

EVALUATION OF SAFETY AWARENESS AND  
PERCEPTION OF WAYFINDING TOOLS AMONG  
STUDENTS AND STAFF IN ENGINEERING  
CAMPUS, UNIVERSITI SAINS MALAYSIA

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EVALUATION OF SAFETY AWARENESS AND PERCEPTION OF  
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ENGINEERING CAMPUS, UNIVERSITI SAINS MALAYSIA

By

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## ABSTRAK

Disertasi ini mengkaji kesedaran keselamatan dan perspektif alat pencari laluan dalam kalangan pelajar dan kakitangan di Kampus Kejuruteraan, Universiti Sains Malaysia (USM) yang memberi tumpuan kepada pemahaman pelajar dan kakitangan tentang lokasi pelan pemindahan, butang kecemasan, papan tanda keluar kecemasan, kawasan perhimpunan dan laluan pemindahan. . Tinjauan yang dijalankan terhadap 185 responden menunjukkan tahap kesedaran dan persepsi keselamatan terhadap alat pencari laluan dalam kalangan pelajar dan kakitangan di Kampus Kejuruteraan, USM berada pada tahap yang baik. Lebih tepat lagi, peratusan besar responden mengetahui bunyi penggera kecemasan (78.95%), tahu di mana untuk mencari pelan/peta pemindahan (74.2%), tahu di mana pintu keluar kecemasan (90.9%) dan mengetahui kawasan perhimpunan untuk melarikan diri. (91.85%). Dari segi perbezaan demografi, hasil daripada Ujian Mann Whitney U menunjukkan bahawa tidak terdapat perbezaan yang signifikan dalam kesedaran keselamatan dan persepsi tentang alat pencari laluan antara lelaki dan perempuan. Pengalaman dalam pendidikan dan latihan pemindahan atau keselamatan mempengaruhi kesedaran keselamatan dan persepsi pencari laluan dalam kalangan pelajar dan kakitangan di Kampus Kejuruteraan, USM. Ini kerana dengan pengalaman dan latihan dalam keselamatan, mereka akan lebih mengetahui keselamatan dan alat mencari laluan berbanding orang yang tidak berpengalaman. Selain itu, keputusan daripada Ujian Kruskal-Wallis juga menunjukkan bahawa tiada perbezaan yang signifikan antara kumpulan umur dan tahap latar belakang pendidikan. Hasil kajian ini boleh membantu pengurusan universiti dalam mewujudkan strategi yang sesuai, penyelesaian reka bentuk, latihan, dan kempen pendidikan untuk pemindahan yang cekap dan selamat. Selain itu, hasilnya juga merupakan sumber yang berharga dalam membangunkan dan mengesahkan model matematik dan teori yang bertujuan untuk mengkaji pemindahan pelajar dan kakitangan dalam situasi kecemasan.

## ABSTRACT

This dissertation examines safety awareness and perception of wayfinding tools among students and staff in Engineering Campus, Universiti Sains Malaysia (USM). That focus is to investigate the understanding of students and staff about location of evacuation plans, emergency buttons, emergency exit sign, assembly area and evacuation route. A conducted survey with 185 respondents shows that the level of safety awareness and perception of wayfinding tools among students and staff in Engineering Campus, USM are good based on findings of this study. More precisely, a significant percentage of respondents know the sound of an emergency alarm (78.95%), know where to find the evacuation plan/map (74.2%), know where the emergency exits (90.9%) and know the assembly area to escape (91.85%). In terms of demographic differences, results from Mann Whitney U Test revealed that there is no significance difference in safety awareness and perception on wayfinding tools between males and females. Besides, experience in evacuation or safety education and training influences safety awareness and perception of wayfinding tools among student and staff in Engineering Campus, USM. This is because with experience and training in safety/evacuation, people will be more aware about safety and wayfinding tools compare to not experience people. Additionally, results from Kruskal-Wallis Test also show that no significance difference between age group and the level of educational background. The results of this study can assist university management in creating suitable strategies, design solutions, training, and educational campaigns for efficient and secure transfers. Moreover, the outcome is also a valuable resource in developing and verifying mathematical and theoretical models aiming to study students and staff' evacuation in an emergency situation.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background Study

Wayfinding tools are an essential part of the emergency evacuation identification system in a building, which can improve personal perception of the evacuation process and guide people to evacuate quickly. Wayfinding tool is a tool and information provided in a building which can help occupant navigate efficiently in a building in case of an emergency evacuation. Hence, it is crucial for people in any infrastructures to understand and be aware of the location of the emergency exit sign, emergency buttons, evacuation maps, fire extinguisher, and the assembly area. Emergency wayfinding systems are designed in order to provide safety to people in case of evacuation. In developing safe and efficient evacuation strategies, it is crucial to understand the people safety awareness and perception of wayfinding tools.

As defined in Advanced Consulting and Training Ltd. (2022), safety awareness is a constant realization that every people should have at all times, this should involves being constantly aware of surrounding conditions and being able to recognize the hazards they face. Meanwhile, taken from International Online Medical Council (IOMC) (2022), perceptions of wayfinding tools is the organization, identification, and interpretation of sensory information in order to represent and understand the presented information or environment.

