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Original Research Article

Co-Curricular Activity Risk Management (CoARM) Development and Validation: A Fuzzy-Delphi Method

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Abstract

Co-curricular activities encompassing uniform units, clubs, and associations are compulsory courses in all educational institutions in Malaysia. The implementation of co-curricular activities requires neat preparation in order to reduce exposure to the risk of loss, injury, and accidents during the activities. Therefore, this study aimed to produce an instrument for effective co-curricular activity risk management (also known as (CoARM) to guide administrators, lecturers, and students, in conducting safe co-curricular activities, especially at Malaysian teacher education institute (TEIM). This study used the Fuzzy-Delphi method involving 30 experts in the field of co-curriculum from public universities and TEIM. The questionnaire was constructed based on the analysis of field expert interviews and a literature review. It was then sent for expert agreement on the elements, sub-elements, and content of CoARM at TEIM. The findings distinguish three (3) elements and fifteen (15) sub-elements of CoARM when planning and implementing co-curricular activities. The first element was the human element involving trainers, participants, support staff, service providers, and external agencies. The second element, the equipment element, involved anchorage, accommodation, facilities for special activity equipment, and safety equipment. The third element was the environment element with the sub-elements of weather, location, activity routes, security threats, and rescue routes. The CoARM instrument is expected to provide new knowledge as well as to serve as a guide in the field to increase the public's confidence in organising co-curricular activities at Malaysian educational institutions and as a reference source in the future construction of CoARM modules.

Keywords: Risk Management, TEIM, Co-curricular activities, Fuzzy-Delphi method.

INTRODUCTION

Risk management, safety, and health at work are integral to education. In fact, they have become part of the routine of educators, staff, and students in schools, as reported by the European Agency for Safety and Health at Work (EU-OSHA) (2013). Policymakers emphasise that new teachers should know how to evaluate, manage, and integrate risk education into the classroom, particularly when planning extra-curricular activities alongside adequate training. In accordance with that, the culture of risk management in Malaysian education is structured with the hopes to produce educators, staff, and students who are more sensitive to the risk of physical accidents and are better prepared at managing other risks relevant to risk management such as energy, financial, and time losses.

Teacher Education Institute Malaysia (TEIM) is a public higher education institution with 27 campuses that trains prospective trainee teachers to meet the needs of primary schools in Malaysia. TEIM which is an institution under the supervision of the Malaysian Ministry of Education (KPM) is entitled to follow the circular letter 9/2000 dated 20 March 2000: Guidelines for Student Personal Safety During Physical Education and Health Teaching as well as Co-curricular Activities and Indoor Sports and Outside the School Area. This necessitates programmes to guide trainee teachers to future organise extra-curricular activities at schools. In response to that, TEIM prepares a risk management plan based on the Plan-Do-Check-Act (PDCA) model to reduce the impact of risks incurred with efforts to minimise losses (IPG KPM EOMS, 2021).

In Malaysia, there is criticism from many researchers on the issue of security risks in education. The criticism is stronger against educational activities related to extracurricular activities, especially in events of accidents involving students as victims while outside the home or place of study. The number of accidents has been in an increase and the number includes the number of fatal accidents. Among them were the dragon boat racing accident in Penang in January 2010, which killed five scout students and a teacher, the pulley accident at a different camp in January 2011, which resulted in scouts having their heads crushed by a pulley, and the falling accident in October 2009, which resulted in a number of students drowning while crossing a suspension bridge at the Kuala Dipang camp in Kampar, Perak. (Utusan Malaysia, 2011). The latest fatal accident was the landslide incident that claimed 31 lives including 5 teachers and other visitors on 16 December 2022 at 2.30 am in Batang Kali, Selangor, Malaysia (Sinar Harian, 2022; Berita Harian, 2022). Accidents like these are also common in other countries. For example, in North Yorkshire, a student reportedly died while tripping during a school trip (Wainwright, 2005). Also, during a school trip in the Italian Alps, a teenager drowned in a frozen and treacherous river while trying to take a shortcut back to a mountain refuge (Wainwright, 2005). Meanwhile, in Norfolk, a 10-year-old boy was killed and three of his classmates were injured after they were crushed by a falling tree branch (Glendinning, 2007). These accidents have sparked a consensus in the request to reduce or eliminate risk during learning activities (Gu *et al*., 2018).

