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KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) ON FIRE EVACUATION TIME AMONG SECONDARY STUDENTS

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Abstract: The relationship between the fire risk factors and the overall evacuation time was examined using a Knowledge, Attitude and Practice (KAP) analysis. A convenient random sampling technique was used to draw samples from 290 secondary school students. The strength of the relationship between the variables was assessed using a correlation test and the contribution of KAP level to the overall evacuation time was calculated using a multiple linear regression. The majority of students had extensive knowledge of the fire evacuation procedure. Despite the fact that most of the students agreed that attitude and practice were crucial to a safe evacuation, in reality, most of the students can be categorised as having only a fair attitude and experience. The knowledge component did not correlate significantly with either attitude or practice, whereas attitude and practice had a significant and strong correlation. While there was little correlation between the expected and actual values, the knowledge gap could account for the 2 percent variation in the total evacuation time. The total evacuation time would be shortened by 20.52 seconds for every point of knowledge gained. The results of this study can offer insights on the relationship between knowledge, perspective, and actual conduct among students that affects emergency responses. This study may be seen as a pillar for the development of a fresh method for evaluating threats during the evacuation procedure to take the place of traditional time observation-based evaluations during fire drills.

Keywords: Knowledge, attitude, practice, fire risk, evacuation time.
Abbreviations: Knowledge, Attitude and Practice (KAP), Available Safe Evacuation Time (ASET), Social Packages for Social Sciences (SPSS), Items Content Validity Index (I-CVI), Scale Content Validity Index (S-CVI).

Introduction

In tandem with the rapid growth of the economy, infrastructure and a sharp increase in material prosperity, the number of enormous and ultra-large structures, as well as the potential threats they pose to people's safety, has been rising steadily. Fire is one of the most common threats to human life and property and it has a direct impact on economic and social development (Jiang & Liu, 2012). Due to the growing number of high-rise buildings and the advancing age of existing structures, the risk of accidents, particularly building fires, is growing. It is astounding how many people perish in building fires as a result of delayed evacuations, resulting in substantial loss of life and property. The evacuation procedure has a considerable impact on the inhabitants' behaviour, attitudes, and perceptions, as well as the victim's interpretation, of the situation during the emergency (Senin *et al*., 2022). Performance-based safety evacuation

design has gained popularity as a crucial part of building fire prevention. Performance-based building and fire egress design has even been applied to educational institutions such as schools (Chixiang *et al*., 2012).

Because the gait patterns of children might differ from those of adults and from those of older children, it is important to distinguish between the age groups when considering evacuation plans for children. As a child grows and matures, he or she undergoes substantial changes to his or her growth and development. Preschool and elementary school years are considered early childhood and middle childhood, respectively; these two phases are distinct from each other. It is common for most youngsters to have formed movement patterns that underlie their basic motor abilities by the age of six or seven. These findings show that a child's pre-school motor abilities differ significantly from their later-life motor skills and abilities and this must be taken into consideration when a childs safety evacuation is being evaluated (Najmanová & Ronchi, 2017).

Evacuation is the process of moving to a safer place away from a hazardous condition, either individually or in a group. Emergency situations like fires, and natural disasters like earthquakes, or threats like terrorist bombings are examples of circumstances that require the initiation of building evacuations to avoid or minimise injuries or deaths. The whole procedure is complicated since the safety and health of evacuees during an evacuation is determined by multiple factors, one of which is human characteristics. Specifically, the three critical factors in human characteristics are knowledge, attitude, and practice, which are often assessed in a group known as a KAP analysis. Knowledge is a measure of one's level of understanding of a subject. Attitude can be defined as the beliefs and perspective on issues that arise, while practice is the action taken by people in a specific condition. Safe evacuation will probably be achieved if the occupants can evacuate in less than the available time, or what is always termed "available safe evacuation time" (ASET) (Chixiang *et al.*, 2012; Mu *et al*., 2013; De Sanctis & Fontana, 2016). Based on existing literature, the duration of an evacuation time varies depending on the abilities of the building's occupants (Proulx, 1995).

A building's evacuation procedure can be studied using either a physical or a computer simulation. Resident indifference to a building evacuation is typically deadly in a physical simulation since they do not take the threat seriously. As a result, physical simulations will not be able to deliver actual and satisfying outcomes. Additionally, parents are afraid that their children could be wounded during physical simulations in a learning setting, school administrators are more likely to oppose them. Computer simulations are the best way to examine an evacuation procedure in this case. It is possible to create simulations with different starting conditions on a regular basis, as well as manage the simulation period and observe the evacuation from various angles. Probability distribution and essential parameters are necessary for every successful simulation. It is important to perform at least one successful evacuation operation in the understudied region before running computer simulations of the evacuation procedure (Rostami & Alaghmandan, 2021).

Previous emergency event studies have highlighted the need to consider occupants behaviour in order to better understand evacuation patterns. Occupants' history and knowledge (such as familiarity with the location and past emergency experience) will impact how individuals interpret emergency circumstances, which can lead to a variety of individual actions being observed during an evacuation (Chu & Law, 2018). The physical qualities of the building, the behavioural and physiological characteristics of the residents, and the fire characteristics in the environment are the three categories identified as affecting the efficacy of the evacuation (Oven & Cakici, 2009). While fire could start from multiple sources, previous literature specifically states the causes of fire in schools as arson, low attitudes, faulty electrical

systems, poor housekeeping standards, smoking, and improper storage management (Hassanain, 2006). Chu *et al*. (2012) stated explicitly in a study on fire risk assessment the one critical element to consider in the evacuation time was the ability to interpret the environment and the knowledge, judgement, and movement, which are often interpreted as knowledge, attitude, and practices.

Based on a case study done on the BP Deepwater Horizon accident, the authors classified one of the human factors as personnel, which includes knowledge, experience, training, skills, and physical and psychological conditions (Norazahar *et al*., 2014). Even though the determing factor of total evacuation time is not limited to KAP alone, the elements under study are critical as they represent the response and behaviour of evacuees during an emergency. Those who are unable to safely leave the building may have made gaps in their knowledge, attitudes, or perceptions, or in their ability to make sound decisions or execute safe procedures (Hofinger *et al*., 2014).

