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The Impacts of Knowledge, Attitude, Awareness and Organizational Commitment on Risk Management Effectiveness in Laboratories

(Kesan Pengetahuan, Sikap, Kesedaran, dan Komitmen Organisasi terhadap Keberkesanan Pengurusan Risiko di Makmal)

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ABSTRACT

Whether medical, chemical, or nuclear, the laboratory presents inherent risks, which are further amplified by lab equipment usage. Ensuring laboratory safety in universities and research institutions is thus critical. Based on the knowledge, attitude, and practice model, this study examines how student knowledge, attitude, awareness, and organizational commitment impact the effectiveness of laboratory and workshop risk management. Survey data was collected from 251 engineering students from four southern Malaysian polytechnics and analyzed using partial least squares structural equation modeling (PLS-SEM). The findings reveal that knowledge, awareness, and organizational commitment significantly enhance risk management effectiveness, while attitude has no effect. These results emphasize the need for institutions to improve students' risk management knowledge and awareness to fortify safety measures and risk management strategies against hazards on campus or in the community.

Keywords: Risk; risk management; KAP model; knowledge; attitude; awareness; PLS-SEM

ABSTRAK

Sama ada perubatan, kimia, atau nuklear, makmal menimbulkan risiko sedia ada, yang diperkuatkan lagi oleh penggunaan peralatan makmal. Maka, memastikan keselamatan makmal di universiti dan institusi penyelidikan adalah mustahak. Berdasarkan model pengetahuan, sikap, dan amalan, kajian ini menyelidik bagaimana pengetahuan, sikap, kesedaran, dan komitmen organisasi pelajar mempengaruhi keberkesanan pengurusan risiko makmal dan bengkel. Data tinjauan dikumpul daripada 251 pelajar kejuruteraan dari empat politeknik di selatan Malaysia dan dianalisis menggunakan partial least squares structural equation modeling (PLS-SEM). Dapatan mendedahkan bahawa pengetahuan, kesedaran dan komitmen organisasi secara signifikan meningkatkan keberkesanan pengurusan risiko, manakala sikap tidak memberi kesan. Keputusan ini menekankan keperluan untuk institusi meningkatkan pengetahuan dan kesedaran pengurusan risiko pelajar untuk memperkukuh langkah keselamatan dan strategi pengurusan risiko terhadap bahaya di kampus atau dalam komuniti.

Kata kunci: Risiko; pengurusan risiko, model KAP; pengetahuan; sikap; kesedaran; PLS-SEM

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INTRODUCTION

As a global concern that spans various disciplines, including medicine, chemistry, and nuclear science, university laboratory accidents demand immediate attention and resolution (Abdullah & Aziz 2020). The urgency to ensure safety in university and research settings becomes evident when considering that the annual incidence of laboratory accidents worldwide is a staggering 49%, compounded by the use of laboratory equipment (Walters et al. 2017). This statistic underscores the gravity of the issue, particularly when juxtaposed with the finding that the incidence rate within university laboratories is up to 10 to 50 times higher than that of industrial sector laboratories (Salazar-Escoboza et al. 2020). Disturbingly, Cahyaningrum et al. (2019) highlighted that laboratory mishaps at universities often result in both human casualties and property damage.

Educational institutions, especially universities, house various facilities such as laboratories, dormitories, and cafeterias, each presenting inherent safety and health hazards requiring specific solutions (Abdullah & Aziz 2020).

Laboratories, in particular, hold myriad hazardous materials and equipment, exposing students to potential accidents and threats (Ismail et al. 2015). In Malaysia, certain polytechnics offer technical and vocational programs, wherein teaching and learning activities, known as Pengajaran dan Pembelajaran (PdP), encompass both theoretical and practical components. The practical PdP activities involve the utilization of laboratories and workshops, in which students are exposed to various risks and dangers (Bowolaksono et al. 2021). The implications of inadequate risk management in these settings are dire, with potential accidents like fire incidents, chemical spills, pollution, and toxin exposure posing threats to students (Lestari et al. 2019). For example, Universiti Malaysia Terengganu's (UMT's) JIKKP (2020) report provides critical insights into laboratory accidents related to chemical and sharp equipment use among students (Terengganu 2020). Table 1 presents a three-year (2017, 2018, and 2019) frequency count of such accidents. In 2017, 10 accidents were split evenly between chemical substances and sharp equipment. In 2018, two accidents occurred, both involving chemicals. In 2019, there were another equally split 10 accidents, similar to the pattern observed in 2017.