In Malaysia, the response to accidents during learning activities is more extreme. Parents are worried and doubtful about their children's outdoor activities. As a result, many parents do not allow their children to participate in school activities, especially those that are conducted outside of school (Harun and Salamuddin, 2014). Masud *et al*., (2018) also found that the Malaysian education system is focused on academics, marginalising extracurricular and extracurricular activities because parents protect their children from the risk of accidents and create a safe learning environment for their children. In addition, Da Silva *et al*., (2018) state that students who often do physical activities are at higher risk of serious injury compared to their peers who are involved in structured learning activities inside the classroom and are carefully supervised by teachers. Even though the risk of accidents heightens when students do co-curricular activities, accidents can happen anywhere within the school area (Zhang *et al.*, 2020). Therefore, there is a need to explore elements and sub-elements through the Fuzzy-Delphi method (FDM) to develop co-curricular activity risk management instruments (CoARM) at TEIM.

The teaching staff is also found to have caused many accidents, creating anxiety for students to participate in outdoor learning activities (Mustafa, 2015). Therefore, further research needs to be carried out so that the authorities and educators who are responsible for programme management take the initiatives to provide effective teaching staff or trainers. These initiatives should include providing formal training sessions to help trainers get a thorough understanding of their respective duties and the programme's risk management and safety plan within the school setting. A specialised certificate can be awarded, especially to those who are involved in water sports activities such as diving (Abu Bakar, 2007; Ang, 2007).

Previous studies on co-curricular activities have been limited. For example, even though Fatimah Mustafa (2015) highlighted the elements of risk management practices for sports coaches at TEIM, the study did not cover the elements of risk management practices for co-curricular activities. In addition, Abidah Aina Mohamed (2018) produced an outdoor education risk management framework for the use of public Malaysian Higher Institution Education (HIEs) with a primary focus on jungle tracking activities. However, the study did not cover the entire co-curricular activities at TEIM. In accordance with that, there is a need to develop co-curricular activity risk management instruments to be used by co-curricular trainers when conducting activities, particularly at TEIM.

LITERATURE REVIEW

The co-curriculum in education in Malaysia is also referred to as extra-curriculum or extra-curricular activities, as contained in the Regulation of School Study Courses, Education Act 1956. Since the 1960s, the implementation of co-curricular activities has been treated separately from the education curriculum and considered as additional activities of teaching and learning processes at school (Ab Alim, 2004). Over time, the importance of co-curricular activities rises, aligning with current educational developments and has become a top priority in education planning.

The current co-curricular implementation framework at the school level is based on the recommendations of the Cabinet Report 1979, the National Education Philosophy 1988, and the Education (School Association) Regulations 1998. These recommendations emphasis the crucial role of co-curricular activities for all students at various school levels. At TEIM, co-curricular activities are structured based on a curriculum that is specifically designed for trainee teachers with the primary objective to strengthen the construction of their identity, leadership, teamwork, social skills, and professionalism. It is expected that the activities could produce trainee teachers who are knowledgeable, proactive, resilient, and competitive, as well as teachers with values and professional attitudes that are compatible with local values. These skills are honed through the application of soft skills during authentic, holistic, and contextual activities conducted outside the classroom setting (IPGM, 2017).

Four (4) components of co-curricular activities, namely the uniform unit, teacher character building, sports, and games involving camping activities, jungle tracking, life endeavours, water confidence, kayaking, flying fox/abseiling, and community and school services are carried out off campus. Even though the co-curricular activities provide a space to gain knowledge, practical theories, and concepts in a more meaningful and holistic way as preparation to become a dedicated teacher, the activities still expose them to the risk of loss, injury, and accident.

According to Bacud (2020), Henri Fayol introduced the fundamental components of management. Management, which refers to the organisational process, includes the process of strategic planning, organising, directing, coordinating, and controlling resources to achieve the objectives or goals of an organisation (Godwin *et al*., 2017; Kontz and Weihrich, 2008; Loch and Wu, 2007). Members must comply with the process which is planned, controlled, and monitored by their organisation's leaders because their agreement is needed to achieve their organisation's objectives. This is because each member has their roles and responsibilities to achieve the objectives of the planned programme. In addition, the elements in the Public Risk Communication Model (2020) and the Berg Risk Management Model (2010) in management are still practical. The model elements extracted facilitate a three-way communication between the government, experts, and the public. Besides that, this approach helps organisations to create goals, it allows the identification, prediction, evaluation, treatment, and selection of risks in order to make decisions based on scientific data.

