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Cross-cultural qualitative study of students' awareness of natural disasters in Saudi Arabia, Yemen, and Egypt

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Abstract

In recent years, there has been a remarkable increase in the intensity and frequency of natural disasters. There is no doubt that a thorough knowledge of natural disasters and an adequate awareness of how to protect against their negative consequences will spare many individuals considerable losses. Accordingly, the present study aims to investigate students' level of awareness of natural disasters within a cross-cultural perspective. Twelve schools in Saudi Arabia, Egypt and Yemen were selected (four schools from each country). The total research sample consisted of 180 sixth and ninth grade students randomly selected from the targeted schools, with 60 students from each country. Semi-structured interviews were implemented. The results indicated that most students in the three countries have a false or incomplete perception of earthquakes and volcanoes. Only 20.6% of students had a correct perception of how earthquakes occur. An analysis of students' drawings of earthquakes and volcanoes revealed that, on average, only 13.3% were able to clarify the scientific reason for earthquakes; the highest percentage of correct answers came from Egyptian students (15.0%), followed by Saudi students (13.3%) and then Yemeni students (11.7%). Religious understanding, culture, and day-to-day experiences of the learners turned out to influence their cognizance and analysis of natural events. It was concluded that students develop intricate understanding and theories based on their beliefs and experiences.

Keywords: cross-cultural study; earthquakes; natural disasters; science education; volcanoes.

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1. Introduction:

In recent years, there has been a remarkable increase in the intensity and frequency of natural disasters. Such disasters have become a focus of the world's public opinion, and they are one of the most important challenges facing humanity due to their devastating effects. According to Abdul Aziz (2011), natural disasters kill more than 14,000 people per year and affect the lives of more than 100 million people worldwide, directly, or indirectly. This increase in human and material losses has contributed to the necessity of finding mechanisms to limit the damage and risks of natural disasters as far as possible, in part by working to educate individuals on how to deal with such disasters (Al-Tantawi, 1997).

In this context, many international conferences have stressed the need to enhance disaster awareness and find better ways to deal with disasters. For example, the World Summit on Sustainable Development in 2002, and the 10th annual conference on disaster management in 2005 which emphasized the importance of educating and training students in mitigating the risks of natural disasters (Al-Najjar, 2005). Besides, the second world conference on natural disaster reduction in Japan emphasized the inclusion of information and knowledge on natural disasters and their risk mitigation in the curricula of all educational stages (United Nations, 2005). More importantly, a thorough knowledge of natural disasters and awareness of how to protect against their negative consequences will save considerable losses. Therefore, countries are working to provide their populations with knowledge and awareness through school curricula.

This study responds to the recommendations of national and international conferences to use science and knowledge as effective means for reducing the risks of natural disasters through the school curricula by raising students 'awareness and training them to deal with natural disaster. This study also helps to fill the void of new and up-to-date research on the role of science curricula in enhancing students' awareness of natural disasters. It also aligns with the growing focus of interest in the study of natural disasters in the disciplines of the humanities and social sciences (Janku et al., 2012).

It has been widely acknowledged that education has a pivotal role in reducing the impacts of disasters and achieving human security. To illustrate, children who are familiar with the phenomenon of natural disasters and know how to react in such situations are capable of promptly and properly responding to protect themselves and provide relevant information to others. Therefore, schools play a key role in providing basic information about potential and actual disasters in local communities (Rajib, 2011).

Disaster awareness can be significantly raised through school education (Kurita et al., 2006). Forinstance, Becker et al. (2012) asserted the effectiveness of preventive education on disaster response and concluded that participants motivated their parents to prepare the whole family for such disasters indicating that students transfer knowledge to their parents. As schools are regarded as centers of cultural education, the real outputs of the educational process are transferred to learners' families and to the local community (Cvetković et al., 2015). Similarly, Panic et al. (2013) argued that disaster awareness in education is critical for giving students necessary information to minimize risks and increase students 'capacity to act. As students are a vulnerable population, and as preparedness for natural disasters and mitigation of their risks are not the sole responsibility of governments or concerned agencies, educational institutions are also responsible for teaching learners how to protect themselves from preventable accidents, and how to behave in a reasonable manner when critical incidents or disasters occur.

As students are informed how to prepare for and deal with disasters, they become involved in the process. Through involvement, students gain a greater ability to control the effects of a potential disaster on their own personal safety, making them less vulnerable both during and after a

disaster. Such students are also less likely to suffer from after-disaster psychological responses and are more likely to be more resilient (Khalaf & Al-Said, 2021, Khalaf, 2020). Hence, providing information to protect against natural disasters and events has become a major area of research (Merchant, 2015).

It has been emphasized that education plays a crucial role in enhancing the capacities of individuals and communities to limit the risks of disasters (UNESCO, 2007). UNESCO considered education for natural disaster preparedness as a major issue to be addressed under the decade of education for sustainable development (DESD). Thus, education about natural disasters is continuing to grow in importance and is being considered as a main factor in reducing the effects of unpreventable disasters.

Overall, science curricula play an important role in developing learners' awareness of natural disasters and of how to reduce their risks. Science curriculum provides students with actual experience and practical real-life activities. It improves students' competence and skills which enable them to explore the surrounding nature (Depdikbud, 2008). Project-based instructional approaches are beneficial in this context (Khalaf and Alshammari, 2023).