To protect students, colleagues, and the external environment from danger, adherence to safety protocols must be the responsibility of all laboratory personnel (Alshammari et al. 2021). However, the past two decades have seen the frequent neglect of safety measures, leading to alarming statistics. The U.S. CSB (2018) reported 152 laboratory incidents in the United States between 2001 and 2018, resulting in 58 fatalities between 2001 and 2020 (Laboratory Safety Institute 2020). Michael's (2019) study further reveals that teaching laboratories account for a substantial share of university laboratory accidents, constituting 81%, followed by research laboratories at 13% and fabrication laboratories at 2%. Therefore, as universities globally adapt to evolving technological and informational advancements, the commitment of top leaders to effective security measures takes center stage (Lazim et al. 2022). Importantly, understanding potential hazards and risks associated with laboratory instruments and equipment is imperative in the educational environment (Alshammari et al. 2021). Proper equipment operation methods are also essential for accident prevention in this setting, emphasizing the need for effective risk management.

TABLE 1. Statistics of student laboratory accidents caused by chemicals and sharp equipment

Type of accident	Year		
	2017	2018	2019
Chemical substance	5	2	5
Sharp equipment	5	0	5
Total	10	2	10

Notes: Obtainable at http://pppl.umt.edu.my/wp-content/uploads/sites/28/2020/05/Minit Mesyuarat-JKKP-Induk-UMT-1_2020.pdf. Copyright 2020 Parental Committee for Occupational Safety and Health at the University of Malaysia, Terengganu

In light of these issues, this study examined the effects of students' knowledge, attitude, awareness, and organizational commitment on the effectiveness of laboratory and workshop risk management, thereby facilitating a comprehensive understanding of safety in educational environments. Unlike previous research, this study emphasizes the importance of organizational commitment in laboratory safety, addressing a gap in existing literature. It further provides context-specific insights on polytechnics in the southern region of Malaysia. From the practical standpoint, the holistic predictive model introduced by this study provides insights for improving safety in university laboratories and workshops to prevent student accidents. It also offers customized recommendations on safety protocols and accident reduction to Malaysian polytechnics' engineering department. In summary, this research enriches the current understanding of safety in university laboratories and workshops (Jackson 2019; Susanto 2018).

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Laboratory or physical activity is a crucial component of a student's scientific education (Högström et al. 2010; Nakhleh et al. 2006). Despite the various risks and dangers present in the laboratory environment (Gestal 1987; Shannon 1976), laboratory safety has not been a high concern because only limited materials pose minimal threats to individuals or the environment (Langerman 2009). An accident is an unplanned event resulting in physical harm to individuals, property damage, and losses (Aziz et al. 2015). In recent years, laboratory safety has gained heightened global attention due to severe accidents in universities, including the tragic death of Sheri Sangji at the University of California, Los Angeles (Allen 2014). Additionally, a study by the Occupational Safety and Health Committee at UMT Malaysia uncovered alarming reports of 42 incidents involving chemical use and 45 incidents involving the use of sharp equipment in laboratories between 2014 and 2019 (Terengganu 2020). In fact, James Kaufman calculated the danger of laboratory accidents at schools and universities, concluding it to be 100 to 1000 times higher than at chemical companies like Dow or DuPont (Benderly 2009). As such, science students using laboratories are highly vulnerable

to a variety of hazards or risks, including chemical, biological, physical, radioactive, and musculoskeletal (Bahr & Bahr 1997). These risks and incident rates underscore the critical need for stringent safety measures in university laboratories.

RISK CONCEPT

Risk, as defined by Boehm (1991), refers to the likelihood of experiencing loss or harm. It is a prevalent and unavoidable aspect of different situations. Notably, safety and risk are inseparable; while safety is frequently associated with the absence of danger, the absence of risk does not necessarily constitute a safe environment (Ale et al. n.d.). Managing risk is important in individual and organizational contexts and requires careful attention (Susanto 2018). For organizations and institutions, effective risk management is crucial (Jackson 2019) to identify weaknesses and create a plan that minimizes risks and achieves goals. It is the responsibility of every employee and employer to maintain a safe and healthy workplace. As such, an individual or organization should implement risk management, control, and prevention measures at work to avoid anticipated risks. Although risk management is perceived as a newly emerging concept, organizations have implemented relevant risk-related practices to boost their corporate image. Nonetheless, the concept of risk management requires a deeper understanding to be completely accepted.

RISK MANAGEMENT EFFECTIVENESS

The practice of risk management involves measuring, evaluating, and managing organizational risk using strategies, people, technology, processes, and knowledge (Dabari & Saidin 2014). Thus, communication, discussion, and consultation throughout the risk management process ensure successful and beneficial outcomes for all parties, including the public. Effective and efficient risk management can boost organizational performance and success (Durst et al. 2019; Mohammed & Knapkova 2016). Risk management policies can also enhance awareness and demonstrate empathy towards an individual or employee, which can affect management. For educational institutions, risk management measures, especially among instructors, can help them compete in the globalized world. Indeed, Saberi and Hamzah (2020) suggested that instructors trained in risk management can better handle outside-the-classroom incidents and injuries.

