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Contributing Factors of Safety Culture in the Education Sector: A Systematic Review

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ABSTRACT

The practices of safety culture at industrial sectors are common but it rarely discusses in education sector. The safety culture is aim to reduce the potential of accident as well as lowering the reoccurrence of accidents. Moreover, the study on the contributing factor to form a safety culture in the education sector or learning institutions is still lacking. The objective of study is to investigate the trends of safety culture studies and its contributing factors in the education sector in year 2019 to 2023.A systematic literature review (SLR) study was conducted by applying a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) review method has identified 17 articles on safety culture from two main databases (Science Direct and Scopus). One theme with 15 subthemes have been developed by using thematic analysis. The study found the behaviour has greatest contributing factor to form a positive safety culture was behaviour dimension (87%) followed by psychological (6.5%) and situational (6.5%). The study also found the safety training, safety awareness, safety awareness, safety knowledge, safety commitment and safety communication from behaviour dimension were the top five contributing factors to create a positive safety culture in elementary school, public and private university. In conclusion, systematic review study hopefully could increase awareness among top management level in education sector, government and policymakers in creating a safe learning environment to students.

1. Introduction

The perception that a university, whether public or private or an elementary school, is a secure environment is debatable. For instance, an increase in university accidents in China has alarmed Chinese society [1]. According to Faller *et al.,* [2], more than 50% of all reported injuries among German university students were contusions, compressions, and strains. Moreover, numerous campus safety incidents have been reported, including dormitory fires that resulted in the deaths of 41 students and injured nearly 200 others in the dormitory building of Peoples' Friendship University

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of Russia in 2003 and lab explosions that caused the deaths of one student and injured four others at China University of Mining and Technology in 2015 [3]. These tragic incidents serve as a reminder to institutions of the value of encouraging undergraduates to practice and believe in safety [3].

Moreover, educating students about safety continuously throughout their undergraduate experience can help them develop good attitudes and a safety-conscious culture as the school year progresses [1]. Research on safety culture has usually been discussed in industrial sectors compared to education sectors. High-risk industries have come to recognize the importance of safety culture in creating safe surroundings over the past few years. The idea of safety culture has attracted the attention of numerous high-reliability industries all over the world as a means of lowering the likelihood of catastrophic events. However, according to recent studies, the safety culture in the education sector has been recorded in several nations, including the United States [4], China [5], Vietnam [6] and Brazil [7]. The awareness has been raised in order to create safe learning environments for students and staff. However, there is scarce in a systematic literature review (SLR) conducted to understand the safety culture in the education sector. To fill a gap, the main research question guiding this systematic review is: What are the trends of safety culture studies and their contributing factor in the education sector? Therefore, the objective of the study is to investigate trends of safety culture studies and its contributing factors in the education sector in the years 2019 to 2023.

2. Methodology

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was chosen to establish a systematic literature review (SLR) on safety culture in the education sector. The goal of a systematic review or systematic literature review (SLR) is to find, search, and synthesize literature that is systematically related to prior studies or research in a well-organized and transparent process with repeatable methods at each step. SLRs are sometimes known as meta-narrative reviews or mixed studies reviews [8]. PRISMA is a very well-known approach to conducting SLR in various fields of study, such as safety research [9], medical and healthcare [10], business and management [11] and many more.

Identification, screening, eligibility, and data abstraction and analysis are the four core PRISMA phases [8]. Identification is the initial step in the systematic review process, and identification was carried out in August 2023. The primary research and the research objective were both clearly defined at this point. ScienceDirect and Scopus, two reputable indexed databases, were employed for this review. These indexed databases were selected to assure the quality of the publications assessed in this work and because of their well-established indexing systems for citations. Peer-reviewed journal research also has a solid reputation as a representative of academic inquiry in a particular field of study. The keywords and search string employed are;

TITLE-ABS-KEY (“safety culture” AND “education”) OR (“safety culture” AND “academic institution") OR (“safety culture” AND “higher learning") OR (“safety culture” AND “secondary school") OR (“safety culture” AND “primary school")

130 articles from Science Direct and 1003 items from Scopus databases were obtained as an outcome of this process. Numerous search terms were employed to obtain comprehensive coverage of safety culture in the education sector. However, after the screening process was completed, fewer papers were obtained as a result of the authors' inclusion or exclusion criteria, as indicated in Table 1. In the screening process, eligibility, inclusion, and exclusion criteria were determined to find

suitable articles to be included in the systematic review process, as shown in Table 1. After the identification process, out of 1133 articles to be screened. The results obtained 47 articles after the screening stage. The research articles published from 2019 until September 2023 and focused on safety culture in the education sector only were selected at this stage. The journals, including systematic reviews or review papers, proceedings, chapters in the books, book series, and books, were excluded. The purpose is to focus on the actual research on safety culture in education sectors worldwide.

