framework

The first phase involved the construction of the theoretical and conceptual framework, which was based on established models such as the Signage Pyramid Model (Calori & Vanden-Eynden, 2015) and the Elements and Principles of Design (Jafari, 2014). This framework guided the formulation of research questions, instrument design, and the identification of variables related to signage effectiveness at KLIA2.

3.3.2 Phase Two: Quantitative Data Collection and Analysis

In the second phase, quantitative data were collected through structured questionnaires administered to 237 respondents who had prior experience navigating KLIA2. The instrument included items measuring clarity of signage, continuity, placement, and language accessibility. Respondents evaluated these items using a Likert scale, allowing for statistical interpretation. The collected data were subjected to descriptive statistical analysis, including frequencies, percentages, and measures of reliability such as Cronbach's Alpha. This phase provided measurable evidence of passenger perceptions and highlighted recurring issues that required deeper investigation.

3.3.3 Phase Three: Qualitative Data Collection

The third phase concentrated on qualitative data collection through semi-structured interviews with selected expert participants. The interviewees included professionals in graphic design, airport operations, and environmental wayfinding systems. Open-ended questions were used to encourage elaboration on the factors that contributed to signage ineffectiveness, as well as recommendations for improvement. The qualitative phase was specifically intended to expand upon and explain the findings from the quantitative phase, ensuring alignment with the sequential explanatory design.

3.3.4 Phase Four: Qualitative Data Analysis

The fourth phase involved the thematic analysis of the interview transcripts. Following Braun and Clarke's (2006) six-step approach, the transcripts were coded, categorized, and synthesized into key themes such as signage placement, multilingual inclusivity, design consistency, and hardware durability. The qualitative findings not only confirmed patterns identified in the quantitative data but also provided contextual depth, professional justification, and practical recommendations. The integration of both analyses strengthened the overall validity of the research and supported the formulation of design guidelines for wayfinding signage at KLIA2.

3.4 Research Design

The research design adopted in this study followed a sequential explanatory mixed-method approach, integrating both quantitative and qualitative phases in a structured sequence. This design was selected because it allowed the researcher to first obtain broad statistical evidence through quantitative surveys and subsequently explain and elaborate on these results through qualitative interviews. Creswell (1999) emphasized that the sequential explanatory model is most effective when numerical data require deeper contextual interpretation, making it suitable for this study of wayfinding signage at KLIA2.

The descriptive component of the design aimed to capture and summarize the characteristics of existing signage and its perceived effectiveness among passengers. This included measurable aspects such as clarity, placement, continuity, and multilingual accessibility. The explanatory component was embedded in the sequential design, where the quantitative findings were further explained and contextualized through interviews with expert participants. This alignment ensured that the study was not only descriptive in nature but also interpretive, enhancing the depth of the conclusions drawn. The sampling method employed was purposive sampling, ensuring that only individuals with prior experience at KLIA2 participated in the survey. A total of 237 respondents completed the questionnaire, representing a sufficiently large sample size for statistical reliability.

A framework has been created after choosing the method that will serve as a guideline for this study. The sequence order that carries this study up to the process of

data analysis is shown in the figure that has been sketched out below. The method chosen is a mixed method and the sequential explanatory is the most appropriate method for this study. Using the sequential explanatory guideline, this study developed an instrument to complement the first phase of quantitative data collection.

The next phase is the distribution of the questionnaire to the sample size. The sample size determined using Krejcie Morgan's table is a total of 237 Malaysians aged eighteen years and older. The distribution of the questionnaire takes up to five months to receive the responses from the respondents. The next phase is data analysis. The data collected with the questionnaire is quantitative data. These quantitative data are analysed using SPSS and are descriptive-analytical. The process of analysing this data also takes some time, as each item or question of the instrument must be examined and researched. In the mixed method, both quantitative and qualitative approached are used in a study. This study passed the first method, quantitative. After analysing the data obtained and obtaining results that meet the goal of the study, the next process is qualitative. The qualitative results of this study depend on the results of the first, quantitative method.

The sequential explanatory used as a guide in the study requires a qualitative procedure to further explain the results obtained with the first method. The main factors that respondents believe lead to ineffective wayfinding signage at KLIA2 are observed in this phase. Visit the KLIA2 site and make observations on the most important factors. Pictures of wayfinding signage were taken and will be used as material to explain the factors agreed upon by the respondents.

The data collected through observation will be analysed and explained in detail according to the requirements of the study. After completing both qualitative and quantitative methods, more detailed results were obtained. The results and conclusions are discussed in the next chapter.

The research instruments consisted of a structured questionnaire and a semi-structured interview protocol. The questionnaire was divided into several sections, including demographic information, clarity and readability of signage, placement and continuity, and overall effectiveness. Responses were measured using a five-point Likert scale, enabling quantitative analysis. The interview protocol, meanwhile, encouraged participants to elaborate on key themes such as design criteria, multilingual inclusivity, and airport navigation challenges. To enhance validity, both instruments

underwent pilot testing and expert review, which ensured that the items were clear, reliable, and appropriate for the study context.

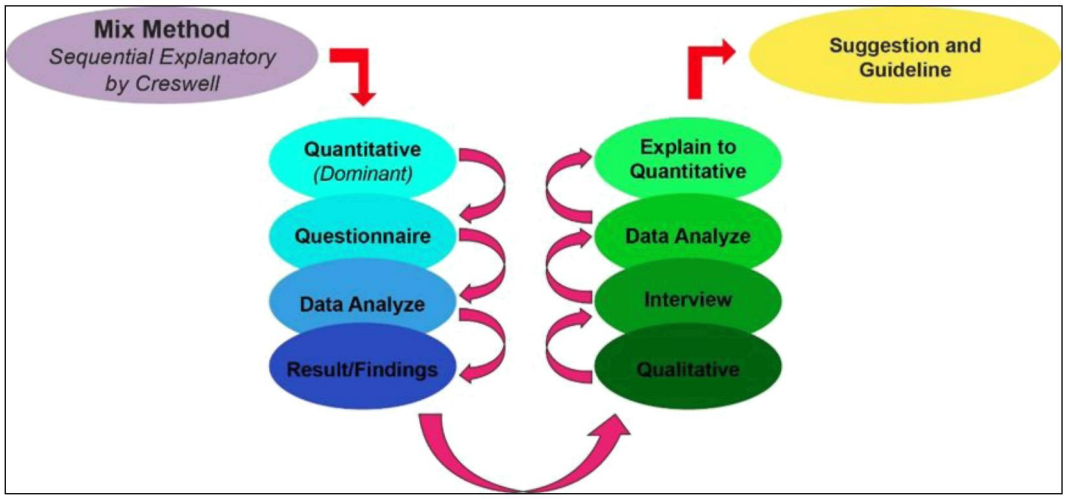

Figure 3.2 Research Design Framework

3.5 Data Collection Process

The process of data collection was executed systematically to ensure accuracy and representativeness. The questionnaire focused on aspects such as clarity of information, placement at decision points, continuity of signage sequences, and the effectiveness of multilingual communication. Respondents evaluated these factors using a five-point Likert scale, ranging from strongly disagree to strongly agree. The high response rate provided confidence in the representativeness of the findings.

The quantitative approach is a survey through an online intermediary, e.g., an instrument that includes questions to study the groups involved. The results of this quantitative approach are presented in the form of figures and aggregates. Sequential explanatory nature used in this study shows that the quantitative method is predominant. This means that this quantitative study is conducted using a questionnaire method to obtain data from respondents. In this study, the questionnaire was distributed to two hundred airport users to determine the ineffectiveness of the wayfinding signs at KLIA2 in conveying messages. This is based on Krejcie and Morgan (1970) table for sample size since the population of the airport has a high number of visitors. The instruments in this study consist of five constructs.

The qualitative phase, semi-structured interviews were carried out with selected experts. Each interview lasted between 20 and 40 minutes and was audio-recorded with the consent of participants. Open-ended questions were posed to encourage detailed

responses on issues such as typography, language, sign placement, and hardware durability. Interview transcripts were later transcribed and coded for thematic analysis. This qualitative input was particularly valuable in generating recommendations that extended beyond user perceptions. According to Hertzog (2008) that adopted from Prescott and Soeken (1989) there is purpose why pilot study need to done at first place before the actual figure of sampling measured. It is included to evaluate the feasibility, adequacy of instrumentation, problem of data collection strategies and proposed method. Additionally, pilot study also answering methodological question and also planning for larger study. Hertzog (2008) also mentioned that pilot study aims to obtaining sufficient preliminary data to justify a grant award by Jairath, Hogerney, and Parsons (2000). Hence, this study started with pilot test to ensure the feasibility of the questionnaire.

Construct A is demographic. According to Connelly (2013) demography is the population of an area. It shows historical changes from time to time. Vogt and Johnson (2011) defined demography as human characters in an area such as age, birth, death, health, fertility, and migration. He added that demographics are social and economic data that lead to changes in the shape of the population over time. The general background of the respondents is very helpful in analysing the relevant data to achieve the objectives of the study. This study is about wayfinding signage at KLIA2. The demographic data in this study is refers to the population of KLIA2, i.e., those who visited the airport. Due to the large number of visitors from different countries, the study was limited to Malaysian nationals. Demographic data is a tool that can be used in a quantitative study.

Theory of Wayfinding. A sign should tell the navigator what's in the direction it points, and the destinations so indicated should help the navigator reach his eventual goal (Arthur & Passini, 1992). According to Lynch (1960) the book *The Image of the City,* "wayfinding" to describe his concept of environmental legibility—that is, the elements of the built environment that allow us to navigate successfully through complex spaces like cities and towns. Section B, C and D of the instruments contains questions to achieve the first objective of the study which is to identify the factors that influence the ineffectiveness of wayfinding signage to convey messages clearly among visitors in KLIA2.

Section B contains 17 questions that adopted from the previous indicator of the authority. This ensures that the instruments are still valid and that the reliability of the

questionnaire is guaranteed. Section B of the survey represents questions containing elements of information system present on wayfinding signage in KLIA2. To pinpoint the factors contributing to the ineffectiveness of wayfinding signage from an informational perspective, Likert scale survey questions are utilized. The indicator and authorship were found that relates to the study. See timetable below. There is how instruments or construct B created. The adopted items are from the earlier journal and refer to the wayfinding signage. The modified items are the improvisation of the questionnaire based on the current study, but still in the same track and meaning.

Table 3.2
Original and Modified Items for Construct B

No.	Original Item/Item Asal	Modified Item/ Item Ubah Suai
1.	Clarity of the signage at airport – Clear or Unclear (Ardi et al., 2019)	Is the signage at KLIA2 clearly visible?
2.	Frequency of visual communication elements such as sign and maps at airport terminal – High or Low (Ardi et al., 2019)	What is the frequency of signage at KLIA2?
3.	Is ist understandable? (Zuhudi et al., 2017)	Is the signage at KLIA2 understandable?
4.	The quality of the signage in the airport terminal (Ardi et al., 2019)	What is the quality of the signage at KLIA2?
5.	It was easy to navigate in the airport terminal (Anuar et al., 2019)	Is the signage help you navigate easily?
6.	The variable directional signs were noticeable (Anuar et al., 2019)	Are you notice the variable of directional sign while navigating?
7.	Is it informative?(Zuhudi et al., 2017)	Is it the signage informative?
8.	There were too many adverts in the airport terminal (Anuar et al., 2019)	Is it too many adverts at KLIA2?
9.	I was distracted by the adverts (Anuar et al., 2019)	Are you distracted by advert while navigating?
10.	Is it good enough to find a correct direction to your location? (Zuhudi et al., 2017)	Is it signage at KLIA2 good enough to find direction to your location?
11.	Have you ever lost by using way finding? (Zuhudi et al., 2017)	Have you ever lost by using wayfinding signage at KLIA2?
12.	Do you always need some other aids to find location rather than use way finding? (Zuhudi et al., 2017)	Do you ever need some other aids to find location rather than wayfinding signage?
13.	Do you think it's helpful? (Zuhudi et al., 2017)	Do you think wayfinding signage at KLIA2 is helpful?
14.	Do you think it's friendly user? (Zuhudi et al., 2017)	Do you think its friendly user?
15.	I noticed that the terminal building structure were blocking some of the signs (Anuar et al., 2019)	Have u seen the building structure blocking the signage at KLIA2?
16.	The distance that must be traveled by passengers at the airport (Ardi et al., 2019)	What do you feel about the travel distance in the airport?
17.	The numbers are enough (Buyruk, 2019)	Are the numbers of signage at KLIA2 enough?

These include the clarity of the words, the overall frequency of wayfinding signs, visitors' understanding of the information, and the condition of the wayfinding signs. The questionnaire also asks whether the wayfinding signs help visitors navigate,

how variable the direction is during navigation, or whether the wayfinding signs are inadequate. See timetable below. This is the final questionnaire for section B. Refer to Chris Calori's pyramid, the information system is the first thing to clarify when creating good signage. This section is more about the information that appears on the signage.

Table 3.3
Items for Construct B

No. Items	Items
B1	Is the signage at KLIA2 clearly visible?
B2	Is the frequency of signage at KLIA2 satisfactory?
B3	Is the signage at KLIA2 understandable?
B4	What is the condition of the signage in klia2?
B5	Is the signage help you navigate easily?
B6	Are you notice the variable of directional sign while navigating?
B7	Is it the signage informative?
B8	Does the number of advertising signs equal the wayfinding sign at KLIA2?
B9	Are you distracted by advert while navigating?
B10	Is it signage at KLIA2 good enough to find direction to your location?
B11	Have you ever lost by using wayfinding signage at KLIA2?
B12	Do you ever need some other aids to find location rather than wayfinding signage?
B13	Do you think wayfinding signage at KLIA2 is helpful?
B14	Do you think its friendly user?
B15	Have u seen the building structure blocking the signage at KLIA2?
B16	What do you feel about the travel distance in the airport?
B17	Are the numbers of signage at KLIA2 enough?

The purpose of Section C is to identify and examine the main causes of the insufficient message effectiveness of the wayfinding signs at KLIA2. This section of the survey was designed using a descriptive analytic strategy to ensure a thorough examination of the factors involved. The questions in Section C focus specifically on the graphic system of the wayfinding signage. This involves evaluating the various graphic elements present on the signs, such as design, color schemes, symbols, icons, and overall visual layout.

