Indian Journal of Information Sources and Services
ISSN: 2231-6094 (P) Vol.16, No.1, 2026, pp. 324-337

DOI: https://doi.org/10.51983/ijiss-2026.16.1.34

Bridging the Fire Safety Awareness Training Gaps: Survey Findings from Dubai and Sharjah Emirates

Tauqeer Faiz[1*], Dr. Mark Tee Kit Tsun[2] and Abdullah Al Mahmud[3]

[1*]Faculty of Engineering, Computing and Science, Swinburne University of Technology, Sarawak, Malaysia
[2]Faculty of Engineering, Computing and Science, Swinburne University of Technology, Sarawak, Malaysia
[3]Department of Architecture and Industrial Design, Swinburne University of Technology, Melbourne, Australia

E-mail: [1]tauqeer98@hotmail.com, [2]mtktsun@swinburne.edu.my, [3]aalmahmud@swin.edu.au
ORCID: [1]https://orcid.org/0000-0002-1641-9813, [2]https://orcid.org/0000-0002-4413-2000, [3]https://orcid.org/0000-0002-2801-723X

(Received 04 November 2025; Revised 29 November 2025, Accepted 18 December 2025; Available online 05 January 2026)

Abstract - **Dubai and Sharjah, twin cities of the United Arab Emirates, offer a diverse living environment, attracting residents from around the globe. Despite their cosmopolitan nature, these emirates have a concerning rate of fire incidents. To address fire-related issues, the public and private sectors provide extensive fire safety training/workshops and run awareness campaigns. The increase in fire incidents has been encouraged by the possible deficiencies in these training programs; a survey was conducted to assess the effectiveness of available training resources. Employing basic statistics and thematic analysis, we collected data from 149 participants. We aimed to assess the effectiveness of fire safety training programs provided by different organizations in Dubai and Sharjah. The proposed survey had 12 questions about fire safety training and awareness campaigns run in the Dubai and Sharjah Emirates, yielding valuable insights. The lack of adequate fire safety training among the residents of Dubai and Sharjah was revealed through thematic analysis. Conventional approaches in training, such as PowerPoint slides, brochures, and discussions, make the training passive learning. Residents wait for the opportunity to attend fire safety training, and it happens rarely. The available training often lacks contextual learning and inclusion of technological resources. Residents of Dubai and Sharjah rely on their employers or the public sector to sponsor their fire safety training. Additionally, many residents use search engines to learn about fire safety, unaware of existing awareness campaigns. Survey respondents in larger workshops frequently complained about limited individual attention, the long duration of these workshops, participants' education level, time constraints, and the language of instruction. These are the major causes of difficulties in the fire safety training. Most residents recommended incorporating mobile, augmented, and virtual reality applications to make training safe, contextually rich, engaging, and motivating. The survey results supported practical demonstrations, smartphone-enabled training, and augmented and virtual reality-based training over leaflets, PowerPoint presentations, and discussion. Age, gender, and qualification variables were used to establish relationships with the survey responses using thematic analysis to improve fire safety training and awareness campaigns. However, the question left unanswered by respondents requires further investigation to address the gaps and how technology, such as augmented and virtual reality, can transform perception of awareness campaigns by integrating contextual learning, motivation, and engagement.**

Keywords: **Safety Education, Fire Safety, Awareness Campaigns, Fire Education, Barriers in Fire Safety**

I. INTRODUCTION

The United Arab Emirates (UAE) has seen a significant increase in the developing world-class initiatives such as state-of-the-art infrastructure, modern means of transportation, and towering skyscrapers. The country faces two significant challenges of rising temperature and rapid urbanization (Al Blooshi et al., 2020; Subraelu et al., 2022). Global warming is not a future threat but a grave current issue. Rising temperatures, prolonged heatwaves, and frequent draughts are creating favorable conditions for wildfire and urban fires. Regions that once experienced occasional fires are now experiencing them regularly (Jones et al., 2022). Combustible materials used in high-rise buildings and dry vegetation in villas ignite easily under hot and humid conditions. According to recent data, climate change has lengthened fire seasons in many parts of the world, including North America, Australia, Southern Europe, and Asia (Solorzano et al., 2019). Heat waves can damage buildings of combustible materials and electrical systems, leading to sparks that ignites fires (Lassandro & Di Turi, 2019). In short, the global climate and increased urbanization crisis have turned fire from a manageable hazard into a substantial threat.

Increased urbanization leads to increased use of resources and congestion in cities, which leads to increased global warming (Al Blooshi et al., 2018). Building maintenance becomes difficult, resulting in increased negligence due to high maintenance charges. Some recent fires in the areas of Dubai Marina and Al Barsha, are one such example. More than 10,000 residents were affected by the recent Dubai and Sharjah high-rise residential buildings in both Emirates (Alqassim & Daeid, 2014; Omar et al., 2023; Rathnayake et

al., 2020). Gas cylinders heat up and cause blasts due to hot and humid conditions. Electric transformers can heat up and catch fire both inside and outside homes. Inaccurate disposal and storage techniques of chemicals can lead to fire incidents due to global warming and heat waves. Hence, fire safety training & thematic analysis has become more essential than ever, as a safety measure and a vital life-saving skill. Residents who are not adequately educated on fire safety can pose serious challenges to firefighting and jeopardize the safety of others during the remedial process (Kodur et al., 2020; Mudiono et al., 2016).

Though the UAE is following standards for fire safety design, the same standards must be followed in building materials, fire protection systems and awareness campaigns (Ali & Mubin, 2023; Fu et al., 2024). Fire safety awareness campaigns incorporate diverse strategies to prevent, identify and mitigate fire hazards (Omar et al., 2023). In the modern and vibrant environment of Dubai and Sharjah, fostering a culture of fire safety awareness is essential (Veera Boopathy et al., 2025; Faiz et al., 2024). In order to effectively mitigate risks, it is highly recommended that individuals, businesses, and communities comprehend the importance of fire prevention, preparedness, and proper emergency planning (Oudh et al., 2025). The country is home to numerous reputable firefighting companies committed to delivering workshops, trainings, and comprehensive fire safety solutions and public organization (Al-Kaabi, 2003; Toapanta et al., 2024). These organizations provide various services, such as emergency response planning, evacuation drills, use of fire extinguishers, fire risk assessments, fire suppression system installation, and so on (Al-Kaabi, 2003).

Many fire incidents are reported in the United Arab Emirates every year, despite the ongoing awareness campaigns and training workshops (Alqassim & Daeid, 2014; Rathnayake et al., 2020). The scope of this research does not permit the examination of underlying fire incident causes; however, a comprehensive investigation is necessary to identify potential deficiencies in the current fire safety education and awareness initiatives (Omar, Mahmoud, & Abdul Aziz, 2023). A survey was conducted to evaluate the effectiveness of fire safety education in the Dubai and Sharjah emirates. The survey included the following questions:

***Q1**: Have you ever received any fire hazard workshop or similar training in the past?*

***Q2**: What training methodologies were used during the training or workshop?*

***Q3**: How often do you attend such training or campaigns?*

***Q4**: Are you satisfied with the training received in fire safety?*

***Q5**: What do you like about these training workshops or awareness campaigns?*

***Q6**: What do you dislike about these training workshops or awareness campaigns?*

***Q7**: Who sponsored the workshop/training?*

***Q8**: Do you use search engines or any other platform to learn more about fire safety?*

***Q9**: Have you seen these awareness campaign materials, such as brochures and videos before and how easy is it for you to find these brochures or training materials to enhance your fire safety skills?*

***Q10**: Which of the following difficulties did you face to develop fire hazard recognition skills?*

***Q11**: Do you think that the fire safety training campaigns should have ease of accessibility, relevant content, and practical demonstrations in a safe manner?*

***Q12**: What will be your preferred source of fire safety training in the future?*

II. METHODOLOGY

The Dubai and Sharjah Emirates have a combined approximate total population of 5,500,000 (Blogger, 2024). A sample size of 69 is recommended to obtain a 90% confidence level with a 10% margin of error, based on the population size studied. This sample size was calculated through the Qualtrics sample size calculator (https://www.qualtrics.com/blog/calculating-sample-size/). The survey was conducted at Skyline University of Sharjah, UAE, during Orientation Day. The Qualtrics platform was used to conduct the survey, which offers improved data security and traceability (Boas et al., 2020). This survey followed a cross-sectional, structured approach that included both items with fixed response options and open-ended questions (Connelly, 2016; Engelbrecht et al., 2019). Initially, the survey was shared with visitors of the university during the orientation day. However, due to the low response rate, the survey was distributed through email and university WhatsApp groups requesting more participation. Of the 155 respondents, 149 were found eligible for inclusion in the research analysis. Implied consent was obtained from all the participants, and only Dubai and Sharjah residents were invited to participate. A total of 78 people from Sharjah, while 71 from the Dubai region, including 65 males and 83 females, and one participant who preferred not to disclose the gender, contributed to this survey (Tomkovicz, 2020). Thematic analysis was applied to discover the hidden patterns in the survey responses, considering age, gender, and qualification. During the result analysis, the balanced range was found in age, as 76 participants were older than 35 years, 72 participants were under 35 years of age, and one participant opted for the 'Prefer not to say' option. A diverse range of educational backgrounds was found in this survey. A significant portion of 66 participants possessed a bachelor's degree, 44 individuals held master's or doctorate degrees, and 36 participants had completed high school or less, representing a wider spectrum of educational experiences.