According to Fletcher and Nicholas (2016), 'There is a scarcity of studies on educational management during natural disasters' (p. 359). Additionally, scientific research on disasters has made little attempt to explore and compare experiences and perceptions of the communities hit by natural disasters within a cross cultural perspective (Alexander 1993; Schlehe 1996; Lavigne et al., 2008; Chester, 2005; Paton et al., 2001). Any population affected by a disaster will have its own societal and cultural consequences. Thus, societal culture should be considered to have a valid measurement of vulnerability and risk (Harris, 2012). Cultural and intercultural contrasts regarding awareness of natural disasters and their consequences is highly needed for both practitioners and students (Alexander, 2007).

Alshammari (2014) has noted Education in the Arab countries is shaped by each country's distinctive culture, the Muslim faith, and language, as a result changes in science curricula must be mindful of daily societal practices, requirements, context, and culture. Haider (1997) argued that school-based science education may be obstructed and restrained when the scientific position is significantly departed from non-Western cultures. This situation may certainly occur in Arab countries. Islam has markedly shaped Arab-Muslim cultures. Daily activities within society, norms, settled practices and education have all been influenced by Islamic culture. Aikenhead (1998) noted the presence of a secular underpinning of the science subculture in Arabic educational systems and deemed Western culture to be responsible for this subculture of science. Even if the syllabus overhaul may be advantageous to the progression of Arab education, and indeed of Arab countries, religious and socio-cultural circumstances still play a significant role in this regard and must be acknowledged when changes are cautiously introduced through the adoption of a Western syllabus. Little research has been focused on investigating the awareness of natural disasters within a cross-cultural perspective in non-Western countries. Accordingly, the present study explored the students' awareness of natural disasters in KSA, Yemen and Egypt.

Previous literature recommended that natural disasters issues should be incorporated in the content of the science curricula (Samaan, 1994). Even though, science curricula were ineffective in developing students' awareness of natural disasters in middle schools (Mustafa, 1996). However, geographical literacy approach was effective in increasing 11th grade students' knowledge and understanding by 91.6% in Indonesia (Kamil et al., 2020). In Egypt, Al-Tantawi (1997) investigated the role of science curricula in supporting learning of disaster risk reduction and found that science curricula did not provide students with sufficient basic knowledge regarding the risks of natural disasters. Students have shown a lack awareness of the seriousness of disasters or crises, lack in the ability to use modern safety devices, such as firefighting equipment and first aid materials (Amer,

1997).

Misconceptions and wrong beliefs about natural disasters are deeply rooted and widespread (Thorup-Binger and Charania, 2019; Shehata et al., 2023). For example, Alexander (2007) examined the common beliefs and misconceptions of 232 general education students and a class of graduate students in University of Massachusetts, and three groups of emergency workers from Italy. Results indicated that the concept that robbery and pillage were widespread during natural disasters. Adiyoso and Kanegae (2013) showed that Islamic creeds are utilised in both school and community to clarify how religion and natural disasters are associated, and unfortunately, this occurs mostly after a disaster instead of prior as part of preparation. Cvetković al. (2015) examined the shortage of education on natural disasters in Serbia and reported that the sources of information on natural disasters and their threats impacted the perceptions of the high school students about these natural phenomena. Fletcher & Nicholas (2016) found that the main priority after the earthquake was continual connection with the students during the difficult times of the disaster. Schools' principals adopted transformative leadership utilized modern technology which facilitated tremendously effective instruments for keeping in touch with parents and students during and after earthquakes. The most striking outcomes on students from earthquakes were inability to cope, substance abuse, irritability, and behavioural problems.

The aim of the present research is to investigate the level of awareness students have regarding natural disasters within cross-cultural perspective. Additionally, it explored the roles played by science curricula in improving this awareness. The following main question guided this study: How do Saudi, Egyptian and the Yemeni students understand how earthquakes and volcanoes occur?

2.Methods and Materials:

To answer this question, qualitative research strategies were used. This method focused on the description of the phenomena and seeking a deeper understanding of earthquakes and volcanoes through the interpretative induction of information gathered in the natural context of the phenomenon.

Instrument

Interview

The researchers randomly selected students from each school. Interviews were conducted in separate rooms assigned by schools' coordinators. The duration of the individual interviews ranged from 15–25 minutes. During the interviews, the researchers familiarised the students with the purpose of the interview and that they have the right to withdraw at any time. Investigators were careful to avoid making suggestions to the students, except when necessary, and very briefly. We documented the interviews using audio recordings for each student. The recordings were then transcribed so the data could be read, analysed, and scrutinized in depth. The qualitative data were processed using inductive analysis method as follows: (1) The data were read and listed more than once;(2) based on the purpose of the research, non-relevant data were excluded; (3) data were coded by placing a title for each piece of important data; (4) verbal data were read and audios were listened again to ensure nothing had been left out; (5) titles were re-read to search for relations between themes; (6) titles were classified into groups to extract meanings; (7) themes were identified based on elicited relationships; (8) themes were examined to determine whether they were supported by the data, different themes and examples were excluded; and (9) quotes and evidence that supported the results were selected and presented within the body text.