By focusing on these elements, the survey aims to understand how the visual aspects of the signage contribute to or detract from their ability to convey clear messages to visitors. Like Construct B, Construct C has been carefully adapted from previous research to maintain the validity and reliability of the questions. By using established research as a foundation, the study ensures that the questions are relevant and effective in assessing the graphic components of the signage. This approach allows for a detailed analysis of how graphic design factors impact the overall effectiveness of wayfinding signs at KLIA2. By identifying specific graphic-related issues, the study

can provide targeted recommendations for improvements, ultimately helping to enhance the visitor experience by making navigation easier and more intuitive. This section plays a crucial role in the overall research by pinpointing the visual factors that need to be addressed to improve the clarity and usability of wayfinding signage at the airport. Data collection was analysed using SPSS software. This questionnaire's goal is to identify the key causes of KLIA2's wayfinding signage's failure to effectively communicate with travellers.

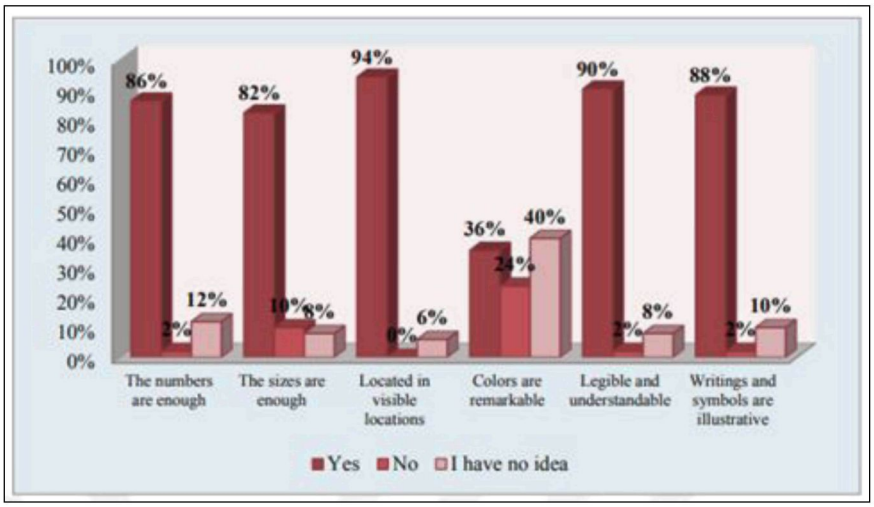

Figure 3.3 Evaluations of participants about signage systems. Indicator by Buyruk (2019)

Item No.	Section B3 (The effectiveness of the indicator's characteristic)
B3-1	Health hazard warning signage has warning words. Example: DANGER! CAUTION! WARNING!
B3-2	The health hazard warning signage does not clearly describe the disease.
B3-3	The available message explains the effect of non-compliance on the health hazard warning signage.
B3-4	The message on the health hazard warning signage does not explain the disease prevention measures.
B3-5	The health hazard warning signage is clearly visible.
B3-6	The health hazard warning signage is in an inappropriate location.
B3-7	The health hazard warning signage is compelling to read.
B3-8	The health hazard warning signage is small in size.
B3-9	The health hazard warning signage has a bright colour.
B3-10	The number of health hazard warning signage at this recreation park is not sufficient.
B3-11	The message displayed by the health hazard warning signage is easy to read.
B3-12	The health hazard warning signage should have a picture.
B3-13	The message displayed by the health hazard warning signage is easy to understand.
B3-14	Health hazard warning signage must use multiple languages (Malay, English, Mandarin or Tamil)
B3-15	I am willing to use the displayed message on the health hazard warning signage to convey to others.

Figure 3.4 Indicator by Abd Wahil et al.

Item No.	Section C1 (Perception of the visitors toward the leptospirosis health hazard warning signage)
C1-1	Is the message on the health hazard warning signage reliable?
C1-2	Health hazard warning signage does not have complete information.
C1-3	The health hazard warning signage has an up-to-date information.
C1-4	I will not obey any instructions or messages that are displayed on the health hazard warning signage.
C1-5	Health warning signage is an appropriate channel to convey health hazard warning messages at recreation park.
C1-6	There is no evidence that the health hazard warning signage at the recreation park has been endorsed by the respected authority
C1-7	The message displayed on the health hazard warning signage is appropriate in providing the relevant information.
C1-8	Is the message displayed by the health hazard warning signage not useful to you?
C1-9	If the same health hazard warning signage need to be placed in another recreation park, does the content need to be changed?
C1-10	Health hazard warning signage has more than one recurring message or the same meaning.

Figure 3.5 Indicator by ACRP Research Report 177

P-PD.12	Large, unadorned, illuminated fonts are used for directional signs.	P-PD.15	Arrows are consistently applied. Plain language is used: "straight ahead" instead of an arrow pointing up or down when there is risk of being confused with "upstairs" or "downstairs." Conversely, the words "upstairs" or "downstairs" are used when communicating guidance through non-intuitive vertical transition wayfinding scenarios. Use of diagonal arrows is avoided when possible.
P-PD.13	Symbols are used consistently with messaging on signs. Familiar or easy-to-learn pictograms are used to reinforce text and bypass language-based information.		

Figure 3.6 Indicator by Basri and Sulaiman (2017)

Table 2: Respondents' Review on Signage Height in Kajang Hospital

Review By The Respondent	Frequency	Percent (%)
Very Low	6	1.5
Low	7	1.8
Slightly Low	12	3.0
Moderate Low	64	16.0
Moderate High	72	18.0
Slightly High	68	17.0
High	94	23.5
Very High	52	13.0
Extremely High	25	6.3
Total	400	100.0

Figure 3.7 Indicator by Hidayetoglu et al. (2012)

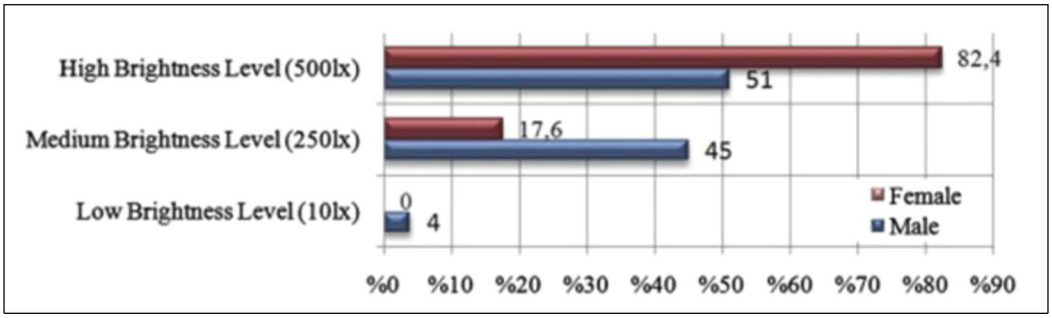

Figure 3.8 Brightness Level Preferences by Gender. Indicator by Hidayetoglu et al. (2012)

Table 3.4
Original and Modified Items for Construct C

No.	Original Item/Item Asal	Modified Item/ Item Ubah Suai
1.	The suitability of placement of visual communication elements such as signs and maps at airport terminal (Ardi et al., 2019)	The suitability of location of signages and the information at KLIA2. / Kesesuaian tempat keberadaan papantanda dan informasinya.
2.	At the decision point in the airport terminal, I was able to make a fast decision (Anuar et al., 2019)	At the decision point in the airport terminal, wayfinding signage make me decide the right way faster. / Apabila berada di persimpangan, papantanda arah membuatkan saya memilih laluan dengan cepat.
3.	Is it informative? (Zuhudi et al., 2017)	The wayfinding signage di KLIA2 is very informative. / Papantanda arah di KLIA2 sangat berinformasi.
4.	Health hazard warning signage must use multiple languages (Malay, English, Mandarin or Tamil) (Abd Wahil et al.)	Wayfinding signage must include multiple languages such as Mandarin or Tamil. / Papantanda arah mesti memasukkan pelbagai bahasa seperti Mandarin atau Tamil.
5.	The health hazard warning signage should have a picture (Abd Wahil et al.)	The wayfinding signage should have a picture. / Papantanda arah perlulah berserta gambar.
6.	Health hazard warning signage does not have complete information (Abd Wahil et al.)	Wayfinding signage at KLIA2 does not have complete information. / Papantanda arah di KLIA2 tidak mempunyai informasi yang mencukupi.
7.	I was looking for the word of "departure" on the sign (Anuar et al., 2019)	I always looking for the word "departure" on the sign. / Saya tercari-cari perkataan "perlepasan" pada papantanda.
8.	The message on the health hazard warning signage does not explain the disease prevention measures (Abd Wahil et al.)	The information on the wayfinding signage does not direct to the loation. / Informasi di papantanda arah tidak membawa ke lokasi.
9.	Located in visible location (Buyruk, 2019)	The signage is located in visible location. / Papantanda terletak ditempat yang boleh dilihat.
10.	The health hazard warning signage is in an inappropriate location (Abd Wahil et al.)	The wayfinding signage is in an inappropriate location. / Papantanda arah berada di tempat yang tidak sesuai.
11.	The font of the airport signs was clear and readable (Anuar et al., 2019)	The font of the airport signs was clear and readable. / Jenis huruf pada papantanda jelas dan mudah dibaca.
12.	I could not read the text on the signs (Anuar et al., 2019)	I could not read the text on the signs. / Saya tidak dapat baca tulisan yang berada pada papantanda.
13.	Color tones used in the	Cool tones used in the KLIA2. / Warna-warna sejuk

No.	Original Item/Item Asal	Modified Item/ Item Ubah Suai
	airport terminals – Cool or Warm (Ardi et al., 2019)	digunakan di KLIA2.
14.	Colours are remarkable (Buyruk, 2019)	The wayfinding signage colours at KLIA2 are remarkable. / Warna papantanda arah di KLIA2 dapat dilihat.
15.	The health hazard warning signage has a bright colour (Abd Wahil et al.)	The wayfinding signage has a bright colour. / Papantanda arah mempunyai warna yang terang.
16.	Directional and identification signs include pictograms to aid comprehension by person with intellectual disabilities and international travellers (ACRP Research report 177)	Pictograms/symbols at wayfinding signage is clear enough to be understanding by disabilities and international visitors. / Piktogram/simbol pada papan tanda arah yang jelas untuk difahami oleh orang kurang upaya dan pelawat antarabangsa.
17.	Symbols are used consistently with messages on signs. (ACRP Research report 177)	Symbols are used consistently with information on signs. / Simbol digunakan secara sekata bersama informasi pada papantanda.
18.	Placements of signs (visual communication) in the shopping mall (Juhari et al., 2015)	Placements or layout of wayfinding signage (visual communication) at KLIA2 is good and easy to understand. / Kedudukkan atau susun atur (komunikasi visual) di KLIA2 adalah baik dan mudah difahami.
19.	Arrows are consistently applied. (ACRP Research Report 177)	Arrows are consistently applied on KLIA2 wayfinding signage. / Anak panah digunakan secara konsisten pada papantandda arah di KLIA2.
20.	The size are enough (Buyruk, 2019)	The size of the signage is enough. / Saiz papantanda adalah memadai.
21.	The health hazard warning signage is small in size (Abd Wahil et al.)	The wayfinding signage at KLIA2 is small in size. / Papantanda arah di KLIA2 bersaiz agak kecil.
22.	The signage height in Kajang Hospital – extremely high (Basri & Sulaiman)	The wayfinding signage installed at KLIA2 is extremely high. / Papantanda arah yang dipasang di KLIA2 tersangat tinggi.
23.	The signage height in Kajang Hospital – high (Basri & Sulaiman)	The wayfinding signage installed at KLIA2 is high. / Papantanda arah yang dipasang di KLIA2 adalah tinggi.
24.	The signage height in Kajang Hospital – verry low (Basri & Sulaiman)	The wayfinding signage installed at KLIA2 is verry low. / Papantanda arah yang dipasang di KLIA2 adalah sangat rendah.
25.	High brightness level (500lx) (Hidayetoglu et al., 2012)	The wayfinding signage lighting at KLIA2 are in high brightness. / Cahaya lampu papantanda arah di KLIA2 adalah terlatu terang.
26.	Low brightness level (10lx) (Hidayetoglu et al., 2012)	The wayfinding signage lighting at KLIA2 are low brightness. / Cahaya lampu papantanda arah di KLIA2 adalah tidak terang.

Table 3.5
Items for Construct C

No. Items	Items
C1	The suitability of location of signages and the information at KLIA2.
C2	At the decision point in the airport terminal, wayfinding signage make me decide the right way faster.
C3	The wayfinding signage di KLIA2 is very informative.
C4	Wayfinding signage must include multiple languages such as Mandarin or Tamil.
C5	The wayfinding signage should have a picture.
C6	Wayfinding signage at KLIA2 does not have complete information.
C7	I always looking for the word "departure" on the sign.
C8	The information on the wayfinding signage does not direct to the loation.
C9	The signage is located in visible location.
C10	The wayfinding signage is in an inappropriate location.
C11	The font of the airport signs was clear and readable
C12	I could not read the text on the signs.
C13	Cool tones used in the KLIA2.
C14	The wayfinding signage colours at KLIA2 are remarkable.
C15	The wayfinding signage has a bright colour.
C16	Pictograms/symbols at wayfinding signage is clear enough to be understanding by disabilities and international visitors.
C17	Symbols are used consistently with information on signs.
C18	Placements or layout of wayfinding signage (visual communication) at KLIA2 is good and easy to understand.
C19	Arrows are consistently applied on KLIA2 wayfinding signage.
C20	The size of the signage is enough.
C21	The wayfinding signage at KLIA2 is small in size.
C22	The wayfinding signage installed at KLIA2 is extremely high.
C23	The wayfinding signage installed at KLIA2 is high.
C24	The wayfinding signage installed at KLIA2 is verry low.
C25	The wayfinding signage lighting at KLIA2 are in high brightness.
C26	The wayfinding signage lighting at KLIA2 are low brightness.

Construct D is the final section of this instrument, consisting of eight questions. The objective of Construct D is to recommend criteria to improve the effectiveness of wayfinding signage to aid in visitors' navigation at KLIA2. After addressing Constructs B and C, which aim to identify the factors contributing to the ineffectiveness of wayfinding signage, Construct D focuses on providing recommendations to enhance the clarity and usefulness of these signs.

