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USING KNOWLEDGE TO SAVE LIVES IN CASE OF EARTHQUAKE

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Summary: *The effects of earthquakes have occupied an important part of life on earth since the beginning of history up to the present day. The historical facts and data regarding the disasters suggest that earthquakes occur more frequently at a periodical frequency at certain points on earth. In this study, using knowledge to save lives in case of earthquake were reviewed. It is already acclaimed by many nations that some precautions must be taken at once. One of the most important of these precautions is the (HFA priority 3) "Use knowledge, innovation and education to build a culture of safety and resilience at all levels". Disaster of earthquake can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards of earthquake, vulnerabilities and capacities. In this paper, immediate arrangements must also be made for life-long education and training of people in these issues. It is the sole responsibility of human beings to pay utmost attention to the issues of earthquakes before we reach the point of total loss of a sustainable world. It is not possible to eliminate the occurrence of natural disasters such as earthquakes. However, It is possible to minimize damage of earthquakes and other disasters since steps and measures can be taken before and after they occur. Recent experiences have proven that preparatory work must be carried out before they actually take place***.*** *This could be done by taking the following precautions: "Improvement in the education and training systems".*

Key words: *prevention, education & knowledge, earthquakes.*

KORIŠĆENJE ZNANJA ZA SPAŠAVANJE LJUDSKIH ŽIVOTA U SLUČAJU ZEMLJOTRESA

Rezime: *Posledice zemljotresa zauzimaju značajan deo života na zemlji od postanka čovečanstva do danas. Istorijske činjenice i podaci u vezi sa ovim nepogodama ukazuju na to da se zemljotresi javljaju periodično na određenim mestima na zemlji češće nego na drugim mestima. Ovaj rad sagledava aspekte korišćenja znanja kako bi se spasili životi ljudi u slučaju zemljotresa. Prihvaćeno je od strane mnogih naroda da se određene mere*

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predostrožnosti moraju pothitno preduzeti. Jedna od najvažnijih od ovih mera je (HFA prioritet 3) "koristite znanja, inovacije i obrazovanje da biste stvorili kulturu sigurnosti i otpornosti na svim nivoima". Katastrofa koju prouzrokuje zemljotres moze se znatno smanjiti ukoliko su ljudi dobro informisani i motivisani u vezi sprečavanja nepogoda što sa druge strane zahteva prikupljanje i širenje relevantnih znanja i informacija o opasnostima od zemljotresa, izlozenosti zemljotresima i kapacitetima. Ovaj rad ukazuje na potrebu da se pothitno moraju izvršiti pripreme za doživotno obrazovanje i obuku ljudi u vezi sa ovim pitanjima. Neophodno je da ljudi obrate paznju na probleme koje prouzrokuju zemljotresi pre nego što se dodje do tačke u kojojoj je potpuni opstanak sveta doveden u pitanje. Nemoguće je eliminisati pojavu prirodnih katastrofa kao što su zemljotresi. Međutim, moguće je smanjiti štetu koju prouzrokuju zemljotresi i druge katastrofe jer se određeni koraci i mere mogu preduzeti pre i nakon njihove pojave. Skorija iskustva pokazuju da se pripreme moraju sprovesti pre same pojave katastrofe. Ove pripreme se mogu obaviti kroz sledeće mere predostrožnosti: "Usavršavanje obrazovanja i sistema obuke".

Ključne reci: *sprečavanje, obrazovanje & znanje, zemljotresi.*

1. INTRODUCTION

A safe and secure environment is a prerequisite for effective teaching and learning. Threats to the safety and security of people and property can arise from natural hazards – such as earthquakes

While catastrophic events and human tragedies cannot be eliminated entirely, their negative impact can be mitigated.