In accordance with the work of Silverman (2015), triangulation was undertaken by formulating questions, carrying out interviews and adopting open-ended questions, to ensure validity and "*overcome partial views and present something like a complete picture*" (p.92). According to Scott and Morrison (2007), information validity will be strengthened by ensuring that the concepts

identified as significant are double-checked by obtaining various forms of information relevant to the issues. As Blaikie (2000) noted, inclusion bias can thus be averted to overcome bias. Ultimately, the dependability and validity of the research was ensured through the process of triangulation. Based on Glesne's (1999) recommendations, the veracity of results was guaranteed through the process of member verification. This was done by creating a sample comprising instructional methods, and then approaching science education experts to get them complete the questions and interview process. The analytical results of the information obtained in this way were presented to a panel of jury involved, who were then able to validate the initial research outcomes.

Participants

The research population included 6th grade and 9th grade students in Saudi Arabia, Egypt, and Yemen. Their ages ranged between 12 and 15 years. In accordance with the nature of qualitative research, which is based on a deep understanding of the phenomenon studied in its natural context, and to answer the research question, a total of twelve schools were selected, with four schools from each country. The total research sample consisted of 180 students randomly selected from the targeted schools, with sixty students from each country. Their ages ranged between twelve and fifteen years. They were interviewed individually after obtaining an informed consent from schools' principals and participants. Table 1 shows the distribution of the sample.

Table 1.

Table 1. Distribution of participants according to the country.

	Saudi Arabia	Yemen	Egypt	total
6th grade	30	30	30	90 (50%)
9th grade	30	30	30	90 (50%)
	60	60	60	180

Data collection and analysis

To obtain realistic results, non-standardised interviews were used to collect qualitative data; the interviews relied on asking open-ended questions about earthquakes and volcanoes. At the end of the interview, the students were asked to express their understanding of these natural phenomena using illustrative drawings. It is commonly accepted that thinking comprises more than just language, and that perception and imagery are at least as fundamental as language (Paivio, 1990). Thus, to gain a deeper understanding of students' conceptual understanding of natural disasters, students were asked to both verbally respond to the interview and create drawings. We coordinated with the principals of the targeted schools and visited them on a regular basis. Individual interview was conducted with each student in the three countries. We carried out interviews with sixth and ninth graders in Saudi Arabia, Egypt, and Yemen. Verbatim transcription of the interviews was made that retained the structure and essence of the discourses. Next, the authors read and reread the transcriptions several times, focusing on the wording used by the participants. The data were re-examined to detect themes within each category. To facilitate the reading of the data, the frequencies of themes were recorded. The discourses were coded before and after performing thematic analysis. The following themes and categories were identified: (a) students' perceptions of what earthquakes and volcanoes are and how they occur, (b) students' beliefs regarding the phenomena of earthquakes and volcanoes.

4. **Results /Findings**:

Perceptions of earthquakes and volcanoes concepts

Analysis of students' perceptions of earthquakes and volcanoes were classified into four groups in table 2 as follows: "completely correct" (CC), "partially correct" (PC), "incorrect" (IC), and "Do not know" (DK). Table 2 provides the results.

Table 2. Students' perception of earthquakes and volcanoes.

	Earthquakes				Volcanoes			
Perceptions	KSA	Yemen	Egypt	total	KSA	Yemen	Egypt	total
CC	10*(17%)*	14 *(23%)*	13 *(22%)*	37 *(20%)*	6 *(10%)*	9 *(15%)*	10 *(17%)*	25 *(14%)*
PC	15*(25%)*	16 *(27%)*	18 *(30%)*	49 *(27%)*	15 *(25%)*	14 *(23%)*	19 *(32%)*	48 *(27%)*
IC	28 *(46%)*	21 *(35%)*	25 *(42%)*	74 *(41%)*	24 *(40%)*	27 *(45%)*	26 *(43%)*	77 *(43%)*
DK	7*(12%)*	9 *(15%)*	4 *(7%)*	20 *(11%)*	15 *(25%)*	10 *(17%)*	5 *(8%)*	29 *(16%)*

As shown in Table 2, most students in the three countries have incorrect perception or lack of knowledge of earthquakes. Of the total sample, 20% answered correctly, 27% answered partially correct, 41% gave incorrect answer, and 11% did not know the answer at all. Regarding their perceptions of volcanoes, 14% answered correctly, 27% answered partially correct, 43% gave incorrect answer, and 16% did not know the answer at all. Examples of the students' illustrative drawings of earthquakes are given in figures 1 and 2.