Thematic analysis used in this study helped to identify patterns, themes, and underlying meanings within the responses that were not immediately apparent through simple data analysis (Yusoff et al., 2018). Analysis of the survey responses to recognize patterns, themes, and hidden meanings are discussed below.

III. Results

***Q1**: Have you ever received any fire hazard workshop or similar training in the past?*

Out of 149 respondents, 55.70% opted 'Yes' for the question, "Have you ever received any fire hazard workshop or similar training in the past?', 37.58% responded 'No' and 6.71% were not sure about this. The gathered survey responses were passed through Power BI reporting services to find the hidden data patterns and are discussed below.

To begin with, it is very important to know the participants' involvement in the fire safety training in the past. All three variables, such as age, gender, and qualifications, were analyzed to recognize any useful information that can be helpful in our data findings.

Have you ever received any fire hazard workshop or similar training in the past?

Age	No	Not sure	Yes
18 - 24	37.78%	8.89%	53.33%
25 - 34	35.71%	3.57%	60.71%
35 - 44	37.50%	8.33%	54.17%
36 - 44	100.00%		
45 - 54	47.37%		52.63%
55 - 64		25.00%	75.00%
Older than 65	25.00%		75.00%
Total	**37.58%**	**6.71%**	**55.70%**

Gender	No	Not sure	Yes
Female	32.84%	2.99%	64.18%
Male	40.74%	9.88%	49.38%
Prefer not to say	100.00%		
Total	**37.58%**	**6.71%**	**55.70%**

Education	No	Not sure	Yes
Bachelor's degree	32.20%	10.17%	57.63%
College diploma	37.50%		62.50%
High school diploma or equivalent	51.85%	7.41%	40.74%
Less than high school	75.00%		25.00%
Master's or PhD Degree	34.09%	2.27%	63.64%
Some college, no degree	28.57%	14.29%	57.14%
Total	**37.58%**	**6.71%**	**55.70%**

Fig. 1 Age, Gender And Qualification In Terms Of Fire Safety Training

These variables possess useful information to reflect whether fire hazard workshops or similar training were received by the participants. According to the Power BI matrix report in Fig. 1, 47% of the age group 45 – 54, 37.78% of the age group 18–24, and a similar percentage of 37.50% and 35.71% from the age range of 25–34 opted for 'No'. This reflects a smooth variation in terms of age groups who have never received fire hazard workshops or training in the past. A total of 37.58% of all age groups have never received any fire safety training. Surprisingly, a similar percentage of male and female groups have never attended workshops on fire safety; whereas males made most of this contribution, and 40.74% of males have been deprived of fire safety trainings. When we broaden our findings on education level, it is evident that participants who hold less than a high school degree never appeared in fire safety training, and 51.85% of participants who received a high school diploma or equivalent have never received fire hazard training. College diploma holders made up 37.50%, master's or PhD degree holders 34.09%, bachelor's degree holders 32.30% and some college, no degree made 28.57% who opted 'No' for the question 'Have you ever received any fire hazard workshop or similar training in the past?'. Though the training should be given to all age groups, including males and females, there should be more concentration on training high school or less than high school degree holders (Fig. 1).

***Q2**: What training methodologies were used during the training or workshop?*

In this training methodologies question, practical demonstrations were the most frequently mentioned training methodology, appearing 57 times; PowerPoint presentations were the second most popular aid, with a frequency of 39, followed by videos, which appeared 34 times in the training methods. Discussions were significantly apparent in 31

responses, whereas leaflets/brochures and others were mentioned significantly less, with 15 and 3 appearances, respectively, as shown in Fig. 2.

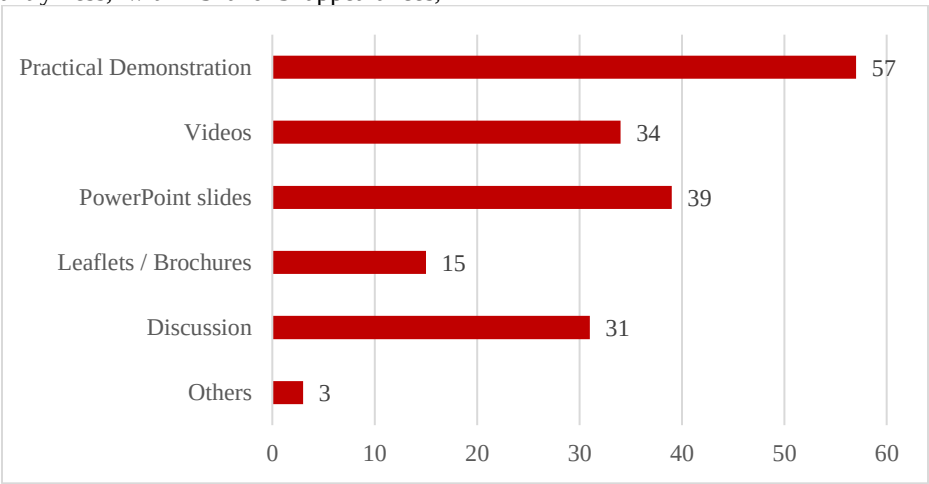

Fig. 2 Training Methodologies used in Fire Safety Training Workshops

Practical demonstrations are highly effective in fire hazard recognition training, but they require additional fire safety equipment such as fire extinguishers, fire blankets, fire balls, kitchen appliances, and physical setup, which increases the training cost. Conventional training techniques such as PowerPoint slides, videos, brochures, and discussions can still provide information but lack contextual learning (Leder et al., 2019). Fire safety and hazard awareness training demands practical skills, contextual learning, and guidance from experienced professionals (Kodur et al., 2020). These requirements often challenge the needs of residents, leading to a gap in fire safety skills development and preparedness among the general public.

***Q3**: How often do you attend such training or campaigns?*

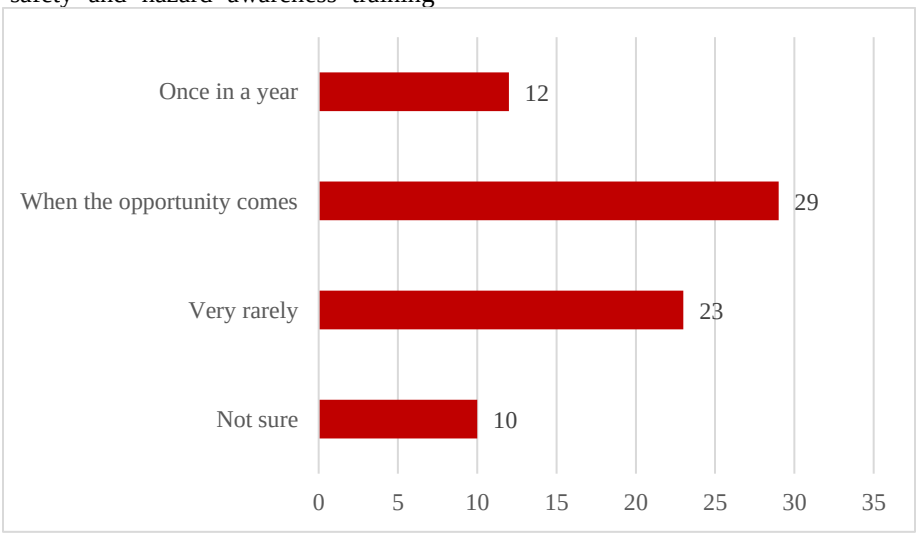

Fig. 3 Frequency Of Training/Workshop Campaigns

The answer to this question reveals valuable insights. While most respondents (29) indicated attending training when opportunities arise, 23 stated it's very rare to attend such training, 12 attended the training once in a year, and 10 were unsure about it. Notably, many respondents declined to answer, raising further questions as illustrated in Fig. 3. It is clear that many individuals do seek fire safety training when offered. The high rate of employer-provided training (as indicated in response to question 7) aligns with this observation. To enhance the public preparedness, increasing the availability and accessibility of fire safety training opportunities is crucial.