This paper describes the performance of educational in Macedonia in recent earthquakes, such as the Skopje earthquake in 1963, where 57% of the total urban school building stock was destroyed, and our working to keep schools safe in earthquakes. We prepare School Emergency Preparedness Plans and other educational programmes to provide essential data on potential damage to school buildings from earthquakes of different magnitudes, as well as elements for effective first-response and emergency management operations. The aim of this paper is to initiate an activity that would improve earthquake safety in schools and education systems: encourage students for critical thinking skills when sharing and receiving earthquake-related information, empower students to utilize all resources to protect themselves and their communities from earthquake hazards and encourage an innate interest in earthquake hazards, focused on safety and security risk assessment in schools; planning and management; infrastructural approaches to school safety; collaborative approaches to school safety; and education, training and support approaches to school safety. As part of our activities on school safety and security, Protection and rescue directorate seeks to improve understanding of such issues, to identify appropriate responses and to initiate action.

2. BASIC TERMINOLOGY AND CONCEPTS ABOUT EARTHQUAKE AND EARTHQUAKE HAZARDS

Earthquakes are among the most terrifying and fascinating natural phenomena occurring on the Earth. They terrify us because they are powerful enough to destroying civilizations and turn cities into ghost towns. But they have fascinated us since the dawn of recorded time.

One must not forget that we live on a very unique planet. The Earth, unlike any other planet in the solar system, is dynamic and alive, and because of this we are alive. The livelihood of the Earth can be appreciated in part through the study of earthquakes and other natural phenomena. It is by the knowledge we gain from studying earthquakes that we can start to understand their impact on societies and to find ways to mitigate damage In this training activity, there are a number of hands-on and interactive scientific lesson plans, each inviting students to learn what is known about earthquakes, earthquake hazards, and hazards preparedness.

Earthquakes generally occur without warning and may cause minor or serious injuries, and damage to buildings. It is important to note that even a mild tremor can create a potentially hazardous situation and the following procedures should be implemented in response to all earthquakes regardless of the magnitude.

Like other natural phenomena, earthquakes have played an important role in triggering our curiosity about the natural world we live in.

2.1 What are the causes of earthquake?

An earthquake is the result of a sudden release of energy in the Earth's crust that creates seismic waves. Earthquakes are recorded with a seismometer, also known as a seismograph. The magnitude of an earthquake is conventionally reported on the Richter scale. Intensity of shaking is measured on the Modified Mercalli scale. At the Earth's surface, earthquakes manifest themselves by shaking and sometimes displacing the ground. When a large earthquake‘s epicentre is located offshore, the seabed sometimes suffers sufficient displacement to cause a tsunami. The shaking in earthquakes can also trigger landslides and occasionally volcanic activity.

In its most generic sense, the word earthquake is used to describe any seismic event – whether a natural phenomenon or an event caused by humans – that generates seismic waves. Earthquakes are caused mostly by rupture of geological faults, but also by volcanic activity, landslides, nuclear experiments and mine blasts.

2.2 How does an earthquake affect us?

Lives are lost in an earthquake due to collapse of houses. People are hurt by falling plaster and heavy objects that are not firmly fixed. Earthquake may trigger tsunami, landslide, dam failure, or fire. Services such as hospitals, fire stations, electricity and water supply may also be affected. The degree of destruction caused by an earthquake depends on the magnitude and duration of the earthquake, depth of rupture location, distance from epicentre, soil conditions, preparedness of the population, time of occurrence. Earthquake shaking results in reducing the strength of soil. Saturated fine-grained non-cohesive soils such as silt can lose the strength completely during shaking and flow like liquid.

2.3 Earthquake Terms Are:

- Focus is the place where an Earthquake starts.
- Epicenter -The place on the earth’s surface directly above the point on the fault where the earthquake rupture began. Once fault slippage begins, it expands along the fault during the earthquake and can extend hundreds of miles before stopping.
- A Fault is a break in the Earth’s rocky surface along which the two sides have been displaced relative to each other.
- Earthquake Waves -Vibrations that travel outward from the earthquake fault at speeds

of several miles per second. Although fault slippage directly under a structure can cause considerable damage, the vibrations of seismic waves cause most of the destruction during earthquakes.

- Aftershock- An earthquake of similar or lesser intensity that follows the main earthquake.
- Magnitude - The amount of energy released during an earthquake, which is computed from the amplitude of the seismic waves. A magnitude of 7.0 on the Richter Scale indicates an extremely strong earthquake. Each whole number on the scale represents an increase of about 30 times more energy released than the previous whole number represents. Therefore, an earthquake measuring 6.0 is about 30 times more powerful than one measuring 5.0.