In designing this instrument, the study adopted a systematic approach by including questions inspired by previous research. These questions are geared towards gathering insights on how to make wayfinding signage more effective, ensuring visitors can navigate the airport more efficiently. The questions in Construct D were carefully crafted based on examples from past studies that provided recommendations for

improving wayfinding signage criteria. This ensures that the suggestions are grounded in proven strategies and can effectively address the issues identified in Constructs B and C. By incorporating insights from previous research and focusing on detailed recommendations, Construct D provides a comprehensive framework for gathering valuable data. This data will be instrumental in developing effective strategies to enhance wayfinding signage at KLIA2, ultimately improving the overall visitor experience. This final construct ensures that the study not only identifies the problems but also offers practical solutions to address them, making it a crucial component of the research instrument.

Table 2
Recommendations in improving the concept of way finding in Malaysia

Section B - Recommendations in improving the concept of way finding in Malaysia	MALE	FEMALE
Use text to perceive meaning	11	24
Use color to differentiate meaning	7	24
Increase sizing to grab eye message	8	18
Use appropriate medium such as 3D Signboard or Light up Lettering	8	21
Relocate new position or hierarchy	9	22
Use specific language to differentiate location	8	18
Use particular color to differentiate location	8	20
Use particular sizing to differentiate location	7	23
Use vibrant symbols or icons to grab attention	7	26
Use translation	7	23
Way finding with for specific age	6	22
Way finding with specific gender	8	21
Way finding shows culture	11	24
Way finding shows political views	9	16
Way finding shows heritage value	7	22
Way finding shows religion	9	18

Figure 3.9 Indicator by Zuhudi et al. (2017)

SECTION D: Objective 3 - To recommend the criteria to improve the effectiveness of wayfinding signage to aid in the visitor's navigation in KLIA2.

Table 3.6
Original and Modified Items for Construct D

No.	Original Item/Item Asal	Modified Item/ Item Ubah Suai
1.	Use text to perceive meaning	Use text to perceive meaning. / Gunakan perkataan untuk terjemahan makna.
2.	Use color to differentiate meaning	Use color to differentiate meaning on the signage. / Gunakan warna untuk membezakan maksud pada signage.
3.	Increase sizing to grab eye message	Increase the size of the signage to grab an eye attention. / Tingkatkan saiz papantanda supaya mudah dilihat.
4.	Relocate new position or hierarchy	Relocate to the new position that can be seen. / Pindahkan ditempat yang mudah dilihat.
5.	Use specific language to	Use specific language to differentiate location. / Gunakan bahasa

No.	Original Item/Item Asal	Modified Item/ Item Ubah Suai
	differentiate location	tertentu bagi membezakan tempat.
6.	Use particular color to differentiate location	Use particular color to differentiate location. / Gunakan warna bagi membezakan sesuatu kawasan.
7.	Use vibrant symbols or icons to grab attention	Use vibrant symbols or pictograms to grab attention. / Gunakan pelbagai jenis symbol atau ikon supaya lebih menarik.
8.	Use translation	Use translation for more understandability for visitors from other country. / Gunakan pelbagai Bahasa agar mudah difahami oleh pengunjung dari luar negara.

Construct D

Please tick (/) in the appropriate box. / Sila tandakan (/) pada petak yang berkenaan.

1. Use text to perceive meaning. / Gunakan perkataan untuk terjemahan makna.	1	2	3	4	5
2. Use color to differentiate meaning. / Gunakan warna untuk membezakan maksud.	1	2	3	4	5
3. Increase sizing to grab an eye attention. / Tingkatkan saiz bagi mudah dilihat.	1	2	3	4	5
4. Relocate to the new position that can be seen. / Pindahkan ditempat yang mudah dilihat.	1	2	3	4	5
5. Use specific language to differentiate location. / Gunakan bahasa tertentu bagi membezakan tempat.	1	2	3	4	5
6. Use particular color to differentiate location. / Gunakan warna bagi membezakan sesuatu kawasan.	1	2	3	4	5
7. Use vibrant symbols or pictograms to grab attention. / Gunakan pelbagai jenis symbol atau ikon supaya lebih menarik.	1	2	3	4	5
8. Use translation for more understandability for visitors from other country. / Gunakan pelbagai Bahasa agar mudah difahami oleh pengunjung dari luar negara.	1	2	3	4	5

Figure 3.10 Items for Construct D using a 5-point Likert scale

Table 3.7
Items for Construct D

No. Items	Items
D1	Use text to perceive meaning
D2	Use color to differentiate meaning.
D3	Increase sizing to grab an eye attention.
D4	Relocate to the new position that can be seen.
D5	Use specific language to differentiate location.
D6	Use particular color to differentiate location.
D7	Use vibrant symbols or pictograms to grab attention.
D8	Use translation for more understandability for visitors from other country.

The qualitative data derived from the open-ended questionnaire were analyzed using a thematic analysis approach, which is widely applied in qualitative research (Braun & Clarke, 2006). The analysis process involved several stages to ensure that the findings were systematic and reflective of participants' views.

Data Preparation. All responses were compiled and transcribed into a written format. The data were organized in a spreadsheet to facilitate systematic analysis.

Familiarization. The researcher read the responses repeatedly to gain a comprehensive understanding of the content and to identify initial impressions and recurring patterns.

Initial Coding. The responses were segmented into meaningful units, and initial codes were manually generated to capture significant ideas or statements. Each code represented a specific aspect of participants' perceptions.

Categorization. The initial codes were then clustered into categories based on similarity and relevance. For example, codes such as "unclear direction" and "confusing symbols" were grouped under the broader category of "wayfinding challenges".

Theme Development. From these categories, broader themes were constructed to represent the main issues highlighted in the responses. These themes were aligned with the research objectives and provided a structured framework for reporting the findings.

Interpretation. Finally, the identified themes were interpreted and discussed in relation to the research objectives and existing literature. This step ensured that the analysis not only described the data but also provided meaningful insights into the effectiveness of signage at KLIA2.

3.6 Data Analysis Procedure

After the existence of a complete instrument or questionnaire, it must go through the validity phase. According to Davis (1992) most researchers suggest the use of experts in research methods to determine the best and quality research instruments. Appointed experts can also determine that the questionnaire of a study is organized very well. Davis (1992) adopted from Waltz 1991 set at least two experts in a study who are skilled in the field under study and an expert who is skilled in structuring sentences for instruments. In addition, there are several important characteristics in the selection of experts that should be considered. The first category is those who have a professional level achievement certificate in the related field as well as those who have participated in the presentation of professional level research papers or have published papers on the related topic. He added, for the second category the selection of experts is from those who have skills in instrument structuring. It consists of those who are skilled in the use of sentences and good grammar to explain the real meaning and be easy to understand. This study has appointed four experts based on the guidelines set by Linda Lindsey Davis in her writing. The experts selected in this study are those who have high skills in evaluating a design. In addition, in-depth industry experience on the topic discussed makes them experts and able to confirm things more accurately. Some of the selected experts have high academic achievements and become examiner and critics in this field. Thus, with the selection of these four experts, the constructed questionnaire can be improved and achieve consistent standards.

The first expert is Dr. Fauzi Harun who has professional achievements in the field of Computers and Creative Industry. He has published several research papers throughout his career as a lecturer at University Pendidikan Sultan Idris (UPSI). He is also a former student of University Technology Mara (UiTM) and is a first-class student who excels in the field of graphic design. The second expert is Miss Futri Alya who has an academic qualification at the master's level in the field of Creative Industry. With the expertise she has, she is now a company owner in Kuala Lumpur. The third and fourth experts are those who work in the industry that involves the design and fabrication process. Mr. Azuan bin Rani has expertise in designing and fabricating signage throughout Malaysia. He is knowledgeable in every aspect of signage making from producing designs that have an impact on users and effective manufacturing techniques. The fourth expert is Encik Rusdy bin Ghazali in the field of industrial design

and is the head of design department for one of event companies in Kuala Lumpur. These people, however, have good skills in producing content and writing a work. This is very consistent with the characteristics of the experts set in this study.

Every assessment from an expert must go through a validation process. This validity process needs to be recorded to find out how the answers and the level of validity can be proven in this study. This is usually known as content validation. The main purpose of this content validation is to ensure that each item in the instrument meets or achieves the objectives that have been set. Polit et al. (2007) through his study suggested the use of the content validation index (CVI) technique as an indicator that measures the accuracy of experts on the instrument. This indicator is a process of calculating the level of agreement of each expert on the items in the instrument to be recorded. Thus, in determining this content validation index, there are two categories commonly used by previous studies, namely item-level content validation index (I-CVI) and scale-level content validation index (S-CVI). I-CVI is the score for each item recorded while S-CVI is the score for all items recorded through expert evaluation. There are guidelines that have been made by researchers before to facilitate the process of determining the level of validity of content. According to Polit et al. (2007) that adopted from Lynn (1986), when the number of experts does not exceed five people, then the total item-level content validation index or I-CVI is 1.00 and this number shows that all the experts are satisfied with the item. This is an accurate guide for this study where four experts were selected to determine the reliability of the instrument. There are several variations of labelling the four ordinal points. The scale that seems to be used most often is 0.25 not relevant, 0.50 somewhat relevant, 0.75 quite relevant, 1.00 highly relevant (Davis, 1992).

The main purpose of this verification is to ensure that each question in the research questionnaire meets or achieves the objectives that have been set. In addition, the appointed experts should also examine the structure of the sentences used which are easy to understand by the respondents. The experts selected in this study are those who have high skills in evaluating a design. In-depth industry experience on the topic discussed makes them experts and able to confirm things more accurately. Some of the selected experts have high academic achievements and become inspectors and critics in this field. Thus, with the selection of these four experts, the constructed questionnaire can be improved and improve the quality of the answers obtained from the respondents.

The construct B items in Table 3.1 below evaluate the information on wayfinding signage. The phase of gathering information for the wayfinding signage at KLIA2 has begun for construct B. This construct B has been created in order to accomplish the first goal of this study, which is to identify the factors that influence the ineffectiveness of wayfinding signage to convey messages clearly among visitors in KLIA2. There are sixteen questions that have been raised throughout the research and literature review phase that are directly relevant to the study's initial objective. Each piece was carefully categorised, and four experts were consulted for confirmation.

After review by four appointed experts, the S-CVI value was determined. The overall S-CVI value for construct B is 0.75, which shows that the items or questions are well classified. The results of the evaluation by these 4 experts also show that five of the sixteen items are relevant or excellent, namely items B1, B5, B13, B14, and B15. This is evidenced by the fact that the I-CVI score for each of the mentioned items is 1.00. B1 is an item that refers to the presence or not of highly visible wayfinding signage. This item is simple and suitable to answer the questions about the goal of the study. B5, on the other hand, refers to the wayfinding function, that is, whether or not they are able to provide directional information to visitors. The I-CVI score for item B5 is also excellent, with four experts agreeing on the content and sentence structure. Next, item B13 also received the agreement of four experts through their evaluation. Item B13 is a question about the information on the wayfinding signage to help visitors navigate. This item is very important in construct B because it can provide information about whether the wayfinding signs at KLIA2 are useful to visitors or vice versa. B14 is an important element where four experts confirmed that the I-CVI value of this element is 1.00 or even excellent. This item refers to visitors' acceptance of the information on the wayfinding signage at KLIA2, regardless of whether it is easy or difficult for visitors. Among the items that received an excellent I-CVI score in construct B is B15, in addition to those already mentioned. This indicates that the question of wayfinding sign location is also valued in determining the effectiveness of a wayfinding signage. Item B15 refers to the location of wayfinding signs in KLIA2 that are clearly on the visitor's path or even hidden behind a large and complicated building structure.

Apart from the items in construct B that received an I-CVI of 1.00 or better, there are twelve other items that were rated by the same four experts. Eight of them had an I-CVI of 0.75, which is good or fairly relevant. According to Davis (1992), an I-CVI of 0.75 is a satisfactory level of the items. It shows that only one out of four experts

disagree with the item. The item that received an I-CVI of 0.75 is Item B3, which is about visitors' understanding of the wayfinding signage in KLIA2. Visitors' understanding of the information displayed on the wayfinding signs is very important as it can lead to errors in navigation.

Three items have a score of 0.5, which is average or somewhat relevant where it needs improvement. These are items B2, B4, and B8, where the sentence structure and terms used should be improved to make them more understandable and not confusing. Question B16, 'What do you think about the distance to the airport?' received the lowest score of 0.25, which represents poor or not relevant and should be deleted on the advice of experts. This question is unrelated to the goal to be achieved in this study and is outside the scope of this study. See timetable below.

Table 3.8
Experts Analysis for Construct B

Item	Expert 1	Expert 2	Expert 3	Expert 4	I-CVI	Interpretation
B1	/	/	/	/	1.00	Excellent
B2	X	X	/	/	0.50	Average
B3	/	/	X	/	0.75	Good
B4	X	/	/	X	0.50	Average
B5	/	/	/	/	1.00	Excellent
B6	/	X	/	/	0.75	Good
B7	/	X	/	/	0.75	Good
B8	X	/	/	X	0.50	Average
B9	/	X	/	/	0.75	Good
B10	/	X	/	/	0.75	Good
B11	/	/	X	/	0.75	Good
B12	/	/	X	/	0.75	Good
B13	/	/	/	/	1.00	Excellent
B14	/	/	/	/	1.00	Excellent
B15	/	/	/	/	1.00	Excellent
B16	X	X	/	X	0.25	Poor
B17	/	/	/	X	0.75	Good
S-CVI					0.75	Good

The second objective of this study is to analyze the significant factors of wayfinding signage that are ineffective to convey messages clearly among visitors in KLIA2. The challenge of preparing the questions for the second objective is greater because more specific words and phrases must be used. The comments of the selected experts are very important to ensure that each item is well presented and easy for respondents to understand. There are a total of 26 questions or items for construct C. Construct C includes three parts of the wayfinding signage criteria according to Chris

Calori's theory, namely information system, graphic system, and hardware system. This is intended to measure the next cause contributing to the ineffectiveness of wayfinding signage at KLIA2.

The S-CVI value of construct C is 0.80, which puts it at a good level overall. This proves that the items created are below the scope and objective goals that were set. Ten of the 26 items show that they are rated as relevant or excellent by four selected experts. This is the case when the four experts did not make any corrections to the structure and meaning of each item. The items that have a value of 0.75 in construct C are C3, C5, C6, C8, C12, C14, C15, C21, C23, C24, and C25. The items are in the "good" category and the correction is minimal. There was no CVI value of 0.25 for construct C, which means that there are no items that need to be eliminated before distribution to respondents. However, there are 4 items that have an average CVI value, namely C4, C7, C13, and C22. These 4 items need improvement in terms of sentence structure and translation based on the objectives of the study. Overall, construct C does not have low I-CVI values of 0.25 or 0.00, indicating poor items.