Data analysis of participants based on education and gender revealed intriguing patterns as shown in Table I. Notably, 48.99% left this question without providing the answer, reducing the effective sample size to around 51%. Focusing on the 51% of the remaining population in this question, we observed the following trends:

In the 'Less than high school' education stream, only female respondents answered by choosing the option 'When the opportunity comes'. 'High school diploma or equivalent', 20% of females selected 'Not sure', the same proportion in this category chose 'Once in a year' and 10% of females in this educational category answered, 'very rarely'. Whereas

6.25% of males were 'Not sure' about this question, 12.50% received trainings/workshops 'Once in a year' and the remaining 6.25% chose 'Very rarely'.

TABLE I EDUCATION/GENDER WISE FREQUENCY OF TRAINING/WORKSHOP CAMPAIGNS

Education/Gender	No Answer	Not sure	Once in a year	Very rarely	When the opportunity comes
Less than high school	**75.00%**	**0.00%**	**0.00%**	**0.00%**	**25.00%**
Female	0.00%	0.00%	0.00%	0.00%	100.00%
Male	100.00%	0.00%	0.00%	0.00%	0.00%
High school diploma or equivalent	**66.67%**	**11.11%**	**14.81%**	**7.41%**	**0.00%**
Female	50.00%	20.00%	20.00%	10.00%	0.00%
Male	75.00%	6.25%	12.50%	6.25%	0.00%
Prefer not to say	100.00%	0.00%	0.00%	0.00%	0.00%
College diploma	**50.00%**	**0.00%**	**25.00%**	**25.00%**	**0.00%**
Female	50.00%	0.00%	16.67%	33.33%	0.00%
Male	50.00%	0.00%	50.00%	0.00%	0.00%
Some college, no degree	**57.14%**	**0.00%**	**42.86%**	**0.00%**	**0.00%**
Female	50.00%	0.00%	50.00%	0.00%	0.00%
Male	66.67%	0.00%	33.33%	0.00%	0.00%
Bachelor's degree	**47.46%**	**8.47%**	**1.69%**	**13.56%**	**28.81%**
Female	40.91%	18.18%	0.00%	9.09%	31.82%
Male	51.35%	2.70%	2.70%	16.22%	27.03%
Master's or PhD Degree	**36.36%**	**4.55%**	**4.55%**	**27.27%**	**27.27%**
Female	29.17%	8.33%	4.17%	25.00%	33.33%
Male	45.00%	0.00%	5.00%	30.00%	20.00%
Grand Total	**48.99%**	**6.71%**	**8.05%**	**16.11%**	**20.13%**

Among males and females in the 'College diploma' educational category, 16.67% of female participants received training 'Once in a year', 33.33% expressed 'Very rarely', whereas 50% of male respondents attended workshops 'Once in a year'. In the 'Some college, no degree' category 50%, of female and 33.33% of male participants attended trainings or workshops, 'Once in a year' respectively. In the 'Bachelor education' category, 18.18% of females and 2.70% of males opted for 'Not sure', 9.09% of females and 16.22% of males revealed that they received these trainings very rarely. A small portion of 2.70% of males chose 'Once in a year' in this survey question. 31.82% of females and 27.03% of males followed the 'When the opportunity comes' option. 'Master's degree or PhD Degree' holders, 8.33% of female participants opted for 'Not sure', 4.17% answered 'Once in a year', 25% chose 'Very rarely', and 33.33% expressed 'When the opportunity comes'. 5%, 30% and 20% of males selected 'Once in a year', 'Very rarely', and 'When the opportunity comes' respectively.

Q4*: Are you satisfied with the training received in fire safety?*

66 out of 149 respondents expressed satisfaction with their training received, eight were dissatisfied, and 75 individuals did not provide an answer. Further investigation is needed to determine why a significant portion of participants were unable or unwilling to answer this question. 46 males and 28 females did not answer the question. This shows that the ratio of male participants is more than that of female participants who left this question blank.

Q5*: What do you like about these training workshops or awareness campaigns?*

The word-cloud shown in Fig. 4, illustrates respondents' overall liking of the training workshops or awareness campaigns they received. Key aspects that were appreciated by the participants included practical demonstrations, fire safety lessons, information and knowledge gathering, situational awareness, financed by the employer, evacuation drills, smoke alarm testing, and discussion. Some respondents filled this field with meaningless words or sentences, such as 'yes', 'nothing', 'everything', '.', 'none', 'good' and 'class', etc.

The word-cloud reveals the participants' liking of their training, as the prominent features of fire safety training include hazard awareness, practical demonstrations, knowledge acquisition, fire safety techniques, emergency procedures, education, situations, etc. These highlights are relevant to fire safety education.

Q6: What do you dislike about these training workshops or awareness campaigns?

Due to the diverse nature of the responses received in this question, some adjustments were required to ensure accuracy and consistency. Similar phrases such as 'overcrowded', 'too many people', 'duration', 'time-consuming', 'no practical demonstration', 'lack of context', 'lack of situational learning', 'missing emerging technologies' or 'lack of technology' were consolidated into single relevant terms. This standardization allowed a more focused analysis of the making of word-cloud. Once the data was refined, the word-cloud visually represented the distribution of responses as shown in Fig. 5. The word-cloud provided valuable

information on the key issues and concerns expressed by the respondents. The participants' feedback highlighted several recurring themes that emerged as significant challenges in the fire safety and awareness campaigns.

Fig. 4 Word-Cloud - Positive Feedback Of These Campaigns

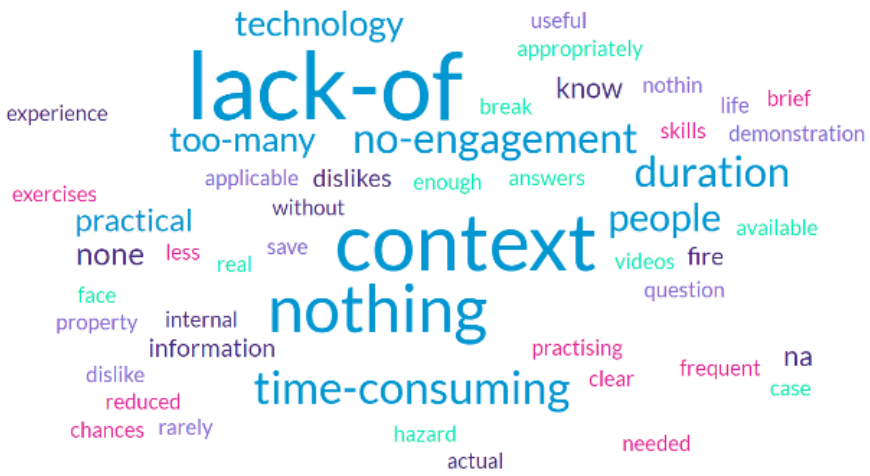

Fig. 5 Word-Cloud Negative Aspects Of These Awareness Campaigns

These included:

- Lack of contextual learning: Participants expressed a true desire to incorporate more realistic scenarios to better prepare them for fire emergencies.
- Lack of technology: There is an urge for making use of the latest emerging technologies during the fire safety workshops/training. This suggestion is highly recommended, as it can reduce the dependency on fire safety equipment, which increases the fire safety training costs, and the provision of these hardware resources to different community levels can be challenging as well.
- No engagement: Many respondents indicated that maintaining engagement throughout the training workshops/awareness campaigns was difficult. The material used in these workshops should be reassessed in order to engage different audiences.
- Too many people: Survey respondents in larger workshops frequently complained about limited individual attention and difficulty in practicing life-saving skills due to overcrowding. This also refers that participants during the workshop/training were unable to receive constructive feedback for their effective learning growth.
- Duration: The long duration of these workshops was sometimes perceived as a barrier to effective learning. This can be considered by organizing similar workshops frequently with targeted messages instead of dumping all the information in a single session.