Previous studies have shown that, due to the complex structure of building systems and people' unfamiliarity with the environment, providing people with wayfinding assistance or guidance information in an emergency is extremely important to facilitate the evacuation process (Fridolf et al., 2013, Shiwakoti et al.,

2016). Wayfinding information and tools such as evacuation map, exit sign, emergency alarm, succinct directions to assembly areas can positively influence the routing choice behaviour and evacuation process of passengers (Shiwakoti et al., 2016, Shiwakoti et al., 2019b).

Currently, some researchers have studied how people in road tunnel (Lovreglio et al., 2015a, Lovreglio et al., 2015b, Ronchi et al., 2018, Ronchi et al., 2015, Shiwakoti et al., 2016), train stations (Haghani and Sarvi, 2016, Shiwakoti et al., 2016) and airports (Shiwakoti et al., 2019b, Shiwakoti et al., 2020) perceive emergency wayfinding tools and evacuation procedures. However, there has been lack number of systematic research report among students and staff perception of emergency wayfinding information and tools in university area.

In general, although there have been studies on people' perception of emergency wayfinding tools and evacuation procedures in land-based infrastructure, there are few systematic investigations into people' safety awareness and perception of wayfinding tools and evacuation procedures in case of students and staff in university area. To address the lack of exploration on the above subject, this study was purposely conducted to study on students and staff safety awareness and their perception on emergency evacuation wayfinding tools in engineering campus, USM. In addition, the focus of this study is also to investigate the demographic differences regarding safety awareness and perception of emergency wayfinding tools.

University is considered as a second home for the students and staff of the university during process of seeking and imparting knowledge. Hence, safety awareness and perceptions of wayfinding tools among students and staff is very important to prevent unwanted situation from happening.

## 1.2 Problem Statement

Wayfinding tools in the university is very important to helps students and university staff deal with emergencies effectively and safely. The majority of researchers paid little attention on building occupants safety awareness and perception on wayfinding tools (Rahman et al., 2022). Therefore, it is necessary to evaluate people' safety awareness and perception of wayfinding tools for emergency evacuation in closed building such as the in the University area.

University campus consists of many buildings in which students, staff and visitors navigate. Unfortunately, navigating around the campus can be challenging, as the existing wayfinding system is complex and not straightforward.

Wayfinding tools studies help in creating a comprehensive, clear and consistent visual communication system with concise messaging. By studying students and staff awareness and perception of wayfinding tools, the authorities can develop effective evacuation strategies at Engineering Campus, USM as confusion and delay in an emergency can result in injuries and fatalities. Many of the earlier studies in developed countries have been conducted to explore wayfinding tools experiences among university's residents especially in university libraries, e.g., Florida State University Library, (Kinsley & Spitler, 2008), University of Chicago (Larsen & Tatarka, 2008) and University of Illinois (Hahn & Zitron, 2011) due to the complexities of such huge buildings.

In addition, the focus of this study is also to investigate the demographic differences regarding safety awareness and perception of emergency wayfinding tools in Engineering Campus, USM. It is because safety is very essential to everyone, especially those who dwell in the building, as if there is emergency, their safety is

linked to a good and effective combination of life safety measures already in place. The good access to the evacuation route only is not enough but safety awareness and perception of wayfinding play an important role since how people react to certain warning could be different among the people and this could also enhance the vulnerability, especially during the warning distribution (Rahman et al., 2022).

### **1.3 Objectives**

The objective of the study is to accomplish the following objectives:

- i. To demonstrate the current status of safety awareness and the perception of emergency wayfinding tools among students and staff in Engineering Campus, USM.
- ii. To investigate the demographic difference regarding safety awareness and perception of emergency wayfinding tools in Engineering Campus, USM.

### **1.4 Scope of Work**

The scope of the study is limited to students and staff of the Engineering Campus, USM. Wayfinding tools facilities are including emergency exit sign, emergency buttons, evacuation maps, fire extinguisher, and the assembly area. The wayfinding parameters that need to be measured are the familiarity of emergency tools, the understanding about available wayfinding information, knowing the location of wayfinding tool and know how to use the tools incase emergency happens.

Mode of survey was conducted online to make it easier for students and staff to complete the survey. In addition, online survey also easier to access for respondent and the data obtained is more accurate and valid. As a limitation of this study, the researchers acknowledged that the problem of generalizability is hampered by the

Malaysian government's movement control order (MCO) as a study constraint. The poll was done on just one campus of Universiti Sains Malaysia, out of the various institutions in Malaysia, due to the proximity of respondents. Future safety awareness and management efforts should be extended to other university campuses to have a better understanding of human behavior in emergency evacuation. Further study might be conducted to determine the factors that contributed to the level of occupant awareness and perception of wayfinding tools in University. Respondent must be students and staff of Engineering Campus, USM

### **1.5 Significance of the Study**

By conducting this study, it is expected that we can understand the status of safety awareness and perception of students and staff about the wayfinding tools provided at Engineering Campus, USM. By understanding the status of safety awareness and perception of wayfinding tools, the suitable measure can be taken to increase the safety of students, staff and occupants in Engineering Campus, so that, the casualty and fatality can be avoided or minimized if accident or emergency happened.



## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

A wayfinding tool is an important part of the emergency evacuation identification system, which can improve passengers' personal perception of the evacuation process, and guide people to evacuate quickly (Shiwakoti et al., 2016, Shiwakoti et al., 2019b, Xie et al., 2012). Bode and Codling (2019), Bode et al., (2015), Lovreglio et al., (2018), Lovreglio et al., (2016) have studied evacuation from buildings, attempting to demonstrate how humans may choose an escape route. Similarly, Galea et al., (2014), Galea et al., (2017), Xie et al., (2012) found that participants who can observe the wayfinding signs save half of the average time required to make a wayfinding decision when compared with those who cannot correctly interpret the signs.

Safety awareness and wayfinding tools perception measures are intended to ensure the safety of the occupants in the event of any emergency while in the building. This chapter explains the wayfinding tools in depth. The significant kinds of wayfinding tools typically installed in a building are defined in general and this chapter also is aiming to review past research related to safety awareness and wayfinding tools perception.

#### **2.2 Terminology Wayfinding, Safety Awareness and Perception**

This sub-section discusses the terminology used in this study.

##### **2.2.1 Wayfinding**

Wayfinding tools is the information systems that lead people through a physical

location and improve their understanding and experience of the space. Emergency wayfinding systems are designed in order to provide safety to people in case of evacuation. They should be available at any moment and must work even when the power supply is affected (Troncoso, 2014). Actually, the ability to work when the main systems fail in order to show evacuees the way to a safe location is the most critical characteristic of these types of systems. Wayfinding studies help in creating a comprehensive, clear and consistent visual communication system with concise messaging. The typical wayfinding system/tools available in one particular building are emergency exit sign, evacuation map/plan and assembly area.

### **2.2.2 Safety Awareness**

Safety awareness is a constant realization that every people should have at all times. It involves being constantly aware of surrounding conditions and being able to recognize the hazards they face. Awareness and preparedness can be enhanced through proper training schemes, which could be the key in reducing the loss of life and personal injuries. Yoon et al. (2013) stated that passengers who did not know evacuation procedures and tools were slower to evacuate than those who had an adequate level of awareness. In addition, according to Shiwakoti et al. (2016), knowledge of the emergency exits, evacuation plans, emergency red buttons, assembly areas, and evacuation routes can help a person avoids unsafe conditions and remain alert in public spaces. According to Rahman et al. (2022), self-preparedness can be defined as a proactive approach that people take to prepare for unexpected situations and emergencies. Passengers who are self-prepared can reduce the impact of an incident on themselves as well as the number of fatalities and property damage during an emergency. Self-preparedness is a collection of acts conducted individually as a

preventative strategy in the event of a calamity (Rahman et al., 2022). According to Shiwakoti et al. (2016), these actions include ‘know-how’ and ‘know-who’ actions such as know how to read the evacuation plan, know how to use an emergency red button, know how to get to the assembly area quickly, and know whom to get help from in case of emergencies.

### **2.2.3 Perception**

According to Cambridge Dictionary (2022), perception is the organization, identification, and interpretation of sensory information in order to represent and understand the presented information or environment. Perceptions, like attitudes, have been recognized as an important factor in safety. Previous research suggested that when measured, perceptions can predict the likelihood of certain behaviors (Boufous et al., 2009). The importance of this factor is especially critical when occupant have little or no direct supervision during emergency. In such settings, occupants make important choices and decisions about safety rules, practices and procedures. If perceptions about safety are low, that occupants may be more likely to take a shortcut or engage in some other at-risk behavior that can lead to an injury.

In summary, although there have been some studies on passenger surveys to understand passenger perceptions of safety at train stations and other open space area, there is lack of comprehensive studies that consider the perception of occupants in university areas in emergency evacuations. Failure to handle safety properly all too often results in death or injury, chronic illness, property damage, and/or environmental degradation. These advancements have a significant impact on society's health and economic well-being (Muckett, 2007).

## **2.3 Common Wayfinding Tools Installed in University Building**

University must ensure that students' lives are safe while they are in the building. The university management has developed emergency guidelines in terms of personal protection in the event of any emergency to save lives, prevent property and financial loss. Evacuation map/plan, emergency exits sign, fire extinguisher, emergency alarm and assembly area are among the most common type wayfinding tools installed in a building.