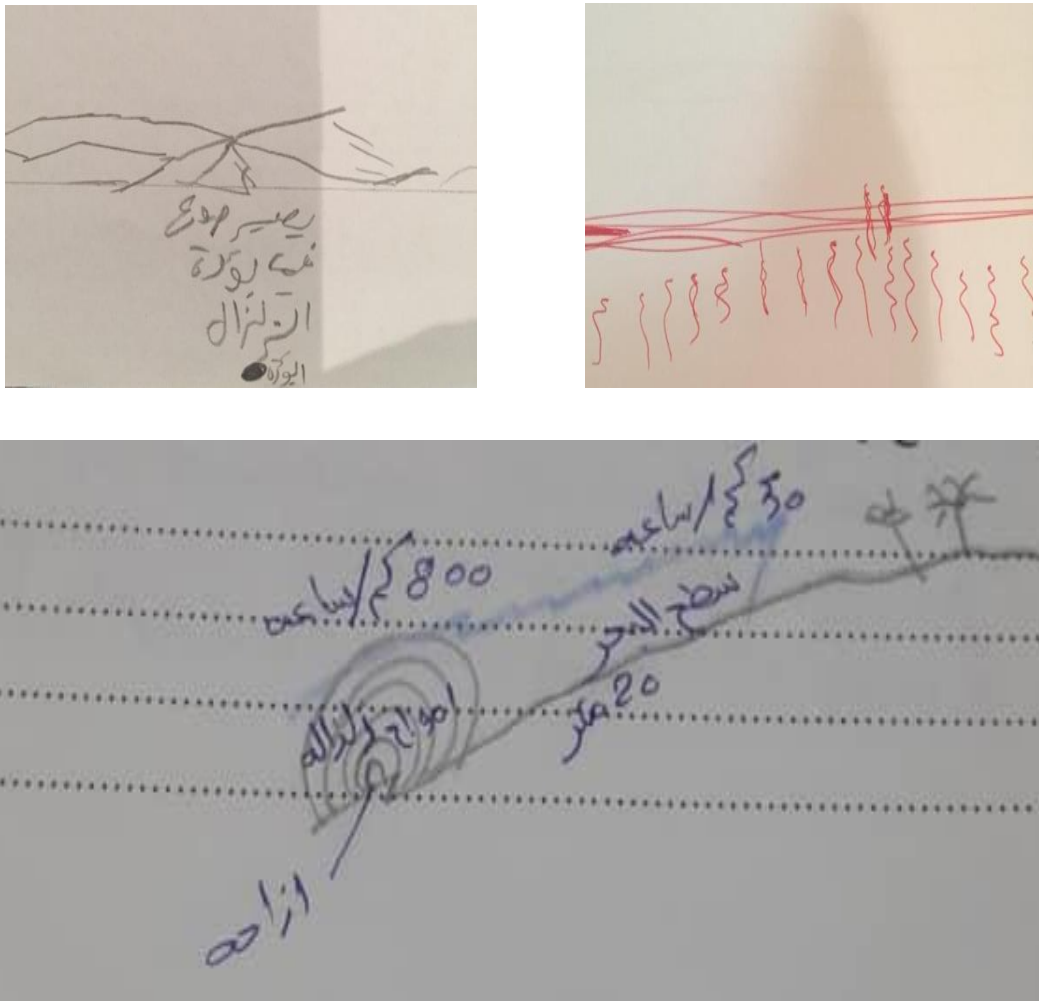

Figure 1. Correct drawings of the phenomenon of earthquakes.

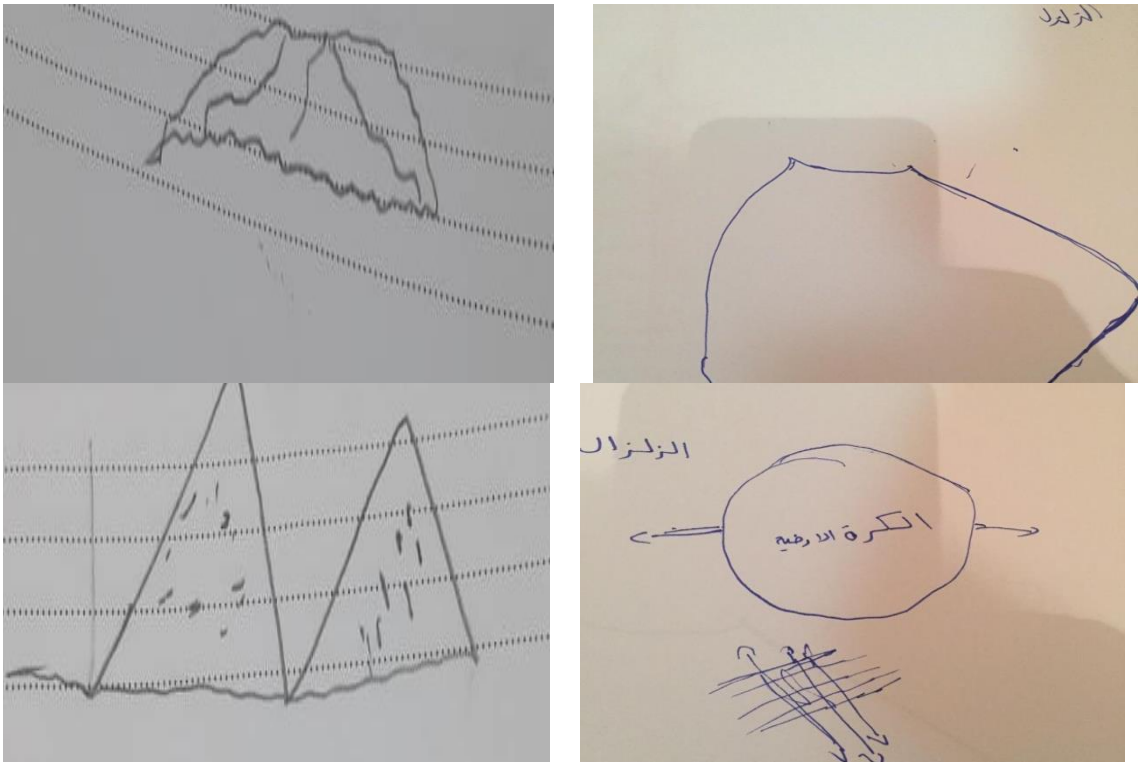

Figure 2. Incorrect drawings of the earthquakes.