***Q7**: Who sponsored the workshop/training?*

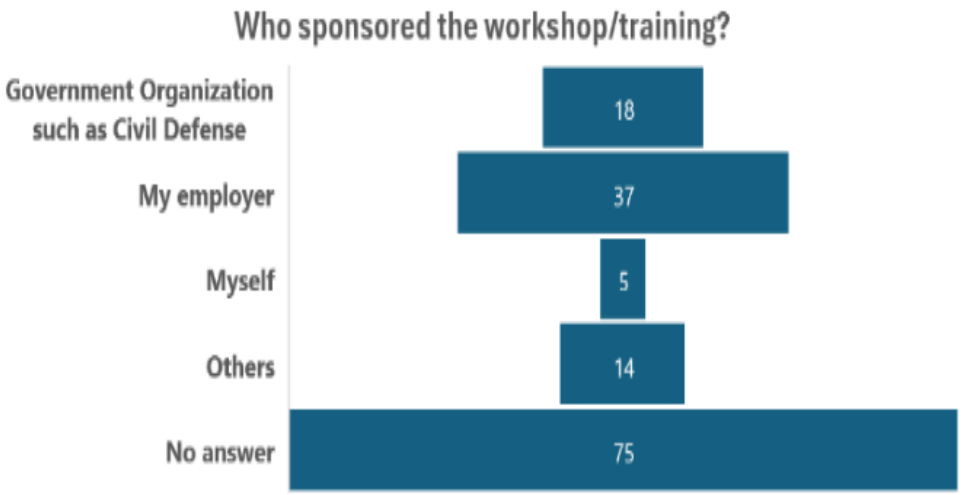

Fig. 6 Who Sponsored The Workshop/Training?

The question about who sponsored the workshop/training brings valuable information. While most participants (75 out of 149) refused to answer this question, the remaining responses were varied. According to Fig. 6, the majority of participants (37 out of 149) indicated that their 'Employer' arranged fire safety workshops or training sessions, followed by 'Government Organizations such as Civil Defense' (18 out of 149). The 'others' category was selected by a smaller number (14 out of 149), and only a few (five out of 149) self-funded fire safety training. Thematic analysis shows that almost 68% of the population in this survey received bachelor's degree education or below, and these samples did not answer this question, and the remaining population relied on receiving training from their employers. It is evident that of the participants who answered this question, only 3.36% relied on themselves in training themselves for fire safety training.

***Q8**: Do you use search engines or any other platform to learn more about fire safety?*

The survey question concerning the use of search engines or similar platforms in fire safety training was incorporated to evaluate the extent to which individuals use these tools for better fire safety education. The responses supplied valuable information; despite the fact that half of the respondents, 75 out of 149, left the question without an answer, the remaining responses provided valuable information. A substantial majority of respondents (46 out of 149) indicated using search engines to learn more about fire safety, as shown in Table II below.

TABLE II USE OF SEARCH ENGINES IN FIRE SAFETY

No answer	**75**
No	28
Yes	46

The high percentage of participants using search engines to learn fire safety skills highlights the potential for learning more about fire safety using digital platforms. A small number of respondents (28 out of 149) opted for 'No', which indicates their self-sufficiency in the available resources. Overall, the data received in this research question indicates a significant interest in fire safety training and a preference for online resources.

***Q9**: Have you seen these awareness campaigns material such as brochures and videos before and how easy is it for you to find these brochures or training materials to enhance your fire safety skills?*

It is highly recommended to know whether the general public knows about available training materials and awareness campaigns in their community. During the survey, some brochures/leaflets and awareness campaign videos were shown to respondents to know their familiarity with these learning sources. The results of Q9 are listed in Table III and discussed below.

TABLE III Q9 (AVAILABILITY OF LEARNING MATERIALS)

Have you seen these brochures before?	Yes	50
	No	43
	Maybe	56
How easy is it for you to find these brochures or training materials to enhance your fire safety skills?	Very difficult to find	9
	Somewhat difficult to find	29
	Neutral	50
	Fairly easy to find	43
	Very easy to find	18

Out of 149 participants, 50 revealed a clear preference that 'Yes', they have seen these brochures or awareness campaign materials before. 43 chose 'No', and the remaining 56 participants were unsure about these available materials and opted for 'Maybe'. According to this information, we can confirm that the majority of participants have not come across these awareness campaign materials.

On the other hand, answering, 'How easy is it for you to find these brochures or training materials to enhance your fire safety skills?' A wide range of experiences were revealed. A significant portion of the sample (61) found it easy to find the available learning materials, such as brochures, leaflets, and awareness videos. However, 50 participants remained neutral in answering the question, whereas 38 participants found accessing these awareness campaign materials difficult. If we ignore neutral answers, 38% of the sample population faced challenges accessing these available materials.

Q10: Which of the following difficulties did you face to develop fire hazard recognition skills?

Survey participants were asked to choose the difficulties they encountered in developing fire hazard recognition skills. In this case, some choices were presented to survey respondents, and they were allowed to choose multiple options from the available ones.

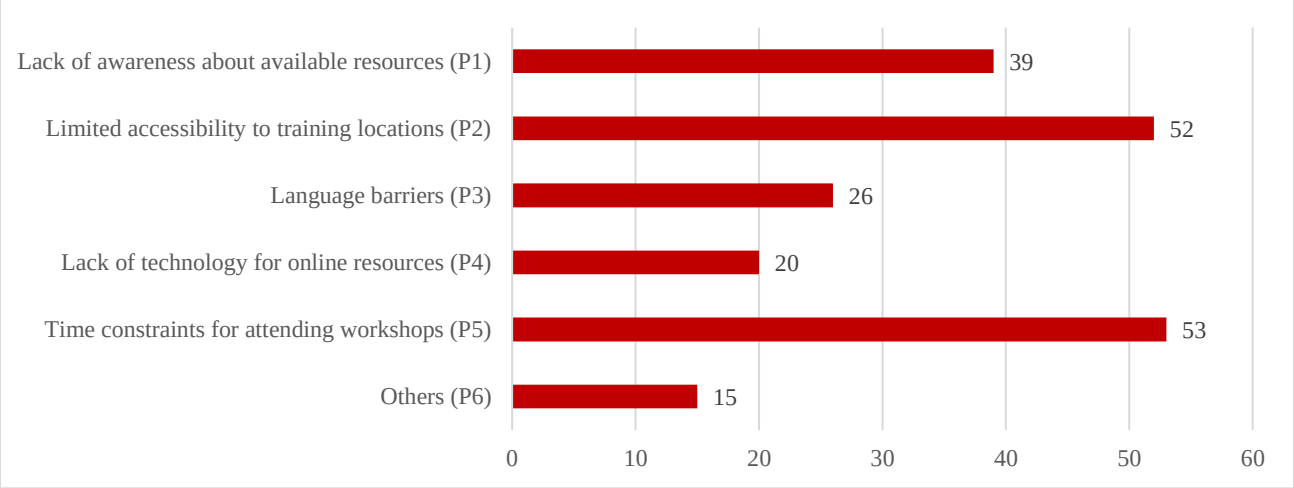

Fig. 7 Types Of Difficulties Faced In Developing Fire Safety Skills

As illustrated in Fig. 7 above, the foremost difficulty faced by participants is 'Time constraints for attending workshops or trainings', the second most difficulty identified by participants is 'Limited accessibility to training locations', the third most notable concern is the 'Lack of awareness about available resources', and the fourth most common issue found in fire hazard recognition skills development is the 'Language barriers in education materials'. The second last difficulty recognized by the participants is the 'Lack of technological access for online resources'. Finally, a few participants chose 'Others', which was not listed in the survey as the possible difficulty level. The question 'Which of the following difficulties did you face to develop fire hazard recognition skills? (Select all that apply)' options were coded as per the categories to identify the hidden patterns. Since participants were given the choice to make one or more selections out of the given choices. First, choices were categorized into P1, P2, P3, P4, P5, and P6 with respect to 'Lack of awareness about available resources', 'Limited accessibility to training locations', 'Language barriers', 'Lack of technology for online resources', 'Time constraints for attending workshops', and 'Others'. After coding the available choices into P1, P2, P3, P4, P5 and P6, two independent variables, age and gender were assessed to find the common difficulties faced by participants.