THE KAP MODEL

The present study established theoretical linkages using the knowledge, attitude, and practice (KAP) model (Rav-Marathe et al. 2016), which states that knowledge improves attitude before influencing behavior. Many previous KAP studies have linked knowledge and attitude to risky behaviors (Kim et al. 2020; Mahendra et al. 2019; Ohajinwa et al. 2017; Papadopoli et al. 2020; Shawal et al. 2018). According to Saqlain et al. (2020), risk management effectiveness is enhanced by individuals who possess extensive knowledge, carry a positive attitude, and adhere to consistent risk management practices. Kim and Kim (2020) explained that ignorance, negativity, and poor practices can exacerbate risk-related problems, which firms can alleviate by providing extensive training, cultivating a favorable organizational culture, and establishing protocols to guarantee compliance with risk management practices. Overall, the KAP model facilitates the assessment and mitigation of factors to enhance risk management.

KNOWLEDGE AND RISK MANAGEMENT EFFECTIVENESS

Knowledge is crucial in the current knowledge-based economy, emphasizing the significance of knowledge acquisition and management. Numerous studies have proven that organizations can benefit from managing and leveraging knowledge (Edvardsson & Durst 2013; Massingham & Massingham 2014). As risks affect many companies and industries (Zieba et al. 2022), organizations, including universities, must enhance knowledge-related risk management. Additionally, knowledge may improve risk management implementation (Akhavan et al. 2019). Thus, university students with a better grasp of risks and effective knowledge management strategies are more likely to execute safety measures successfully (Anand et al. 2020; Banagou et al. 2021; Butt 2021; Zieba et al. 2022). The following hypothesis was thus proposed:

H_1 Knowledge positively influences risk management effectiveness.

ATTITUDE AND RISK MANAGEMENT EFFECTIVENESS

Attitude is an individual's response to unknown situations or information, indicating their tendency to act consistently while experiencing something new (Fishbein 1977). Mueller (1986) defined attitude as a person's evaluation or expression of personal views, indicating behavioral willingness. Different abilities, interests, knowledge, emotional intensities, and contextual situations grant individuals unique perspectives and beliefs (Suharyat 2009). In this regard, students' good attitude towards lab safety can prevent mishaps, whereas a negative attitude that lacks understanding can cause accidents in laboratories (Hafezad et al. 2021; Walters et al. 2017). To improve lab safety and avoid injury, a positive attitude towards risk management should be promoted (Abdullah & Aziz 2021). Specifically, students should understand, learn, and follow safety measures on how to use laboratory and workshop equipment under the correct settings and standards, whether before, during, or after lab activities (Cullen 2010). Given that prior studies have confirmed the link between risk attitude and risk management (Phan 2020; Moreno Alarcon et al. 2020), this study hypothesized that:

H_2 Attitude positively influences risk management effectiveness.

AWARENESS AND RISK MANAGEMENT EFFECTIVENESS

Though students need formal instruction and training to understand and shape a positive attitude towards safety regulations and procedures, according to Şenkal et al. (2021), students' awareness of workplace safety is beneficial even before formal instruction. Awareness of safety is the first thing students should learn in school when preparing for the workplace (Ansari 2022; Nasrudin et al. 2014; Ross et al. 2012), as safety begins with the realization of potential threats and risks (Nasrudin et al. 2014). This awareness is put to action by implementing safety practices like following safety standards, wearing proper gear, and encouraging careful behavior (Ross et al. 2012). Ultimately, combining pre-existing awareness, practical application, and structured education prepares students for safe and responsible laboratory, workshop, and workplace experiences. The present study thus posited that:

H_3 Awareness positively influences risk management effectiveness.

ORGANIZATIONAL COMMITMENT AND RISK MANAGEMENT EFFECTIVENESS

Organizational commitment improves risk management in several ways. Employees who believe in their company's aims and values are more likely to follow risk management rules because they want to achieve the company's goals. Such employees are essential for implementing risk management, as they foster positive attitudes and innovations in managerial and general functions (Anh 2023). Accordingly, Golabdost and Rezaei (2016) found that linking personal beliefs with company ideals promotes compliance with organizational standards, particularly risk management standards. Colquitt et al. (2015) and Chen (2006) also concluded that personal commitment increases engagement in organizational processes, including risk-management-related discussions and reporting. Committed employees' passion for their job and willingness to stay with the company fuel their risk reduction practices, which improves risk management effectiveness. Organizational commitment further encourages employees to examine the long-term effects of risk decisions and promotes strategic risk management practices that ensure organizational sustainability and success. Extending these notions to the context of students' commitment to their university, the present study posited that:

H_4 Organizational commitment positively influences risk management effectiveness.