67 percent of students from intervention schools in India have an accurate knowledge of what to do in the event of a fire, whereas only 9 percent of students from non-intervention schools demonstrated the same level of knowledge. Bhatia *et al*., 2013). Comparing college students, to high school students, where 96 percent of them possessed basic fire safety knowledge, 68 percent exhibited negative attitudes due to ignorance of fire hazards, and 61 percent did not practice the required fire safety actions in a safe manner (Meng *et al*., 2016). In another study, 23 percent university students were unable to identify the evacuation alarm, which can be attributed to a lack of knowledge (Hofinger *et al*., 2014).

Oven and Cakici (2009) showed that men are more likely than women to intervene in a risky situation and to take longer to warn or aid other inhabitants, and their findings are consistent with the observation that men are more likely to enter smoke-filled passageways. Malaysia is frequently shocked by fires that have occurred in the distant past. One of the most tragic events occurred on September 22, 1989, where 27 students perished due to a school fire. Multiple fire incidents occurred in Malaysia in 2017. On September 14, a fire at a hostel resulted in the deaths of 23 students, making it one of the worst fire tragedies which was widely reported in the media. Although an investigation by the police and fire departments revealed that arson was the cause of the fire, the recorded video emphasised the importance of having a proper fire evacuation protocol because several evacuees were injured in the process. In addition to causing injuries, fire is known to result in property damage or loss. From 2012 to 2013, it is estimated that fire-related property losses increased by approximately RM874.31 million (Rahim, 2015).

The study concludes that medical students' knowledge, attitudes, and actions regarding catastrophe planning and mitigation were lacking (Sinha *et al*., 2008). On the other hand, studies on KAP involving students has had mixed results. A Swedish study discovered that students' lacked an understanding about safety and health, as well as had access to inadequate safety instruction (Mohamed *et al*., 2021). Due to the lack of multiple exits in the school building, the evacuation procedure took a considerable amount of time. As a result, the students were unable to quickly evacuate the school, putting their lives at risk. Consequently, it is evident that structures of this type requires more than one fire escape for safety purposes (Bathina & Siddapureddy, 2020).

Despite the critical role of human and social elements in egress, quantifying these aspects through equations and design code rules is challenging due to the uniqueness of each emergency circumstance and the vast range of occupant characteristics (Chu & Law, 2018). This study interprets the fire evacuation process as the movement of students from their classrooms to the evacuation point, which is a pavilion. The fixed selection of movement from classrooms and laboratories is intended to create a standard evacuation scenario, as students

spend a majority of their time in classrooms and laboratories as opposed to other areas of the building. Being prepared for disasters is crucial for handling emergencies. Measures taken to prepare for and lessen the consequences of disasters are referred to as 'disaster preparation' (Alshakka *et al*., 2022). In a crisis, knowledge is essential for increasing the likelihood of survival.

One's degree of readiness for a disaster may be affected by the extent to which one is informed about the subject (Khoirunisa, 2016). One of the most devastating disasters is fire, which threatens lives and damages properties. More than 95 percent of all burn-related deaths occur in underdeveloped nations, and these numbers are in the hundreds of thousands annually (Davarani *et. al.*, 2020). Building fires are one of the most common accidents that result in many deaths and injuries each year.

All nations, including those with low, middle, and high incomes, are thought to be at risk from building fires. From 2008 to 2017, there were 1,300,000 fires every year, resulting in 3,400 fatalities and 15,000 injuries, according to the statistics of the United States Fire Administration's fire department (Dowlati *et al*., 2020). The Fire Department reported that in 2020, carelessness was the cause of 49.6 percent of the 38,659 fires that broke out in South Korea. Between 2015 and 2019, an average of 9.5 large fires occurred a year, resulting in the injury or death of 829 people. Large-scale fires that have been investigated typically result from carelessness or indifference to safety on the part of those involved (Soon-Beom *et al*., 2021).

Schools, office buildings, and other structures are all susceptible to fire. The inhabitants' actions have a big impact on fire disasters. Residents are one of the most vulnerable groups of society, and children and students are among them. Every year, catastrophes and calamities affect over 100 million children. The growth, relationships, physical health, and emotional health of students are jeopardised when incidents disturb their educational activities. Students may struggle to master critical academic concepts and skills when educational processes are disrupted. In turn, this can pave the way for future failures in the classroom. After disasters, secure schools are therefore necessary to safeguard the students social and cultural development (Dowlati *et al*., 2020). Fires caused by a lack of safety knowledge and insensitivity; are a raising safety concern in schools responsible for teaching future generations (Soon-Beom *et al*., 2021). Knowing what causes school fires can help increase school safety and provide preventative measures that are both affordable and effective. (Davarani *et al*., 2020). Despite the prevalence of fire safety programmes in schools, there are no comprehensive criteria to standardise the creation or assessment of these initiatives (Pooley *et al*., 2021).

Asian and African emerging countries have been hit more by fire disasters than any other industrialised nations. In 1995, a fire in an Indian school killed 400 kids, and in 2008, another fire at a different school killed 90 (Nyagawa, 2018). In addition to human casualties, fire disasters have been linked to an increase in disease prevalence, which is estimated to account for around one percent of the total world illness burden. When it comes to the loss of life and property, fire catastrophes in structures are among the most often known and frequently occurring man-made disasters (Kishoyian *et al*., 2021).

Children have the highest fatality rate from burn injuries and are at a significant higher risk. Children under the age of 14 are the most susceptible to the consequences of hazardous environmental exposures because they are less aware of potential dangers and have less time to react appropriately. Additionally, they panic quickly and are hard to control in an emergency or crisis (Davarani *et. al*., 2020). In the US, there were over 403,000 residential building fires in 2008, leading to 2,780 fatalities and 13,560 injuries. 509 children under the age of 14 perished in those fires, which represented 13 percent of all fire fatalities (Kumara & Ferdinando, 2016).