TABLE IV TYPES OF DIFFICULTIES WITH RESPECT TO AGE AND GENDER

Category		Lack of awareness about available resources (P1)	Limited accessibility to training locations (P2)	Language barriers (P3)	Lack of technology for online resources (P4)	Time constraints for attending workshops (P5)	Others (P6)
Age	18-24	8	15	9	4	12	0
	25-34	7	11	4	1	12	8
	35-44	17	18	9	12	20	6
	45-54	6	5	3	3	8	0
	55-64	0	1	1	0	0	0
	>65	1	2	0	0	1	1
	Age Total	**39**	**52**	**26**	**20**	**53**	**15**
Gender	MALE	18	25	11	7	22	8
	FEMALE	20	26	15	13	31	7
	PREFER NOT TO SAY	1	1	0	0	0	0
	Gender Total	**39**	**52**	**26**	**20**	**53**	**15**

Table IV provides a summary of difficulties with respect to age and gender. The most common difficulty faced by participants by all age groups were 'Time constraints for attending workshops (P5)' (53), 'Limited accessibility to training locations (P2)' (52), 'Lack of awareness about available resources (P1)' (39), 'Language barriers (P3)' (26), 'Lack of technology for online resources (P4)' (20) and 'Others (P6)' (15). These difficulties are repeated by all age groups in the survey data. Almost similar patterns were found in gender data and all these patterns become the common issues concerning age and gender.

Q11: Do you think that the fire safety training campaigns should have ease of *accessibility*, relevant contents, and practical demonstrations in a safe manner?

This question was pertinent to the current state of accessibility, relevant training content, and practical demonstrations. 119 out of 149 candidates showed a positive response ('Yes') and supported the strong need for easy accessibility, relevant materials, and practical demonstration while ensuring participant safety. 16 out of 149 recorded their opinion against this question and opted 'no', whereas 14 out of 149 were not sure how to answer this question and chose the 'not sure' option. With the available data, we can confidently confirm that participants were strongly motivated that the safety campaigns and fire safety training should have easy accessibility, relevant contents, and practical demonstrations.

Q12*: What will be your preferred source of fire safety training in the future?*

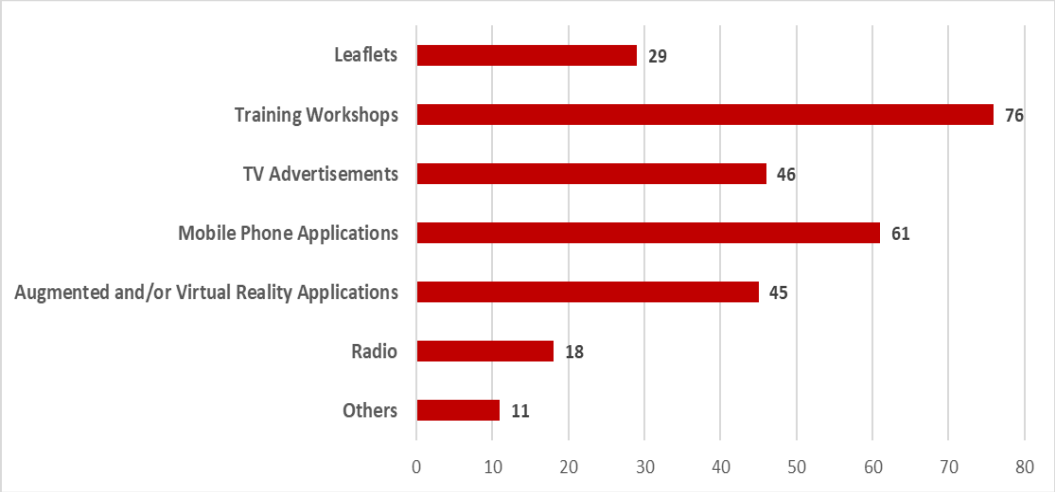

Fig. 8 Future preferred source of fire safety training

This is one of the core questions, highlighting how the community wants to develop their skills in fire safety training. Some options were provided to respondents to make selections from the given options, such as *'leaflets, training workshops, TV advertisements, mobile phone applications, augmented and/or virtual reality applications, radio, and others.*'. We received interesting facts about future training, and a few of them were promising as well if adapted to fire safety training. Since participants were given the choice to make multiple selections, they recorded several choices. Training workshops stood on top, picking this option 76 times over all other options. Mobile phone applications were picked 61 times and secured second place; TV advertisements made third place by being chosen 46 times, whereas augmented and virtual reality placed fourth as they appeared 45 times, one point short of third place. Leaflets ranked fifth, as they were repeated 29 times in the participants' selection; radio ranked second last, with a frequency of 18 times, and others came last, with 11 times being picked, as illustrated in Fig. 8.

The summary of the Fig. 8 is reflected in table V below.

TABLE V PREFERRED SOURCE OF FIRE SAFETY TRAINING IN THE FUTURE

Gender	Leaflets (P1)	Training workshops (P2)	TV Advertisements (P3)	Mobile Phone Applications (P4)	Augmented and/or virtual reality applications (P5)	Radio (P6)	Others (P7)
Male	16	33	24	30	25	10	5
Female	13	42	22	31	20	8	6
Prefer not to say	0	1	0	0	0	0	0
Total	**29**	**76**	**46**	**61**	**45**	**18**	**11**

The same data was analyzed to find patterns with respect to age, and to achieve this, first options were categorized to P1 - P7, such as 'Leaflets (P1)', 'Training Workshops (P2)', 'TV Advertisements (P3)', 'Mobile Phone Applications (P4)', 'Augmented and/or virtual reality applications (P5)', 'Radio (P6)', and 'Others (P7)'. This analysis helps understand

individuals learning preferences as per gender information. Training workshops (P2) were the most popular learning method among participants, with 42 females and 33 males choosing this method over the other available options. It is apparent that mobile phone (P4) applications were popular in training because of their convenience, as every adult owns a smartphone these days, and it is convenient for them to practice lifesaving skills (Singh & Samah, 2018). 31 females and 30 males chose smartphones as the second most preferred source of skills transfer. TV advertisements were at third place, as 24 males and 22 females suggested using this broadcast media for fire safety awareness campaigns. With one point short of third position, augmented and virtual reality applications (P5) were found the fourth popular training platform to build serious skills, as 25 males and 20 females recorded their contributions in favor of emerging technology. Leaflets (P1) with 29 selections made by male and female participants took fifth position, and the last two places were taken by Radio (P6) with 18 frequencies and Others (P7) were repeated 11 times in the data.

IV. Discussion

Question 1 contains key information on the current status of awareness campaigns and training workshops conducted in the twin cities. Nearly half of the respondents lacked fire hazard training or awareness campaigns, increasing the lack of preparedness to fire related emergencies. This may contribute to the rise of fire incidents observed in the Dubai and Sharjah Emirates. It is vital to ensure that everyone receives fire hazard recognition training to enhance fire prevention and response. Thematic analysis was employed to find hidden patterns or data insights. Almost 50% males have not received the fire safety training in the past, and 35% females could not attend any fire safety training. An individual who did not disclose gender has never received training in the past. These are alarming Figures and correlate to the number of incidents reported in the Dubai and Sharjah Emirates. The qualification level also plays an important role in attending training workshops or participating in fire safety campaigns (Yaman et al., 2024). The majority of the participants whose education was a bachelor's degree or lower, were deprived of fire safety training. It seems that highly qualified people get more chances, either through employers or government agencies, to receive fire safety training. Since Dubai and Sharjah are the two diverse metropolitan cities, and the housemaids come from different countries and qualification backgrounds; this factor can cause fire threats. It is recommended that less qualified people should be given more chances to train themselves in understanding fire threats and taking appropriate measures. Considering the age variable, we received mixed responses among the participants; however, people below 40 years of age get fewer chances to receive fire safety training.

Question 2 of the survey highlights the training methodologies used during the training. This provides the common training techniques, which include practical demonstration, videos, PowerPoint presentations, leaflets, and discussion. While practical demonstrations are extremely useful in fire safety trainings, they add additional cost to training as they require resources such as qualified instructors, fire safety training equipment, and environment setup (Lawson et al., 2020). Ensuring the safety of the learners also becomes challenging during practical demonstrations (Huseyin & Satyen, 2006). Use of emerging technologies such as augmented and/or virtual reality-based training can overcome these challenges and provide contextual fire safety trainings to individuals (Zhang et al., 2017). PowerPoint slides are very useful for knowledge transfer, but it is considered an extremely passive technique, as the learning styles of participants differ from each other (Leder et al., 2019). As we are aware, fire safety training requires contextual learning, such as how a fire can start when using candles, throwing cigarette butts, or due to mechanical issues, etc. All these scenarios can't be depicted in PowerPoint presentations, or if someone has used them in a slide deck, they still will not achieve the feel of presence or realism (Leder et al., 2019). The distribution of leaflets/brochures to the general public can be questioned as well, as it is unclear whether the brochures and/or leaflets reach to the right person and convey useful information (Seymour, 2018). On the other hand, these awareness campaigns target only the specific message, which limits the effectiveness of such techniques for ensuring skills development in public (McGuire et al., 2021). The 'Other' option in the survey reveals that there are other techniques used during the training or workshops. Though the number of participants who selected this option is negligible, we failed to capture further information on any uncommon training methodologies.