Table 1
The criteria for inclusion and exclusion

Criteria	Inclusion	Exclusion
Publication timeline	Year 2019- Sept 2023	Year 2018 and before
Document type	Journal (research articles) and	Journals (systematic review), review paper, conference proceeding, chapters in book, book series, books
Type of sector	Safety culture in education	Exclude safety culture other than education sector including patient safety culture
Language	English and Malay language	Non-English and Malay
Accessibility	Open access and subscribed journal	Non open access and subscribed journal

The next step was the eligibility process, where the articles were included or excluded based on the authors 'specific criteria. 47 articles proceeded to the eligibility process and were screened manually for literature focusing on education and criteria from the earlier screening processes (inclusion and exclusion criteria). The review managed to obtain 29 selected articles related to research on safety culture in education sectors. The final step is data abstraction and analysis. The remaining articles were evaluated, reviewed and analysed, and 18 selected articles (studies) were discussed in detail in this paper as tabulated in Table 3. The reviews were based on specific studies that matched the research question and objective of the study. The studies were then extracted to identify relevant themes and sub-themes for the current study by reading the title, then the abstracts, and then throughout the full text of the articles. The summary of the SLR process is shown in Figure 1.

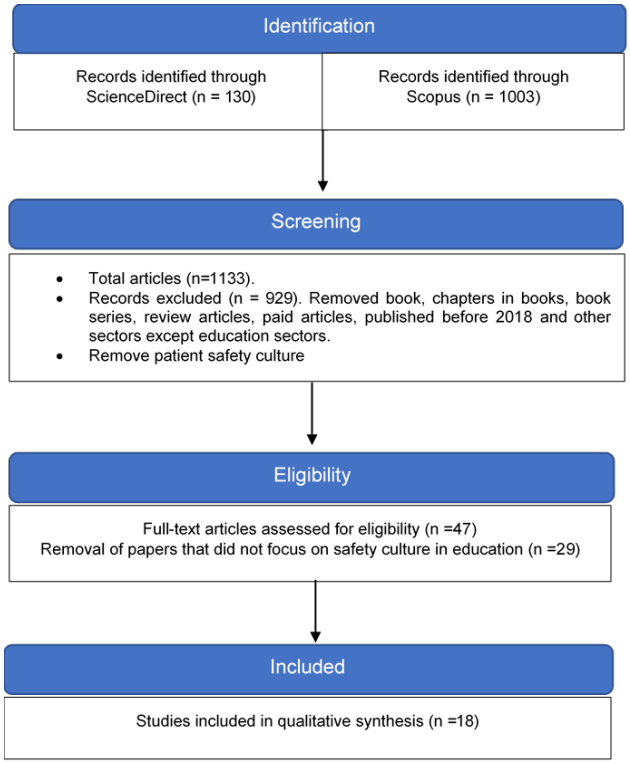

Fig. 1. The flowchart of the PRISMA approach used in the SLR study (Adapted from Page *et al.,* [8])

3. Results

The systematic review managed to obtain seventeen selected articles from the year 2019 to September 2023 based on the PRISMA approach, as illustrated in Figure 2. The highest number of articles published on safety culture in the education sector was in the year 2021, with six articles followed by the year 2022 (5 articles as of Aug 2022) and year 2020 (3 articles). The SLR results based on the type of education sectors, countries and their respective number of papers are shown in Table 2.