CONCEPTUAL FRAMEWORK

The conceptual framework depicted in Figure 1 shows how the KAP model was employed in this study alongside organizational commitment to predict laboratory and workshop risk management in universities. Based on prior research, the model proposes that students' knowledge, attitude, awareness, and organizational commitment can enhance the effectiveness of laboratory and workshop risk management. The empirical findings may be used to improve students' knowledge, attitude, and awareness, leading to safer lab and workshop practices in Malaysian educational institutions.

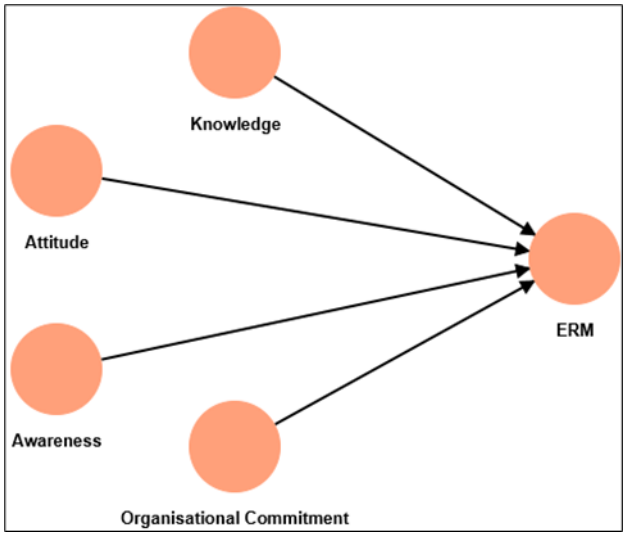

FIGURE 1. The conceptual framework

METHODOLOGY

SAMPLING

Li et al.'s (2020) and Edler's (2020) examination of knowledge, attitude, and risk awareness among students facing natural hazards emphasized the importance of considering regional variations and the impact of educational institutions on disaster risk reduction and safety practices. Both studies highlight the necessity of an adapted, region-specific educational approach to enhance disaster preparedness and resilience. In line with their suggestions, this study chose to sample four polytechnics in the southern Malaysian region: two in Johor (Politeknik Ibrahim Sultan and Politeknik Mersing), one in Melaka (Politeknik Merlimau), and one in Negeri Sembilan (Politeknik Port Dickson). These polytechnics have various engineering departments, including Electrical Engineering, Mechanical Engineering, and in one, Civil Engineering. It is noteworthy that premier polytechnics in southern Malaysia differ from those in the northern, east coast, and Borneo regions, as the latter follow admission criteria similar to public universities.

Given that the four polytechnics had a total engineering student population of 2400, a minimum sample size of 251 students was determined based on the guidelines established by Krejcie and Morgan (1970) at a 95% confidence level and a 5% margin of error. This sample size and simple random sampling approach ensured accurate representation of the actual population. Moreover, previous risk reduction studies targeting the same population have used this sample size to obtain statistically significant results (Tarlochan et al. 2023).

DATA COLLECTION

The data for this study was collected using a cross-sectional survey that was developed on Google Forms and distributed electronically. The link to the survey was sent to 251 randomly chosen engineering students from the aforementioned four polytechnics who actively engage in laboratory activities. The online distribution of the questionnaire allowed the researcher to leverage digital platforms to reach the target audience.

INSTRUMENT

The study's survey questionnaire consisted of 75 items adapted from prior researchers' validated instruments (see Table 2). Respondents' knowledge, attitude, awareness, and risk management effectiveness were measured by adopting and refining instruments from Dan et al. (2021), while the measurement of organizational commitment was derived from Mbengo (2017). Table 2 presents comprehensive information regarding the measurement sources and sample items. All items were rated on a 5-point Likert scale, ranging from "1 = strongly disagree" to "5 = strongly agree." Furthermore, the survey featured demographic questions on respondents' gender, age, ethnicity, department, polytechnic institution, and semester, which were relevant to evaluating laboratory risk management effectiveness.

TABLE 2. Sources of measurement

Construct	Source	Total Items
Knowledge	Dan et al. (2021)	17
Attitude	Dan et al. (2021)	20
Awareness	Dan et al. (2021)	13
Organizational Commitment	Mbengo (2017)	14
Effectiveness of Risk Management	Dan et al. (2021)	11
Total Items		75

ANALYTICAL TECHNIQUE: PLS-SEM

Partial least squares structural equation modeling, better known as PLS-SEM, was the analytical technique employed in this study to test the hypotheses. SEM allows researchers to concurrently investigate complex correlations between several variables using confirmatory factor analysis and path analysis. PLS-SEM was particularly chosen for its suitability to the research's objectives and its advantages over covariance-based SEM in constructing models for exploratory research (Rigdon et al. 2017). It can also handle several modelling issues, such as small sample sizes, non-normal data, and complex models with many latent variables and indicators.