Fig. 3 and Table I offer valuable insights into fire safety training frequency which were revealed in question 3. Notably, individuals with lower qualifications, such as those with less than high school, including males and females, are not part of these awareness campaigns or training workshops. Though it is beyond the scope of this study, it's highly important to note that maids hired in the living community, often with lower education, can make critical mistakes in the house while cooking, cleaning or doing normal activities in the house, which may lead to fires (Gouveia da Silva & Lopes, 2008). Among the remaining participants who hold bachelor's degrees, 1.69% reported receiving fire safety skills training at least once a year. Approximately 42% mentioned that they appeared in such training rarely or when the opportunity comes, whereas 47.46% of the population did not answer this question. To address these gaps, it is suggested that frequent fire safety training should be conducted while participants are completing their education or after the education as well. Majority of participants left question 4 unanswered which requires further scrutiny to avoid any misconceptions about the satisfaction level of fire safety training. Fig. 4 lists the features of an ideal training workshop or awareness campaigns recognized in question 5. Participants like practical demonstrations, situational awareness, knowledge of hazard identification, fire safety techniques and emergency procedures. Fire safety training is essential to every UAE citizen because skyscrapers, subways,

malls, schools, and factories are filled with people who may not know how to respond in a fire. Without adequate fire safety training, panic and chaos often prevail during emergencies, leading to unnecessary injuries and fatalities (Calvo et al., 2021). UAE's diverse population can also contribute, as people from different walks of life have different lifestyles. For example, celebrating indoor Diwali where fire crackers are used, long-unattended cooking during Eid celebrations, cluttered wires, jammed exhaust fan due to dust storm in UAE, storing gas cylinders and chemicals inside the apartment due to hot outside weather, use of candles and indoor smoking are all fire hazards (Kodur et al., 2020). Further, people moving from rural areas may not be aware of sophistication in the urban areas. Sophisticated burners can be difficult to understand, leading to unintended fire accidents. Also, lack of knowledge of using fire extinguishers, evacuation plans, and language barriers are key challenges in urban areas. Fire safety instructional material including text, images and videos supports knowledge building and helps learner's cognitive processes. Several participants complained about the conventional fire safety training and awareness campaigns due to the lack of contextual learning, lack of technology, no engagement, large groups training, and duration in question 6. Typical training methods that use text and multimedia materials may fall short in developing and memorizing special skills (Feng et al., 2018). In addition, if learners are not psychologically involved in the learning practices, the effectiveness of the knowledge development and retention process may fail (Gwynne et al., 2019). Psychological involvement in education enables learners to be emotionally and mentally engaged in the learning process; as a result, learners are motivated, attentive in remembering and applying what they have learnt. This means that if learners are not involved in learning context, they may not improve their behavior (Buttussi & Chittaro, 2018). An example of passive learning could be a student sitting in a classroom and copying notes without thinking about the contents. In contrast, psychologically involved students think about safety rules, recognize hazards and are mentally prepared to emergency responses. The above limitations are the challenges when educating learners about practical skills such as Firefighting and evacuation drills (Feng et al., 2018). The emerging cutting-edge augmented and virtual reality architecture can provide the contextual learning experiences needed to enhance fire safety training, make learning scalable, portable, repeatable and providing real-time feedback (Faiz et al., 2024). Fig. 6 in question 7 stipulates an alarming result because the participants rely on either government organizations, employers, or other ways of training. Fire safety training requires resources and qualified trainers and adds to training costs. It is most likely that the general public may not be able to afford these trainings and rely on employers or government resources (Moisanu et al., 2023). People often use search engines or similar platforms for safety training as shown in Table II of question 8 which highlights the importance and inclusion of digital media for these purposes. The results of question 9 raises concerns as majority of the participants have not seen awareness campaigns materials or faced difficulties in accessing these resources as seen in Table III. Time duration, limited accessibility to training locations, lack of awareness about available resources, language barriers and lack of technology integration are prominent challenges identified in question 10, and such barriers can be avoided through augmented and virtual reality applications. This was supported by participants in question 11 and 12 by voting in the favor of mobile phone applications, and the use of augmented and virtual reality training applications which can deliver multilingual training workshops. Every individual possesses a smartphone, and designing and developing fire safety applications for Android and iOS users can overcome the accessibility challenge, as indicated in question 11. Beyond the presence of specialized institutes and advanced apparatus, fire safety initiatives are a shared responsibility. In order to raise awareness of enforcing regulations and following best fire safety practices in prevention and response, government agencies, businesses, and individuals must collaborate effectively (Alfalasi et al., 2022). Education and training programs, emergency exercises, and awareness campaigns among the general public are essential elements of initiatives to promote a proactive approach to fire safety (Al-Kaabi & Hadipriono, 2003). The government requires the best planning, architectural engineering, and building practices in order to protect its citizens and property. This requires prioritizing the fire and life safety skills (Kodur et al., 2020).

AR/VR technologies are evolving rapidly from novel visualization tools to indispensable, mission-critical tools for data-driven fire safety decision making and have the potential to transform how we assess risks, plan response, and train personnel. The real power of this connection, however, is the technology's distinctive capability to operationalize massive and complex datasets – from Building Information Models (BIM) and IoT sensor networks to historical incident reports and drone footage from community – by transforming it into immersive, spatially accurate, intuitively accessible experiences (Patti et al., 2017). This allows for proactive, evidence-based planning and infrastructure design rather than just applying theoretical best practices and validated solutions in a risk-free virtualized space. On the other hand, AR projects vital information directly over an actual Firefighter's field of vision in smart glasses or helmets and establishes an invaluable connection between pre-incident planning and live emergency action. By overlaying the digital twin of a building over the hidden and chaos-ridden environment that it has become with smoke filling it, AR can offer navigation cues in real time to exits, survivors, and utilities–while also presenting live sensor data on oxygen levels or structural warnings right in front of their faces. AR/VR can promote fire safety education to the wider community making it scalable and flexible training options for many residents with learner-centered training options. This technology can provide contextual learning, engagement, motivation and real-time feedback to enhance cognitive learning process and knowledge retention. The immersive nature of AR/VR can make learning safe due to

3D environments, simulations and animation effects which are missing in the conventional passive learning techniques.

V. CONCLUSION

This was our first survey; we recruited 149 participants from the Dubai and Sharjah Emirates for data analysis. Approximately 45% of participants have not participated in any fire safety training or are unsure about any similar training in the past. More frequent training should be given to residents of Dubai and Sharjah by making these life safety skills mandatory in educational institutions and workplaces, and the efficacy of awareness campaigns should be constantly monitored. Training methodologies used in the current awareness campaigns or workshops seem less appropriate because of the nature of the training. To demonstrate practical skills to residents, an immersive and engaging environment needs to be developed (Morélot et al., 2021). PowerPoint slides, videos, discussions, and leaflets are considered as less effective in fire safety skills (Leder et al., 2019). Practical demonstrations are highly effective in enhancing fire safety skills. However, practical demonstrations may increase the training cost and requires some additional setup, such as hiring qualified training staff, etc. (Kodur et al., 2020). Emerging technologies, such as augmented and virtual reality, provide immersive environments where participants disconnect themselves from the physical world. AR/VR technology could be utilized in similar training courses to provide immersive environments, practical demonstrations, interactions, and feedback. This does not require any additional cost, and once the effective platform is built, many users can take advantage of this platform and build their fire safety skills.

Majority of the participants rely on attaining fire safety skills when the opportunity comes, or they get these opportunities very rarely. Education is also critical here, as participants with less than a high school degree are the least likely to get fire safety training opportunities. Housemaids hired in the Dubai and Sharjah Emirates are the least qualified individuals, and they come from underdeveloped countries (Roumani, 2005) These individuals are a potential risk to society if not educated well on fire safety rules. Proper legislation must be announced to the higher authorities of maid service providers to extensively provide fire safety skills to all the employees. Further, fire safety training should be available in public and private schools and universities. Workplaces should be educated to conduct frequent fire safety workshops to avoid emergencies.