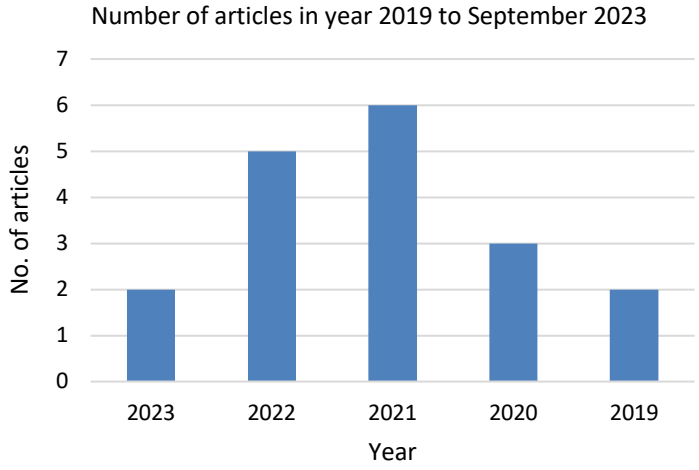

Fig. 2. SLR results on number of publications in year 2019 until September 2023

From Table 2, fifteen countries were identified in publishing articles related to safety culture in the education sector. Most of the articles highlighted safety culture studies in public universities, followed by elementary schools and private universities. Finland and the United States of America, with two articles each, were the most published articles in safety culture studies, followed by Qatar, Lebanon and many more, with a total of one article for each country.

Table 2
SLR results based on type of education sectors, countries and their respective number of papers

Type of Education sector	Countries (no. of articles)
Public university	Germany (1)
	China (1)
	Lebanon (1)
	Finland (1)
	Turkey (1)
	United Kingdom (1)
	Brazil (1)
	Bangladesh (1)
	Qatar (1)
	El Salvador (1)
	Colombia (1)
Private university	China (1)
	Malaysia (1)
Elementary school	United States of America (2)
	Malaysia (1)
	Finland (1)
	Iran (1)
	Total = 18 articles

By applying thematic analysis [12], fifteen sub-themes were created, as shown in Table 3. The fifteen subthemes are safety attitude, working environment, safety policy, safety regulations, safety awareness, safety program, safety training/ education, safety commitment, safety promotion, safety audit, maintenance and inspection, safety communication, safety knowledge, safety beliefs and safety behaviour.

Table 3
SLR results with the theme and sub-themes

Year	Type of Education	Authors	Theme: Contributing factor of safety culture in education sector														
			SA	PO	SR	AW	SP	ST	SC	PR	AU	MI	CO	SK	SB	BE	WO
2023	Public university	[37]				/	/	/						/			
2023	Private university	[38]		/	/	/	/	/				/					
2022	Public university	[13]				/			/				/				
2022	Private university	[3]				/		/					/	/	/		
2022	Elementary school	[14]		/				/									
2022	Public university	[15]		/	/	/		/	/	/	/	/	/	/	/		/
2022	Public university	[16]	/			/		/									
2021	Public university	[17]				/		/									
2021	Public university	[18]	/					/	/				/				
2021	Elementary school	[19]						/									
2021	Public university	[20]							/				/				
2021	Elementary school	[21]	/										/	/			
2021	Public university	[22]				/		/						/	/		
2020	Elementary school	[23]		/	/			/	/		/						
2020	Public university	[24]	/			/		/	/	/						/	
2020	Public university	[25]	/		/			/									
2019	Public university	[1]	/			/	/							/			
2019	Public university	[26]						/									

Themes and Sub-themes;
Psychological Dimension; SA=Safety attitude
Behavioural dimension;
PO= Safety policy SR= Safety regulations AW= Safety awareness
SP= Safety program ST= Safety training/ education SB= Safety beliefs
SC= Safety commitment PR= Safety promotion AU= Safety audit
CO=Safety communication MI= Maintenance and inspection SK=Safety knowledge
BE= Safety behaviour
Situational Dimension; WO= Working environment

4. Discussion

The safety culture studies in the education sector for the past five years were successfully investigated by using the PRISMA approach and generated fifteen subthemes. Based on the PRISMA

approach, three types of education sectors were found, and safety culture at public universities was highly discussed, followed by elementary school and private universities, as shown in Table 2 and Table 3. Various established safety culture models introduced by previous scholars include the Total Safety Culture [28], the Reason Safety Culture Model [29], Guldenmund's Three Layered Organizational Culture [30] and the Reciprocal Safety Culture Model [31]. All of these approaches emphasized psychological (how people feel), situational (what the organization has), and behavioural (what people do) factors as preventative strategies for reducing accidents and promoting a healthy safety culture in organizations.

By referring to safety culture theories, the contributing factors (sub-theme) were mapped according to psychological, situational and behavioural dimensions, as shown in Table 4. Most of the contributing factors lay under behaviour dimensions, followed by psychological and situational.