In the planning process of implementing activities, organisers must minimise risk. Risk in this study refers to the possibility of unwanted events occurring, exposure to dangerous situations, losses, injuries, and accidents that may arise during the implementation of activities or programmes that can affect the goals of their implementation (Baharudin *et al*., 2017; Parna, 2016; Redja, 2011). Knowledge and experience are needed to analyse the risks that may occur before a programme is organised. Thus, the development of a checklist to facilitate the identification of the factors that may cause accidents or injuries during each activity is plausible, enabling organisers to mitigate or avoid risks when conducting co-curricular activities.

Risk management is a systematic process of identifying risk exposures and taking action to minimise risks when organising activities (Brown, 2001). Rejda (2011) states four risk management practice plans: (i) identify loss exposure, (ii) measure and analyse loss exposure, (iii) choose the appropriate combination to treat loss exposure, and (iv) implement and monitor the management programme risk. These four risk management practice plans are predictive in smoothing the process to achieve the objectives of the activity, programme, or organisation.

METHODOLOGY

The design of this study was the exploratory mixed method (Cresswell, 2014; Cresswell and Clark, 2011). The design was adopted to gather a comprehensive picture of the risk management practices of co-curricular activities at TEIM. In addition, this study developed an instrument for co-curricular activity risk management (CoARM) by combining the traditional Delphi method and the Fuzzy numbering sets, named the Fuzzy-Delphi method. The modification of the original Delphi method, combined with the Fuzzy analysis, produces a simpler method that maintains its validity based on expert panel views (Saedah Siraj, Muhammad Ridhuan Tony Lim Abdullah, and Rozaini Muhamad Rozkee, 2020). This method involves the views of a group of experts in the field being studied and usually involves several rounds to produce a consensus on the findings of the study. In addition, according to Mohd. Jamil *et al*., (2017), the Fuzzy-Delphi method is used to obtain expert agreement on a problem. Also, the use of the Fuzzy-Delphi method can save cost and time, especially in the construction of the questionnaire. In this study, the Fuzzy-Delphi method was used to obtain expert consensus in order to determine the elements and sub-elements using quantitative methods.

The newly developed instrument experienced an element exploratory phase involving interviews with six experts in co-curricular activities. The development of items and questionnaires in this study was constructed based on an extensive literature review, interviews, pilot studies, and researcher experience (Skulowski *et al*., 2007), which was done within the scope of this study (Okli and Powlowski, 2004). Based on Table 1, there are six elements listed in the Public Risk Communication Model (2020), Berg Risk Management Model (2010), Mulrooney Model (1998), Clement Model (1998), Berlonghi Model (1990), and Kaiser Model (1986). The elements are: (i) identify, (ii) analyse, (iii) assess, (iv) select and treat, (v) implementation, and (vi) public communication and stakeholder. These elements served as a basis for formulating the interview protocol with study experts during the exploration phase of the risk management elements of co-curricular activities at TEIM.

Table 1: List of Elements Based on Literature Review

Risk Management Models	Element					
	Identify	Analyse	Assess	Select and Treat	Implementation	Public Communications and Stakeholder
Public Risk Communication Model (2020)			√			√
Berg's Risk Management Model (2010)	√	√	√			√
Mulrooney Model (1998)	√		√	√		√
Clement Model (1998)	√		√	√		√
Berlonghi Model (1990)	√	√	√	√	√	√
Kaiser Model (1986)	√		√	√	√	

The expert agreement was obtained through interviews with two (2) University Center of Co-Curriculum Directors and four (4) Heads of the Co-Curriculum Unit in TEIM. They were involved in the planning and implementation of extra-curricular courses and activities at TEIM. A thematic analysis was conducted after the interview transcriptions and the findings were transferred onto the inter-rater reliability form. The data was then returned to the experts for the confirmation of elements and sub-elements which corresponded to risk management of co-curricular activities at TEIM. A sample of the obtained inter-rater reliability results is shown in Table 2.