Similarly, students with an incorrect understanding of volcanoes drew incorrect drawings, while those with a correct understanding provided correct drawings. Figures 3 and 4 provide examples of the students' right drawings.

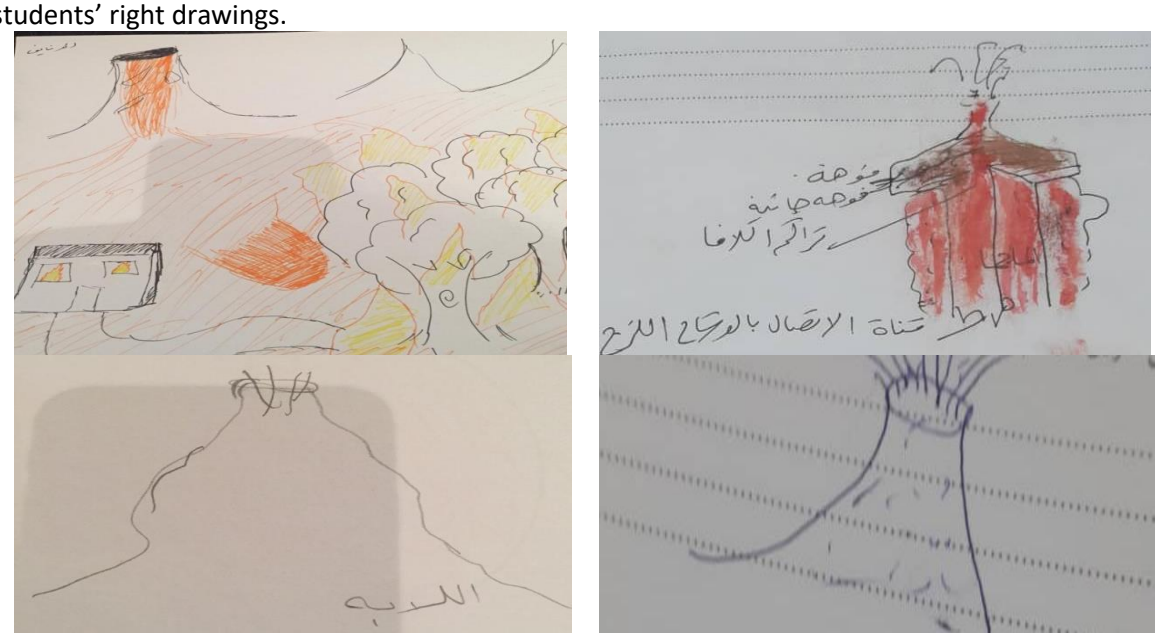

Figure 3. Correct drawings of volcanoes.