PLS-SEM analysis has two stages: the measurement model for establishing validity and reliability (Ramayah, 2018) and the structural model for testing collinearity, path coefficients, coefficient of determination (R^2), effect size (f^2), and Stone-Geisser's predictive relevance (Q^2). The path coefficients of the construct relationships determine their importance and show if exogenous constructs influence endogenous constructs, thereby supporting or disproving hypotheses (Kamarudin 2021). Laboratories' risk management effectiveness was the latent endogenous variable under analysis, while knowledge, attitude, awareness, and organizational commitment were first-order exogenous variables. R^2 calculates the variance in the dependent construct explained by predictor constructs, while f^2 measures the strength of relationships between latent variables and observed variables, indicating practical relevance. Large effect sizes indicate practical consequences, while small ones may not. However, the study topic and theoretical context should guide effect size interpretation.

RESULTS

DEMOGRAPHIC AND DESCRIPTIVE DATA

The 251 students who participated in study consisted of 61.00% males and 39.00% females. In terms of age, 43.00% were between 15 and 19 years old, 56.60% were between 20 and 24 years old, and 0.40% were above 25 years old. Regarding ethnicity, 88.80% of the respondents were Malays, 2.80% were Chinese, 8.00% were Indians, and 1.20% were from other ethnic groups. In their respective universities, 18.70% of the respondents were from the Civil Engineering Department, 60.60% were from the Electrical Engineering Department, and 20.70% were from the Mechanical Engineering Department. The study also considered the distribution of academic year, with 39.1% being first-year students, 31.8% being second-year students, and 29.1% being third-year students.

Table 3 presents the summary of descriptive statistics for the independent constructs (knowledge, attitude, awareness, and organizational commitment) and the dependent construct (effectiveness of risk management). These variables are vital for understanding safety in laboratory and workshop environments.

TABLE 3. Level of knowledge, attitude, awareness, commitment and risk management effectiveness

Research variables	Mean	Std. Dev.	Min	Max
Knowledge	4.581	9.623	1	5
Attitude	4.568	12.790	1	5
Awareness	4.566	8.399	1	5
Organizational Commitment	4.567	6.297	1	5
Effectiveness of Risk Management	4.591	6.288	1	5

On average, respondents exhibited a high level of the measured attributes, as indicated by mean scores far above the midpoint of the five-point scale (i.e., 3). The knowledge score was relatively high (mean = 4.581), showing good knowledge levels among students, while a high attitude score (mean = 4.568) suggests students' positive attitude towards safety. The considerable awareness score (mean = 4.566) reflects good awareness, and the organizational commitment score (mean = 4.567) indicates a strong commitment to safety. The above-average risk management effectiveness score (mean = 4.591) also reveals a positive perception of risk management practices. However, there

was some variability in students' responses, as indicated by standard deviations ranging from 6.288 to 12.790. This variability will be explored further in subsequent sections of the study.

EVALUATION OF THE MEASUREMENT MODEL

Internal consistency reliability in the reflective measurement model was examined using both composite reliability (CR) and Cronbach's alpha (CA), as the latter often underestimates scale reliability (Kwong-Kay 2013; Hengky Latan 2017). In simple terms, CA and CR elucidate how trustworthy the questions in a survey or scale are, and should generally value above 0.70 to be acceptable. However, CR is better at considering that questions might be more important than others for measuring what needs to be understood. Thus, CR is often preferred over CA in research where accuracy matters. Convergent validity was then assessed using the average variance extracted (AVE) value, which should exceed 0.5. Table 4 demonstrates the established construct reliability and convergent validity, with values exceeding the recommended 0.708 and 0.50, respectively (Hair, 2017). For discriminant validity, the Heterotrait-Monotrait (HTMT) value surpassed the threshold of 0.85 (Henseler et al., 2015), confirming the constructs' satisfactory discriminant validity.

TABLE 4. Construct reliability and convergent validity

Construct	Indicator	Outer loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)	Convergent Validity (AVE > .50)
Knowledge	K1	.835	.977	.979	.730	Yes
	K2	.868				
	K3	.836				
	K4	.835				
	K5	.839				
	K6	.801				
	K7	.861				
	K8	.886				
	K9	.886				
	K10	.779				
	K11	.876				
	K12	.921				
	K13	.785				
	K14	.864				
	K15	.868				
	K16	.869				
	K17	.901				
Attitude	A1	.862	.987	.988	.802	Yes
	A2	.900				
	A3	.847				
	A4	.795				
	A5	.865				
	A6	.868				
	A7	.917				
	A8	.923				
	A9	.855				
	A10	.895				
	A11	.910				
	A12	.901				
	A13	.931				
	A14	.923				
	A15	.857				
	A16	.892				
	A17	.940				
	A18	.938				
	A19	.938				
	A20	.939				
Awareness	AW1	.905	.984	.985	.848	Yes
	AW2	.880				
	AW3	.906				
	AW4	.949				
	AW5	.941				
	AW6	.956				
	AW7	.879				