Table 3.9
Experts Analysis for Construct C

Item	Expert 1	Expert 2	Expert 3	Expert 4	I-CVI	Interpretation
C1	/	/	/	/	1.00	Excellent
C2	/	/	/	/	1.00	Excellent
C3	/	/	/	X	0.75	Good
C4	/	/	X	X	0.50	Average
C5	/	/	/	X	0.75	Good
C6	/	/	X	/	0.75	Good
C7	X	/	X	/	0.50	Average
C8	/	/	/	X	0.75	Good
C9	/	/	/	/	1.00	Excellent
C10	/	/	X	X	0.50	Average
C11	/	/	/	/	1.00	Excellent
C12	/	/	/	X	0.75	Good
C13	/	X	X	/	0.50	Average
C14	/	/	/	X	0.75	Good
C15	X	/	/	/	0.75	Good
C16	/	/	/	/	1.00	Excellent
C17	/	/	/	/	1.00	Excellent
C18	/	/	/	/	1.00	Excellent
C19	/	/	/	/	1.00	Excellent
C20	/	/	/	/	1.00	Excellent
C21	/	/	X	/	0.75	Good
C22	/	/	X	X	0.50	Average
C23	/	/	/	X	0.75	Good
C24	/	/	X	/	0.75	Good
C25	/	/	X	/	0.75	Good
C26	/	/	/	/	1.00	Excellent
S-CVI					0.80	Good

The third objective in this study is to recommend the criteria to improve the effectiveness of wayfinding signage to aid in the visitor's navigation in KLIA2. A total of eight questions were developed based on this objective. Similar to Constructs A, B, and C, Construct D also underwent a validation process. Four experts, who were the same as those involved in the previous constructs, were provided with these eight questions, all related to the recommended criteria for improving wayfinding signage to enhance navigation within the airport environment.

The purpose of this validation process is to ensure that the recommendations are not only theoretically sound but also practical and applicable to the unique challenges faced in the airport context. Each expert contributed their professional insights, particularly on how the criteria can be optimized to provide clarity, efficiency, and ease of use for airport visitors. The focus was on improving the legibility, placement, and overall functionality of the signage system, ensuring that it aligns with best practices in wayfinding design while catering to the specific needs of KLIA2's diverse user base. The outcomes from this expert validation were crucial in refining the criteria, ensuring that they are both relevant and actionable, thereby increasing the potential for a significant improvement in the overall navigation experience for KLIA2 visitors.

The Scale Content Validity Index (S-CVI) for Construct D was calculated to be 0.8, which indicates an overall good level of content validity. This suggests that the criteria proposed for improving the wayfinding signage in KLIA2 were generally well-received by the experts, and the recommendations were deemed relevant and appropriate for the intended purpose. However, to further delve into the specifics of the validation process, a more detailed analysis of the Content Validity Index at the item level (I-CVI) for each question, as rated by the individual experts, will be provided. This item-by-item breakdown is critical for identifying any variations in expert agreement across the specific criteria. Each question's CV-I score will be examined in depth to uncover insights into which aspects of the recommended criteria were considered strong and where there may be room for further refinement. For example, while the overall S-CVI score reflects a positive consensus, the I-CVI scores could reveal nuances such as differing opinions among the experts on certain recommendations. These differences could highlight specific areas that need adjustment to meet all the experts' expectations or indicate potential gaps that could be addressed to further enhance the effectiveness of the wayfinding system at KLIA2. This analysis will provide a comprehensive view of the individual questions' content validity,

ensuring that each recommendation for wayfinding signage is rigorously evaluated and tailored for practical application in the airport's context.

Question D2 addresses the criterion of using color to differentiate meaning on the signage and, like D1, received an I-CVI score of 1.00, indicating excellent content validity. All four experts agreed that the use of color is a critical aspect of wayfinding design, particularly in an airport like KLIA2, where passengers need to quickly interpret and navigate through complex spaces. Colors can provide visual cues that are universally understood, making it easier for people, regardless of language, to follow directions. For instance, different colors can be assigned to various functional areas, such as check-in counters, gates, baggage claims, or emergency exits. The expert consensus here suggests that color differentiation significantly enhances the clarity and usability of signage, reducing cognitive load and enabling faster decision-making.

Similarly, Question D6, which discusses using color to differentiate locations within the airport, also received an I-CVI score of 1.00. This further validates the role of color as an important tool for distinguishing between different zones or areas within KLIA2. For example, specific colors can be assigned to denote separate terminals, parking zones, or amenities like restaurants and lounges. Both D2 and D6 reinforce the importance of color as a universal visual language that aids in wayfinding. This criterion can help people quickly identify their desired locations without needing to rely on extensive text, especially for international travellers who may not be familiar with the local language. Color-coded systems are also effective in environments with high levels of foot traffic, where rapid recognition is essential for maintaining smooth flow and minimizing congestion. Overall, the high I-CVI scores for these questions highlight that color is a vital, easily adaptable element in wayfinding signage design. It not only facilitates better orientation for passengers but also creates an intuitive navigation system that caters to a wide variety of users, enhancing their overall experience at KLIA2.

In the evaluation of content validity, both Question D3 and Question D8 were found to have an I-CVI (Item Content Validity Index) score of 0.50, which is classified as an average rating. This outcome indicates that the items may not have fully met the expectations of the experts involved in the validation process. Specifically, for Question D3, the average score resulted from a disagreement among two of the experts, Expert 1 and Expert 3. These experts did not support the proposed suggestion, which was aimed at increasing the size of signage in order to make it more visible to all visitors. The

feedback from these experts highlights the need to improve the structure and phrasing of the question, suggesting that the clarity or appropriateness of the recommendation was not fully conveyed. To ensure the validity and acceptance of the question, it is essential to revisit its design and modify it in a way that aligns with the feedback provided by the panel of experts. Similarly, Question D8 also encountered resistance from some of the experts, which affected its overall I-CVI score. This particular question was intended to propose the use of translations to enhance the understandability of signage for international visitors. However, both Expert 3 and Expert 4 expressed concerns regarding the effectiveness or necessity of the recommendation as it was currently phrased. As a result, the item did not achieve the level of validity required. In response, it is critical to refine the wording and intent of this question so that it can be presented in a manner that gains agreement from a majority of the expert panel. Only through these adjustments can the questions be improved to meet the expected standards of content validity. By addressing the specific feedback related to both the clarity and relevance of these items, the overall validity of the questionnaire can be strengthened, ensuring that it accurately captures the necessary recommendations for improving visitor experience through signage enhancements.

In contrast to the average results obtained for Questions D3 and D8, the analysis of content validity for Questions D4, D5, and D7 revealed a higher I-CVI score of 0.75, which indicates a level of validity that is generally considered good. This suggests that the majority of the experts in the review panel found these questions to be clear and relevant. However, there were still some disagreements, particularly from Expert 4, who expressed reservations about the phrasing or intent of Questions D4 and D5. Specifically, Question D4 proposed the recommendation to "Relocate the signage to a new position that can be more easily seen." While this suggestion was well-received by the majority of the panel—Experts 1, 2, and 3—it was met with some resistance from Expert 4. The disagreement could stem from differing perspectives on the practicality of the relocation or the overall feasibility of implementing such a change in the context of the visitor experience. Nevertheless, the consensus among the other experts suggests that this recommendation is valid in terms of clarity and relevance, even though a more nuanced discussion might be required to address Expert 4's concerns.

Similarly, Question D5, which offered the suggestion to "Use specific language to differentiate between locations," also recorded a good I-CVI score. Here, again, Experts 1, 2, and 3 were in agreement regarding both the structure and intent of the

question, acknowledging the usefulness of tailoring language to make locations more distinguishable. This could be particularly beneficial in helping visitors, especially those unfamiliar with the area, to navigate with greater ease. However, Expert 4's dissent indicates that there may be some unresolved issues regarding the specificity of the language proposed or the implementation challenges that could arise from this recommendation. Despite this, the overall validity of the question remains solid, thanks to the positive reception from the majority of the panel.

While the good I-CVI score of 0.75 reflects an overall agreement from most of the experts, it is essential to carefully examine the feedback from Expert 4 to understand the nature of their objections. Addressing these concerns might further strengthen the validity of these items, ensuring that the questionnaire fully meets the needs of all experts involved. Furthermore, considering the broader implications of these recommendations—whether relocating signage or using specific language—the refinements could lead to more effective interventions that enhance the overall experience for visitors. By incorporating the feedback, particularly from the dissenting expert, the recommendations in these questions could be fine-tuned to ensure that they are not only clear but also feasible and beneficial within the context of the study. Ultimately, achieving broader consensus among the experts will improve the robustness of the content validity index across the board.

Table 3.10
Experts Analysis for Construct D

Item	Expert 1	Expert 2	Expert 3	Expert 4	I-CVI	Interpretation
D1	/	/	/	/	1.00	Excellent
D2	/	/	/	/	1.00	Excellent
D3	X	/	X	/	0.50	Average
D4	/	/	/	X	0.75	Good
D5	/	/	/	X	0.75	Good
D6	/	/	/	/	1.00	Excellent
D7	/	/	X	/	0.75	Good
D8	/	/	X	X	0.50	Average
S-CVI					0.8	Good

The qualitative data obtained from the open-ended questionnaire were analyzed using a thematic analysis approach, which is a widely utilized method for identifying, analyzing, and reporting patterns within qualitative data (Braun & Clarke, 2006). Thematic analysis was deemed appropriate as it provided a systematic yet flexible framework for capturing participants' perspectives and linking them to the research

objectives. The analysis process involved several stages. First, all responses were compiled and transcribed into written format, after which the data were organized in a spreadsheet to facilitate systematic handling. Second, the researcher engaged in a stage of familiarization by repeatedly reading the responses to gain a comprehensive understanding of the content and to identify initial ideas. Third, initial coding was conducted, during which meaningful segments of text were manually labeled with descriptive codes that reflected key ideas or perceptions.

Following this, the codes were clustered into categories based on similarity and relevance, allowing for the identification of broader patterns. For instance, responses that mentioned "unclear direction" and "confusing symbols" were grouped together under the broader category of wayfinding challenges. Subsequently, the categories were refined into themes, which represented the main issues emphasized by participants and were aligned with the research objectives. Finally, the themes were interpreted and discussed in relation to the existing literature and conceptual framework, thereby ensuring that the findings not only described the participants' responses but also provided meaningful insights into the effectiveness of signage at KLIA2. This step-by-step process ensured that the qualitative analysis was conducted systematically, with careful attention to validity and reliability, as recommended by Braun and Clarke (2006).

3.7 Conclusion

This chapter had presented the research methodology that was employed in the study. It had outlined the research design, sampling strategy, research instruments, data collection process, and data analysis procedures. A sequential explanatory mixed-methods design was adopted, whereby the quantitative phase was conducted first to obtain general patterns and relationships, followed by the qualitative phase to provide deeper insights and explanations. The procedures for both quantitative and qualitative data analysis were described in detail to ensure that the findings were generated systematically and aligned with the research objectives. Overall, the methodology adopted in this study had ensured rigor, reliability, and validity in the research process. The careful planning and execution of the research design enabled the collection of both breadth and depth of data, while the integration of findings strengthened the credibility

of the study. The subsequent chapter had presented the results obtained from the quantitative and qualitative analyses.

CHAPTER 4
DATA ANALYSIS

4.1 Introduction

Chapter four discusses in detail the findings and analysis of the study. The study findings are based on the objectives that have been set, namely:

1. To identify the factors that influence the ineffectiveness of wayfinding signage in conveying messages clearly among visitors in KLIA2.
2. To analyze the significant factors of wayfinding signage that are ineffective in conveying messages clearly among visitors in KLIA2.
3. To recommend criteria to improve the effectiveness of wayfinding signage to aid visitor navigation in KLIA2.

The study utilizes both descriptive and inferential statistics.

4.2 Background of Respondent

The details regarding the respondents in this study include age, gender, religion, marital status, educational level, occupation sector, experience at the airport, frequency of visits to KLIA2, purpose of travel, and cognitive level.

Table 4.1
Frequency and Percentage Levels for each Item in the Demographic

	Frequency	Percent
A1. Gender/Jantina		
Male/Lelaki	100	42.2
Female/Wanita	137	57.8
A2. Age/Umur		
18 to 35 years (Young adulthood)	108	45.6
36 to 55 years (Middle age)	127	53.6
56 years and older	2	0.8
A3. Races/Bangsa		
Malay/Melayu	222	93.7
Chinese/Cina	11	4.6
Others/Lain-lain	4	1.7

A4. Marital status/Taraf perkahwinan		
Single/Bujang	96	40.5
Married/Berkahwin	139	58.6
Others/Lain-lain	2	0.8
A5. Religion/Agama		
Islam/Islam	224	94.5
Buddhist/Buddha	9	3.8
Cristian/Kristian	1	0.4
Others/Lain-lain	3	1.3
A6. Education level/Taraf pendidikan		
PhD	14	5.9
Master's degree	80	33.8
Bachelor's degree	85	35.9
Diploma	34	14.3
PMR/SPM/Pre Uni	24	10.1
A7. Working area/Sektor Pekerjaan		
Government/Kerajaan	80	33.8
Private/Swasta	97	40.9
Student/Pelajar	21	8.9
Own Work/Bekerja sendiri	39	16.5
A8. Are you familiar with KLIA2?		
Familiar/Sudah biasa	164	69.2
Unfamiliar/Tidak biasa	73	30.8
A9. Do you experience at the airport?		
Experienced/ Berpengalaman	203	85.7
Inexperienced/ Tidak berpengalaman	34	14.3
A10. The purpose of your traveling?		
Business/Bekerja	54	22.8
Personal/Peribadi	183	77.2

Table 4.1 displays the frequency and percentage levels for each item in the demographic. For item A1 below, which pertains to gender, the frequency for males is 100, while the frequency for females is 137. The total number of respondents in this study is 237 individuals (n=237). This yields a percentage of 57.8% female and 42.2% male. The difference indicates that females dominate this study overall. All respondents are Malaysian citizens aged 18 years and above.