1. Risk Management Elements of Cocurricular Activities at TEIM.

Table 2: Inter-rater Reliability Elements Agreement (Sample)

No.	CODING	OPERATIONAL DEFINITION	UNIT SAMPLES	EXPERT AGREEMENT *TICK (√)	
				NO	YES
1.	EPRAKO	Expert opinion on **risk management elements** of co-curricular activities. **HUMAN EQUIPMENT ENVIRONMENT** *Haddock, Cathye (2013). *Outdoor Safety Risk Management for Outdoor Leaders 3rd Ed.* New Zealand.	If it were me, I would like to look at three aspects of these three elements, namely people, equipment and the environment. When we manage risk we look at these three aspects.. Because these three aspects will involve Risk. these three aspects The risk always plays in these three parts, If you follow the risk management book ..HADDOCK said there are three elements that contribute to accidents. The first is Humans, the second is equipment and the third is the environment **(INFORMAN TBTI2UNI: 2:7 ¶ 289)** not only the coaches but the admin staff, including the students understand the existence of risk. we make sure there is awareness first, Make sure at least they know.. **(INFORMAN TBTI1UNI: 1:10 ¶ 225)** the element that I see is also in terms of expert resources.. human resources, so we can create a SOP related to water activities, so the human resources of expertise needed in terms of qualifications, trainer qualifications.. **(INFORMAN TBTI5IPG: 5:8 ¶ 359)**		TBTI1UNI TBTI2UNI TBTI3IPG TBTI4IPG TBTI5IPG TBTI6IPG

In general, all experts agreed that human, equipment, and environment were the elements in the management of co-curricular activities. The sub-elements for the human element which were agreed upon were coaches, participants, support staff, service providers, and external agencies. The sub-elements for the equipment element were transportation, accommodation, facilities, special activity equipment, and safety equipment. The sub-elements for the environment element were weather, location, activity path, security threat, and rescue path. The summary of the elements and sub-elements is shown in Table 3.

Table 3: Summary of Inter-rater Reliability Elements and Sub-elements Agreement

ELEMENTS	SUB ELEMENTS	EXPERTS						%
		1	2	3	4	5	6	
Human	Coaches	/	/	/	/	/	/	100.0
	Participants	/	/	/	/	/	/	100.0
	Support staff	/	/	/	/	/	/	100.0
	Service providers	/	/	/	/	/	/	100.0
	External agencies	/	/	/	/	/	/	100.0
Equipment	Transportation	/	/	/	/	/	/	100.0
	Accommodation	/	/	/	/	/	/	100.0
	Facilities	/	/	/	/	/	/	100.0
	Special activity equipment	/	/	/	/	/	/	100.0
	Safety equipment	/	/	/	/	/	/	100.0
Environment	Weather	/	/	/	/	/	/	100.0
	Location	/	/	/	/	/	/	100.0
	Activity route	X	/	/	/	/	/	83.3
	Security threat	/	/	/	/	/	/	100.0
	Rescue route	/	/	/	/	/	/	100.0

In this study, the questionnaire was constructed following the information from the literature on co-curricular risk management and the implementation of co-curricular and outdoor activities. Also, the questionnaire was guided by the analysis of suggestions for questionnaire items derived from the interviews with experts. As a result of the interview, suggested improvements by the expert were contrived and a questionnaire with face and content validity was produced. The questionnaire was developed in Google Forms and sent to this study's respondents via email.

Questionnaire for Experts

A Fuzzy-Delphi method study requires a minimum of ten (10) sample people to obtain high uniformity among experts (Adler and Ziglio, 1996; Jones and Twiss, 1978). Therefore, this study involved thirty (30) experts from the field of co-curricular activities from public universities and TEIMs in Malaysia. The sample for this study was selected using purposive sampling, in which respondents were chosen from individuals who met certain specified conditions (Chua, 2010). This study involved individuals who (i) owned a bachelor's degree as an academic qualification and a coaching certificate, (ii) had more than ten (10) years of experience in the extra-curricular field, and (iii) were willing to participate in this study and give their opinions. The selection criteria of experts were in line with Berliner (2004) who considers expert in a field as individuals with more than five (5) years of working experience and Gambatese *et al*., (2008) who states that field experts are individuals with high academic qualifications. As a result, experts in the study were individuals from the same field of expertise from a university (1 person), the Ministry of Education (1 person), and TEIMs (28 people). The details of the experts are displayed in Table 4.

Table 4: Expert specification

Institution	Position	Number
University	Dean	1
Ministry Of Education Malaysia	Assistant Director	1
TEIM Campus	Head of Co-Curriculum Unit	27
	Senior Lecturer	1
Total		30

The content validation of the questionnaire was assessed by experts using a 5-point Likert scale, which ranged from 1 (Strongly Disagree) to 5 (Strongly Agree). The score of experts' agreement on the 60 items-indicators was then converted to Fuzzy triangular numbers (see Table 5).