	AW8	.898				
	AW9	.914				
	AW10	.945				
	AW11	.938				
	AW12	.932				
	CO1	.921				
	CO2	.935				
	CO3	.922				
	CO5	.834				
Organizational Commitment	CO7	.798	.978	.980	.834	Yes
	CO8	.934				
	CO9	.942				
	CO10	.943				
	CO11	.953				
	CO12	.937				
	ERM1	.922				
	ERM 2	.929				
	ERM 3	.958				
	ERM 4	.948				
Risk Management Effectiveness	ERM 5	.937	.986	.988	.889	Yes
	ERM 6	.965				
	ERM 7	.949				
	ERM 8	.937				
	ERM 9	.939				
	ERM 10	.942				

EVALUATION OF THE STRUCTURAL MODEL

Table 5 and Figure 2 collectively demonstrate the significant results for the structural model, particularly concerning three hypotheses (H_1, H_3, and H_4). Knowledge ($t < 1.807$, $p < 0.05$, $\alpha = 5\%$), awareness ($t > 1.645$, $p < 0.10$, $\alpha = 10\%$), and organizational commitment ($t > 1.645$, $p < 0.01$, $\alpha = 1\%$) were found to significantly influence risk management effectiveness, strongly supporting H_1, H_3, and H_4. However, the influence of attitude on risk management effectiveness ($t > 1.645$, $p > 0.10$, $\alpha = 10\%$) was not significant, which meant the rejection of H_2. In short, the results indicate that three of the four interactions examined in this study were statistically significant.

Subsequently, the study analyzed the model's R^2, Q^2, and f^2. For R^2, 71.4% of the variation in the effectiveness of risk management was explained by knowledge, attitude, awareness, and organizational commitment. This corresponds to a substantial predictive power of the model, according to Chin (1998). Following Hair's (2017) guidelines for f^2, attitude generated a small effect on risk management effectiveness (0.129), whereas the effect size of organizational commitment was large (0.385). Knowledge (0.242) and awareness (0.205) also produced considerable effects on the effectiveness of risk management.

TABLE 5. Assessment of the structural model (direct effects)

Estimated Path	Original Sample (β)	Standard Deviation	t-value	p-value
H_1: Knowledge → Risk Management Effectiveness	.242	.134	1.807	.071*
H_2: Attitude → Risk Management Effectiveness	.129	.097	1.330	.184
H_3: Awareness → Risk Management Effectiveness	.205	.122	1.677	.094*
H_4: Organizational Commitment → Risk Management Effectiveness	.385	.157	2.453	.014**