One of the prominent drawbacks mentioned by most of the participants was the lack of contextual learning. This indicates that conventional training lacks the contextual fire safety education, or there is a gap in the contents taught or demonstrated concerning the fire safety issues they encounter daily. Lack of technology, lack of engagement, group training, and duration are the limitations that most participants mentioned. All these mentioned issues are relevant to training workshops conducted in groups, as large number of participants are deprived from the use of fire safety tools, lack of feedback and interaction with participants leading to engagement issues (Gosser et al., 1996; Gouveia da Silva & Lopes, 2008). Use of search engines reveals that approximately 60% of the participants use online search engines to develop their fire safety skills, excluding the population that did not answer this question. This figure is extremely high, and it stresses the need for educational resources to be available to the community. Approximately 67% of the participants have not seen or are not sure about seeing these brochures or videos used in the awareness campaigns. This means that awareness campaigns are not effective enough to reach the general community or content designs were not attractive enough to grab residents' attention. Further investigation is required to find out whether awareness campaign materials are not attractive enough to grab people's attention or if these materials are not reaching the community properly.

Time constraints for attending workshops or training, limited accessibility to training locations, and lack of awareness about available resources are the most prominent difficulties highlighted among others. Many participants also cited language barriers and a lack of technological access to online resources, which is understandable, as diverse communities live in these twin cities. Though English is the most widely used language, low qualified people for whom English is not their first language may find it difficult to attend such trainings. Similarly, some tech-savvy people like the inclusion of technology in these available resources, leaving room for improvement in the current training materials. Further investigation is required to understand the difficulties faced by participants. Approximately 80% of the population showed a positive interest in updating the current training materials by ensuring ease of accessibility, relevant content, and practical demonstrations along with safety. This means that the available training resources lack the relevant contents, safety, and practical demonstration. Maybe localized content catering to the needs of Dubai and Sharjah residents can eliminate this gap. The community wants to develop their emergency skills using the latest technology, such as training workshops, mobile phone applications, augmented/virtual reality platforms, and television campaigns. If we consider the issues discussed above by many participants, such as sponsoring workshops, time constraints, lack of practical demonstrations, engagement issues, and lack of resources, it is highly recommended that fire safety trainings should make use of smartphones and emerging technologies such as augmented and/or virtual reality platforms (Sungkur et al., 2016). With these platforms, the training organizations can achieve contextual learning, immersive experiences, a sense of presence, engagement, practical demonstrations, and above all, do so in a safe manner. Participants can be given effective feedback immediately if they make mistakes, they can repeat the training multiple times without misusing the resources, ultimately reducing the cost (Mąkosa, 2013). Accessing training locations and timings will not be any issue, as these technologies can be used anywhere. Further, training contents can be customized to cater to the participants' needs,

and language barriers can be avoided by providing multilingual support. The information identified through the survey highlights the development of fire safety education using technology such as mobile applications and the integration of AR/VR and IoT applications. Fire safety educators must input their feedback and community involvement to offer a rich, context-based, real-time, and interactive fire safety awareness program. Modern awareness campaigns should handle language barriers, scalability, and flexibility of these training workshops. These trainings can enhance human perception about fire safety, emergency decision-making, hazard mitigation, and proper evacuation drills. Future research should adopt the concerns raised above and expand the findings presented in this study. By continuing to investigate this domain further, we can gain a deeper understanding of fire safety and develop more effective strategies for the safety of our community.

Acknowledgment

We are extremely thankful to Skyline University Sharjah's management for allowing us to use their venue for research data gathering.

Data Availability

The survey data can be shared upon request.

Funding

None

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

[1] Al Blooshi, L. S., Abuelgasim, A., Nassar, A., & Ksiksi, T. (2020). Impact of desert urbanization on urban heat islands effect. *Open Journal of Geology*, *10*(7), 760-770.

[2] Al Blooshi, L. S., Ksiksi, T. S., Nassar, A., & Abuelgasim, A. (2018). The impact of desert urbanization on land surface temperature in the United Arab Emirates (UAE). In *Proc.-39th Asian Conf. Remote Sens. Remote Sens. Enabling Prosper. ACRS 2018* (Vol. 1, pp. 480-491).

[3] Alfalasi, S., Akmal, S., & Hakimi, H. (2022). Quality Awareness on Fire Safety Equipment for A Building. A Review Paper from The UAE Perspective. *resmilitaris*, *12*(4), 253-261.

[4] Ali, K., & Mubin, S. (2023). Measuring Effectiveness Of Safety Management System Of Multistory Building: Fire Safety Audit. *Urbanism. Architecture. Constructions/Urbanism. Arhitectura. Constructii*, *14*(3).

[5] Al-Kaabi, N., & Hadipriono, F. (2003). Construction safety performance in the United Arab Emirates. *Civil Engineering and Environmental Systems*, *20*(3), 197-212. https://doi.org/10.1080/1028660031000081536

[6] Alqassim, M. A., & Daeid, N. N. (2014). Fires and related incidents in Dubai, United Arab Emirates (2006–2013). *Case Studies in Fire Safety*, *2*, 28-36. https://doi.org/10.1016/j.csfs.2014.10.001

[7] Blogger, G. (2024, 29/09/2024). United Arab Emirates Population Statistics 2024. *United Arab Emirates Population Statistics 2024*.

[8] Boas, T. C., Christenson, D. P., & Glick, D. M. (2020). Recruiting large online samples in the United States and India: Facebook, mechanical turk, and qualtrics. *Political Science Research and Methods*, *8*(2), 232-250. https://doi.org/10.1017/psrm.2018.28

[9] Buttussi, F., & Chittaro, L. (2017). Effects of different types of virtual reality display on presence and learning in a safety training scenario. *IEEE transactions on visualization and computer graphics*, *24*(2), 1063-1076. https://doi.org/10.1109/TVCG.2017.2653117

[10] Calvo, J. A. S., Merci, B., & Frangi, A. (2021). *Green-Cities, How to Combine Fire Safety and The Fig.ht Against Global Warming* Master thesis ETH Zurich, Switzerland].

[11] Connelly, L. M. (2016). Cross-sectional survey research. *Medsurg nursing*, *25*(5).

[12] Engelbrecht, H., Lindeman, R. W., & Hoermann, S. (2019). A SWOT analysis of the field of virtual reality for fireFig.hter training. *Frontiers in Robotics and AI*, *6*, 101. https://doi.org/10.3389/frobt.2019.00101

[13] Faiz, T., Tsun, M. T. K., Mahmud, A. A., & Sim, K. Y. (2024). A Scoping Review on Hazard Recognition and Prevention Using Augmented and Virtual Reality. *Computers*, *13*(12), 307. https://doi.org/10.3390/computers13120307

[14] Feng, Z., González, V. A., Amor, R., Lovreglio, R., & Cabrera-Guerrero, G. (2018). Immersive virtual reality serious games for evacuation training and research: A systematic literature review. *Computers & Education*, *127*, 252-266. https://doi.org/10.1016/j.compedu.2018.09.002

[15] Fu, S., Yusoff, Y. M., & Muhaiyuddin, N. D. M. (2024). Immersive Virtual Reality (IVR) Systems for Comprehensive Fire Safety Education in Primary School. *J. Wirel. Mob. Networks Ubiquitous Comput. Dependable Appl.*, *15*(3), 424-444. https://doi.org/10.58346/JOWUA.2024.I3.028

[16] Gosser, D., Roth, V., Gafney, L., Kampmeier, J., Strozak, V., Varma-Nelson, P., ... & Weiner, M. (1996). Workshop chemistry: Overcoming the barriers to student success. *The Chemical Educator*, *1*(1), 1-17.

[17] Gouveia da Silva, P. F., & Lopes, M. D. F. (2008). Feminine experience, domestic job, low qualification and social exclusion.

[18] Gwynne, S. M. V., Kuligowski, E. D., Boyce, K. E., Nilsson, D., Robbins, A. P., Lovreglio, R., Thomas, J. R., & Roy-Poirier, A. (2019). Enhancing egress drills: Preparation and assessment of evacuee performance. *Fire and Materials*, *43*(6), 613-631. https://doi.org/10.1002/fam.2448

[19] Huseyin, I., & Satyen, L. (2006). Fire safety training: Its importance in enhancing fire safety knowledge and response to fire. *Australian Journal of Emergency Management, The*, *21*(4), 48-53.