A crucial aspect of occupant's safety in an emergency event is the evacuation of buildings. There have been several significant research projects in this field that have examined a variety of emergency evacuation-related topics, including behavioural responses, human behaviour in emergency-related scenarios, movement of people, and egress design. Information is given on how to evacuate buildings in an emergency, including business buildings, residences, public buildings, hospitals, and sports facilities. Few studies have focused on or examined the evacuation of schools, despite the enormous number of emergency movement and egress studies that have been conducted (Horasan & Bruck, 1994). Along with improving catastrophe risk reduction and overall community resilience, safe schools are also necessary to safeguard children, teachers, and other adult staff members from harm and death.

After vehicular accidents and drowning, burn injuries have been identified as the third most common cause of child fatalities. The Shinabad fire, which killed two children and burned 28 primary school girls in Iran, was the most significant of the school fires that have claimed the lives of tens of students and staff since 1997. Using oil heaters and unconventional heating systems was the primary cause of fire in majority of incidents that were comparable to these. Based on the lessons learned from past occurrences, closing the gaps in fire safety and preparation promotion policies can improve the health of children and instructors. Most schools across the world lack a heating system, making them hazardous. As a result, there is a chance that students will suffer significant injuries in a fire (Dowlati *et al*., 2020).

Global statistics show, a large number of fire-related deaths and injuries have occurred at schools (Lambie *et al*., 2018). This is due to two risk factors: the presence of a large number of users in a confined area and the availability of flammable materials such as wooden furniture, combustible paper-based documents, classroom decorations, and chemicals used in scientific laboratories (Hassanain, 2006). Despite the presence of these elements, many schools have inadequate fire safety preventive measures implemented (Moore & Lackney, 1993).

The fire prevention and safety management situation is not much better in Malaysia. According to a study conducted by the Malaysia Fire and Rescue Department (Bomba), there were 63 and 71 occurrences throughout Malaysia for the years 2017 and 2018, respectively, involving fires in student hostel buildings at school. The research stated that, overall, electricity was the primary factor in 36 incidents of fire in 2017 and 38 cases in 2018. Selangor, the state with the highest incident rates, saw home fires most frequently caused by electrical failures and human error. According to the Malaysian Fire and Rescue Department there were 158 fire-related fatalities nationally in 2015; this number dropped to 107 in 2016, it rose to 145 in 2017, and fell to 97 in 2018. There was no distinct upward-increasing or downward-decreasing patterns in the five-year general trend. As socio-economic backgrounds, lifestyles, behaviours, knowledge, and experiences of the students who live in hostels might range widely, it is assumed that these factors will have an impact on their knowledge, attitude, and practice (KAP) regarding fire safety and its prevention (AlWaqfi *et al*., 2022).

In school buildings, fires are a significant hazard (Jonsson *et al*., 2017; Bhebhe *et al*., 2019). In Saudi Arabia, the Civil Defence General Directorate reported that a total of 248 firefighting operations were conducted in educational facilities for the year 2020, with electrical circuit malfunctions, pranks, open flames, misuse and mishandling of flammable liquids, and arson bring the leading causes. The projected damages amounted to around 416,000 saudi riyals (approximately US$111,000). In addition, according to the National Fire Protection Association's (NFPA) posted statistics for the year 2020, a total of 4,760 fires had been reported in educational facilities in the US, with intentional acts, cooking equipment, playing with heat sources, heating equipment, electrical distribution and lighting equipment,

and smoking materials were the leading causes. These fires caused around US$28 million in damages, according to estimates (Hassanain *et al*., 2022).

There are various reasons for fires in schools. These include electrical, thermal, smoking, and deliberate causes (DHS, 2007). Furthermore, inadequate safety management and housekeeping standards are major contributors to school fires (Bhebhe *et al*., 2019). Other human-initiated causes of school fires include smoking and purposeful fire starting, commonly known as arson (Hassanain *et al*., 2022). This study proposed three main objectives: to determine the level of knowledge, attitude, and practice among secondary students regarding a building's evacuation during a fire emergency; to identify the relationship between the KAP level and its influence on the total evacuation time of the students; and to determine the weightage of each KAP element in predicting total evacuation time. The development of a numerical model is intended to provide an alternative, more convenient approach to calculating the evacuation time than manual calculation of the time.