### **2.3.1 Evacuation Map/Plan**

Evacuation maps are typically a simplified picture of a building that provides straightforward, easy-to-understand directions to guide the building's occupants to the most appropriate assembly place when emergency happen. Shiwakoti et al. (2020) applied the “role-rule” model to study passengers' perception of safe evacuation ability from the airport during emergency evacuation. It was found that passengers were less likely to trust emergency wayfinding tools and procedures to evacuate safely. Shiwakoti et al. (2020) suggested that planners and managers should conduct evacuation strategies and training activities to guide passengers in using wayfinding tools such as emergency evacuation maps/plans, assembly areas and public address systems during evacuation. In the past, natural as well as human-made disasters have caused mass evacuations in major train stations (BBC, 2016, Fridolf et al., 2013 and Smith-Spark & Felton, 2013). These studies and news reports highlight that it is vital to provide information on evacuation procedures and guide people to safe locations during emergencies. Based on the study and this news report, it highlights that it is important to provide information on evacuation procedures and guide the public to safe locations during emergencies.

### **2.3.2 Emergency Exit Sign**

The purpose of an emergency exit sign is to guide people to safety in the event of an emergency or to guide traffic in the workplace. This signage comes in green bright colours, bold text and attractive pictographs. This is to make certain that the communication is highly visible and clearly delivered. In addition, it comes two types of escape sign, which is the normal one and glow in the dark sign (photoluminescent sign). According to Fridolf et al. (2013), emergency exit signs should be placed at locations where it is easily identifiable to reduce the risk of passengers either missing or misunderstanding these safety indicators. Ensure that each exit is adequately designated by exit signs to assist protect the residents of an enclosed building. In high-stress and emergency situations, people are frequently unable to think clearly. That is why it is critical to have properly illuminated exit signs identifying the location of the exit doors because it will assist persons who are panicked or confused in finding their way to safety (Galea et al., 2014a).

### **2.3.3 Fire Extinguisher**

According to historical data, portable (i.e., manually manipulated and operated) fire extinguishers are the most often used means of extinguishing an incipient fire in the process industry. Human monitoring, coupled with the capacity to respond promptly and efficiently to the onset of an incipient fire, has averted the development of innumerable process accidents into large-scale catastrophes. The purpose of supplying portable fire extinguishers is to ensure that there is a readily accessible supply of extinguishers that can be utilized effectively during the early phases of fire development (Nolan, 2011).

Fire extinguishers are intended to be effective when used in accordance with the

basic instructions labeled on each extinguisher. All new commercial buildings, schools, retail establishments, and industries must be equipped with fire extinguishers (Azmi et al., 2009). According to Azmi et al. (2009), the locations of fire extinguishers are to be based on the following guidelines:

- 1) Fire extinguishers must be prominently placed in areas where they will be easily accessible and available quickly in the event of a fire. They should ideally be placed along well-traveled routes, particularly exits from a region.
- 2) No obstruction or concealment of fire extinguishers is permitted. Exception: In big rooms and particular places where sight blockage cannot be avoided completely, methods for indicating the location must be given.
- 3) Unless the extinguishers are wheeled, they must be placed on the hooks or brackets provided, fixed in cabinets, or positioned on shelves.
- 4) Fire extinguishers placed in locations where they may be dislodged must be mounted in brackets intended to address this issue. Physically vulnerable items must be shielded from impact.
- 5) Fire Extinguishers installed in cabinets, wall recesses, or shelves must be oriented such that the working instructions face outward. Such extinguishers must be prominently labeled with their location.

#### **2.3.4 Emergency Alarm System**

The purpose of an emergency alarm system is to detect the unwelcome presence of fire by monitoring environmental changes caused by combustion (Azmi et al., 2009). These alarms may be triggered automatically by smoke detectors and heat detectors or manually by devices such as manual call points or pull stations (Fennelly, 2020).

Modern emergency alarm systems are capable of detecting smoke and heat

generated by a tiny flame, water flowing through a sprinkler system, or an activated pull station and communicating this information to on-site workers by dedicated phone line to any place in the globe (Azmi et al., 2009). Alarms come in the form of motorized bells, wall-mounted sounders, or horns. Additionally, they may be speaker strobes that sound an alert followed by a spoken evacuation message warning resident not to use the elevators (Fennelly, 2020).

By taking into account every emergency that occurs, the use of this emergency alarm is very helpful by giving early warning of emergencies that occur. Emergency alarm sensors aim to avert major damage by detecting fires in their early stages, providing enough time for protection officers and fire authorities to react (Russell, 2009).

### **2.3.5 Assembly Area**

In the event of an emergency evacuation, such as a fire, an evacuation assembly area is a designated safe zone away from the building where your employees and visitors can meet. This should be located a safe distance from the building, be widely recognised among your personnel, and allow your employees and guests to be identified during an evacuation. Exit routes to the evacuation assembly area should be well-lit, well-marked, and large enough to accommodate the expected number of evacuees. The location of the assembly area can be considered as a location such as a nearby park/reserve, community hall, church area, shopping mall car park or other similar public places (Dong, 2018). Assembly areas are first gathering places after emergency happen, and provide temporary sheltering. The right location of safe assembly areas can successfully minimise mortality. Assigning assembly areas is a significant strategy to reduce human loss. During the planning and design process, the

safety of these areas against secondary calamities is the most critical consideration.