Table 5: Item-agreement indicators

Agreement	Fuzzy Scale	Likert Scale
Strongly disagree	0.0, 0.0, 0.2	1
Disagree	0.0, 0.2, 0.4	2
Less Agree	0.2, 0.4, 0.6	3
Agree	0.4, 0.6, 0.8	4
Strongly Agree	0.6, 0.8, 1.0	5

Source: Yaakub *et al.*, 2020

The questionnaire was divided into two sections. The first section was Part A which contained demographic questions and the second section was Part B which contained the question items.

Part B contained three (3) constructs and fifteen (15) elements. The first construct was human (19 items). There were five elements under this construct which were trainers (4 items), participants (4 items), support staff (5 items), service providers (3 items), and external agencies (4 items). The second construct was equipment (21 items). Five elements listed in this construct were transportation (4 items), accommodation (5 items), facilities (4 items), special activity equipment (4 items), and safety equipment (4 items). The final construct was the environment (19 items) with five elements, namely weather (4 items), location (4 items), activity route (4 items), security threat (4 items), and rescue route (3 items). The total number of questions for the three constructs was sixty (60) items, as shown in Table 6.

Table 6: Question details based on constructs

Construct	Element	No	Total
Human	Trainers	4	20
	Participants	4	
	Support staff	5	
	Service providers	3	
	External agencies	4	
Equipment	Transportation	4	21
	Accommodation	5	
	Facilities	4	
	Special activity equipment	4	
	Safety equipment	4	
Environment	Weather	4	19
	Location	4	
	Activity route	4	
	Security threat	4	
	Rescue route	3	
Total			60

Data Analysis

For data analysis purposes, feedback from experts, the threshold value (*d*), and measure expert consensus were calculated using the following formula based on three conditions:

$$d(\tilde{m},\tilde{n}) = \sqrt{\frac{1}{3}\left[(m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2\right]}$$

The three conditions were: (i) the *d* value must be equal to or less than 0.2 (Cheng and Lin, 2002), (ii) the group agreement percentage must be greater than 75 per cent (Chu and Hwang, 2008), and (iii) the average of the Fuzzy number, *A* value, must exceed 0.5 when using the formula *A* = 1/3 x (m1+m2+m3) (Tang and Wu, 2010), The items are accepted if all requirements were met.

Under the first condition, the threshold value (*d*) of the study did not exceed 0.2. Table 7 displays the results of the formula calculation for the threshold value (*d*) concerning trainer elements (four items) within the human construct. The table also presents the overall specialist value threshold (*d*) for each item.

Table 7: The Threshold Value (*d*) Generated for Four (4) Items (Trainer's element)

Expert / Item	Item 1	Item 2	Item 3	Item 4
KU1	0.02	0.04	0.02	0.05
KU2	0.02	0.04	0.02	0.05
KU3	0.02	0.04	0.02	0.05
KU4	0.02	0.04	0.02	0.05
KU5	0.02	0.04	0.02	0.05
KU6	0.02	0.04	0.02	0.05
KU7	0.02	0.04	0.02	0.05
KU8	0.02	0.04	0.29	0.25
KU9	0.02	0.04	0.02	0.05
PR30	0.04	0.07	0.04	0.09
d Value Every Items (Threshold)	0.04	0.07	0.04	0.09

The determination of the percentage value of the expert agreement was executed to confirm the second condition. The second condition required the percentage of experts' agreement to be equal to or greater than 75 per cent (Chu and Hwang, 2008). Table 8 shows the percentage of specialist agreements for the four (4) items studied by thirty (30) experts in this study. As the percentages of expert agreements of Item 1, Item 2, Item 3, and Item 4 exceeded 75 per cent, all items were accepted.

Table 8: Percentage of Experts' Agreement for Four (4) Items (Trainer's element)

Item	Item 1	Item 2	Item 3	Item 4
Number of Items d ≤ 0.2	28	27	28	26
Percentage of Each Item d ≤ 0.2	93%	90%	93%	87%

The third condition necessitated that the average of the Fuzzy number, *A* value, must exceed 0.5. One of the functions of the value of Fuzzy scores (*A*) is to be used as a determinant and a priority indicator for an element according to experts' opinions. Data analysis was conducted to identify the average of Fuzzy numbers or the average response (Defuzzification Process). Thus, an analysis aimed to determine the study's Fuzzy score (*A*) was conducted. To ensure the third condition was followed, the value of the Fuzzy score (*A*) must be greater than or equal to the median value (α - cut value) of 0.5 (Bodjanova, 2006; Tang and Wu, 2010;). This study utilised the following formula to determine the score of Fuzzy (A):

$$A = (1/3) * (m1 + m2 + m3)$$

Table 9 illustrates an example of Fuzzy scores (*A*) conducted using defuzzification process analysis, utilising the FDM approach. According to the table, all items were unanimously accepted by experts.