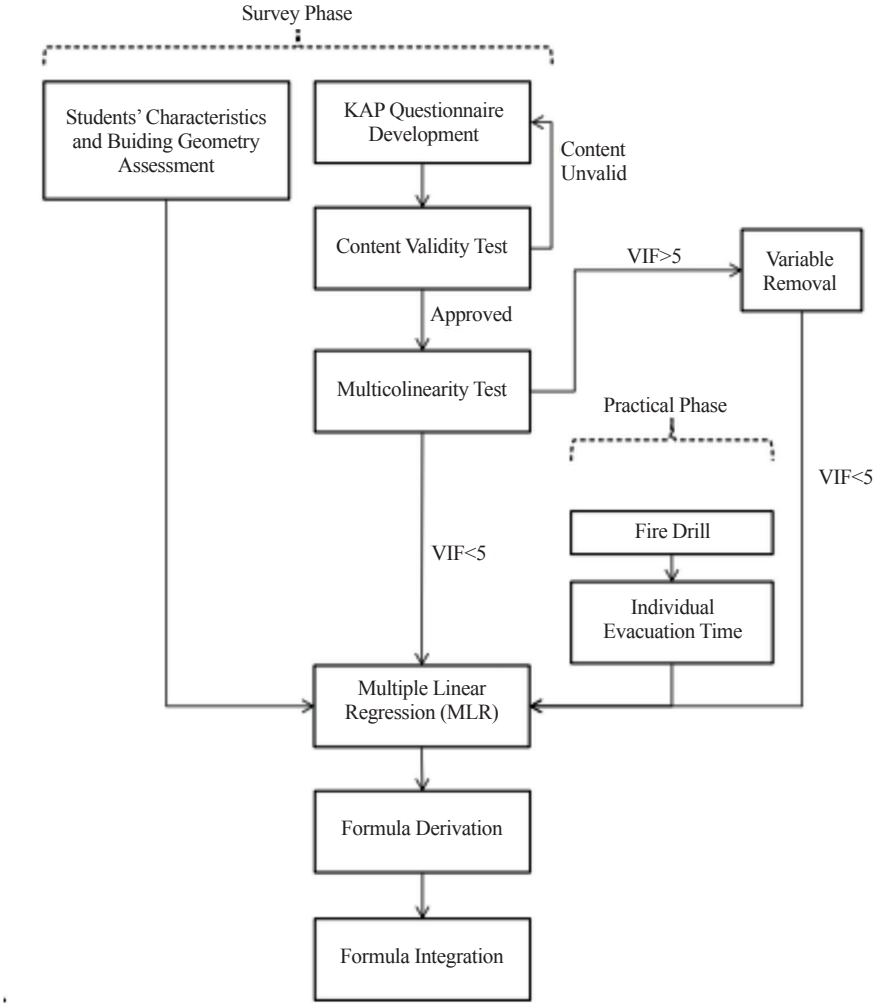

Figure 1: The research flow chart

Materials and Methods

This section provided specifics on the research procedures used to meet the objectives, including information on the study population, the instruments used, and data analyses.

Study Flow

This research paper's flowchart is shown in Figure 1. The goal of the study is to offer solutions to research problems, which prompted the development of a formula to determine how long each student would need to flee. The process' data gathering, methodology, tools, analysis, and result interpretation are included in a succinct explanation.

The most important aspect of this study was the development of the KAP questionnaire, which was based on a modification of relevant literature because there is no standard questionnaire for the specific objectives of this study. Before being distributed to students, the questionnaire was validated and tested for content validity. Through regression analysis, significant variables and their coefficients were identified using multiple linear regression (MLR) analysis is a statistical technique used to determine the causal relationship between two variables. The primary goal of univariate regression is to analyse the relationship between a dependent variable and a single independent variable and to derive the linear relationship equation between them. In this study, evacuation time served as the dependent variable and KAP elements served as the independent variables in a multiple linear regression analysis.

Study Respondents

The 290 secondary students who participated in this study, included both male and female students, who were selected via simple random sampling. In Malaysia, there are two levels of education: Primary or elementary and secondary. Primary school students range in age from seven to twelve years old for Standard One through Six. The next level is secondary school, where students range in age from 13 to 17 for Form 1 and Form 5, respectively. However, as stated previously, the engagement of Form 3 and Form 5 students is limited by ministry level, as detailed in the limitation section of the discussion. A majority of students from all grade levels were selected to represent the diversity of students. Since the primary school's evacuation plan and procedures are distinct from those of the secondary school, nearby elementary students were not included as study participants.

Study Location

The research was conducted at a secondary school in the Federal Territory of Putrajaya in Malaysia. The school's primary structures include classrooms, a teachers' lounge, school administration building, cafeteria, and a pavilion. The study focused on only two major structures, which were the classrooms in the laboratory building, and pavilion. The former is where the evacuation begins, while the latter is the assembly area where the evacuation ends. The classroom building has five floors, and the ground level serves as a parking garage. The first and second floor contain classrooms, while the first floor houses the laboratory. The third floor contains a small space that serves primarily as the music room. The Fire and Rescue Department determined the location of the assembly area or evacuation point. The selection of the school as a study location was based on a number of factors, including the availability and permission to access buildings information, such as floor plans, and the school's location within an urban area, which is expected to have higher building safety specifications.

Development of KAP Questionnaire

Knowledge, Attitude and Practice (KAP) factors are used to determine the extent of human influences on evacuation time. The first two criteria were collected via questionnaire, while the third component was collected via questionnaire and direct physical examination. The four-part questionnaire was created and distributed to students to assess their knowledge, attitudes, and behaviour regarding fire emergencies. All

of the questions were written in Malay (Bahasa Malaysia) to aid in student comprehension and data collection. Part A consisted of questions on the students' demographics and personal information, while Part B captured the knowledge test. Part C assessed the students' attitudes toward fire emergencies, while Part D assessed their practices. The Knowledge exam contained nine questions, while the Attitude and Practice sections contained 13 and 7 questions, respectively. The knowledge questions were designed to assess a students' understanding of fire emergency and evacuation procedures. The questions in the attitude section were intended to assess the most common attitudes, beliefs, and misunderstandings about the topic. Practice-related questions were asked to elicit information about what students would do in the event of a fire.

Some questions were repeated in various formats to determine whether or not students were well-informed, could comprehend, and were able to provide identical responses to the same question. Adoption of the questionnaire survey as a practical method of data collection is predicated on its capacity to rapidly collect information from a large number of students. The questionnaire allows students to express their opinions and choose specific actions to take during a fire emergency.

The provided questions were closed-ended, and scale-rated questions that were interspersed throughout the relevant sections and related to specific topics. The stated questions were based on previous research; some were modified versions of conventional questionnaires, while others were created by the researcher to fit the circumstances of the study. Multiple-choice and scale questions were chosen as the two types of closed-ended questions in the questionnaire's design. Multiple-choice questions were used to assess the students' Knowledge and Practice, whereas scale-based questions were used to assess their attitudes.

A test was conducted to determine the significance of the content's relevance. The test was divided into two categories: the items content validity index (I-CVI) and the scale content validity index (S-CVI), and the results were evaluated using two separate values: Index and ratio (CVR). Each item's content validity ratio (CVR) was calculated using the Lawshe method (Lawshe, 1975). The ratio fluctuated between -1 and 1, indicating a range of validity from low to high. CVR is 1 when all panellists rated an item as 'vital' and -1 when none of the items was rated as 'crucial' (Lawshe, 1975). If more than fifty percent of panellists rated the item as 'important,' the CVR would lie between 0 and 0.99 (Gilbert & Prion, 2016). Eleven experts all having a background in fire safety, emergency response, and risk assessment were chosen for evaluation purposes to review and score each individual question and the overall questionnaire structure using the provided scores. Based on the score assigned by experts, the outcome was analysed to determine the validity of the content in addressing the fire evacuation issue and procedure. Figure 2 depicts the KAP questionnaire creation and validation flowchart.