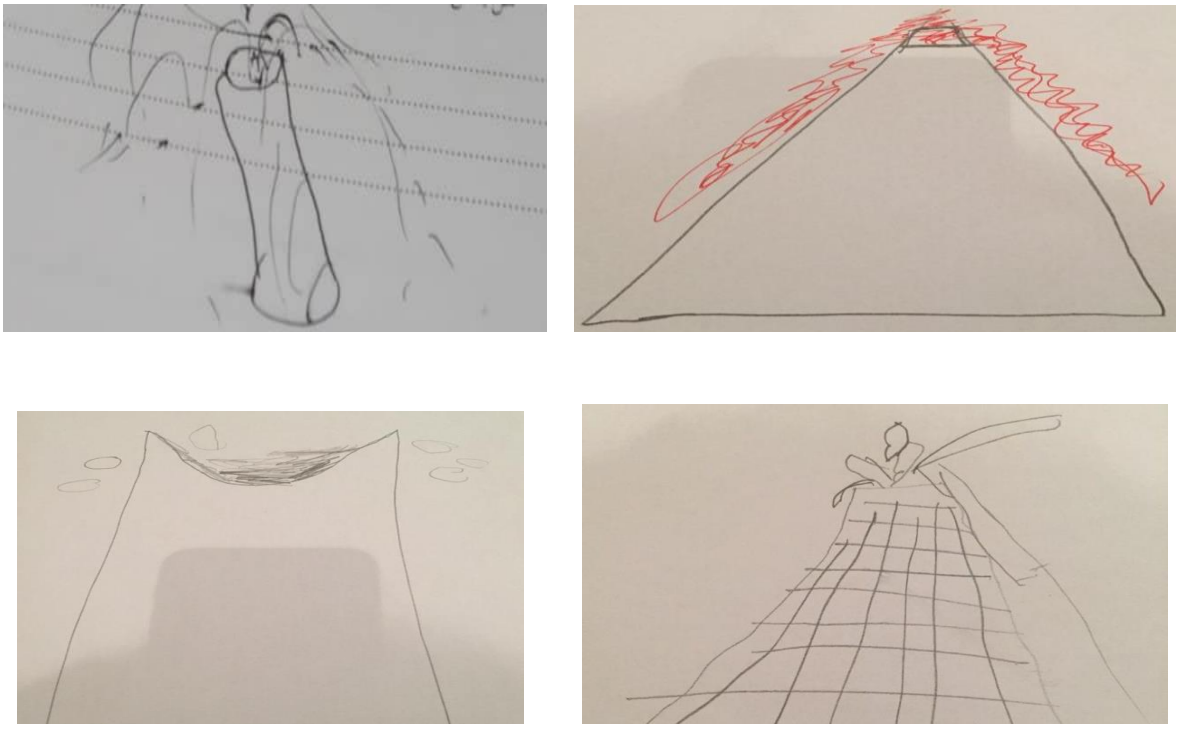

Figure 4. Incorrect drawings of the volcanoes.

Perceptions of earthquakes and volcanoes causes.

Analysis of students' understanding of earthquakes and volcanoes causes were categorized into the following groups:(i) scientific causes; (ii) irrelevant causes; and (iii) religious causes. Table 3 provides these results.

Table 3.

Table 3. Frequencies of causes of earthquakes and volcanoes.

	Earthquakes				**Volcanoes**			
Causes	KSA	Yemen	Egypt	total	KSA	Yemen	Egypt	total
Scientific	8*(13%)*	7 *(12%)*	9 *(15%)*	24 *(13%)*	7 *(12%)*	9 *(15%)*	11 *(18%)*	27 *(15%)*
irrelevant	15*(25%)*	26 *(43%)*	38 *(63%)*	79 *(34%)*	9 *(15%)*	24 *(40%)*	44 *(73%)*	77 *(43%)*
Religious	25 *(42%)*	19 *(32%)*	2 *(3%)*	46 *(26%)*	23 *(38%)*	17 *(28%)*	0 *(0%)*	40 *(22%)*
Unknown	12*(20%)*	8 *(13%)*	11 *(18%)*	31 *(17%)*	21 *(35%)*	10 *(17%)*	5 *(8%)*	36 *(20%)*

Table 3 shows that 44% of students provided irrelevant causes of earthquake indicating little awareness of this phenomenon. The highest percentage of irrelevant causes came from Egyptian students 63%, followed by Yemeni students 43%, and then Saudi students 25%. Egyptian students believed that heavy rain causes earthquakes, while Saudi students thought that digging in the ground, fluctuations of the weather, and deforestation bring about earthquakes. Yemeni students attributed earthquakes to climate change and soil disturbances.

In terms of religious perspective in interpretation of the earthquake's occurrence, Saudi students came in the first rank 42%, followed by Yemeni students 32% and then Egyptian students 3%. Saudi students believed that as human sins increase, God sends earthquakes out of indignation.

The highest percentage of students giving irrelevant causes of volcanoes was that of the Egyptian students 73%, followed by Yemeni students 40%, and then Saudi students 15%. The most surprising reason given by a Yemeni student for volcanoes was that motorcycles and over-population can cause

volcanoes. Another Yemeni student thought that floods occurring in the bottom of the ground lead to volcanoes. Egyptian students believed that global warming and weaknesses in the ground layers are potential causes of volcanoes, while both Yemeni and Saudi students considered that heaven sends volcanoes to punish humanity.

Scientific and religious beliefs about earthquakes and volcanoes.

Students' responses were grouped according to the following areas: (i) earthquakes and volcanoes are natural phenomena; (ii) earthquakes and volcanoes are religious phenomena; and (iii) earthquakes and volcanoes are both religious and natural phenomena.

Table 4.

Table 4. Frequencies of Scientific and religious beliefs about earthquakes and volcanoes.

	Earthquakes				**Volcanoes**			
Causes	KSA	Yemen	Egypt	total	KSA	Yemen	Egypt	total
Natural	15*(25%)*	16 *(27%)*	*19 (32%)*	50 *(28%)*	15 *(25%)*	15 *(25%)*	19 *(32%)*	49 *(27%)*
Religious	20*(33%)*	18 *(30%)*	16 *(27%)*	54 *(30%)*	19 *(32%)*	17 *(28%)*	16 *(27%)*	52 *(29%)*
Both	15 *(25%)*	22 *(37%)*	24 *(40%)*	61 *(34%)*	14 *(23%)*	23 *(38%)*	23 *(38%)*	60 *(33%)*
Unknown	10*(17%)*	4 *(7%)*	1 *(2%)*	15 *(9%)*	12 *(20%)*	5 *(8%)*	2 *(3%)*	19 *(11%)*

Table 5.

Table 5. Frequencies of natural and religious causes of earthquakes.