## **2.4 Factors influence people's awareness of wayfinding tools during an evacuation**

Strong safety awareness-raising programs provide the greatest protection against injury or potential loss. The following three components, such as education, training, and attitude, must be adequately addressed by all relevant authorities (Mydin, 2014). The following are the factors that contribute to the level of awareness of residents about wayfinding tools information

### **2.4.1 Evacuation/safety education/training**

A building occupant with adequate training may reduce danger threats while responding swiftly and effectively if any incidents occurs in the building. Without adequate training, a little incidence may easily escalate into a big event with potentially fatal consequences if left unattended.

An analysis conducted by Fridolf et al. (2013) found that people with safety education will be more sensitive and quick to respond if an emergency occurs. According to Gerges et al. (2016), When there is a fire, an educated person is more likely to evacuate quickly than uneducated people, who are more inclined to do other activities before fleeing. In addition, Galea et al. (2014), Galea et al. (2017), Xie et al. (2012) found that participants who could observe the wayfinding signs (had education on evacuation) saved half of the average time required to make a wayfinding decision when compared with those who cannot correctly interpret the signs.

#### **2.4 1.1 Extinguisher Training**

In order to reduce the damage to life and property due to fire, practical advice for having a fire extinguisher in a building that you occupy, including training and



support, if necessary (Lee et al., 2015). According to the National Fire Protection Association (NFPA), The use of a fire extinguisher may prevent fires. A fire extinguisher is a critical component of an active fire prevention system, which should be installed in every structure. Wherever a fire occurs, the occupants must be aware of extinguisher training, if only to prevent the fire from spreading to a larger area.

### 2.4.1.2 Fire Drill Training

In the event of a fire, it is necessary that the building management know the protocol and be prepared to take precautionary action. Fire safety equipments like the sprinkler, fire extinguisher, smoke detector, and hose reel are essential to decrease the possibility of a fire breaking out. The first thing a person who becomes aware of a fire must do is access the fire alarm to transmit information to someone else about the location of the fire. In this case, it is better to be calm to prevent the possibility of ill-advised decisions being made. For example, if the building occupants (students and staff) know how to react to fire and the fire safety system is essential, they will not initially attempt to mess with the equipment (Shazrizil et al., 2019).

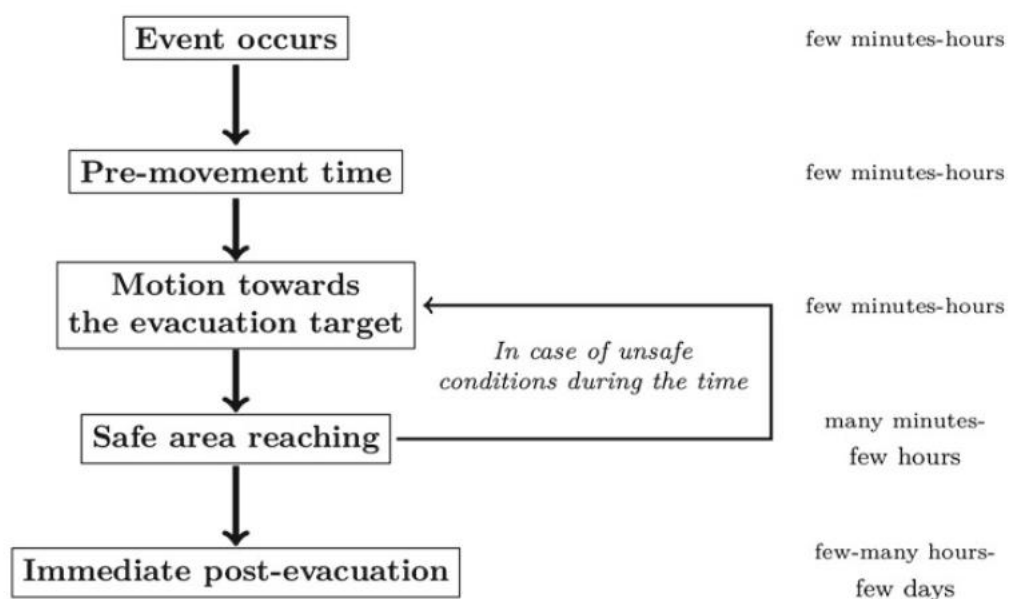


Figure 2.1: Evacuation phases as a sequence of human responses to a disastrous

event. (Bernardini, 2017)

This general behavioral system may be arranged chronologically throughout typical evacuation stages in the emergency flowchart, as illustrated in Figure 2.1, notwithstanding particular variations owing to catastrophe impacts or architectural damage (e.g., smoke in a fire, earthquake debris) (Bernardini, 2017).

## **2.4.2 Knowledge about Wayfinding Tools**

In a study by Shazrizil et al. (2019), the students are unable to react appropriately to a fire or are unaware of the correct evacuation route and assembly point. As a result, based on that study, knowledge is essential to improve the occupants' awareness and perception level of wayfinding tools.