Data Collection and Analyses

A total of 290 questionnaires were distributed from class to class among secondary students. The study included secondary students as respondents. Those students were permitted to have a 15-minute answer session with the permission of the in-charge teacher. Before they were allowed to answer, they were given adequate instructions, and the entire answering session was continuously supervised with the help of teachers to avoid misunderstandings. The completed questionnaires were collected for analysis as soon as the students finished answering all of the questions.

The first step in performing a KAP analysis is to assign an itemise, or individual score. A score of 1 is usually assigned to the correct answer for the knowledge section, and the same score was maintained for the sections on positive attitude and practice, while a score of 0 was assigned to other circumstances (Wang *et al*., 2015). KAP was primarily analysed through

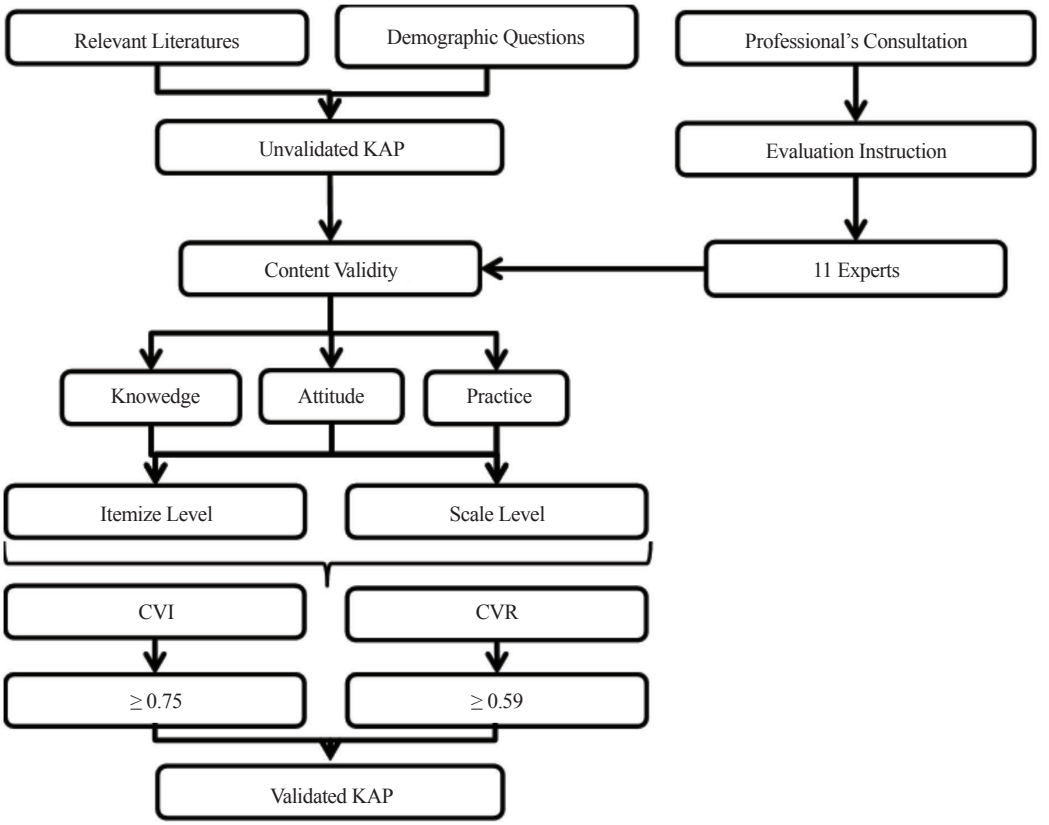

Figure 2: The flowchart of KAP questionnaire development and validation

the distribution of questionnaires in order to address several issues underlying the topic under discussion. The data obtained for the three respected KAP components was based on rating or score. KAP scores were calculated using the mean and standard deviation values. High KAP was defined as a score greater than the sum of mean and standard deviation, while low KAP was defined as a score less than the difference between mean and standard deviation. The range between these two values is typically regarded as medium level (Musigapong & Phanprasit, 2013).

For each question in the knowledge section, one was assigned to the correct answer, and zero was assigned to both the uncertain answers and incorrect answers. The score for questions in the attitude section was determined by the positivity of attitude demonstrated by the answers provided. However, those questions where the students were supposed to disagree were scored differently, with the highest score of five given to those who strongly disagreed and continued to do so till they strongly agreed with one score. For the practice section, the positive answer would be given a score of one, while the negative answer will be given a score of zero. The total scores for knowledge, attitude, and practice were calculated and varied based on the sum of scores over the highest possible scores for each part, which were 27, 65, and 7, respectively.

Those who received total scores greater than 60 percent of the highest score were classified as having high knowledge, while those who received lower scores were classified as having low knowledge. The classification of attitude and practice was based on the mean and standard deviation of the scores, with a good attitude and practice defined as a value greater

than the mean plus the standard deviation. A negative attitude and practice employed a value less than the difference between the mean and standard deviation. The range between these two values was labelled 'fair attitude' and 'fair practice' (Musigapong & Phanprasit 2013). As a result, high knowledge is defined as a score greater than 16.2. Positive attitude and good practice were assigned scores greater than 51.28 and 5.67, respectively, while negative attitude and negative practice were assigned scores less than 40.3 and 3.29, respectively.

The total evacuation time for each student was obtained through direct measurement with a digital watch, with time calculated as the time from when the alarm was triggered until the respective student arrived at the evacuation area. For further analysis, all collected data was entered into the Social Packages for Social Sciences (SPSS) software. The demographic information and general KAP level of respondents were presented comprehensively through analysis. A correlation test was used to determine the strength and magnitude of the relationship between KAP and total evacuation time for those students.

Multiple Linear Regression (MLR)

The Statistical Package for Social Sciences was used to enter the KAP scores of each student (SPSS). On the premise that KAP and total evacuation time has a linear relationship, multiple linear regression analysis was conducted. A statistical technique called multiple linear regression can be used to investigate the relationship between a single continuous dependent variable and two or more independent variables (x) (y). Using variable coefficients, the MLR statistical analysis can be used to assess the significance of a connection, the proportion of factors that affect total evacuation time, and the degree of correlation between the dependent and independent variables.