Table 9: The Score of Fuzzy Scores (*A*) Analysis of Defuzzification Process

Item	Item 1			Item 2			Item 3			Item 4		
Fuzzy Scale	m1	m2	m3	m1	m2	m3	m1	m2	m3	m1	m2	m3
1	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0
2	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0
3	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0
4	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0
5	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0	0.6	0.8	1.0
Average Each Unit	0.59	0.79	0.99	0.57	0.77	0.97	0.59	0.79	0.99	0.57	0.77	0.97
Fuzzy Score Value (Average)	0.79			0.77			0.79			0.77		
Ranking	1			3			1			4		

FINDING AND DISCUSSION

A content validity test using FDM was conducted on a total of sixty (60) questionnaire items across three (3) constructs namely human, equipment, and environment. Table 10 shows the findings of the analysis using the Fuzzy Numbering Triangle.

The findings of the first construct, human, which consisted of nineteen (19) items showed compliance with the first condition of *d* Value Threshold (<0.2), as evidenced by the average value of 0.097, the second condition with the expert agreement higher than 75 per cent (85.6 %), and the third condition with α – cut value higher than 0.5 (0.748).

The findings of the second construct, equipment, which consisted of twenty-one (21) items showed compliance with the first condition of *d* Value Threshold (<0.2), as evidenced by the average value of 0.078, the second condition with the expert agreement higher than 75 per cent (88.8 %), and the third condition with α – cut value higher than 0.5 (0.769).

The findings of the final construct, environment, which consisted of nineteen (19) items showed compliance with the first condition of *d* Value Threshold (<0.2), as evidenced by the average value of 0.086, the second condition with the expert agreement higher than 75 per cent (90.4 %), and the third condition with α - cut value higher than 0.5 (0.765). In short, according to the results, all sixty (60) items in the questionnaire met the three conditions set in the FDM. Therefore, no items were removed.

The first construct, human, which consisted of nineteen (19) items, complied with the first condition of *d* Value Threshold (<0.2), with an average value of 0.097, the second condition with an expert agreement higher than 75 per cent (85.6 %), and the third condition with α - cut value higher than 0.5 (0.748). As a result, no items we removed. This indicated the understanding of human factors contributing to accidents. Therefore, sub-elements in the human construct are valuable and important to help organisations to reduce human error when organising events. The risks of an accident can be minimised when the staff is experienced and knowledgeable (Jaffry, 2015).

The findings of the second construct, equipment, which consisted of twenty-one (21) items, showed that the elements of the construct complied with the first condition of *d* Value Threshold (<0.2) with the average value of 0.078. It scored the lowest value among the constructs. The finding indicated the importance of managing equipment for co-curricular activities. This finding concurs with the study by Dicken and Tajul (2017) which highlights the importance of repairing obsolete equipment such as hockey sticks, kayaks, and pedals to avoid the risk of accidents. As a result, it is concluded that scheduled equipment inspections are necessary to identify the need for equipment maintenance. These inspections ensure that the equipment can properly and safely function.

The environment construct, which consisted of nineteen (19) items, complied with the second condition with the expert agreement higher than 75 per cent (90.4 %), the highest percentage among the three constructs. This indicated that a safe environment is the most important when managing the risk of accidents. This finding concurs with Pirontha and Megat (2021), who have emphasised the importance of confirming the safety and feasibility of the environment construct before carrying out any activities.

Table 10: Summary of Fuzzy-Delphi method findings

CONSTRUCT	NO. ITEM	1st Condition *d* Value Threshold (<0.2)	2nd Condition expert agreement (> 75%)	3rd Condition ITEMs (a - cut value THRESHOLD >0.5)	Item Removed
HUMAN					
Trainers	4	0.059	91	0.778	NIL
Participants	4	0.081	85	0.768	NIL
Support staff	5	0.127	83	0.692	NIL
Service providers	3	0.115	89	0.749	NIL
External agencies	4	0.105	80	0.757	NIL
EQUIPMENT					
Transportation	4	0.063	91	0.777	NIL
Accommodation	5	0.063	92	0.777	NIL
Facilities	4	0.109	88	0.753	NIL
Special activity equipment	4	0.077	86	0.77	NIL
Safety equipment	4	0.078	87	0.77	NIL
ENVIRONMENT					
Weather	4	0.055	90	0.778	NIL
Location	4	0.083	88	0.768	NIL
Activity route	4	0.048	91	0.782	NIL
Security threat	4	0.116	92	0.742	NIL
Rescue route	3	0.132	91	0.738	NIL
TOTAL	60				