### **2.4.2.1 Knowledge of Emergency Action Plan**

In the case of an emergency, an emergency plan should explicitly outline what should be done and when. It should also outline the roles of critical occupants as well as the tasks that they must do. In addition, a documented evacuation protocol should be developed and implemented. In the case that an emergency alarm is activated, this process should outline what should be done in such circumstances. For example, the placement of fire alarms, call points, extinguishers, and exits sign, as well as the names and contact information of designated personnel and their areas of responsibility (Healthy Working Lives - Fire - Fire safety precautions, 2021).

According to Shazrizil et al. (2019), where most students not aware of their own colleges' assembly points sites is large, the administrative action that can be taken is more strategic areas where they have access to information with ease by placing appropriate signs and a emergency action plan. In the context of this study, it is

essential that to train building' occupants in order to ensure that they are familiar with the emergency plan.

#### 2.4.2.2 Knowledge in Using the Fire Extinguisher

One of the issues in our community is a lack of knowledge about how to properly utilize a fire extinguisher, as shown by awareness-raising seminars, inefficient practices by community members in preserving property during fire crises, and a high rate of loss during fire emergencies. The majority of students are not familiar with how to utilize a fire extinguisher and other wayfinding tools equipment provided by their institutions (Shazrizil et al., 2019). There is a need to expand educational opportunities, firefighting education in current living spaces (schools, workplaces, etc.) on using and knowing fire extinguishers toward fire safety education (Lee et al., 2015).

#### 2.4.3 Demographic factor

Table 2.1 summarizes some of the previous research conducted in studying the perception of wayfinding tools in relation to some demographic factors.

Table 2.1: Summary of the previous research of wayfinding tools in relation to demographic factors

Factor	Author and Titles	Finding
Gender	Muhammad Syahir., Mohd Johari et al. (2021) (Exploratory Study on Self-Awareness and Self-Preparedness of Malaysian Rail Passengers for Emergency Evacuations)	This study explores the self-awareness and self-preparedness among Malaysian rail passengers during potential emergency evacuations. A questionnaire survey was conducted at a major rail transit terminal in Kuala Lumpur, and 329 complete responses were collected. Results indicated that most survey respondents were unaware of the evacuation information and tools, although 48% of them declared that they were familiar with the rail transit terminal. Males were found to be more prepared than females.
	Shiwakoti et al. (2016)	This paper examines the passengers' way

	(Passengers' awareness and perceptions of way finding tools in a train station)	finding in a train station under normal and emergency conditions, with a particular focus on the passengers' understanding and rating of the location of emergency exit signs, emergency buttons, evacuation maps and the assembly area. This paper reported that male passengers responded to a higher level of wayfinding awareness and better perceptions of the wayfinding tools in a train station.
	Enarson, E., & Chakrabarti, P. D. (2009). (Women, gender and disaster: global issues and initiatives (1st ed.). India: SAGE Publications)	This book examines gender within the context of disaster risk management. It argues for gender mainstreaming as an effective strategy towards achieving disaster risk reduction and mitigating post-disaster gender disparity. Highlighting that gender inequalities pervade all aspects of life, it analyses the failure to implement inclusive and gender-sensitive approaches to relief and rehabilitation work. Based previous theory of different risk perceptions among males and females, which states that males are more likely to take risks, whereas, females are more likely to avoid risks.
Ages	Baffoe, B., & Shiyuan, Z. (2017). (Subway emergency preparedness in Shanghai: A focused group and interview study exploring the perceived experiences of senior citizens and the disabled)	The findings reveal that most aged and disabled subway riders have little or no knowledge about emergency safety measures or safety symbols, the administering of first aid and have language barrier concerns. This study recommends that policy makers and sub-way operators should get the aged and disabled people involved in developing more educational programs that will help them to better the concept of safety prevention measures and it also suggests holding more emergency drills involving the aged and disabled.
	Pan, F., Zhang, L., Qi, R., Ma, C., Yang, J., & Tang, H. (2019). (Analysis of psychologies and behaviors of subway crowds under special events based on survey)	Based on a logistic model, the study analyzed the influence of gender, age, occupation, level of education, and degree of safety knowledge regarding crowd evacuation behavior. The results led to the following conclusions. First, gender, age, level of education, and degree of safety knowledge are significantly correlated with the psychological and behavioral responses of crowds. This research reported that during events that typically attract large crowds, pedestrians who are younger than age 45 tend to evacuate faster.
	Shiwakoti, N., Tay, R.,	This paper examines the passengers' way