2.4 Measuring an Earthquake

Probably the best-known gauge of earthquake intensity is the local Richter magnitude scale, developed in 1935 by United States seismologist Charles F. Richter. This scale, commonly known as the Richter scale, measures the ground motion caused by an earthquake. Every increase of one number in magnitude means the energy release of the quake is 32 times greater. Earthquakes generate seismic waves, which can be detected with a sensitive instrument called a seismograph. Advances in seismograph technology have increased our understanding of both earthquakes and the Earth itself.

In order to explore the issue of how to initiate to use knowledge, we will follow an evolution of themes – to acknowledge the problem, to recognise obstacles, to define key safety principles, to assess vulnerability and risk, and to identify strategies and programmes for improving school seismic safety – that would lead to a concrete proposal towards action. Key elements contained within them are presented below.

2.5 Danger of earthquake

Danger of earthquake is defined as a danger of maximum movement of ground (acceleration, particle speed, temporary or permanent displace) caused by an earthquake that can happen any time in any place with a magnitude which results damage and fatalities.

The risk is the definition of the losses caused by a danger and sum of the answers of these questions: What is the magnitude of the earthquake, what is the distance, what kind of soil, what is the structure, what would be the damage and the losses? There are lots of studies regarding the danger of earthquake.

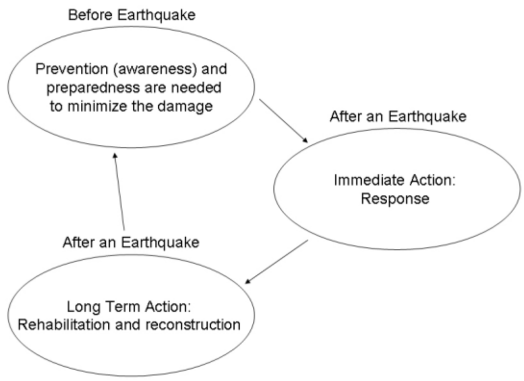

Figure 1. *Action Cycle proposed by Shaw et.al. 2000.*

It is possible to minimize damage of earthquakes and other disasters since steps and measures can be taken before and after they occur. Recent experiences have proven that preparatory work must be carried out before they actually take place.

Fact… Earthquakes below 4.0 on the Richter scale usually do not cause damage, and earthquakes below 2.0 usually can't be felt. Earthquakes over 5.0 on the scale can cause damage. A magnitude 6.0 earthquake is considered strong and a magnitude 7.0 is a major earthquake.

Responsibilities of Individuals

- Individuals have a responsibility to prepare themselves and those around them with friends and family.
- With small precautionary steps, which lower risks, we can help ourselves and others after an earthquake
- Awareness and knowledge of for earthquakes and one with basic earthquake preparedness must be increased disaster awareness is created.

The Responsibilities of Schools

- Earthquake education in schools is essential
- They must teach us what to do before, during and after an earthquake takes place.
- Drills should be frequent and students encouraged sharing their knowledge with friends and family
- Schools should monitor the spread of information so that a society prepared for earthquakes and one with basic disaster awareness is created.

2.6 How does it affect you?

- Damage caused by earthquakes is immense. Perhaps the reason they cause so much fear and devastation is that they damage complete infrastructures, not just buildings or bridges but also roads, gas pipes, slopes, dams, retaing walls,......the list is endless! Millions of people are killed and billions of dollars of damage result from them
- Earthquakes can shift the ground yards up, down, left or right in the blink of an eye.

When this happens

- Earthquakes can cause severe and widespread damage to weak buildings or structures, or to those located on ground subject to fault breakage, strong shaking, or land sliding.
- Earthquakes affect our community in many ways. They affect our social life, because now many houses have been destroyed and friends of ours have been killed.
- It also affects our government as well, because now the government has to spend money trying to repair the immense damage caused by the earthquakes. But what about the damage that the earthquakes have caused in people's lives that no one can fix, not even the government?
- Children are separated from their parents or have lost both parents during the children have lost their lives or lost members of their families
- Loss of homes and personal belongings
- Physical injuries
- School Building collapses leading to death of many children

- Academic performance suffers; falling grades, disruptiveness in class, rudeness and falling asleep in class contribute to academic problems

3. ACKNOWLEDGING THE IMPORTANCE OF IMPROVING KNOWLEDGE OF EARTHQUAKE AND SAFETY IN SCHOOLS

Schools play a vital role in every community. They are not only the places where students learn and teachers teach; they are also used for social gatherings, theatre and sports. In addition, school buildings play an important role in responding to and recovering from natural disasters.