The validity and reliability of expert agreement in determining constructs and elements within CoARM using FDM have been acknowledged to be contingent upon the selection of experts that is accurate and adheres to the specified characteristics (Jamelaa and Siti, 2018; Gambatese *et al*., 2008; Berliner, 2004). In the current study, the confirmation of the academic qualifications and experience of the experts before their appointment was to ensure that the generated results were accurate. Also, the experts' participation in this study was voluntary. It is important that their participation is voluntary because the willingness to contribute to the study is pivotal so that knowledge can be shared and developed for the common good.

The use of the FDM yielded a preliminary finding on the CoARM instrument. The results confirm that the instrument can serve as a clear direction for trainers to empower organisations and create a school culture that prioritises co-curriculum risk management. From the current study, it is evident that FDM can be used to determine the constructs and elements of risk management for co-curricular activities. Therefore, the CoARM instrument for TEIM was developed using FDM, as shown in Appendix 1.

Appendix 1

CoARM Questionnaire

The following elements and sub elements related to the risk management of co-curricular activities at the Malaysian Teacher Education Institute (TEIM). Please mark (/) on a scale according to the following:

Strongly Disagree (SDA)	**Disagree (DA)**	**Neutral (N)**	**Agree (A)**	**Strongly Agree (SA)**
1	2	3	4	5

In implementing co-curricular activities at the TEIM, the elements (E) and sub elements (SE) required are:

***(E)* HUMAN**						
NO	***(SE)* TRAINERS**	**SDA**	**DA**	**N**	**A**	**SA**
1	Have a recognized qualification certificate.	1	2	3	4	5
2	Have the skills to interpret the co-curricular activities guidebook.	1	2	3	4	5
3	Have knowledge to predict risk in co-curricular activities.	1	2	3	4	5
4	Have a good level of fitness to handle co-curricular activities.	1	2	3	4	5
NO	***(SE)* PARTICIPANTS**					
5	Knowledge of co-curricular activities.	1	2	3	4	5
6	A good level of health to be involved in co-curricular activities.	1	2	3	4	5
7	Information about the risks in co-curricular activities carried out.	1	2	3	4	5
8	Knowledge of self-ability in participating the activity.	1	2	3	4	5
NO	***(SE)* SUPPORT STAFF**					
9	Knowledge of the program.	1	2	3	4	5
10	Good level of health to work in the field.	1	2	3	4	5
11	Knowledge of program risk management.	1	2	3	4	5
12	Recognized qualification certificate.	1	2	3	4	5
13	Responsibility in the task given.	1	2	3	4	5

CoARM Questionnaire (Cont.)

***(E)* HUMAN**						
NO	***(SE)* SERVICE PROVIDERS**	**SDA**	**DA**	**N**	**A**	**SA**
14	Knowing clearly the policy of the co-curricular program being carried out.	1	2	3	4	5
15	Have a recognized qualification certificate.	1	2	3	4	5
16	Have a valid service provider license.	1	2	3	4	5
NO	***(SE)* EXTERNAL AGENCIES**					
17	Give feedback related to co-curricular activities that will be carried out.	1	2	3	4	5
18	Make a risk assessment at the location.	1	2	3	4	5
19	Patrolling during the program.	1	2	3	4	5
20	Communicate with all agencies in the event of an emergency.	1	2	3	4	5
***(E)* EQUIPMENTS**						
NO	***(SE)* TRANSPORTATION**					
21	Have a valid operating permit.	1	2	3	4	5
22	Have valid passenger protection insurance.	1	2	3	4	5
23	Have a scheduled maintenance record.	1	2	3	4	5
24	Do not carry loads exceeding the limits specified in the permit.	1	2	3	4	5
NO	***(SE)* ACCOMODATION**					
25	Has basic facilities (water, toilet, prayer room, hall)	1	2	3	4	5
26	Have an emergency route plan.	1	2	3	4	5
27	Not located in a natural disaster area.	1	2	3	4	5
28	Not in the area of dangerous animals.	1	2	3	4	5
29	Appropriate to the number of participants.	1	2	3	4	5
NO	***(SE)* FACILITIES**					
30	Comply with safety standards in the sports and recreation industry.	1	2	3	4	5
31	Have a written emergency plan.	1	2	3	4	5
32	Have an emergency plan that is reviewed every 6 months.	1	2	3	4	5
33	Operated by certified experts.	1	2	3	4	5

CoARM Questionnaire (Cont.)