** significant at $\alpha = 5\%$

* significant at $\alpha = 10\%$

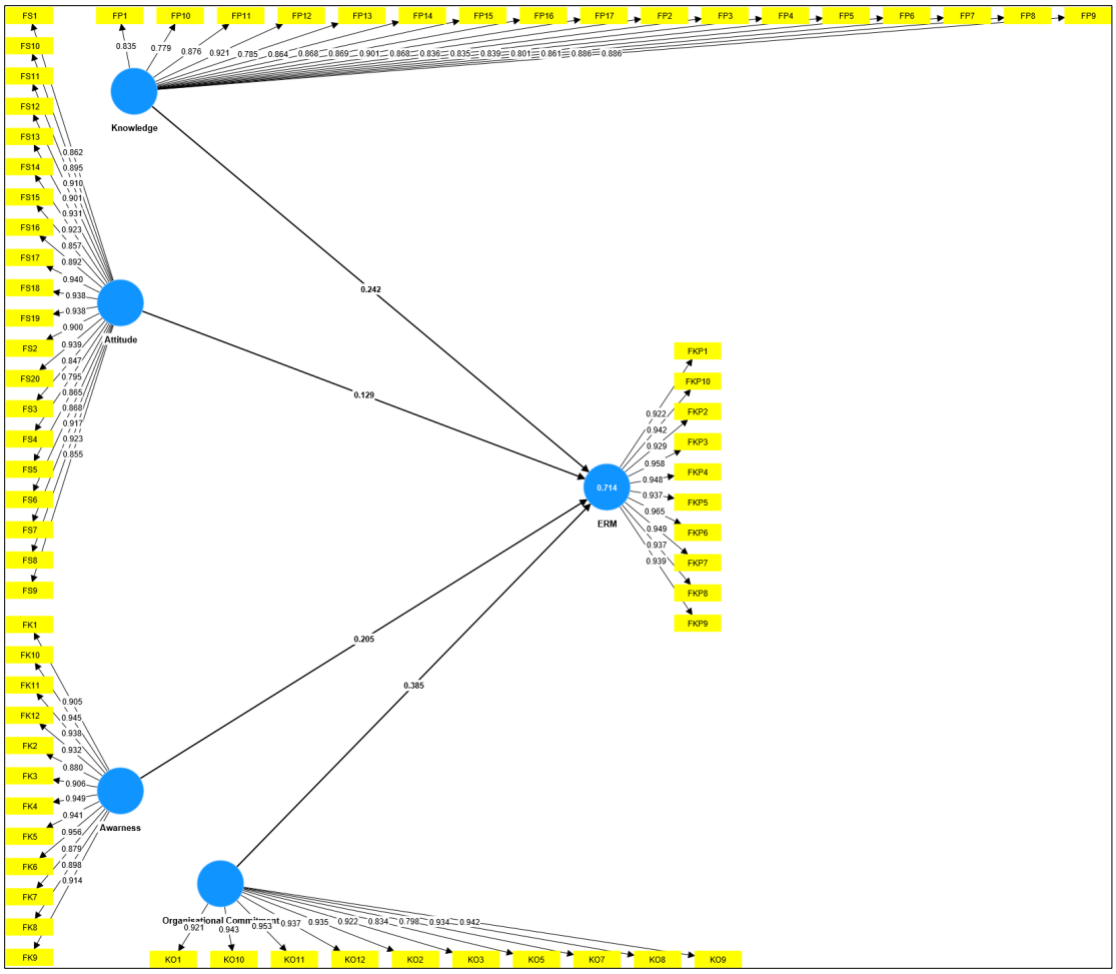

FIGURE 2. Structural model

Table 6 presents model fit indices for both the Saturated Model and the Estimated Model, offering valuable insights into the goodness of fit. Including model validation tests is warranted to enhance the analysis's validity, reliability, stability, and predictive power, contributing to a more comprehensive evaluation of its suitability for the research context. To bolster the validity and credibility of the SEM outcomes, adding model validation tests, such as fit statistics, is therefore imperative. These tests provide quantitative measures to confirm that SEM accurately represents the data, making results more robust and dependable. In essence, while Figure 2 showcases the PLS-SEM results comprehensibly, Table 6, with model fit statistics, reinforces the soundness of analysis, thus enhancing the overall quality of research.

TABLE 6. Model fit statistics

Model Fit Indices	Saturated Model	Estimated Model
SRMR	.041	.041
d_ULS	4.076	4.076
d_G	10.079	10.079
Chi_square	9,820.141	9,820.141
NFI	.715	.715

DISCUSSION

This study has found that knowledge and awareness, from the KAP model, directly improve risk management effectiveness among Malaysian polytechnic students who use laboratories. This suggests that students' knowledge and awareness are essential for lab and workshop risk management. The KAP paradigm links knowledge, attitudes, and

practices theoretically, indicating that knowledge positively affects an individual's attitude before impacting relevant behaviors. Previous studies using the KAP model have established a substantial association between knowledge, attitude, awareness, and risk practices. Thus, knowledge levels determine accident-resolution readiness (Ul Haq et al. 2012) and imply students' ability to learn safely, such as by active involvement in safety training and informed decision-making in lab and workshop activities. Knowledge also improves risk management implementation, boosting students' ability to conduct themselves properly throughout learning. For example, student knowledge during safety training would positively influence students' readiness to respond to a crisis and act ethically in a lab (Abdullah & Aziz 2020). This suggests that students' knowledge helps them implement risk management techniques in laboratory settings.

Moreover, this finding demonstrates the importance of information in fostering a healthy environment. In this study, students were well-versed in risk management for lab and workshop activities to prevent injuries. In contrast, ignorance, indifference, and improper implementation of laboratory safety would cause various mishaps (Goswami et al. 2011). Laboratory and workshop safety training should therefore be required in the first year of polytechnics or before starting lab and workshop work. In conclusion, knowledge improves risk management and has consequences for educational safety, specifically by upholding proactive safety measures and making learning safer.

Similarly, awareness positively and directly affects risk management effectiveness, thereby preventing accidents and injuries (Zakaria et al. 2016). Like knowledge, awareness of threats and safety measures encourages proactive and preventive action among student to avoid hazards. Accidents are unpredictable, but being aware of them can manage and mitigate their risk (Mohd Sidi et al. 2019). For example, laboratory mishaps can be avoided by training students to be more cautious and responsive (Withanage 2016). Consequently, polytechnics' administration should mandate all students using laboratories and workshops to participate in safety activities and programs to increase student safety awareness and promote a culture of safety. Ultimately, this would improve risk management effectiveness and reduce laboratory accidents and injuries.