The following fundamental presumptions guided the MLR's execution:

(1) Relationship between IVs and DV is linear: Regardless of the strength of the correlation, each predictor was assumed to have a linear correlation with DV (positive or negative). Theoretically, the time needed to evacuate completely would grow as the distance increased.

(2) Data is normally distributed: The collected data was thought to fit a bell-shaped normal distribution curve. Perfectly regularly distributed data has an equal mean, median, and mode. Based on this supposition, it was discovered that 95 percent of respondents were within two standard deviations of the mean.

(3) Data is uniformly distributed: The independent variables' error variances were predicated to be the same. In other words, the projected value ought to follow the normal distribution curve with a similar variance at each observed value.

(4) The IVs are unrelated: No explanatory variable should be related to any other. Collinearity may be caused by the existence of a correlation between independent variables. Low or comparable variances between independent variables—sometimes referred to as being interrelated—are indicative of the collinearity problem. The Variance Inflation Factor (VIF) is frequently used to measure collinearity, with VIF values greater than five indicating the existence of a collinearity issue (Akinwande *et al*., 2015).

Results and Discussion

I-CVI and S-CVI results

Itemise (I-CVI) and scale level (S-CVI) content validity tests were used to evaluate the validity of the questionnaire, and the results were interpreted as the content validity index (CVI). Scale content validity is used to assess the level of validity of the questionnaire as a whole, whereas itemise content validity is used to evaluate the validity of each individual question. The I-CVI of 0.75, the bare minimum accepted index for content validity, was found to be exceeded by 26 out of 33 questions. Because KAP evaluations

are independent of one another, the S-CVI was performed for each distinct section of KAP parts. Knowledge, attitude, and practice all had a S-CVIs of 0.95, 0.81, and 0.82, respectively. In addition to CVI, the Content Validity Ratio was used to assess the validity of the survey. In contrast to the remaining 26 questions, which were regarded as valid, seven out of the 33 questions had a CVR that was lower than the 0.59 threshold value set by Lawshe (1975), which indicated a low validity. Two questions were asked in the practice section and five were asked under the attitude section. The attitude section's questions 9 and 11 and the practice section's questions 4 and 5 had the lowest CVRs (0.27) and (0.45). The CVR for the final three questions was 0.45. In both the general and knowledge sections, every question received a score greater than 0.59.

Students Information

The respondents were secondary school students between the ages of 13 and 16 who represented Form 1, Form 2, and Form 4 students. There were 290 respondents in total, 148 were men and 142 were women. According to the analysis, 188 students, or 64.8 percent, claimed they had no experience with fire emergencies, while 102 students, or 35.2 percent, had participated in at least one training. The purpose of the following inquiry is to determine whether the students had any prior experience handling a fire emergency. 76.6 percent of the students responded that they had never actually experienced a fire emergency, while 22.1 percent said they had in another building. Four students, or the remaining 1.4 percent, claimed to have experienced a fire emergency in the same school building.

Figure 3 demonstrates that majority of students concur that practice, attitude, and knowledge are crucial for fire prevention. Only a small minority of students said that the three components were not at all important. However, it would be helpful to compare their opinions with the KAP results to see where the students' perceptions and reality diverge.

KAP Level

Figure 4 showed the level for each KAP component. The subsequent classifications of each knowledge item, attitude, and practice was done based on the calculated scores. 5.86 percent of secondary students were classified as having low knowledge, compared to 94.14 percent of secondary students who were classified as having high knowledge. Most of the students, or 63.1 percent and 60.69 percent, were categorised as having fair attitudes and fair

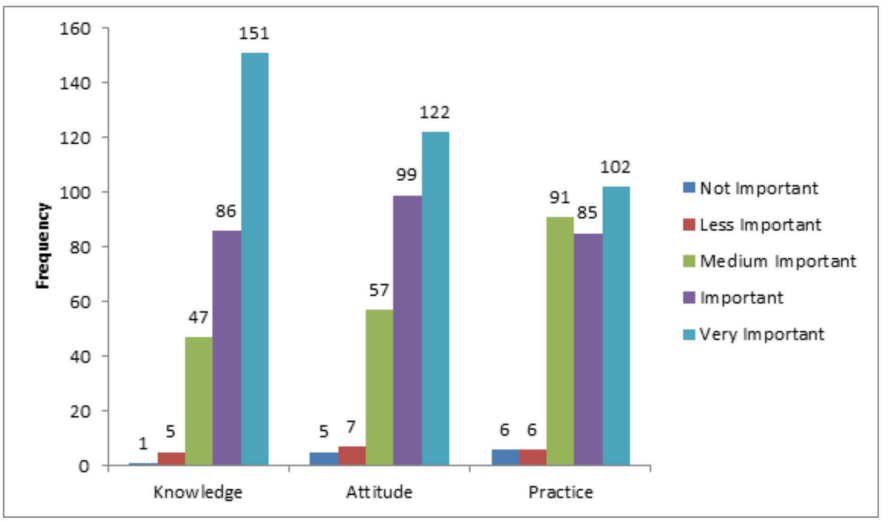

Figure 3: Perspective on the importance of KAP in the fire prevention among students