***(E)* EQUIPMENT**						
NO	***(SE)* SPECIAL ACTIVITY EQUIPEMENT**	**SDA**	**DA**	**N**	**A**	**SA**
34	Comply with safety standards in the sports and recreation industry.	1	2	3	4	5
35	Has an *easy-to-understand* user manual.	1	2	3	4	5
36	Conducted by certified trainers.	1	2	3	4	5
37	Scheduled maintenance.	1	2	3	4	5
NO	***(SE)* SAFETY EQUIPMENT**					
38	Easy to reach in case of emergency in all areas.	1	2	3	4	5
39	Scheduled maintenance.	1	2	3	4	5
40	Maintained by certified parties.	1	2	3	4	5
41	Has an *easy-to-understand* user manual.	1	2	3	4	5
***(E)* ENVIRONMENT**						
NO	***(SE)* WEATHER**					
42	Plan activities based on the weather forecast.	1	2	3	4	5
43	Information data from the Meteorological Department.	1	2	3	4	5
44	Able to interpret the basic signs of weather changes.	1	2	3	4	5
45	Modify activities based on current weather.	1	2	3	4	5
NO	***(SE)* LOCATION**					
46	Visit the location before the activity is carried out.	1	2	3	4	5
47	The site has basic facilities.	1	2	3	4	5
48	The site of the activity is confirmed safe by the authorities.	1	2	3	4	5
49	The site of the activity has telecommunication coverage.	1	2	3	4	5
NO	***(SE)* ACTIVITY ROUTE**					
54	Obtained environmental safety information from residents.	1	2	3	4	5
55	A list of activity risks is provided.	1	2	3	4	5
56	Emergency procedure plan prepared.	1	2	3	4	5
57	Provide qualified rescue team at the location of the activity.	1	2	3	4	5

Figure 1: CoARM Questionnaire (Cont.)

***(E)* ENVIRONMENT**						
NO	***(SE)*RESCUE ROUTE**	**SDA**	**DA**	**N**	**A**	**SA**
58	Easily accessible.	1	2	3	4	5
59	Checked by the rescue team.	1	2	3	4	5
60	The rescue team was notified by a notice letter.	1	2	3	4	5

CONCLUSION

This study listed three (3) elements and fifteen (15) sub-elements of the CoARM instrument that was developed to minimise the risk of loss, injuries, and accidents when organising co-curricular activities. For the first element (human), the sub-elements were trainers, participants, support staff, service providers, and external agencies. The second element (equipment) involved sub-elements namely anchorage, accommodation, facilities for special activity equipment, and safety equipment. The last element (environment) consisted of sub-elements namely weather, location, activity route, security threat, and rescue route. These three elements have been identified as factors that can cause accidents in the events of poor planning and implementation of outdoor activities, especially during co-curricular activities.

Therefore, the safety aspect of outdoor activities, including co-curricular activities, should be given attention so that all parties can understand the implications of every taken decision. The awareness of the importance of managing risk should not only be spread in a singular organisation but throughout society. Thus, it is hoped that the designed CoARM instrument provides new knowledge that can be applied by curriculum administrators at TEIM to be delivered to trainee teachers to increase their confidence in organising co-curricular activities in Malaysian educational institutions. In addition, this study can serve as a reference or source in the construction of CoARM modules to support more practical and safe co-curricular activities at the TEIM, such as those organised by uniform units, clubs, and associations.

There were some limitations in this study. Among the limitations were that the respondents of this study consisted of co-curricular trainers at TEIM and that the study was administered online. However, the researcher posited that all respondents provided authentic and sincere answers to this study. Nevertheless, researchers suggest that a future study be conducted involving co-curricular trainers at public universities, state co-curricular centres, public training centres, and private recreation centres to obtain a comprehensive picture related to the risk management of co-curricular activities in other settings. In addition, the CoArm instrument design can be used for future pilot studies in which the collected data can be analysed using the Winsteps software to determine if the values correspond to respondent items for confirmation.

The implication of this study is significant as the instrument produced can be used by other parties such as schools and event organisers to provide safe activity environments by minimising the risks of accidents, thus increasing confidence among participants, parents, and the wider community to participate in co-curricular activities.

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