Table 4
Mapping on Contributing Factors of Safety Culture to Safety Culture Dimension

Safety Culture Dimension	Contributing Factors of Safety Culture (subtheme)	No of articles discussed on each factor	Type of Education sector
Psychological	Safety Attitude	6	Elementary school Public university
Situational	Working Environment	1	Public university
Behaviour	Safety Policy	4	Elementary school Public university
	Safety Regulations (Wear PPE)	4	Elementary school Public university
	Safety Awareness	10	Elementary school Public university Private university
	Safety Program	13	Public university
	Safety Training/ Education	14	Elementary school Public university Private university
	Safety Commitment	6	Elementary school Public university
	Safety Promotion	2	Elementary school Public university
	Safety Audit	2	Elementary school Public university
	Maintenance and Inspection	2	Elementary school Public university
	Safety Communication	6	Elementary school Public university Private university
	Safety Knowledge	6	Elementary school Public university Private university
	Safety Beliefs	3	Public university Private university
	Safety Behaviour	1	Public university

Total = 80
** Note: The total refers to the number of frequencies for each article discussed on each factor*

The percentage for each dimension was illustrated in Figure 3. According to Figure 3, the behaviour dimension with thirteen subthemes was the most highlighted (87%), followed by psychology (10%) and situational (5%).

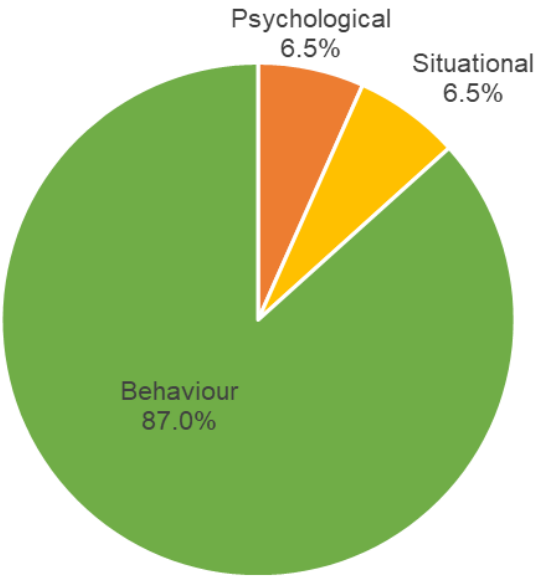

Fig. 3. The percentage of safety culture dimensions in education sectors

4.1 Behaviour Dimension of Safety Culture

For behaviour safety culture, the contributing factors highlighted were safety policy, safety regulations, safety awareness, safety program, safety training/ education, safety commitment, safety promotion, safety audit, maintenance and inspection, safety communication, safety knowledge, safety beliefs and safety behaviour as shown in Table 4. Safety training is the most important contributing factor to creating a safety culture, as agreed by researchers, as shown in Table 3, followed by safety awareness, safety knowledge, safety commitment, and safety communication

Safety training is essential to ensure the culture of safety itself can be prioritized and practised continuously in every aspect while working or handling any machine or chemical substances. For instance, Pollock and Sørensen [22] studied chemical engineering students at a public university in the United Kingdom and discovered that the safety culture is crucial to be deeply embedded in their curriculum, such as capstone design projects that aim to produce well-rounded, responsible graduate engineers with a strong safety culture rooted in how they will approach their future work [22]. According to Viitaharju *et al.,* [17] safety training is crucial to fostering a culture of safety among students at public universities. Furthermore, safe laboratory procedures are a crucial component of a chemist's professional career. Historically, in higher education, they are gradually taught in various laboratory courses throughout the study curriculum. He concluded that the approach to safety training encourages students to participate in deep learning, which will enhance the safety culture in the laboratory [17].

Safety awareness is one of the main contributing factors to safety culture. For instance, a recent study by Pekdağ [32] indicates that video education may be more successful than conventional safety instructions, at least when looking at how well students performed in the safety exam that carried [32]. However, it also underlines that mental overload is one of the crucial elements in video-based training since overly complex films lead to confusion over various safety regulations. Additionally, students' capacities to put all of their learned skills to use in solving real-world problems, as well as their mastery of safe work, practises. Prospective analysis abilities will aid in averting any circumstance that could be dangerous for environmental, industrial, or occupational safety, as well as in coming up with novel solutions in rapidly changing circumstances [27].