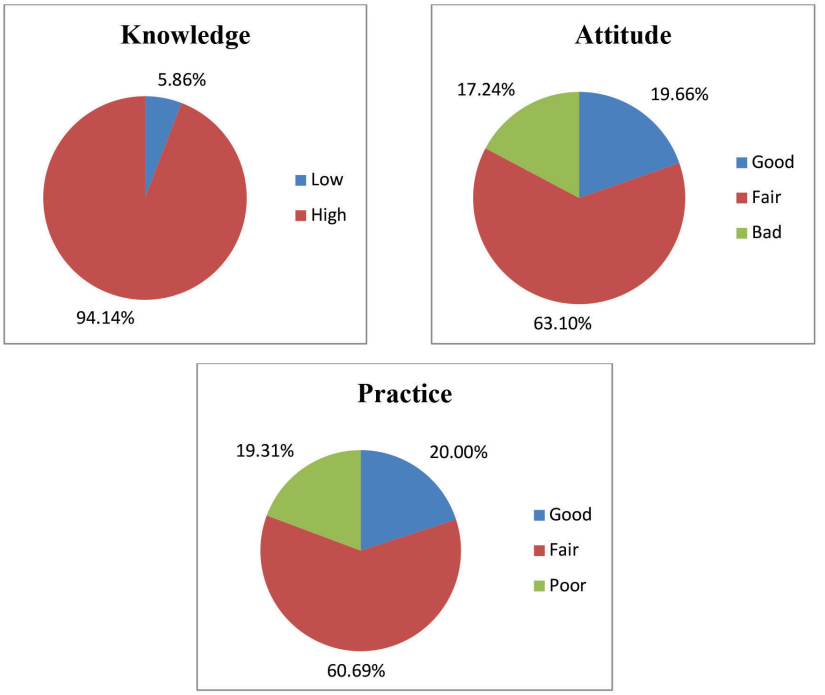

Figure 4: Level of Knowledge, Attitude, and Practice on fire evacuation among students

practices. Nearly 20 percent of students were seen to have a positive attitude and good practice when it came to fire emergency situations, while the remaining 17.24 percent and 19.31 percent did not.

KAP Distribution

Figure 5 displays the distribution of each KAP in a graphical format. It demonstrates that the scores were normally distributed, with knowledge, attitude, and practice having a respective means of 20.822.64, 45.795.49, and 4.481.20. Most of the students were classified as having "high knowledge", "a fair attitude", and a "fair practice" of fire evacuation, according to these results.

Using Pearson's correlation test, we assessed the size and strength of the relationship between knowledge, attitude, and behaviour. According to Table 1, there was no significant correlation between knowledge and attitude and practice, despite the fact that there was a significant correlation between attitude and practice (*p*-value 0.001) and attitude and practice and knowledge (r 0.29).

KAP Regression Model on Evacuation Time

Based on the results shown in Table 2, KAP alone was unable to predict the evacuation time, as indicated by the R-value of 0.13, which showed a weak correlation between predicted and observed values. There may be additional factors to take into account that could affect the evacuation time. Additionally, an R^2 value of 0.02, or two percent indicates that the KAP variables can account for a two percent of the variation in total evacuation time.

Table 3 presents the subsequent results of the MLR analysis. When collinearity was investigated, the tiny variance inflation factor (VIF) indicated that there were no problems with collinearity between the independent variables. The only variable in the model with a significant relationship was knowledge, with a p-value of less than 0.05; while attitude and practice had no appreciable influence.

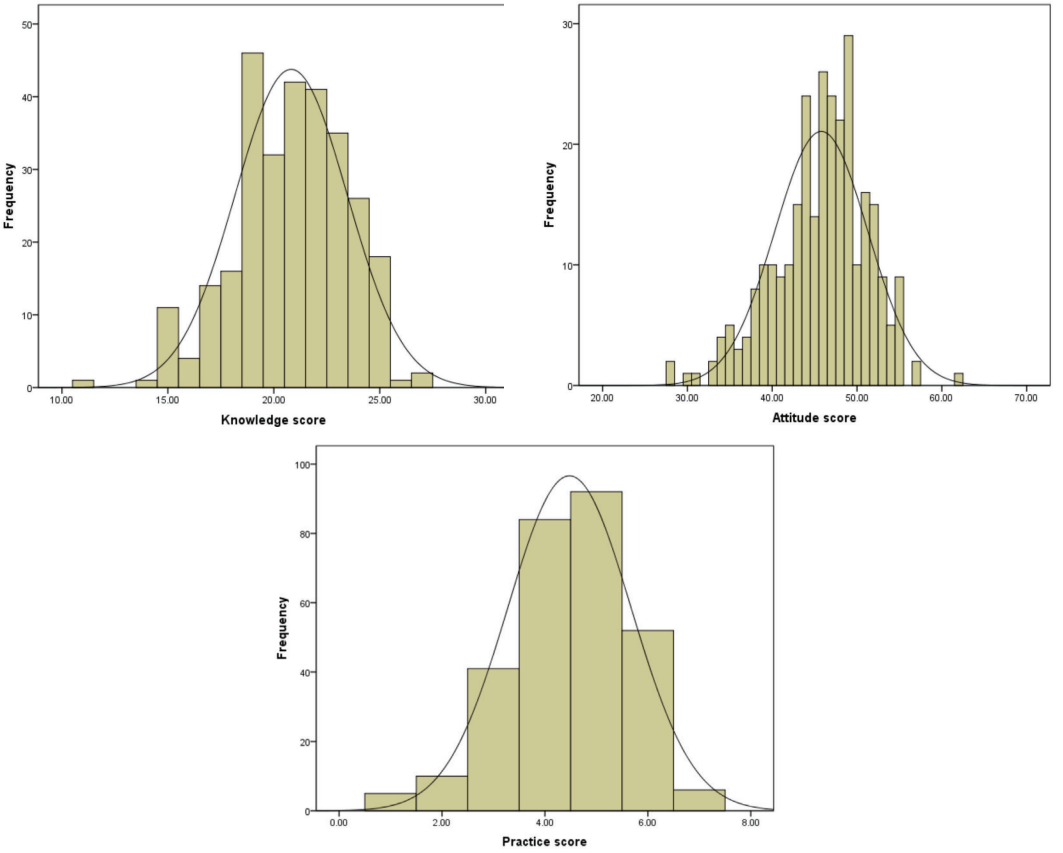

Figure 5: The scores obtained by students on Knowledge, Attitude, and Practice

Table 1: The determination of correlation between KAP components

	Knowledge	Attitude	Practice
Knowledge	1	0.10	0.04
Attitude	0.10	1	0.29[a]
Practice	0.04	0.29[a]	1

[a] Correlation is significant at the p-value <0.001

Table 2: The prediction model from Multiple Linear Regression

Model	R	R Square	Std. Error of the Estimate
1	0.13	0.02	16.93

The KAP assessment of fire evacuation among secondary students was be based on both questions and scale level, and according to preliminary content validity index analysis of the KAP questionnaire for both itemise and scale level.