	Stasinopoulos, P., & Woolley, P. J. (2016). (Passengers' awareness and perceptions of way finding tools in a train station)	finding in a train station under normal and emergency conditions. In terms of demographic differences, results from the ordered logit and generalised ordered logit models demonstrate that there are some differences in the understanding of way finding tools between males and females as well as among the different age groups. From their finding, it concluded that the level of awareness and preparedness among younger passengers is better than older passengers.
Races	Shiwakoti et al. (2020) (A 'role-rule' model to examine passengers' likely behaviour and their perceived ability to evacuate safely from airport in an emergency evacuation)	This study aims to examine the airline passengers' likely behaviour and their perceived ability to evacuate safely from airport buildings in an emergency evacuation by testing and applying the socio-psychological 'role-rule' model. It stated that difference in culture may influence response behavior as well as response time.
	Leib et al. (2012) (A Comparison of the Effect of Variations to U.S. Airport Terminal Signage on the Successful Wayfinding of Chinese and American Cultural Groups)	This study aims to examine the passengers' awareness and perceptions of the emergency way-finding tools and procedure in the airport. In addition, the study also investigates the relationship of passengers' perceptions of feeling safe at the airport with the awareness of way-finding tools and procedur. The findings show that understanding the passengers' perceptions and knowledge of emergency evacuation tools and procedure in different regions or culture is important to develop a robust emergency plans and procedure in the airport. In future, it is recommended to examine if the correlation between different culture and emergency wayfinding is additionally driven by the architectural layout and features of the airports.
Educational Level	Gerges, M., Mayouf, M., Peter, & Moore, D. (2016). (Human-Behaviour under Fire situations in High Rise residential Building)	An educated person is more likely to evacuate quickly than uneducated people, who are more inclined to do other activities before fleeing. Those who stated they were educated to a degree level or above would quickly evacuate a building upon hearing the alarm if they were unfamiliar with its layout.
	Fridolf, K., Nilsson, D., & Frantzich, H. (2013). (Fire evacuation in underground transportation systems:	Found that people with safety education will be more sensitive and quick to respond if an emergency occurs.

	a review of accidents and empirical research)	
Familiarity	Yoon, S.-H., Lee, M.-J., & Yee, J.-J. (2013). (An experimental study on evacuation times in a subway station using evacuation parameters)	Stated that passengers who did not know evacuation procedures and tools were slower to evacuate than those who had an adequate level of awareness.
	Mohamed, M. A. I., Abd Rahman, N., & Dias, C. (2021). (Self-reported likely behaviour of rail passengers during an emergency evacuation-a case study of Kuala Lumpur, Malaysia)	This finding explains why the competitive behaviour of passengers increases as their familiarity grows. This observation is logical since passengers who are familiar with the premises are aware of the location of the exits and they tend to move toward exits by themselves

Based on the prior research compiled in Table 2.1, the majority of the discussion focused on the communities in the specific safety awareness and perception of wayfinding tools for emergency evacuation. There is very little research on people's perception of the safety of students and staff in the educational center in Malaysia. Most researchers paid little attention to the people inside the building regarding safety awareness and perception of wayfinding tools. Therefore, it is necessary to assess the level of safety awareness and perception of wayfinding tools of the people for an emergency evacuation in a closed structure like in the University area.

## 2.5 Summary of the chapter

This chapter contains basic information regarding wayfinding tools and a definition of the term "wayfinding". The various types of wayfinding tools frequently installed in any building are evacuation map/plan, emergency exits sign, fire extinguisher, emergency alarm and assembly area are thoroughly explained in order to ascertain occupants' awareness and knowledge regarding wayfinding tools in buildings.

This chapter also discusses the level of awareness and perception toward wayfinding tools and the factors that impact occupants' awareness toward wayfinding tools, such as safety training, knowledge and demographic factor. The researcher must go through all sources and cite the authors' names, and include them as references. Conducting a literature study reveals everything about the degree of understanding of wayfinding tools. As a result, this may assist the researcher in obtaining accurate data on this subject.

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 Introduction**

This chapter describes the data gathering strategies utilized to accomplish the study's objectives. Firstly, the research objectives must be unambiguous and easily understood in light of the investigation. These two components are critical in determining how successfully research may be done. Additionally, it can serve as a guide for implementing the research. As a result, it must guarantee that data collecting is accurate, practicable, and valuable.

#### **3.2 General Information about Targeted Survey Sampling**

Universiti Sains Malaysia is a public university that was established on 1 June 1969. USM is one of the APEX university in Malaysia. The development area of Engineering Campus is about 320 acres. It's about 45 kilometres from the main campus in Gelugor, Penang. Within the 320 acres area, there are various buildings such as 6 blocks of Desasiswa (residential colleges), 6 blocks of school (Pusat Pengajian), administration buildings, research centres, health centers, director's offices, library and others building.

This engineering campus is in a unique region that is on the borders of three Malaysian states: Penang, Perak, and Kedah. Nibong Tebal is 4 kilometres away, Parit Buntar is 4 kilometres away, and Bandar Baharu is 8.3 kilometres away.





Figure 3.1: Main entrance of USM Engineering Campus



Figure 3.2: Region that is on the borders of three Malaysian states: Penang, Perak, and Kedah. (Source: Google maps)

### 3.3 Research Process

The workflow of the study is shown in detail in Figure 3.3. The questionnaire was formulated based on the objective stated in chapter 1. The questionnaire must achieve the criteria from the objective stated. There was 2 part of the questionnaire: a demographic question and 8 measurement statement in part 2. The designed questionnaire must have criteria to investigate the demographic difference, demonstrate the current status and to evaluate level of knowledge, awareness and

perception of emergency wayfinding tools among students and staff in Engineering Campus, USM.