In the event of an earthquake, schools can serve as emergency shelters and, as such, can be used to house, feed and care for the local population. Earthquake-threatened communities need earthquake-resistant schools. When schools are closed because of earthquake damage, education is hampered, community life disrupted, and emergency shelters unavailable. Where school attendance is compulsory, communities have a moral obligation to provide a safe study and work environment.

But the most important reason earthquake-threatened communities need earthquake resistant schools is to protect their children and teachers. Improving the seismic resistance of school facilities is a pressing issue, because children spend a large part of their daily lives in school, and schools need to secure the safety of children as well as act as emergency evacuation facilities for local communities when an earthquake occurs.

The importance is providing compulsory education for all children. Even fewer people will argue with the fact that earthquakes kill people and damage property. But these three essential principles do not hold up in modern society. In many earthquake-prone countries, a surprisingly high number of school buildings are not constructed to withstand the most moderate of earthquakes. The fundamental question that we must ask ourselves is “Why is it so simple to acknowledge the importance of the education and safety of our children, yet so difficult to ensure?”

Over the last decade or more, there has been a strong movement towards establishing a culture of disaster prevention and mitigation, which has been reflected in the responses of these stakeholders to the issue of improving the safety of schools in earthquakes. But despite the success of community advocacy groups, the commitment of engineers and other scientists, efforts by some governments to address the problem and the considerable international attention generated by such global initiatives. In the face of advancing technologies, growing urbanisation and increasing populations, a new approach to addressing such problems is required.

3.1 Earthquakes - a culture of disaster prevention and mitigation

As societies have developed and knowledge about seismic events has improved over the centuries, the task of engaging governments, communities and others to reduce risk and vulnerability of the world’s populations has made variable progress. Over the last decade or more, there has been a movement towards a “culture of risk prevention”, meaning that the focus of many programmes has moved from response and recovery towards prevention and mitigation. The responses of the principle stakeholders described in this paper attest to this evolution. Yet the fact that structures continue to collapse as a result of earthquakes would indicate that insuffi cient priority is being given to this issue by decision-makers.

3.2 Recognising the obstacles to improving seismic safety of schools

To first identify the scope of the problem, describe and assess the relative importance of the specific factors contributing to the poor performance of school buildings, and also to measure the extent to which the lessons learned from past earthquakes have been used to improve building codes and construction practices. Common, inter-related and in most cases avoidable obstacles of Macedonia from lack of awareness of the threat of school collapse and poor communication between the scientific, public and government communities; to basic deficiencies in the nature, implementation and enforcement of laws and regulations concerning planning, maintenance and construction of schools buildings.

3.3 Identifying strategies and programmes for improving school seismic safety

In this section, we will describe the application of known seismic safety concepts and principles to existing strategies and programmes for school safety, and to consider the most effective ways to encourage, facilitate and assess progress made towards seismic safety goals. Importantly, to establish programmes that build seismically-resistant schools. Awareness-raising through the dissemination of knowledge and data regarding school seismic safety, an important role in empowering and motivating individuals for change,establishing criteria and procedures to compare the vulnerability national building typologies, include delivering lectures to school communities on seismic resistance improvements to school buildings. In developing countries, implementing a strategic programme is further complicated by such factors as lack of local knowledge, shortage of finances, disagreement between external experts and scarcity of materials. In a European context, while the material, financial and human resources exist to establish a number of programmes for screening, evaluating and strengthening existing buildings in earthquake-prone countries, much greater regulatory effort is required in all countries to significantly reduce the highest risk to public buildings.