The Malaysian Education Ministry mandated Forms 3 and 5 students, who were

Table 3: The significance of KAP in the linear regression model

Variable	Unstandardized Coefficients		Sig.	Collinearity Statistics	
	B	Std. Error		Tolerance	VIF
(Constant)	128.10	11.01	0.00[b]	-	-
Knowledge	-20.52	10.23	0.05[a]	0.99	1.01
Attitude	15.05	12.38	0.23	0.91	1.10
Practice	0.14	6.08	0.98	0.92	1.09

[a]Significant at p-value < 0.05
[b]Significant at p-value <0.001

taking exams at the time of the study be excluded in order to prevent disruptions to the classrooms and study sessions. These students are not allowed to participate in any extracurricular activities that might present themselves throughout their academic programme. Age disparity may affect how much is understood, appreciated, and implemented, so the existence of this restriction, however unavoidable, may still have an effect on the outcome.

It was evident from comparing the students' KAP scores to those of other students that their perception of the importance of KAP did not correspond to how well they actually performed. The vast majority of students still fell into the fair attitude and practice categories, despite the fact that most of them agreed that all three KAP components are essential.

According to the results of the correlation analysis, knowledge does not directly influence attitude or practice, but attitude and practice may have direct effects on one another. The connection between these elements and the student's total evacuation time was further explained by the MLR result. It can be inferred from the knowledge coefficient of -20.52 that a one-point increase in knowledge would lead to a 2.24-second decrease in the overall evacuation time. The following equation represents the entire model derived from the MLR results:

$$\text{Total evacuation time} = [\![-20.52]\!]_{\text{Knowledge}} + 128.1 \quad (1)$$

Even though knowledge was the only factor that significantly correlated with the evacuation time, it is still important because it represents the awareness phase of safety. It is assumed that behaviour and practice had little to no influence on the model, possibly because it was too early to evaluate behaviour and practice at the secondary level. The variables in this study are essential because they reflect the actions and reactions of evacuees in an emergency, even though KAP is not the only factor that affects the total evacuation time. According to some studies, some passengers may be unable to safely evacuate due to a lack of knowledge, an incorrect attitude or perspective, or even a mistake in judgement or practice (Hofinger *et al*., 2014).

Conclusion

The following recommendations are made in light of the findings of this article. Due to lessons being scheduled with adequate time for evacuation in mind, it is intended that every student would have enough time to leave the building safely in the event of a fire. Based on the level of innovation, this new technique could be incorporated into the current evacuation system. To achieve the highest level of school safety, it is important to emphasize the variables influencing evacuation time, such as those mentioned in the findings, when assigning children to different classroom locations. A student's evacuation time must be calculated before they are allowed to enrol in school. Students who have been labelled as being at risk must be monitored and must take part in specific control-measure programmes, like having their knowledge level increased.

It is necessary to perform a preliminary assessment of these evacuees' abilities. Evacuation times are frequently used to describe a key aspect of evacuation capability. The current approach always relies on a manual and direct estimation of evacuation time, which seems outdated today. The creation of this numerical model offers a more appropriate way to gauge evacuation time. Despite the limitations, the obtained results have achieved the goal of the study. Although many students emphasized the significance of knowledge, attitude, and practice in choosing a safe fire evacuation, it is clear that the students did not exhibit the necessary level of knowledge, attitude, and practice. Regression analysis was used to determine that a lack of knowledge would increase each person's overall evacuation time, posing a risk and having the potential to result in unintended injury or death.

It was suggested that students receive ongoing instruction on fire situations in addition to other safety precautions. It is strongly advised that future research examine the effects of attitude and practice across a wider age range, such as up to the level of youth. To broaden the scope of total evacuation time prediction, it is advised that other potential contributing factors, such as human characteristics and building geometry, be included with the KAP.

As different variables may change over time, it is necessary to regularly conduct research on how KAP factors can affect a person's evacuation time. For instance, due to factors like the improvement of the educational system and the expansion of programmes promoting fire safety awareness, the knowledge level of future students may differ from that of the present students. Periodic modifications of the effect must be made in order to increase the time estimate's accuracy.

The effectiveness of the evacuation procedure during emergencies such as building fires is contingent on a number of variables, including environmental and human factors. In addition to environmental assessments, such as design evaluation and the presence of building safety systems, an emphasis should be placed on understanding human factors. Despite the fact that human factors can be evaluated from a variety of perspectives, specific studies should be conducted on the human factor elements evaluated in this study, which included knowledge, attitude, and practice. This study is viewed as a catalyst for the field of occupational risk assessment, where the resulting formula can replace the previous assessment based on observational and experimental analysis of evacuation quality during evacuation drills. This study makes a significant contribution to the field of workplace safety and health through the use of cost- and time-efficient calculation methods that replace the previous method. In terms of application at the school level, it is anticipated that the created formula will be a pre-assessment tool that should be employed as a condition for evaluation at the level of arranging pupils according to the suitable degree of evacuation performance.

Although knowledge, attitude, and practice factors were considered in the studies, it is believed that other human factors, such as emotional and physical factors, influence the effectiveness of the evacuation process. To ensure the production of a comprehensive formula that encompasses all aspects, it is proposed to expand the scope of the study beyond the human factor to include environmental and other factors.

Ethical Approval

The ethical approval was given at several levels prior to the start of the research. Permission from the university was obtained from the Universiti Putra Malaysia Ethical Research Committee to avoid violations of the standardised ethical rules and regulations, especially with regard to research involving human intervention. The second level of permission was granted by the Education Ministry, Malaysia, followed by permission from Federal Territory Education Department in Putrajaya and lastly from the school management respectively. The ethical approval letter by the Universiti Putra Malaysia Ethical Research Committee was granted bearing reference number FPSK (EXP16) p167.

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