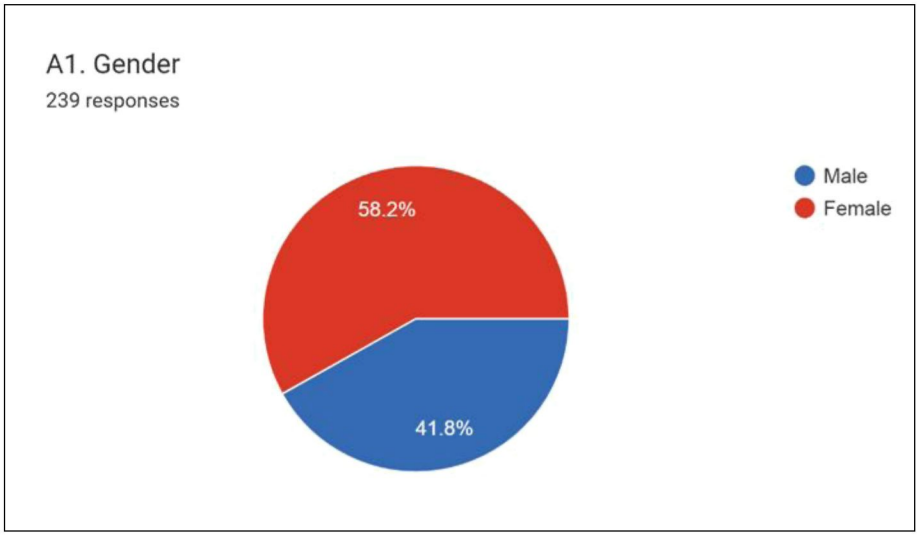

Figure 4.1 Illustrates the Percentage Distribution of Male and Female Respondents (n=237)

Item A2 in the demographic is the age of the respondents. The level of age in this study is divided into three categories: young adulthood, middle age, and older. The young adult category comprises respondents aged 18 to 35 years, while the middle age category is from 35 to 55 years old. Lastly, the older category is 56 years and above. The data shows that the middle age category has the highest number of participants in this study. This category recorded a total of 127 respondents, while the young adulthood category had 108 respondents. As for the older category, there were only 2 respondents, which represents only 0.8% of the total respondents. The young adult and middle age categories each recorded 45.5% and 53.6% of the total respondents, respectively.

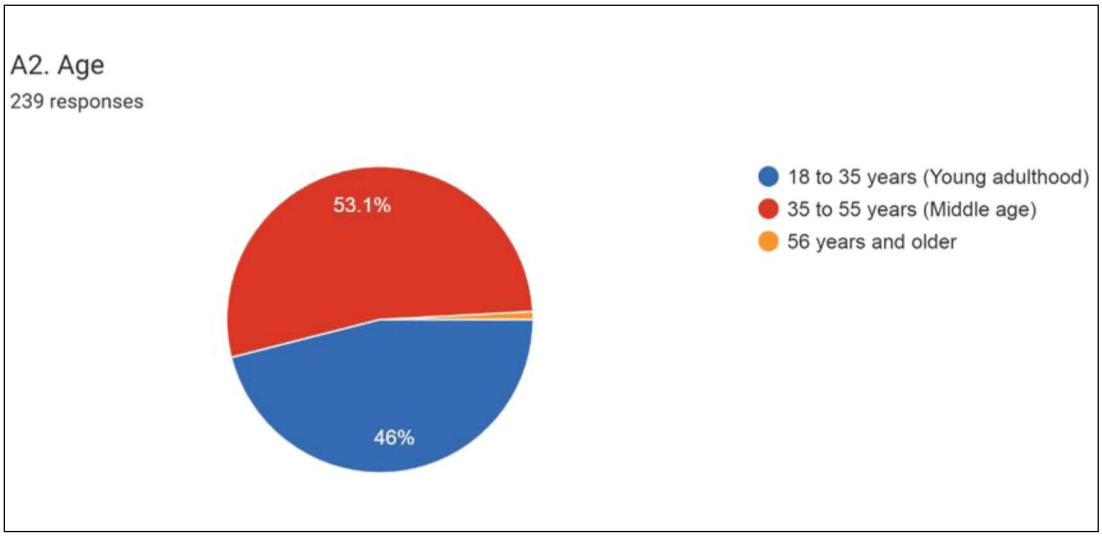

Figure 4.2 Depicts the Percentage Distribution with Respect to Age (n = 237)

One of the demographic categories under consideration is race, represented by item A3. This category reflects the multi-racial nature of our country, and the data collected can be used to determine which race(s) travels the most in this study. The race category in this research comprises three categories: Malay, Chinese, and Others. The Others category includes respondents from Indian, Kadazan, Iban, Bidayuh, and other ethnicities. Among the three categories, Malay respondents constitute the highest proportion, with a recorded number of 222 respondents, representing 93.7 percent of the total sample (n=237). Chinese respondents, on the other hand, recorded a total of 11 respondents, representing only 4.6 percent of the total sample. The remaining 1.7 percent or 4 respondents are from other ethnicities in Malaysia.

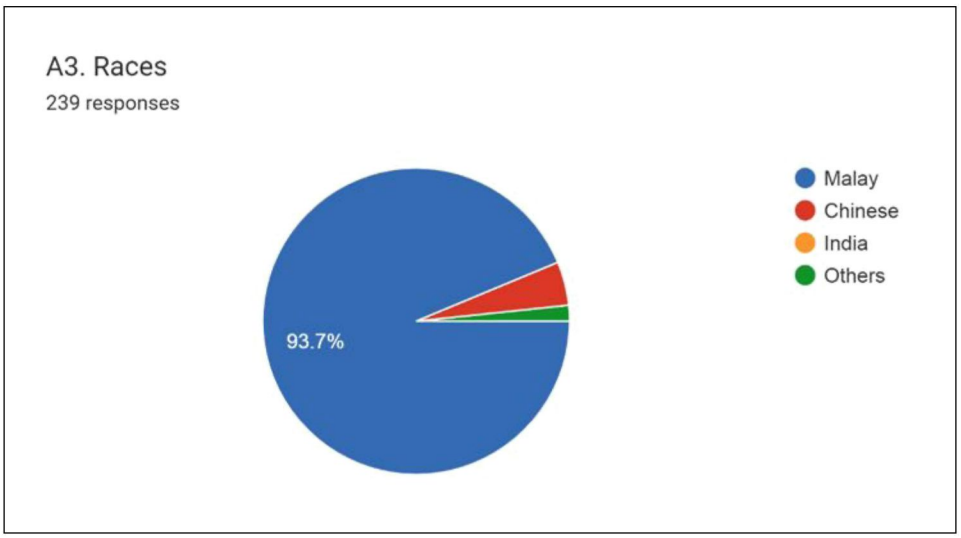

Figure 4.3 Represents the Percentage Distribution of Respondents by Ethnicity

This study has restricted participation to respondents who have visited KLIA2. However, to obtain accurate data, it is important to determine whether respondents are familiar with the airport environment. According to the graft, item A8 indicates that 69.2 percent of the respondents, which is equivalent to 164 out of 237 participants, reported being familiar with the airport. The remaining 30.8 percent (73 respondents) reported not being familiar with the airport, and this group constituted less than 50 percent of the total sample.

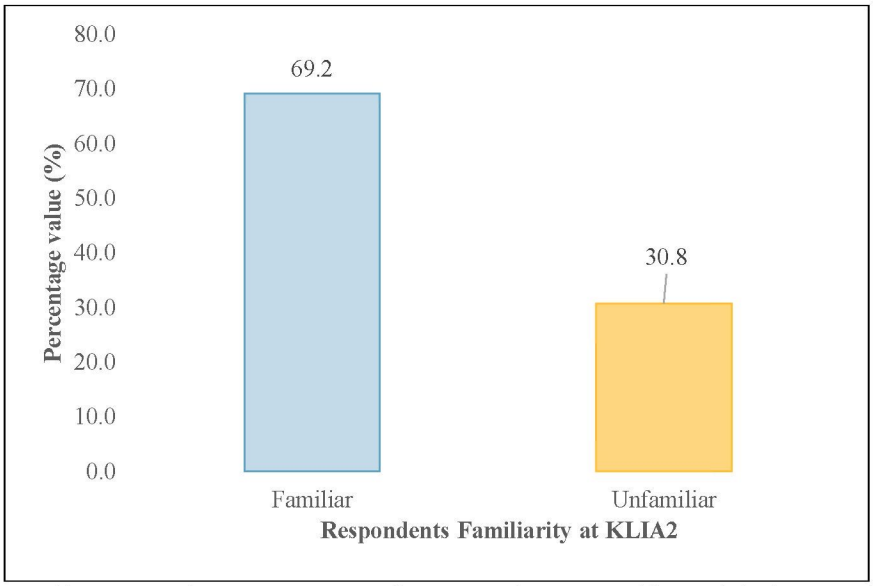

Figure 4.4 Illustrates the Percentage of Respondents Familiar with the Conditions of KLIA2

This study has restricted participation to respondents who have visited KLIA2. However, to obtain accurate data, it is important to determine whether respondents are familiar with the airport environment. According to the graft, item A8 indicates that 69.2 percent of the respondents, which is equivalent to 164 out of 237 participants, reported being familiar with the airport. The remaining 30.8 percent (73 respondents) reported not being familiar with the airport, and this group constituted less than 50 percent of the total sample. However, it should be noted that there were inexperienced respondents who participated in this research. Specifically, 34 respondents, comprising up to 14 percent of the sample size, reported having no prior experience with airports or KLIA2. On the other hand, 85.7 percent of the respondents reported having some level of experience with airports, indicating that the majority of the sample had at least visited an airport before (item A9).

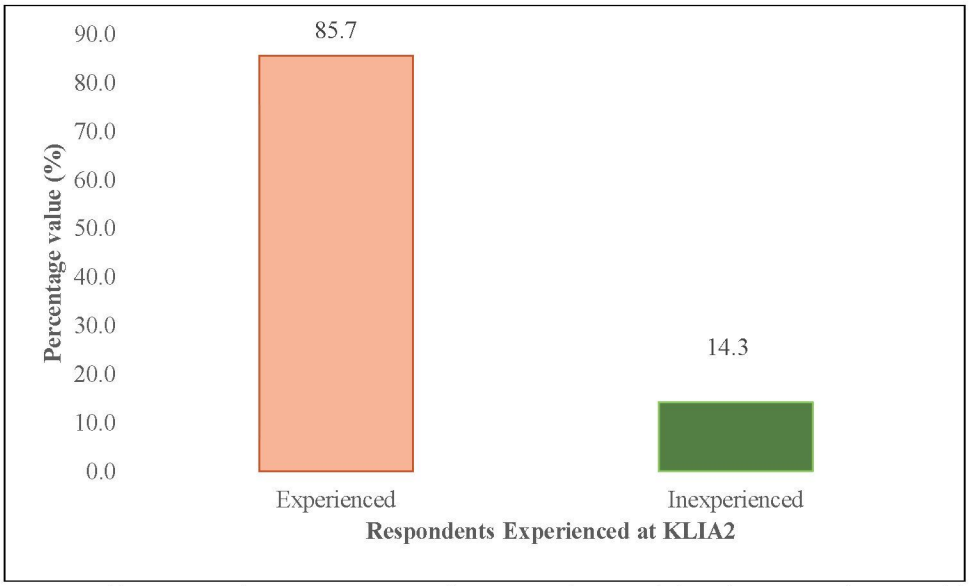

Figure 4.5 Illustrates the Percentage of Respondents with Prior Experience of being at KLIA2

4.3 Reliability of Questionnaire

The assessment of reliability is a critical aspect of validating psychometric instruments and ensuring the consistency of measures over time and across samples. One widely used method for estimating the internal consistency of a construct is Cronbach's Alpha coefficient. This study focuses on the application of Cronbach's Alpha to assess the reliability of constructs, employing standardized items. By examining the resulting coefficients, we aim to draw conclusions regarding the stability and consistency of the construct.

Participants is the sample used in this study consists of [N] individuals, who were recruited from [description of the population/sample]. Instrumentation represent set of [N] items was utilized to measure constructs. The items were standardized to facilitate a meaningful comparison and interpretation of results. Data were collected through method of data collection, e.g., surveys, questionnaires. The collected data were subjected to reliability analysis using Cronbach's Alpha coefficient.

4.4 Reliability Test

This term refers to the assessment or evaluation of the reliability of a measurement instrument, such as a survey, questionnaire, or test. It aims to determine how consistent and dependable the instrument's results are when it is administered repeatedly or under different conditions. Reliability testing is a critical aspect of

research methodology, ensuring that the data collected is trustworthy and replicable. The construct B reliability test is a measurement tool used to measure construct B in a specific population. Test reliability is a measure of the consistency and dependability of the measurement tool in measuring construct B.

One commonly used reliability statistic for the test is Cronbach's alpha. In this construct B reliability test, the Cronbach's alpha value obtained was 0.760. This indicates that the measurement tool has good reliability, as Cronbach's alpha values that are considered good are usually above 0.7. In addition to Cronbach's alpha, standardized items are also an important reliability statistic. In this construct B reliability test, the standardized items value obtained was 0.8. This indicates that all items in the measurement tool have good reliability, as standardized items values that are considered good are usually above 0.7.

Furthermore, the N of items, or the number of items in the measurement tool, was 13. A sufficient number of items can increase the reliability of the measurement tool, as the more items used, the greater the likelihood that the measurement tool can accurately measure construct B. From the results of this construct B reliability test, it can be concluded that the measurement tool has good reliability, as evidenced by the good values of Cronbach's alpha and standardized items, as well as the sufficient number of items used. Therefore, the measurement tool can be used to measure construct B in a specific population accurately and reliably.

Table 4.2
Reliability Statistics for Construct B

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.760	.800	13

The Inter-Item Correlation Matrix is a statistical tool used to measure the relationship between different items in a measurement tool. In the case of Construct B, an Inter-Item Correlation Matrix was used to identify which items could be removed to obtain a score that is more accurate. Based on the Inter-Item Correlation Matrix analysis, it was found that items 11, 12, and 15 had weak correlations with the other items in the Construct B measurement tool. Therefore, these items were removed to improve the accuracy of the Construct B score. After removing items 11, 12, and 15, a new Inter-Item Correlation Matrix was created to measure the correlations between the

remaining items. The results showed that the remaining items had stronger correlations with each other, indicating that the new Construct B score would be more accurate. In conclusion, the Inter-Item Correlation Matrix is a useful tool for identifying items that can be removed from a measurement tool to improve its accuracy. In the case of Construct B, items 11, 12, and 15 were removed based on the Inter-Item Correlation Matrix analysis to obtain a more accurate score.