[20] Jones, M. W., Abatzoglou, J. T., Veraverbeke, S., Andela, N., Lasslop, G., Forkel, M., Smith, A. J., Burton, C., Betts, R. A., & van der Werf, G. R. (2022). Global and regional trends and drivers of fire under climate change. *Reviews of Geophysics*, *60*(3), e2020RG000726. https://doi.org/10.1029/2020RG000726

[21] Khuan, L. S., & Nasruddin, E. (2018). Stakeholder Salience on Purchasing Social Responsibility Activities in Northern Malaysia: A Focus on Labour and Health & Safety. *International Academic Journal of Science and Engineering*, *5*(2), 24–42. https://doi.org/10.9756/IAJSE/V5I1/1810024

[22] Kodur, V., Kumar, P., & Rafi, M. M. (2020). Fire hazard in buildings: review, assessment and strategies for improving fire safety. *PSU research review*, *4*(1), 1-23. https://doi.org/10.1108/PRR-12-2018-0033

[23] Lassandro, P., & Di Turi, S. (2019). Multi-criteria and multiscale assessment of building envelope response-ability to rising heat waves. *Sustainable Cities and Society*, *51*, 101755. https://doi.org/10.1016/j.scs.2019.101755

[24] Lawson, G., Roper, T., Shaw, E., Hsieh, M.-K., & Cobb, S. (2020). Multimodal virtual environments: an opportunity to improve fire safety training? *Policy and Practice in Health and Safety*, *18*(2), 155-168. https://doi.org/10.1080/14773996.2020.1796085

[25] Leder, J., Horlitz, T., Puschmann, P., Wittstock, V., & Schütz, A. (2019). Comparing immersive virtual reality and powerpoint as methods for delivering safety training: Impacts on risk perception, learning, and decision making. *Safety Science*, *111*, 271-286. https://doi.org/10.1016/j.ssci.2018.07.021

[26] Mąkosa, P. (2013). Advantages and disadvantages of digital education. *Biuletyn Edukacji Medialnej*(2), 21-31.

[27] McGuire, J., Evans, E., Kane, E., McGuire, J., Evans, E., & Kane, E. (2021). What works in public awareness campaigns? A scoping review. *Evidence-based policing and community crime prevention*, 417-433.

[28] Moisanu, C. M., Gattis, B. S., Williams, B. R., Gesmundo, K. A., & Blayney, M. B. (2023). The Importance of Fire Extinguisher Training among Graduate Student Laboratory Teaching Assistants: A General Chemistry Laboratory Fire Incident. *ACS Chemical Health & Safety*, *30*(3), 124-128. https://pubs.acs.org/doi/10.1021/acs.chas.2c00094

[29] Morélot, S., Garrigou, A., Dedieu, J., & N'Kaoua, B. (2021). Virtual reality for fire safety training: Influence of immersion and sense of presence on conceptual and procedural acquisition. *Computers & Education*, *166*, 104145. https://doi.org/10.1016/j.compedu.2021.104145

[30] Mudiono, A., Gipayana, M., & Madyono, S. (2016). Developing of integrated thematic learning model through scientific approaching with discovery learning technique in elementary school. *International Academic Journal of Social Sciences*, *3*(10), 19-27.

[31] Omar, M., Mahmoud, A., & Abdul Aziz, S. a. B. (2023). Critical Factors Affecting Fire Safety in High-Rise Buildings in the Emirate of Sharjah, UAE. *Fire*, *6*(2), 68. https://doi.org/10.3390/fire6020068

[32] Omar, M., Mahmoud, A., & Aziz, S. a. B. A. (2023). Fire safety index for high-rise buildings in the Emirate of Sharjah, UAE. *Fire*, *6*(2), 51. https://doi.org/10.3390/fire6020051

[33] Oudh, A. J. A., Kadhim, M. J. H., Abdul-Hussein, A. K., & Al-Khafaji, Z. (2025). Natural and Anthropogenic Radionuclides Concentration and Risk Assessment in Legumes and Grains, which Provides in a Basket Foodstuffs in Iraq Country. *Natural and Engineering Sciences*, *10*(1), 1-13. https://doi.org/10.28978/nesciences.1482014

[34] Patti, E., Mollame, A., Erba, D., Dalmasso, D., Osello, A., Macii, E., & Acquaviva, A. (2017). Information Modeling for Virtual and Augmented Reality. *IT Professional*, *19*(3), 52-60. https://doi.org/10.1109/MITP.2017.43

[35] Rathnayake, R. M. D. I. M., Sridarran, P., & Abeynayake, M. D. T. E. (2020, March). Factors contributing to building fire incidents: A review. In *Proceedings of the international conference on industrial engineering and operations management, Dubai, United Arab Emirates* (pp. 10-12).

[36] Roumani, H. B. (2005). maids in Arabia: the impact of maids as carers on children's social and emotional development. *Journal of Early Childhood Research*, *3*(2), 149-167. https://doi.org/10.1177/1476718X05053925

[37] Seymour, J. (2018). The impact of public health awareness campaigns on the awareness and quality of palliative care. *Journal of palliative medicine*, *21*(S1), S-30. https://doi.org/10.1089/jpm.2017.0391

[38] Singh, M. K. K., & Samah, N. A. (2018). Impact of smartphone: A review on positive and negative effects on students. *Asian Social Science*, *14*(11), 83-89. https://doi.org/10.5539/ass.v14n11p83

[39] Solorzano, J. A. P., Moinuddin, K. A. M., Tretsiakova-McNally, S., & Joseph, P. (2019). A study of the thermal degradation and combustion characteristics of some materials commonly used in the construction sector. *Polymers*, *11*(11), 1833. https://doi.org/10.3390/polym11111833

[40] Subraelu, P., Sefelnasr, A., Yagoub, M., Sherif, M., Ebraheem, A., Raj Sekhar, A., & Nageswara Rao, K. (2022). Global warming climate change and sea level rise: Impact on land use land cover features along UAE coast through remote sensing and GIS. *J. Ecosyst. Ecography*, *12*, 1-8.

[41] Sungkur, R. K., Panchoo, A., & Bhoyroo, N. K. (2016). Augmented reality, the future of contextual mobile learning. *Interactive Technology and Smart Education*, *13*(2), 123-146. https://doi.org/10.1108/ITSE-07-2015-0017

[42] Toapanta, S. M. T., Durango, R. H. D. P., Izurieta, R. R., Guamán, J. A., Trejo, J. A. O., Arellano, M. D. R. M., & Hifóng, M. M. B. (2024). Blockchain-based Security Model to Mitigate the Risks of a Database for a Public Organization. *J. Internet Serv. Inf. Secur.*, *14*(3), 78-98. https://doi.org/10.58346/JISIS.2024.I3.005

[43] Tomkovicz, M. (2020). If You're Reading This, It's Too Late: The Unconstitutionality of Notice Effectuating Implied Consent. *Emory LJ*, *70*, 153.

[44] Veera Boopathy, E., Ishwarya Niranjana, M., Nethaji Naveen Prasath, S., Sivabalvigneshan, P., Sanjesh, R., Sanjay, S., Nithishkumar, A., & Vishal, S. (2025). Aegis Flare: IOT-Enabled Robotic FireFig.hter for Advanced Fire Detection and Suppression. *Archives for Technical Sciences*, *1*(32), 66–74. https://doi.org/10.70102/afts.2025.1732.066

[45] Yaman, S., Kiliç, M., & Turgutlu, K. F. (2024). Assessing teachers' fire security knowledge, training effectiveness and attitudinal changes: a cross-sectional study in Turkey. *Journal of Contingencies and Crisis Management*, *32*(2), e12588. https://doi.org/10.1111/1468-5973.12588

[46] Yusoff, Z., Kamsin, A., Shamshirband, S., & Chronopoulos, A. T. (2018). A survey of educational games as interaction design tools for affective learning: Thematic analysis taxonomy. *Education and Information Technologies*, *23*(1), 393-418.

[47] Zhang, K., Suo, J., Chen, J., Liu, X., & Gao, L. (2017, September). Design and implementation of fire safety education system on campus based on virtual reality technology. In *2017 Federated conference on computer science and information systems (fedcsis)* (pp. 1297-1300). IEEE.