Country	why earthquakes are natural phenomena?	why earthquakes are both natural and religious?
KSA	God frightens people. No one can control earthquakes except God. They are the punishment of God. They show the power of God.	Earthquakes is a sign of God's anger. Earthquakes are a little bit religious and natural. Earthquake is punishment happened to people of Lut. Humans have nothing to do with earthquakes.
Egypt	They show God's power. They are made by God. They are mentioned in the Qur'an. They show the greatness of God.	They occur only in certain places. They show the power of God. They are made by God like everything else. They occur due to scientific reasons.
Yemen	God controls the universe. They occur without human interference. God created earthquakes. No one except God can cause earthquakes.	Earthquakes come from God. They occur due to human sins. They are signs of the Judgment Day. Earthquakes make us contemplate God's power.

Table 6.

Table 6. Causes of volcanoes provided by students.

Country	Natural phenomena	Natural & religious	Religious
KSA	we cannot prevent volcanoes. They occur at any time. They occur in Muslim countries. religion cannot prevent volcanoes.	They occur naturally but at the same time they are made by God.	Disasters are signs of God's discontent and wrath. They occur in non-Muslim countries.
Egypt	Humans cannot control volcanoes. Volcanoes occur without human interference. They have a scientific reason.	Volcanoes are God's wrath. They show God's supreme power.	Volcanoes how God's power. They are mentioned in the Qur'an.
Yemen	Volcanoes occur without human interference. God wants us to think about the universe.	God controls disasters.	Volcanoes are created by God. They occur because of human tyranny and sins.

shown in table 4, only 27.8% believe that earthquakes are natural phenomena. The highest percentage of students who believe that earthquakes are natural is that of the Egyptian students 32% followed by the Yemeni students 27%, and then the Saudi students 25%. Similarly, as it is clear in table 5, 27% believe that volcanoes are natural phenomena. The highest percentage of students who view volcanoes as natural phenomena is that of the Egyptian students 32% followed equally by Yemen students and Saudi students 25.0% for each. As shown in table 6, Out of the 180 students, 28.9% believe that volcanoes have religious causes. The highest percentage of students who see volcanoes as religious phenomena is that of the Saudi students 32% followed by Yemeni students 28%, and then Egyptian students 27%. Approximately, 33% believe that volcanoes are partly natural and partly religious phenomena. The highest percentage of students who hold mixed belief was that of the Egyptian and Yemeni students 38.3% followed by Saudi students 23%. Table 6 provides key justifications students gave when interpreting why volcanoes are natural or religious phenomena.

Discussion:

Most students from three countries showed erroneous understanding of volcanoes and earthquakes causes. This finding is important when considering the findings of Rajib (2011) who reported that within local communities, instruction and understanding of natural disasters occurrence is crucially influenced by educational facilities. Similarly, school-based instruction markedly affects comprehension of natural disasters (Kurita et al., 2006). Thus, when students demonstrate a lack of understanding of natural disasters, it is reasonable to assume that local communities might show a similar lack.

The second main finding relates to methodology. Students who held a correct and comprehensive understanding of earthquakes or volcanoes were able to draw semi-accurate or accurate pictures of such events, whereas students with flawed understandings of such events presented incorrect illustrations. Ben-Zvi Assaraf et al. (2012) previously reported the difficulty of using illustrations to convey scientific concepts. Thus, research techniques that allow language-based comprehension are clearly inimitable. As Prain et al. (2009) discovered, the comprehension of scientific phenomena is enhanced among learners when various representational techniques are pursued, such as interviews and illustrations with written explanations. Multi-representational methods are beneficial for additional science education and explication and scientific understanding (Caiman and Jakobson, 2019; Lundin and Jakobson, 2014; Papandreou and Terzi, 2011; Prain et al., 2009).

The third major finding involved the justifications given by students to explain whether earthquakes and volcanoes were natural or religious phenomena. Students' religious beliefs clearly influenced their responses. One prominent reason was that God sends volcanoes and earthquakes to chastise humans. Similarly, some conspiracy theories and misinformation beliefs spread during COVID-19 pandemic (Khalaf, 2020). Thus, rather than seeing them as natural phenomena, the students considered that volcanoes and earthquakes are God's castigation on humans due to their bad deeds. In that sense, Students should be scientifically and academically oriented and buoyant (Khalaf, 2014; Khalaf & Abulela, 2021) in their interpretation of scientific facts rather than being completely religiously bound.

Given that the Quran tells how humans' departure from God's teachings in different societies being punished by God through natural disasters, it is not entirely erroneous for students to hold these beliefs about earthquakes and volcanoes (Adiyoso and Kanegae, 2013). For example, the Quran says that a great flood was sent by God to eliminate humanity, which had not heeded the warnings of Noah, although Noah himself was saved. Nevertheless, for the population of Arab countries to become ready to accept scientific explanations for such phenomena, various perspectives on such narratives must be debated.

The final and principal result of this study is that 30% of students from Saudi Arabia, Egypt,

and Yemen view volcanoes and earthquakes as religious phenomena. Indeed, the religious and natural characters of such events were roughly referred to by the same proportion of students. Thus, religion, culture, and everyday life experiences influence their cognition and analysis of natural events as they develop intricate understanding and beliefs of such phenomena.