3.4 Preparedness and planning element

- Effective national programmes should require each school organisation and every individual school to take measures to reduce risks and to prepare employees and students to react in safe ways during emergencies. These school safety elements should include the following:
- Education. Develop and teach curricula for primary and secondary school students on earthquakes, societal issues relating to earthquakes and preparedness actions. Use the school curricula to promote a culture of prevention in future generations of the community.
- Risk reduction measures. Undertake measures to improve the safety of the physical environment by bracing and anchoring furnishings, bookcases, and equipment and building components such as lights, heaters and water heaters.
- Emergency plan. Prepare and maintain plans that identify the actions, decisions and responsibilities needed before, during and following an earthquake; the organisation and responsibilities to carry out these plans, including determining whether to shelter or release students or to use school facilities as community shelters; and the equipment and supplies needed to carry out these decisions.
- Safety assessments. Establish standards, line of responsibility and procedures to assess the safety of buildings following earthquakes, and decide on evacuation, repair and re-occupancy procedures.

- Training. Provide training and materials for employees and students on earthquake hazards and actions to take to improve personal safety.
- Drills. Hold periodic drills simulating realistic conditions of earthquake events to reinforce training and to test the adequacy of plans and safety assessments.

3.5 Community awareness and participation element

Paramount t o the success of a programme to improve the seismic safety of schools is the understanding and involvement of the community. All members of the community should understand the seismic hazard of the region, the vulnerability of existing school buildings, the consequences of not properly constructing new school buildings or improving the resistance of existing buildings, and the feasibility of improving seismic safety. In particular, those members of the community who are involved in the construction of school buildings need to understand why they are required to follow prescribed practices, and the consequences of their failing to do so. An effective community awareness effort should include:

- Programmes to raise public awareness and knowledge of the risk from earthquakes and other natural hazards.
- Educational programmes to transfer and disseminate technical knowledge and to explain risk in terms understandable to community stakeholders.
- Activities to empower the community to be part of, and contribute to, the reduction of seismic risk of schools.
- Use of school curricula to promote a culture of prevention in the future generations of community members.

4. MACEDONIAN EARTHQUAKE DATA

The territory of R. of Macedonia, which is located in the Mediterranean and Balkan seismic region, is exposed to intensive neo-tectonic movements, causing relatively high and frequent seismic activity. Over the last 100 years, more than 1 000 earthquakes have occurred within the national territory, a considerable number of which have been of damaging (MMI = VI-VIII) or destructive (MMI = IX-X) intensity. Of the 194 earthquakes with an intensity (MMI) greater than VI, 44 had an MMI of VII, 15 had an MMI of VIII, nine had an MMI of IX and two had an MMI of X. Compared to the number of buildings that comprise the national residential building stock, school buildings have a high occupancy rate and can operate in up to three shifts.

Primary and secondary education in Macedonia is organised in 1 292 school facilities, which accommodate about 344 393 students and 17 849 staff. The total student population represents 18% of the total population of Macedonia, which is estimated at 2 033 964 inhabitants (Republic Bureau of Statistics, 1992).

An analysis of seismic exposure of school buildings and students indicated that there is a high probability that 100% of school buildings might be exposed to an MMI of greater than or equal to VI, and 98% of school buildings and 99% of students to an MMI of greater than or equal to VII.

In the Skopje earthquake of 1963, 44 urban school buildings – or 57% of the total urban school building stock, providing education for about 50 000 children – were destroyed. Fortunately, the Skopje earthquake occurred during the summer holidays, at 5:17 a.m. local time, when school buildings were not being used. Thus, there were no human casualties associated with the heavy school building loss. Nevertheless, schooling was heavily interrupted both in Skopje and throughout the entire country. Most children were evacuated until school buildings were repaired and strengthened and/or new temporary or permanent school facilities were erected. Unfortunately, neither the government nor schools had prepared emergency plans for such a situation. As in many other cases, if the earthquake had occurred while students were in the school building, the Skopje casualty figures would have been enormous (Figure 6.1).. Behaviour of educational buildings in the Skopje earthquake (Milutinovic and Tasevski, 2003).