4.5 Data Analysis for Section B

The survey conducted in this study aims to achieve the first objective of identify the factors that influence the ineffectiveness of wayfinding signage in conveying messages clearly among visitors in KLIA2. To pinpoint the factors contributing to the ineffectiveness of wayfinding signage from an informational system, Likert scale survey questions are utilized.

A total of 211 respondents indicated that the information provided on the wayfinding signage at KLIA2 is clear. In contrast to only 26 respondents constituting 11 percent, who opined that the information on the wayfinding signage at KLIA2 is unclear. The subsequent question pertains to visitors' comprehension of the information displayed on the wayfinding signage. Consequently, the survey indicates that 85.7 percent of respondents stated that the information conveyed through the wayfinding signage is easily understood. This constitutes a high proportion compared to only 14.3 percent who selected that the information provided is difficult to comprehend. This indicates that the information presented on the wayfinding signage at KLIA2 is clear and easily comprehensible. The main purpose of providing wayfinding signage is as an intermediary to convey information. Informative questions were asked to visitors to study its effectiveness. A total of 94.5 percent support that the signage at KLIA2 is informative. The rest, only 5.5 percent of all respondents said it was not enough in conveying information.

The challenge in providing wayfinding signage at the airport is when there are various types of signage installed in conjunction with wayfinding signage. This can confuse visitors who want to find directions to their next destination. This matter was submitted to the respondent which is about the interference faced while navigating by other signage. After analysis, this matter was agreed by almost half of all respondents, 46.8 percent who chose to be distracted by other signage such as advertising signage

while navigating. The rest, 53.2 percent, still protested and chose not to be bothered at all by the presence of other signage. This can contribute to the ineffectiveness of wayfinding signage at KLIA2.

Table 4.3
Frequency and Percentage of Section B

Indicator	Items	Freq.	%
B1. Is the signage at KLIA2 clearly visible?	Clear	211	89.0
	Unclear	26	11.0
B2. Is the frequency of signage at KLIA2 satisfactory?	High	175	73.8
	Low	62	26.2
B3. Is the signage at KLIA2 understandable?	Understandable	203	85.7
	Difficult	34	14.3
B4. What is the condition of the signage in KLIA2?	Good	227	95.8
	Bad	10	4.2
B5. Is the signage help you navigate easily?	Easy	207	87.3
	Uneasy	30	12.7
B6. Are you notice the variable of directional sign while navigating?	Noticed	178	75.1
	Unnoticed	59	24.9
B7. Is it the signage informative?	Informative	224	94.5
	Uninformative	13	5.5
B8. Does the number of advertising signs equal the wayfinding sign at KLIA2?	Many	124	52.3
	Less	113	47.7
B9. Are you distracted by advert while navigating?	Distracted	111	46.8
	Undistracted	126	53.2
B10. Is it signage at KLIA2 good enough to find direction to your location?	Good	197	83.1
	Bad	40	16.9
B13. Do you think wayfinding signage at KLIA2 is helpful?	Helpful	206	86.9
	Not helping	31	13.1
B14. Do you think its friendly user?	Yes	181	76.4
	No	56	23.6
B16. Are the numbers of signage enough for the distance at KLIA2?	Yes	164	69.2
	No	73	30.8

Table 4.4
Inter-Item Correlation Matrix

Inter-Item Correlation Matrix													
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B13	B14	B16
B1	1.000	.405	.357	.195	.435	.079	.271	.043	-.076	.310	.304	.281	.204
B2	.405	1.000	.414	.257	.495	.212	.320	.124	-.230	.424	.395	.505	.455
B3	.357	.414	1.000	.453	.496	.071	.271	.140	-.147	.458	.484	.481	.353
B4	.195	.257	.453	1.000	.425	.073	.134	.094	-.139	.410	.479	.279	.315

B5	.435	.495	.496	.425	1.000	.074	.354	.094	-.075	.574	.379	.505	.378
B6	.079	.212	.071	.073	.074	1.000	-.010	.134	-.144	.131	.153	.254	.208
B7	.271	.320	.271	.134	.354	-.010	1.000	.104	-.034	.337	.401	.346	.201
B8	.043	.124	.140	.094	.094	.134	.104	1.000	-.018	.134	.131	.125	.150
B9	-.076	-.230	-.147	-.139	-.075	-.144	-.034	-.018	1.000	-.209	-.188	-.254	-.198
B10	.310	.424	.458	.410	.574	.131	.337	.134	-.209	1.000	.493	.545	.456
B13	.304	.395	.484	.479	.379	.153	.401	.131	-.188	.493	1.000	.550	.446
B14	.281	.505	.481	.279	.505	.254	.346	.125	-.254	.545	.550	1.000	.489
B16	.204	.455	.353	.315	.378	.208	.201	.150	-.198	.456	.446	.489	1.000

Table 4.5
Item-Total Statistics

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
B1	14.73	5.842	.414	.	.744
B2	14.58	5.211	.578	.	.722
B3	14.70	5.501	.573	.	.727
B4	14.80	6.086	.444	.	.747
B5	14.71	5.477	.628	.	.723
B6	14.59	5.963	.197	.	.767
B7	14.78	6.059	.406	.	.748
B8	14.36	5.859	.189	.	.773
B9	14.31	6.968	-.247	.	.824
B10	14.67	5.357	.615	.	.721
B13	14.71	5.495	.605	.	.725
B14	14.60	5.156	.637	.	.715
B16	14.53	5.225	.534	.	.727

4.6 Data Analysis for Section C

The examination of internal consistency and reliability of Construct C is pursued through the application of the Cronbach's Alpha coefficient, a statistical measure widely used in psychometrics to assess the reliability of scales and questionnaires. In this study, standardized items are employed to gauge the stability and consistency of Construct C. The analysis is grounded in a sample of 5 items, and the resulting Cronbach's Alpha values are reported as .725 and .732. These values provide a quantitative indication of the extent to which the items in Construct C are correlated, offering insights into the overall reliability of the construct in the specific context of KLIA2. The implications

arising from these findings are thoughtfully deliberated, shedding light on the nuances of Construct C's reliability in the given environment.

Upon applying the Cronbach's Alpha coefficient to the [N] items that measure Construct C, a noteworthy value of .725 is obtained. This coefficient, indicative of a moderate level of internal consistency, suggests that the items are reasonably correlated in their assessment of the construct. Additionally, when the analysis is conducted using standardized items, a slightly higher Cronbach's Alpha of .732 is observed. This increase in reliability can be attributed to the reduced impact of varying item scales, thereby fortifying the internal consistency of Construct C. The obtained Cronbach's Alpha coefficients of .725 and .732 collectively signify a satisfactory level of reliability, with the latter indicating a slightly elevated level of consistency.

It is pertinent to note that the reliability value of .732 implies that the items constituting Construct C exhibit a more robust common variance when measured using standardized scores. This signifies a minimization of the effects stemming from differences in the original scales of the items, ultimately leading to a more reliable assessment of the construct. Consequently, researchers engaging with Construct C should conscientiously consider the potential advantages afforded by the utilization of standardized items in order to augment the precision and stability of measurements in their investigations.

Moving on to the percentage values associated with Construct C, it is discerned that the displayed minimum values span from 4.2 to 4.1, corresponding to C1, C2, and C3. C1 pertains to the appropriateness of the location of signage and information at KLIA2, while C2 focuses on the efficacy of wayfinding signage at decision points in the airport terminal, facilitating expeditious decision-making. C3 revolves around the informativeness of the wayfinding signage at KLIA2. Contrastingly, the moderately high average values of 3.4 and 3.2 are attributed to items C5 and C7. C5 underscores the necessity for wayfinding signage to incorporate location pictures, while C7 accentuates the importance of locating one's position through words on the sign. Further exploration reveals that the lowest values of 2.5, 2.6, and 2.8 correspond to C4, C8, and C6, respectively. C4 underscores the inclusion of the Tamil language on wayfinding signage at KLIA2, C6 suggests that the signage lacks comprehensive information, and C8 indicates that the information on the signage does not effectively guide visitors to their intended destinations. The overall minimum value for Construct C is 3.4, signaling

a high level of satisfaction in this aspect of the study, while simultaneously highlighting specific areas that may warrant further attention and improvement.

In conclusion, the detailed analysis of Construct C, incorporating both the application of the Cronbach's Alpha coefficient and the examination of percentage values associated with its constituent items, provides a comprehensive understanding of the reliability and intricacies of wayfinding signage at KLIA2. These findings not only contribute to the existing body of knowledge but also offer valuable insights for practitioners and researchers seeking to enhance the efficacy of signage systems in complex environments like airports.

Table 4.6
Reliability Statistics for Construct C

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.725	.732	5

Table 4.7
Item for Section C

No. Item	**Item**
C1	The suitability of location of signage and the information at KLIA2.
C2	At the decision point in the airport terminal, wayfinding signage make me decide the right way faster.
C3	The wayfinding signage at KLIA2 is very informative.
C4	Wayfinding signage at KLIA2 must include Tamil language.
C5	The wayfinding signage should have the location picture.
C6	Wayfinding signage at KLIA2 does not have complete information.
C7	I always looking for the word of my location on the sign.
C8	The information on the wayfinding signage does not direct to the location.

Table 4.8
Percentage Score of Section C

Item	**Percentage score of each item**						**Standard Deviation**
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	
C1	0.8	1.3	16.0	44.7	37.1	4.2	0.8
C2	0.4	3.0	17.3	35.9	43.5	4.2	0.9
C3	1.3	3.0	18.6	41.4	35.9	4.1	0.9
C4	34.2	13.5	28.3	13.1	11.0	2.5	1.4
C5	12.2	16.0	21.1	24.9	25.7	3.4	1.3
C6	16.5	24.5	31.2	17.7	10.1	2.8	1.2
C7	13.1	17.7	26.6	24.9	17.7	3.2	1.3
C8	23.2	27.4	24.9	17.3	7.2	2.6	1.2

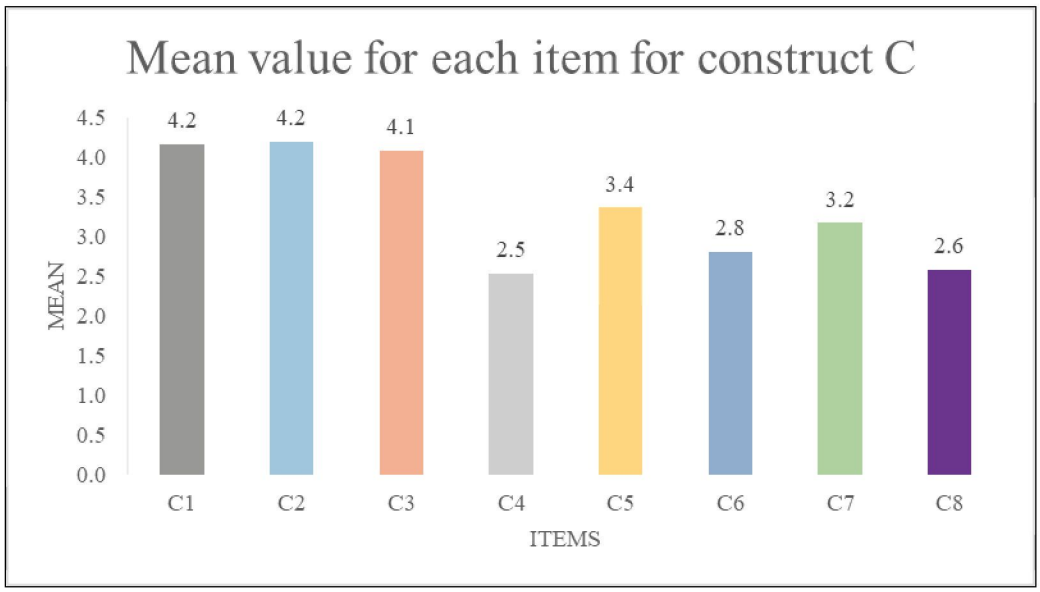

Figure 4.6 Mean Value for Items in Construct C

Table 4.9
Inter-Item Correlation Matrix

Inter-Item Correlation Matrix					
	C4	C5	C6	C7	C8
C4	1.000	.298	.202	.246	.242
C5	.298	1.000	.297	.232	.271
C6	.202	.297	1.000	.548	.652
C7	.246	.232	.548	1.000	.544
C8	.242	.271	.652	.544	1.000

Table 4.10
Item-Total Statistics for Section C

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
C4	11.91	14.347	.331	.129	.740
C5	11.08	14.083	.371	.152	.723
C6	11.63	12.937	.604	.489	.633
C7	11.27	12.946	.548	.372	.652
C8	11.86	12.824	.608	.483	.631

4.7 Data Analysis for Section D

Contract D is dedicated to fulfilling Objective 3, which involves proposing criteria aimed at enhancing the efficacy of wayfinding signage to facilitate visitor navigation within KLIA2. The reliability statistics for Construct D underscore its robustness, with Cronbach's Alpha measuring at .809 and Cronbach's Alpha Based on

Standardized Items slightly higher at .818. The construct encompasses a total of 8 items, ensuring a comprehensive evaluation.

A closer examination of the percentage scores for each item within Construct D reveals valuable insights. The preeminent item, D5, exhibits the highest standard deviation at 1.41. This item accentuates the importance of utilizing specific language to distinguish and delineate different locations. Following closely is D8, registering a percentage score of 1.34. This underscores the significance of incorporating translations to enhance the comprehensibility of signage for visitors from diverse linguistic backgrounds. Meanwhile, three items, namely D1, D4, and D7, share an identical standard deviation percentage of 1.09. D1 emphasizes the use of text to convey meaning, while D4 advocates for the strategic relocation of signage to improve visibility. D7, on the other hand, suggests the utilization of vibrant symbols or pictograms to capture the attention of visitors. This uniformity in scores underscores the equal importance of these aspects within Construct D.

Conversely, the items with the lowest standard deviation percentages in Construct D are D2 and D6, recording 0.97 and 1.02, respectively. D2 underscores the significance of incorporating color to differentiate meanings on signage, while D6 focuses on using color to distinguish various locations. These lower percentages emphasize areas where improvements may be particularly beneficial. In summation, the comprehensive analysis of the reliability statistics and percentage scores within Construct D not only validates its internal consistency but also provides a nuanced understanding of the specific criteria. This detailed exploration lays the groundwork for informed recommendations and interventions to enhance the effectiveness of wayfinding signage in KLIA2, aligning with the overarching objective of the contract.