Various religious explanations, such as the presence of ancestors, the characteristics of the hereafter, or God's supreme powers, may be embraced by learners to explain phenomena, according to how their local communities perceive such phenomena Guessom (2010). In terms of the cohesiveness and mutually supportive nature of science and religious beliefs, this manner of thought among school students may be deemed to be non-conflictual (Adiyoso & Kanegae, 2013). Ultimately, scientific approaches may be applied to rationalise all events as being the will of God. Conversely Roth (2009) argued that *"science and religion are different because of the different forms of experience and modalities of temporality that characterize them" (p.14)*. It has also been suggested that the nature of science and the position of Islam in relation to science have been poorly comprehended, and that miscomprehension may be the sole reason for students' discordance and the belief that they are irreconcilable.

Science is not at odds with Islam, and Muslims' daily lives are influenced by scientific understanding. Students' Islamic beliefs could be solidified if the scientific explications of natural events were accompanied by verses from the Quran as part of the science syllabi. On this basis, it may be necessary to incorporate Hadith and Quranic explanations of scientific occurrences and concepts in textbooks in Muslim countries, rather than omit them. More specifically,Hadith and Quranic examples could be provided by science educators during science classes (Mansour, 2011). In the same context, Adiyoso and Kanegae (2013) concluded that the Quran promotes inquiry into scientific events and concepts because it recognises the importance of science; this perspective could be significant to Muslims who consider disasters to be natural events. Indeed, as referenced by Golshani (2005), "*the Prophet advocated the pursuit of knowledge from one's arrival on Earth until one's departure, with the quest for understanding being cherished by Islam*" (p.78). As such, Islam is characterised by an approach to living and existence that is revelatory and that encapsulates comprehension and belief (Guessoum, 2010).

Accordingly, this study advocates the mindfulness of socio-cultural dynamics in relation to conceptual change as a means of learners expanding their comprehension. Vosniadou (2008) explained the socio-cultural perspective as suggesting that pertinent artefacts of culture should be applied to facilitate comprehension and conceptual change within the wider educational, cultural, and situational environment. As Whitty and Wisby (2007) observed, placing a heavier focus on learners' perspectives would be advantageous for Arabic educational facilitates based on their results. Hargreaves (2004) posited that, in this context, educators should listen more effectively to learners' views about their experiences in classrooms, and education should be more directly shaped by learners. Also as suggested by Abdelrasheed and Khalaf (2022), students' motivation and psychological vitality should be enhanced in schools, and their learning anxiety should be lowered to the minimum (Khalaf, 2016, 2017, Khalaf and Omara, 2022) to maximize learning opportunities.

Arab learners draw on both their pre-existing religious understanding and their personal experiences to develop their cognition and rationalization of natural events. The cultural context of the learners affects their cognition. As a result, it may be problematic for learners to take scientific explanations as a framework within which their own concepts are reconciled. In accordance with Christidou (2011), respect of cultural and social diversity should be adhered to during planning science curricula towards achieving more learner's engagement.

Conclusion(s):

The aim of this study was to investigate students' awareness of natural disasters (earthquakes and volcanoes) from across-cultural perspective using participants from KSA, Egypt, and

Yemen. This attempt was a collaborative endeavour in the field of science education in three different cultures and contexts. Surprisingly, the overall findings demonstrate a weak understanding of the definitions and causes of earthquakes and volcanoes among the three samples regardless of their country of residence. Analysis of the students' drawings indicated that students have developed incorrect visualizations of the phenomena. Few students were able to give the scientific reason for the occurrence of earthquakes. Egyptian students ranked highest in providing correct answers to open ended question of the interview, followed by Saudi and then Yemeni students. These results suggest that natural disasters were insufficiently detailed in the science textbooks taught in these countries. Accordingly, it is recommended that curricula planners exert more effort to increase students' awareness of the reasons and consequences of natural disasters. We expect these findings to promote a vibrant debate concerning the role of mainstreaming education in increasing the level of students' awareness of natural disasters and its preventive precaution measures.

Given that the respondents of the present study were a somewhat restricted sample, the perspectives obtained herein regarding natural disasters could be explored in further research by including additional religious and science educators, as well as individuals from various countries and cultural contexts. Furthermore, observations, interviews and questionnaires could be applied as data collection techniques. It is necessary to comprehend how science instruction and education are detrimentally and beneficially influenced by the religious beliefs of learners and educators. This study found that the religious perspectives of learners from KSA, Egypt, and Yemen were significant in their understanding of the causes of natural disasters. However, further inquiry is needed in how science instruction and its correlates are influenced by religious perspectives. Moreover, future research could examine the views held on the Big Bang theory or Darwin's theory of evolution, by Arab students from the socio-cultural perspective to evaluate how personal, religious, and cultural views affect learners' understanding of science concepts and theories. The findings of this study should not be generalized to larger populations due to its limitations. The first limitation is the use of solely one data collection tool, namely, the unstructured interview.

Recommendations/Future directions

Future research should utilize mixed methods approach to obtain deeper and insightful results that can be generalized. Another limitation is the small number of participants recruited from each country. Further studies could investigate the same variables using a larger sample of high school or university students from wide range of Arab countries. Finally, we used the manual coding and retrieving of data, but future research could benefit from computer-assisted qualitative data analysis software like Nvivo and Atlas.ti.

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