Interestingly, attitude, despite being a component of the KAP model, was shown to have no direct effect on risk management effectiveness in this study. Thus, attitude improvements may not significantly mitigate students' risk of accidents in laboratories and workshop settings. The way people think, feel, and act about an incident influences prevention (Azlan et al. 2020; Yue et al. 2021). Clement (1998) and Ahmad Esa and Fatimah Mustaffa (2014) asserted that attitude is vital for safety awareness, negligence, contract property, and personnel loss. Consequently, this study's finding raises questions about attitude and educational safety. While attitude is often considered a crucial determinant of behavior, this study refutes this idea by stating that it may not influence laboratory and workshop safety practices. Nonetheless, this result mirrors Gong's (2019) finding that other factors, such as gender and academic major, play a much larger role in influencing the behaviors of Chinese university students than their own personal beliefs.

Lastly, an important result of this study is that organizational commitment has the largest positive effect on effective risk management in lab and workshop settings. This result highlights students' dedication to safety and risk management, which increases their safety compliance, participation, and risk mitigation responsibility. Organizational commitment makes students more engaged and supportive of risk management. This discovery has significant implications for educational institutions, particularly polytechnics. It stresses the necessity of reinforcing students' organizational commitment by developing a sense of belonging, promoting safety ideals, and identifying and rewarding safety initiatives. Top management support through training programs, incentives, recognition, application software, efficient organizational structure, and risk management techniques can also improve students' commitment to risk management implementation (Yazid et al. 2018). Ultimately, every student should learn risk management through good policies and courses that build their commitment.

This study has implications for polytechnic and university management's risk management. Management must translate applicable plans, goals, and operations, show sufficient dedication and responsibility, and conduct performance assessments with awards to ensure accountability and improve operational efficiency at all levels (Bakar et al. 2019). Meanwhile, students must be prepared to attend safety training, improve laboratory safety, follow SOPs, and maintain a clean, safe lab with functional safety equipment. Their higher safety and risk management expertise could reduce injuries and accidents in labs and workshops (Mohamed et al. 2021) by fostering a positive attitude towards risk prevention. Thus, applicable PdP activities should improve students' risk management knowledge and safety awareness in labs and workshops.

In conclusion, the current study sheds light on the need for institutional support and student dedication to improving educational safety. Institutions can improve learning safety and reduce laboratory accidents by actively promoting and reinforcing students' knowledge, awareness, and commitment. In addition, insufficient instructional staff attention may affect students (Kalaiselvan & Daud 2021). With enough teaching, instructors can build a positive attitude towards following safety requirements in high-risk activities (Nordin 2021). A safety-focused culture would

also encourage students to follow safety rules, boosting safety performance (Khan et al. 2019). In addition, Al-Zyoud et al. (2019), Tsuji et al. (2016), and Marendaz et al. (2011) found that good risk management can increase students' laboratory safety abilities, training, and awareness, increasing their propensity to behave safely. Overall, while it is recommended that students exercise caution in order to prevent mishaps in laboratory and workshop settings, it is also imperative for the administration of polytechnic institutions to establish comprehensive safety protocols for laboratories and workshops in order to ensure the well-being and protection of students.

CONCLUSION

Effective risk management is essential in educational laboratories and workshops to ensure the safety of students, staff, and the environment. Based on the KAP model, this study examined whether Malaysian polytechnic students' knowledge, attitude, awareness, and organizational commitment affect the effectiveness of laboratory and workshop risk management. The findings show that polytechnic students have good knowledge, awareness, and organizational commitment regarding laboratory and workshop safety, which enhances the effectiveness of risk management. However, the data showed no significant correlation between students' attitude and risk management efficacy. The results of this study point out the interplay between students' KAP factors, organizational commitment, and risk management in improving laboratory and workshop safety, adding to the literature in this area. It also makes a theoretical contribution by integrating organizational commitment with the KAP model to predict risk management effectiveness.

Practically, this research calls for educational institutions to implement strict risk management procedures, develop thorough safety policies, and offer extensive safety training to students. By strengthening managerial support and safety communication, universities can foster the development of a safety culture where proactive steps like audits, open communication, and safety reporting are encouraged. Rewarding students for their commitment to safety and valuing their feedback creates safer learning environments.

One disadvantage of this study is its reliance on self-reported data from online surveys, which may introduce possible bias issues. Apart from using triangulated data to minimize bias, future research could increase the sample size and diversify the type of educational institutions to improve generalizability. Mixed methods and on-site assessments may also improve the evaluation of proactive safety measures' and policies' impacts on educational risk management in future studies.

In conclusion, this study contributes to a better understanding of laboratory and workshop safety in polytechnic institutions by emphasizing the role of students' knowledge, attitude, awareness, and organizational commitment in risk management effectiveness. The findings offer scholars and practitioners valuable avenues to improve educational safety.

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