Table 4.11
Reliability Statistics for Construct D

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.809	.818	8

Table 4.12
Item for Section D

No. Item	**Item**
D1	Use text to perceive meaning.
D2	Use color to differentiate meaning on the signage.

No. Item	Item
D3	Increase the size of the signage to make visible for all visitors.
D4	Relocate to the new position that can be seen.
D5	Use specific language to differentiate location.
D6	Use color to differentiate location.
D7	Use vibrant symbols or pictograms to grab attention.
D8	Use translation for more understandability for visitors from other country.

Table 4.13
Percentage Score for Section D

Item	Percentage score of each item						Standard Deviation
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	
D1	4.6	5.9	23.2	34.2	32.1	3.83	1.09
D2	3.0	2.1	14.3	32.9	47.7	4.20	0.97
D3	3.0	5.1	14.8	32.5	44.7	4.11	1.03
D4	3.4	6.3	17.7	28.3	44.3	4.04	1.09
D5	18.1	13.5	23.2	21.5	23.6	3.19	1.41
D6	3.8	1.7	16.9	29.1	48.5	4.17	1.02
D7	5.1	1.7	18.1	26.2	48.9	4.12	1.09
D8	12.7	7.2	25.7	22.8	31.6	3.54	1.34

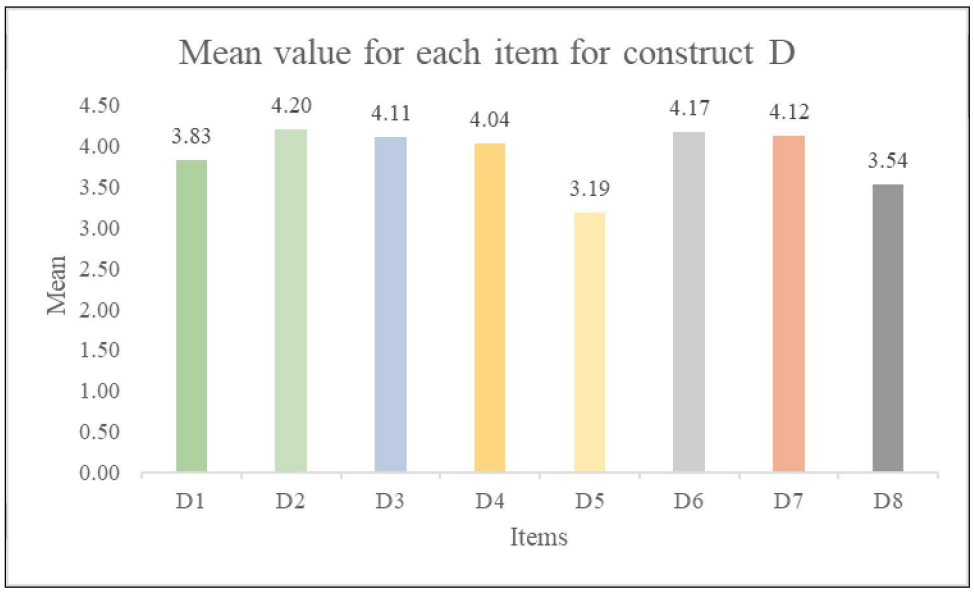

Figure 4.7 Mean Value for Items in Construct D

Table 4.14
Inter-Item Correlation Matrix fo Section D

	Inter-Item Correlation Matrix							
	D1	D2	D3	D4	D5	D6	D7	D8
D1	1.000	.404	.248	.206	.236	.232	.143	.141
D2	.404	1.000	.426	.388	.323	.602	.347	.112
D3	.248	.426	1.000	.759	.415	.581	.496	.250
D4	.206	.388	.759	1.000	.396	.484	.440	.266

D5	.236	.323	.415	.396	1.000	.375	.341	.457
D6	.232	.602	.581	.484	.375	1.000	.451	.173
D7	.143	.347	.496	.440	.341	.451	1.000	.385
D8	.141	.112	.250	.266	.457	.173	.385	1.000

Table 4.15
Item-Total Statistic for Section D

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
D1	27.37	30.386	.323	.188	.814
D2	27.00	28.919	.538	.452	.786
D3	27.09	27.081	.684	.654	.766
D4	27.16	27.169	.627	.592	.772
D5	28.01	25.576	.552	.346	.785
D6	27.03	27.868	.608	.513	.776
D7	27.08	27.876	.556	.364	.783
D8	27.66	28.174	.386	.288	.812

4.8 The Finding of Interview Data

The qualitative phase of the study consisted of interviews with three respondents, and the findings were reported in line with the sequential explanatory design adopted for this research. While the number of interviewees was small, this was consistent with the purpose of the qualitative phase, which was not to generate saturation but to provide explanatory depth to the quantitative findings. In mixed-methods studies, particularly within sequential explanatory designs, qualitative follow-up interviews are often limited in number because the main purpose is to clarify or expand on patterns already established by the survey results (Creswell & Plano Clark, 2018). Thus, interviewing three respondents was sufficient for capturing contrasting viewpoints and generating a deeper understanding of the quantitative outcomes. Importantly, the respondents represented a range of ages, genders, and experiences, which ensured diversity of perspectives even within a small sample size. This diversity strengthened the explanatory function of the interviews and contributed to the credibility of the findings.

The analysis of the interviews was carried out using thematic analysis, but rather than describing the steps as in the methodology, the focus here was on the insights that emerged and how credibility was established in the interpretation process. Each transcript was carefully examined to identify important statements, and comparisons were made across respondents to highlight both convergence and divergence in views.

Patterns that recurred across the participants were considered key themes, while singular but strong views were interpreted in light of their significance to the research objectives. To enhance trustworthiness, the themes were continuously compared against the raw data to ensure that the interpretations were firmly grounded in the respondents' accounts rather than researcher bias.

The first major theme that emerged concerned the divergent navigational experiences of the three respondents. The 67-year-old male described his experience as straightforward, attributing this to clear signage upon entry, whereas the 64-year-old female found the same environment confusing and difficult to navigate. The 23-year-old male offered an intermediate position, acknowledging initial challenges with parking and entry but later reporting improvement once inside the terminal. These differences suggested that navigation within KLIA2 was not experienced uniformly. Rather, it varied depending on factors such as age, familiarity with the airport, and expectations about signage. This finding explained why, in the survey, some respondents rated the signage positively while others expressed dissatisfaction.

A second theme centered on perceptions of signage effectiveness. Respondent 1 considered signage effective and helpful throughout his journey, while Respondent 2 criticized the signage for being insufficient and lacking visibility. Respondent 3 provided a more nuanced view, agreeing that signage was useful but inconsistent, with certain areas well marked and others confusing. These differing perspectives illustrated that the signage system functioned unevenly, which helped clarify the mixed responses reported in the quantitative phase. The credibility of this finding was reinforced by the fact that respondents highlighted not just general opinions but specific aspects of signage placement, visibility, and consistency that influenced their experiences.

The third theme highlighted the reliance on additional navigation assistance. Two of the three respondents reported needing help from airport staff or even family members to locate destinations. This reliance was attributed to obstructed wayfinding signage, structural complexity, and the dominance of commercial advertising signs that distracted attention away from wayfinding aids. In contrast, one respondent explained that he did not require external help due to his repeated visits to KLIA2, which increased his familiarity with the layout. This contrast underscored that the sufficiency of signage was closely linked to visitor familiarity, a factor that had also been hinted at in the survey results. Triangulating these accounts with the quantitative findings enhanced confidence in the credibility of this theme.

Another significant theme concerned the criteria and quality of signage. Respondents evaluated aspects such as visibility, size, placement, and readability. One participant praised the clarity and strategic location of signs, while another criticized them for poor visibility and difficulty in reading. The third respondent recognized the adequacy of most signage but admitted that occasional confusion still occurred. These mixed accounts reinforced the conclusion that signage at KLIA2 was adequate in some respects but inconsistent in others, suggesting areas for improvement. The variation of responses, even within such a small sample, emphasized that user experience depended on individual characteristics and situational factors, a finding that further enhanced the explanatory power of the interviews.

Finally, familiarity with the environment played a clear role in shaping navigational confidence. Respondents who had visited KLIA2 multiple times reported greater ease and independence in finding their way, while those who were less familiar relied heavily on assistance or experienced difficulties. This theme confirmed that wayfinding challenges were not purely a result of poor signage design but were also influenced by user background and prior exposure. Taken together, the interviews with three respondents provided valuable and credible insights into the navigation experiences at KLIA2. Despite the limited number of participants, the diversity of views revealed patterns that both supported and clarified the quantitative results. The qualitative findings highlighted the uneven effectiveness of signage, the impact of familiarity, and the role of additional assistance in shaping navigation outcomes. By presenting these themes, the qualitative phase fulfilled its role within the sequential explanatory design, offering a deeper layer of understanding and strengthening the overall validity of the study.

Table 4.16
Respondents Key Point of View

Interview Question	Respondent 1 (Male, 67)	Respondent 2 (Female, 64)	Respondent 3 (Male, 23)	Key Points Across Respondents
Q1: What is your view as a visitor about KLIA2 which has a mall concept?	Found navigation easy due to signage at entrance; signage facilitated movement.	Described environment as complex and challenging; signage not sufficient to ease movement.	Faced difficulty at parking/entry; navigation improved once inside with signage.	Signage at entrance helped, but experiences varied: older respondents differed in ease vs. difficulty, while younger respondent noted mixed challenges.
Q2: What is your view as a visitor about the effectiveness of	Signage was effective, visible, and useful	Signage was unclear, not visible, and lacked user-friendliness.	Signage was somewhat effective but inconsistent; confusing in some	All acknowledged signage mattered, but opinions diverged: effective (R1),

Interview Question	Respondent 1 (Male, 67)	Respondent 2 (Female, 64)	Respondent 3 (Male, 23)	Key Points Across Respondents
signage?	throughout journey.		areas, especially for first-time visitors.	ineffective (R2), partially effective with gaps (R3).
Q3: Do you require additional navigation assistance besides the existing wayfinding signage?	Occasionally sought staff assistance; generally managed with signage.	Frequently required help from staff/family; signage obstructed and overshadowed by advertisements.	Did not require additional help due to familiarity; acknowledged first-time visitors may struggle.	Two respondents relied on external help due to obstructed/unclear signage; one respondent felt signage sufficient with familiarity.
Q4: What is your view as a visitor about KLIA2 wayfinding signage criteria (clarity, color, size, placement, etc.)?	Clear, easy to understand, strategically placed at entrance.	Not visible, difficult to read, unhelpful.	Generally clear and adequate, but occasional confusion in certain areas.	Clarity and placement were recognized as important; views diverged between positive (R1), negative (R2), and mixed (R3).
Q5: Have you ever gotten lost while navigating KLIA2?	Did not get lost; signage and staff support enabled smooth navigation.	Relied on external help to avoid getting lost, despite repeated visits.	Did not get lost; familiar with layout and signage but noted first-time visitors may face confusion.	Familiarity influenced navigation success: confident (R1, R3), reliant on others (R2).

The table demonstrates both convergence and divergence in respondents' views. Across all questions, signage was acknowledged as a necessary navigational aid. However, the degree of effectiveness perceived varied significantly. Respondent 1 emphasized clarity and usefulness, Respondent 2 highlighted persistent challenges and reliance on external help, while Respondent 3 provided a balanced view, recognizing signage as generally adequate but inconsistent. Overall, the key characteristics of wayfinding signage that emerged were *Clarity and visibility* – signage must be easy to read and strategically placed. *Consistency* – signage should be uniform and continuous across different sections. *Accessibility* – signage must not be obstructed or overshadowed by advertisements. *User familiarity* – repeat visits reduce navigation difficulty, while first-time visitors face greater challenges. These findings underline the importance of improving signage placement, visibility, and consistency to ensure that KLIA2 supports both familiar and first-time travellers in navigating the complex airport-mall environment.

4.9 Conclusion

This chapter had presented the results of both the quantitative and qualitative phases of the study. The quantitative findings had provided an overview of the general trends and relationships regarding the effectiveness of wayfinding signage at KLIA2, while the qualitative interviews had offered deeper insights into visitors' experiences and perceptions. The integration of these two strands of data had enabled a more comprehensive understanding of the research problem, in line with the sequential explanatory design employed in this study. Overall, the results had shown both convergences and divergences in participants' perspectives. While the quantitative data indicated that signage played an important role in facilitating navigation, the qualitative findings revealed nuanced challenges such as signage visibility, inconsistency, and environmental distractions that complicated wayfinding for certain groups of visitors. Together, the findings had addressed the research objectives and highlighted areas where signage design and placement could be improved to enhance the overall visitor experience at KLIA2. The subsequent chapter had further interpreted these findings in light of the theoretical framework and existing literature and had drawn conclusions and practical implications for airport management and wayfinding system design.

CHAPTER 5
DISCUSSION

5.1 Introduction

This chapter provides a critical discussion of the study's findings by interpreting the quantitative results of the questionnaires alongside the qualitative insights derived from interviews. Unlike the previous chapter, which presented the data descriptively, this section engages with the findings to explain how they relate to the research objectives and existing literature. In particular, the discussion highlights the proposed criteria for improving wayfinding signage effectiveness at Kuala Lumpur International Airport 2 (KLIA2). These criteria—enhancing visibility and readability, optimizing placement, and incorporating multilingual and universal support—are analyzed using evidence from both survey responses and interview excerpts.

5.2 Enhancing Visibility and Readability

Visibility and readability emerged as the most pressing concerns among respondents. Although 89% of participants reported that signage at KLIA2 was generally clear, almost half (46.8%) admitted being distracted by advertising displays situated near wayfinding signs. This indicates that clarity is not only a function of design but also of environmental context. As Bullough (2017) argued, sign legibility depends on contrast and freedom from visual clutter, both of which are undermined by competing advertisements.

Interviews reinforced this perception. One participant remarked: "I could see the signs, but sometimes the advertisements were brighter, so I looked at those first and missed the direction." Such feedback underlines the necessity of applying bold typography, high-contrast colors, and lighting that ensures wayfinding signs stand out against commercial displays. This finding aligns with Mollerup (2013), who stressed that effective signage must compete successfully with its visual environment.