Data obtained from the survey were analyzed by SPSS 26 in order to find the frequency, mean and standard deviation. The first part of the questionnaire is to know the background of the responded. Next, the finding for the second part of questionnaire is about awareness of the wayfinding tools information (location, function,). Lastly, the finding was list the statement about perception of wayfinding tool information based on the building occupy.

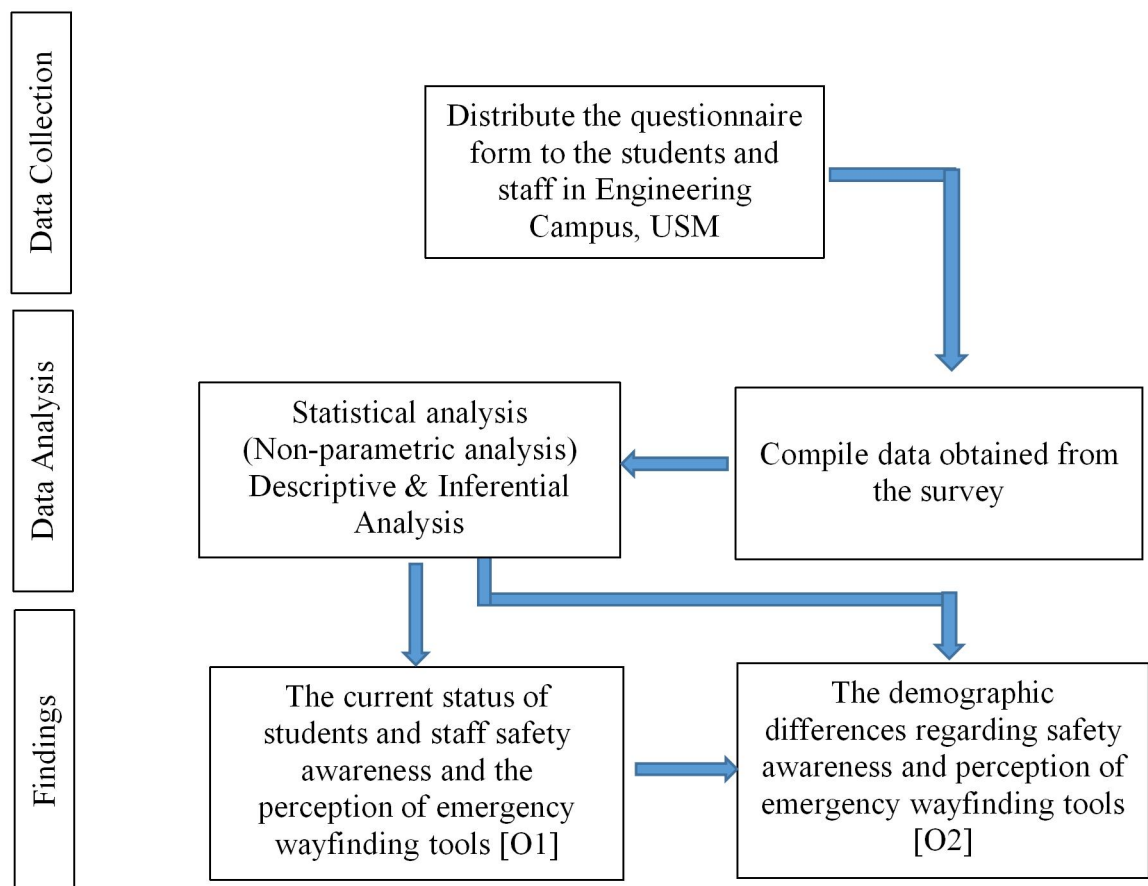


Figure 3.3: Flowchart of this research

### 3.4 Population Size

The study showed that getting as much respondent data as possible is essential for conducting data analysis with a higher quantity and quality of data. The study

population consisted of students (must be on campus) and staff USM engineering campus. The university was chosen to investigate students and staff awareness and perception of wayfinding tools. According to the USM portal, the 13914-hectare engineering campus has accommodated a total of 2174 undergraduate students, 800 postgraduate students, 255 academic staff and 585 non-academic staff in 2022. However, almost half of the students are still studying online and are not in campus. Based on the study mentioned above, 10 percent of the actual amount of population (is on campus) is needed in order to collect data. Hence, for the purpose of this study, the targeted amount of respondents is 150 respondents.

### **3.5 Questionnaire Design**

Questionnaires should always have a specific purpose linked to the study goals, and it should be made clear from the start how the results will be utilized (Roopa & Rani, 2012). According to Foldvari (1989), the study aims and hypotheses dictate the structure of a questionnaire and the items such as constructs, correlates, and variables in the form of questions that should be included. The questionnaire will consist of various items. The variables in the study will be measured in order to meet the objectives of the study, and this will be included in the questions.

For evaluations involving many participants, a questionnaire used in conjunction with sampling is often the most practical and efficient way to collect data (Pope et al., 2010). A good questionnaire takes consideration and work and must be prepared and developed in several phases (Roopa & Rani, 2012), as shown in Figure 3.4.