The term "safety commitment" refers to the promises made by top management, students, and administrative staff to put safety first and foster a supportive learning environment in order to establish a strong safety culture. According to Moreira *et al.,* [20], safety commitment refers to the leadership of top management embedding a safety culture in the workplace. The top management should set a good example for the workers. Moreover, safety commitment can also be included by having a clear safety policy and regulations to ensure all the staff understand and are aware of it. Providing excellent personal protective equipment (PPE) to students, such as at the laboratory, is also essential to educating the students on safety [15]. Furthermore, standard practices in the industrial sector, such as giving safety rewards or incentives to workers who show high safety culture practices while working, can motivate workers to prioritize safety culture in the workplace [9]. This also can be done in the education sector or learning institutions. The reward and recognition can be awarded to students who show a good safety attitude and prioritize safety culture while studying either at school or university

Additionally, it was critical to have a strong safety culture in place at educational facilities. It can be done by taking a university-level course that exposes students to occupational health and safety (OH&S). For instance, Lavasani *et al.,* [33] conducted a study on the knowledge level and safety culture of students enrolled in OHS courses. He concluded that the pupils' knowledge levels had improved as a result of the OH&S lecture. Every university student should be taught OH&S in order to encourage proper safety knowledge and enable the development of a safety culture. In addition, the safety knowledge on the importance of safety culture among students and staff is also important, as highlighted by Abdullah *et al.,* and Nizamuddin *et al.,* [34,35]. Safety communication is one of the top influencing factors in forming a safety culture in the education sector. The dissemination of information on safety culture is also significant to ensure all levels of students and staff in the education sector have the same understanding of safety culture, as highlighted by Olcay *et al.,* [18]. The channels of safety communication, such as safety signage, safety video, safety briefing, safety promotion, safety syllabus, and safety talk, can be prepared or organized by management to ensure the understanding of safety culture can be achieved by all students and staff.

4.2 Psychological Dimension of Safety Culture

For the psychological dimension, the elementary and public universities discussed the safety attitude factors which contribute to the formation of a safety culture [16,18,25]. Safety attitude refers to psychological perception towards safe culture, procedures and accident prevention [36]. According to Nasrallah *et al.,* [15], he revealed that the educational level of students can influence the safety attitude of students. He found that students with a master’s degree contribute 60.6% of the potential risk of accidents compared to Ph.D. students (11.1%). Good safety knowledge could help prepare the students to prevent incidents or accidents while using or working at the laboratory.

4.3 Situational Dimension of Safety Culture

For the situational dimension of safety culture, the working environment of the learning environment was the contributing factor to safety culture in public universities by Nasrallah *et al.,* [15]. For example, he strengthened the necessity of students as well as laboratory workers to have proper personal protective equipment while handling chemical substances. The lab also required safety signage and an emergency exit route in case of an explosion or fire. He found that the potential of the occurrence of accidents among laboratory workers in scientific laboratories was 45.0%. This result was in line with the previous research conducted by Kandel *et al.,* [37] in Nepal, in which 47%

of laboratory workers faced accidents due to various hazards in chemistry teaching laboratories. Moreover, the safety culture for the education sector needs to be strengthened and should follow other industrial sectors such as construction [38,39] and fabrication industry [39].

5. Recommendation and Future works

By highlighting the contributing factors of safety cultures, this study offers good implications for the creation of guidelines, policies, or procedures. From a practical standpoint, this study could be helpful to policy makers, educators, and upper management in understanding the elements that lead to the development of a safety culture in the education sector. By establishing a safe working environment and averting future mishaps, the study's findings also aid in identifying the flaws that can impede the development of a safety culture at academic institutions including schools, colleges, and universities. Several recommendations for further research are made by this review. It is advised to carry out research to find out how elementary and secondary school students learn safety culture practices. Furthermore, in Malaysia, it can be performed for both public and private universities.

6. Conclusions

The systematic review of the current research study on safety culture in the education sector for the years 2019 to September 2023 has successfully developed. Seventeen selected articles have been systematically reviewed from ScienceDirect and Scopus databases using the PRISM approach. The study found that behaviour is the most significant contributing factor to forming a positive safety culture (87%), followed by psychological (6.5%) and situational dimensions (6.5%). The study also found that safety training, safety awareness, safety knowledge, safety commitment, and safety communication from the behaviour dimension were the most critical factors in creating a positive safety culture in elementary schools and public and private universities. This systematic review study is intended to help policymakers better understand the challenges surrounding safety culture and the significance of providing a safe learning environment to students while also lowering the number of incidents, near-misses, and accidents in the future

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