5.3 Optimizing Placement for Maximum Impact

The placement of signage significantly influenced navigation effectiveness. Survey data revealed that respondents frequently struggled to locate signs at key decision points, with several noting that building structures obscured visibility. Misplaced or hidden signage forced visitors to retrace their steps, contributing to delays and stress.

Interview evidence supported this, with one visitor stating: "I missed my gate because the sign was too high and hidden behind a pillar." Another explained: "At intersections, the signs were not clear, so I had to ask staff for help." Such testimony echoes Carpman and Grant's (2002) emphasis on positioning signs at critical decision nodes. Placement must therefore be strategic, ensuring that signage is always visible at eye level and located at entrances, intersections, and transition zones where directional choices must be made.

5.4 Incorporating Multilingual and Universal Support

Given KLIA2's role as an international hub, multilingual and universal accessibility are crucial. While Bahasa Malaysia and English dominate current signage, the absence of Tamil and Mandarin was noted by several participants, limiting accessibility for diverse user groups. Moreover, universally recognized pictograms were inconsistently applied, creating ambiguity.

As one interviewee explained: "My parents don't read English well. They had to ask me for help because the signs were not in Tamil." This observation highlights the importance of linguistic inclusivity, consistent with ISO 7001 standards for universal symbols. Incorporating multiple languages and standardized pictograms would reduce dependence on staff assistance and improve independence among travelers unfamiliar with English or Malay.

5.5 Alignment with Research Objectives

The integration of questionnaire data and interview evidence provides clear answers to the research objectives. The study identified visibility, placement, and inclusivity as critical determinants of signage effectiveness. The findings confirm that while most visitors perceive signage as clear, contextual distractions, poor positioning,

and limited linguistic accessibility undermine overall navigation efficiency. These insights validate the criteria proposed for improving signage at KLIA2 and provide a basis for actionable recommendations in the next chapter.

5.6 Conclusion

This chapter has discussed the findings in depth, drawing connections between quantitative and qualitative evidence to justify the proposed criteria for enhancing wayfinding signage. Visibility and readability, strategic placement, and multilingual/universal support emerged as interrelated elements that directly influence the ease of navigation at KLIA2. The incorporation of participant feedback and interview quotes has demonstrated how signage deficiencies affect real user experiences, often leading to delays and frustration. The subsequent chapter will build on this discussion to present conclusions, practical recommendations, and implications for future research.

CHAPTER 6
CONCLUSION, KNOWLEDGE CONTRIBUTION, AND RECOMMENDATIONS FOR FUTURE WORK

6.1 Conclusion

This study has critically examined the factors that contribute to the ineffectiveness of wayfinding signage at the entrance of Kuala Lumpur International Airport Terminal 2 (KLIA2) and has proposed a set of design criteria aimed at enhancing navigational efficiency. Drawing upon both quantitative evidence from questionnaires and qualitative insights from interviews, the discussion in Chapter Five elucidated how visibility and readability challenges, suboptimal placement, and insufficient multilingual and universal support undermine the clarity and effectiveness of wayfinding communication. The proposed design criteria—enhanced visibility and readability, optimized placement, and multilingual as well as universal inclusivity—constitute a coherent framework for improving wayfinding signage systems. These recommendations were validated through empirical data collected in this study and are consistent with contemporary best practices in airport signage design (Idealogy Journal, 2025). By situating KLIA2 as a case study, this thesis not only addresses a local concern but also contributes to broader international debates on wayfinding in large-scale, complex transportation hubs, particularly within Asian contexts where multilingual and multicultural diversity are paramount. In this regard, the findings hold significance not only for passenger experience and satisfaction but also for Malaysia's efforts to strengthen KLIA2's reputation as a globally competitive international terminal.

6.2 Knowledge Contribution

The contributions of this research are twofold, encompassing both theoretical enrichment and practical application. Theoretically, the study advances the literature on wayfinding by demonstrating how signage design flaws—including deficiencies in visual hierarchy, contrast, clarity, and placement—can diminish navigational effectiveness within mega-scale architectural environments. By highlighting these interrelated variables, the research deepens current understanding of the environmental

and design dimensions that collectively shape wayfinding outcomes in airports and similar transport infrastructures. Practically, the findings extend knowledge by identifying inconsistencies in typography, iconography, spatial positioning, and message comprehensiveness as major constraints to effective wayfinding. In addition, the study underscores the necessity of inclusive content and the integration of multiple language options to accommodate diverse passenger profiles, an insight that echoes contemporary findings emphasizing the centrality of thoughtful message design in signage systems (Sustainability, 2024).

Furthermore, this thesis contributes actionable knowledge by proposing a set of empirically grounded criteria for signage improvement at KLIA2. These criteria, which include enhanced visibility and readability, strategic placement, and multilingual and universal support, offer design professionals, architects, and airport authorities practical guidance for developing signage systems that are not only legible and accessible but also culturally inclusive and visually prioritized. In synthesizing these findings, the research refines existing models of wayfinding by integrating elements of environmental complexity and multicultural inclusivity into signage evaluation. At the same time, it equips practitioners with design strategies that can enhance passenger navigation, reduce stress, and ultimately improve airport operational efficiency. By articulating these dual contributions, the study advances theoretical discourse in the field of wayfinding and environmental psychology while simultaneously offering practical, empirically informed strategies that can be implemented in real-world airport settings.

6.3 Recommendation for Future Work

Building upon the findings of this thesis, future research should investigate the spatial and perceptual aspects of signage placement, particularly in visually complex environments such as retail zones, structural pillars, escalator junctions, and transitional spaces between terminal buildings. Since this study primarily employed self-reported data from questionnaires and semi-structured interviews, subsequent research would benefit from integrating real-time behavioral data collection methods, such as eye-tracking and spatial-visual modeling, to triangulate reported perceptions with observed navigational performance.

Empirical visual saliency analysis is one promising avenue. Advanced tools such as Depthmap or MassMotion, combined with eye-tracking technology, could be employed to quantify passenger gaze behaviors in response to signage located at different positions within the terminal. Multi-modal techniques such as heatmaps and gaze-trace mapping would allow researchers to determine the degree to which signage captures and sustains passenger attention, thereby providing objective evidence of effectiveness. Similar approaches have been successfully deployed in recent studies of transit-oriented development (TOD) stations, demonstrating their applicability in airport contexts (Buildings, 2025).

Controlled placement experiments also represent a critical area for further investigation. These experiments, conducted either on-site or in virtual reality environments, could systematically compare signage performance across different heights, angles, and sightlines. By measuring outcomes such as navigation success rates, decision-making times, and error frequencies under varying conditions of lighting, passenger density, and architectural constraints, researchers would be able to develop empirically grounded recommendations regarding optimal signage placement.

Another dimension for future exploration lies in examining the impact of competing visual stimuli. Airports are increasingly designed as commercial environments, and signage often competes with advertising, retail displays, and ambient lighting. Existing research has shown that such distractions can obscure critical wayfinding information, thereby impeding navigational clarity. The establishment of designated "wayfinding information zones" free from extraneous visuals has been found to significantly improve passenger comprehension and decision-making (National Academies Press, 2023). Incorporating this principle into KLIA2 could enhance signage effectiveness while maintaining commercial viability in the surrounding environment.

Finally, longitudinal field studies should be conducted to evaluate the long-term effectiveness of refined signage placement strategies. By implementing modifications informed by empirical testing and then assessing outcomes through repeated passenger feedback, observational studies, and follow-up questionnaires, researchers can determine the sustainability of improvements over time. Such longitudinal approaches would provide a more robust understanding of whether signage enhancements continue to yield positive outcomes across different passenger demographics and evolving airport conditions.

6.4 Summary

In conclusion, this chapter has drawn together the central findings of the study, reaffirming their alignment with the research objectives while articulating the contributions made to both theory and practice. The study has shown that wayfinding signage at KLIA2 is hindered by challenges of visibility, readability, placement, and inclusivity, but it has also proposed actionable criteria to address these limitations. Through its knowledge contributions, the research has refined theoretical perspectives on wayfinding design in complex environments and provided practitioners with strategies for more effective implementation. At the same time, the chapter has outlined evidence-based directions for future work, emphasizing the need for more advanced empirical testing of visual saliency, placement strategies, and the impact of visual competition. Collectively, these insights establish a foundation for iterative enhancement of airport wayfinding systems. Ultimately, the outcomes of this study extend beyond KLIA2, offering a model that can be scaled and adapted to other mega-transport infrastructures worldwide, ensuring inclusivity, accessibility, and navigational ease within increasingly complex built environments.

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APPENDICES

APPENDIX 1

Interview Questions

1. What are your thoughts on the current placement of wayfinding signage at KLIA2?
2. Have you ever experienced confusion or difficulty in locating signage while navigating KLIA2? Please explain.
3. In your opinion, what are the strengths of the existing signage system at KLIA2?
4. What weaknesses or challenges do you think exist in the current signage placement?
5. How do you think signage design (colour, font, symbols) influences your navigation experience at KLIA2?
6. What improvements would you recommend to enhance the effectiveness of signage placement at KLIA2?

APPENDIX 2

Transcribed Interview Excerpts

Respondent 1

"Sometimes the signage is not visible because it is blocked by pillars or located too high. I had to ask staff for directions, especially when I was in a hurry."

Respondent 2

"The colour contrast is quite good, but the placement can be improved. Some signs appear only after you pass the junction, which makes you turn back."

Respondent 3

"I feel the airport has enough signs, but they are not consistent. For example, the same destination is shown on two different boards, but the arrows point differently. This confuses passengers."

APPENDIX 3

Data Analysis Table

Interview Question	Respondent 1	Respondent 2	Respondent 3	Consolidated Key Point of View
Visibility of signage	Not visible, obstructed by pillars	Poor placement after junction	Inconsistent arrow direction	The main issues relate to placement and visibility
Strengths of signage	Helpful when visible	Strong colour contrast	Adequate number of signs	Signs are available but require improved positioning
Weaknesses of signage	Positioned too high, not user-friendly	Signage placed too late along pathway	Arrow inconsistency	Weaknesses stem from placement and directional accuracy
Suggested improvements	Lower placement, clearer arrows	Earlier placement with improved layout	Consistent directional guidance	Enhancements should focus on placement, visibility, and consistency

APPENDIX 4

Sample Observation Checklist (KLIA2)

Observation Item	Yes/No	Notes
Signage visible from 10 meters	No	Visibility blocked by shop displays
Signage positioned at eye level (1.5–2m)	No	Most signage placed higher than 2.5m
Consistency of arrow direction	No	Conflicting directions observed across signage
Adequate lighting	Yes	Signage areas are well illuminated
Colour contrast (yellow text on black)	Yes	High contrast improves legibility

APPENDIX 5

Ethical Approval & Consent Form

UNIVERSITI TEKNOLOGI MARA
Pejabat
Timbalan Naib Canselor
(Penyelidikan dan Inovasi)

Reference : 600-TNCPI(5/1/6)
Our reference : REC/03/2022 (PG/MR/43)
Date : 21 March 2022

Assoc. Prof. Dr Nur Hisham bin Ibrahim
(Nur Liana binti Kamal Bahari - 2020864514)
College of Creative Arts
Universiti Teknologi MARA
40450 Shah Alam,
SELANGOR

Dear Assoc. Prof. Dr Nur Hisham,

APPROVAL LETTER - UiTM RESEARCH ETHICS COMMITTEE

Thank you for submitting your research proposal to the Research Ethics Committee (REC). After considering your application, the Committee approved your proposal titled "Wayfinding Signage Criteria towards Improving the Effectiveness of Navigation in Kuala Lumpur International Airport 2 (KLIA2)" at the Kuala Lumpur International Airport 2 (KLIA2).

Details of the approval are as follows:

Ref. number:	REC/03/2022 (PG/MR/43)
Approval Period:	21 March 2022 until 28 February 2023
Authorised personnel:	1. Assoc. Prof. Dr Nur Hisham bin Ibrahim 2. Nur Liana binti Kamal Bahari 3. Assoc. Prof. Dr Muhamad Abdul Aziz Ab Gani

The UiTM Research Ethics Committee operates in accordance to the ICH Good Clinical Practice Guidelines, Malaysian Good Clinical Practice Guidelines and the Declaration of Helsinki. The approval of this project is conditional upon your continuing compliance with these guidelines and declaration.

We draw to your attention the requirement that a report on this research, must be submitted every 12 months from the date of the approval or on the completion of the project, whichever occurs first. Failure to submit reports will result in withdrawal of consent for the project to proceed. Amendments, if any, to the study documents are to be submitted to the REC for approval.

If you require further information, please contact the REC Secretariat at 03-55448069/03-55442794 or email at recsecretariat@uitm.edu.my.

Yours sincerely,

EMERITUS PROFESSOR DATO' DR RAYMOND AZMAN ALI
Chairman
UiTM Research Ethics Committee

c.c.: Assistant Vice Chancellor, College of Creative Arts, UiTM

Universiti Teknologi MARA
Aras 3, Bangunan Wawasan
40450 Shah Alam, Selangor, MALAYSIA
Tel: (+603) 5544 2004/2255
Faks: (+603) 5544 2070

AUTHOR'S PROFILE

Nur Liana Binti Kamal Bahari obtained her Bachelor of Art and Design (Hons.) in Graphic and Digital Media from Universiti Teknologi MARA (UiTM), Shah Alam, in 2007. She later pursued and successfully completed her Master of Art and Design (CAAD750) Research at Universiti Teknologi MARA (UiTM), Shah Alam. Throughout her postgraduate studies, she has been actively involved in research and academic writing, particularly in the field of environmental graphic design and wayfinding. She has also participated in conferences and contributed to publications related to design practice and research.

LIST OF PUBLICATION:

Bahari, N. L. K., Ibrahim, N. H., & Radzi, M. Q. A. N. A. (2025). Wayfinding Signage Criteria and Ineffectiveness Factors towards Navigating in Kuala Lumpur International Airport (KLIA2). *Idealogy Journal*, *10*(1)..

UNIVERSITI TEKNOLOGI MARA

PERPUSTAKAAN TUN ABDUL RAZAK
BAHAGIAN SUMBER RUJUKAN UNIVERSITI (BSRU)

BORANG PENYERAHAN BAHAN HARTA INTELEK UiTM

UiTM's Intellectual Property Submission Form

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Faculty / Academic Centres / Department

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