(a) Gymnasium “Cvetan Dimov” (b) Gymnasium “Zefljus Marko”

Figure 6.1. *Partial collapse of secondary schools in the 26 July 1963 Skopje earthquake*

4.1 Earthquake preparedness in Macedonian schools

During the last decade, earthquake preparedness of schools and students has been achieved through the national education system and activities of specialised NGOs (e.g. Macedonian Red Cross, First Children’s Embassy) and agencies of the United Nations (e.g. UNICEF, UNESCO). Topics addressing natural and man-made hazards and disasters have also been integrated into the curricula and in students’ extra-curricular activities.

In order to better educate students and teachers in disaster preparedness and management, UNICEF-Skopje Offi ce launched a project on “Physical and Psychological Management of Earthquake-Related Emergencies in Schools in the Republic of Macedonia”. This project had the following objectives:

Education programmes. Topics addressing natural and man-made disasters will be further integrated into the curriculum, with particular emphasis on the main agents of disaster in Macedonia. The basic elements of emergency management, in addition to stress management and counselling, will also be incorporated in educating and training

existing and future teaching staff.

School Emergency Preparedness Plans. These plans are to be prepared at the school level. The roles and responsibilities of all stakeholders and instructions for emergency procedures will be clearly defi ned. Drills to test the effectiveness of SEPP will be organised regularly in co-ordination with the Pedagogical Institute of Macedonia and the Ministry of Education and Science. A number of project activities have already been realised:

Definition of school survey sampling model. To assess the present condition of school buildings and the prevalent structural typology, 15% (about 150 school buildings) of the overall school building stock was evaluated. The school building sample, sampling criteria and prioritisation were based on the local seismicity of Macedonia , distribution of pedagogical regions, and the typology and present conditions of the exposure

School building survey. A school building survey focused on the characteristics of the building site, school building geometry and structural characteristics, materials used, characteristics of foundation media, age, quality of maintenance, existing conditions, provision of evacuation facilities and capacity. The UNDP/UNIDO-RER/79/015 form was slightly modified to include only pre-earthquake building data and data of interest to the Ministry of Education and Science for improvement of school maintenance, equipment, installations, etc.

Determination of dominant school building structural typology. The principal structural types of school buildings were defined based on data collected in a survey of school buildings.

Development of a GIS-oriented information database. This database was developed from the school-building inventory and from data collected on structural, nonstructural and other school building parameters.

Expected seismic behaviour of school buildings and probability of disaster. The expected seismic behaviour of school buildings and the probability of disaster were estimated for prevalent structural types of school buildings in Macedonia based on detailed analyses of buildings' behaviour in the post-elastic domain.

Definition of cost-effective measures and priorities for reduction of earthquake effects. Cost-effective measures to reduce non-structural school building damage will be proposed, based on disaster potential caused by unacceptable behaviour of nonstructural elements and school equipment.

Development of guidelines for the physical and psychological management of earthquake-related emergencies in schools. These guidelines will provide information on present school building conditions, prevalent school building typology and expected structural behaviour of school buildings in the event of an earthquake. Measures and priorities to consider in the physical and psychological management of earthquakerelated emergencies are defined in accordance with worldwide experiences and are adjusted to the existing seismic and school-building environment in Macedonia.

Preparation of classroom materials. In order to improve the skills and decision-making abilities of teachers and administrative staff, booklets and teachers' manuals will be prepared that contain measures and priorities for the physical and psychological management of earthquake-related emergencies. The booklets will contain approximate

assessment of school building safety and instructions on how to organise building evacuation.

In-service teacher training. Regional workshops for school co-ordinators will be organised to present relevant teaching models.

These recommendations included in the final part of this paper and represent an important step forward in the recognition by governments that greater effort is required to address the urgent problem of improving the safety of schools in earthquakes.

5. CONCLUSION AND RECOMMENDATIONS

There is a high probability that an earthquake will occur within the next twenty years . Minimization of earthquake disaster impacts depends not only on the reduction of physical and social vulnerabilities, but also upon individual and community empowerment through the reduction of "informational vulnerability" (Degg and Homan, 2005). Therefore, knowledge sharing between scientists, educators, administrators and the general public is highly critical. Sharing earthquake information with young is, therefore, not simply an exercise; it can save lives and anguish as the possibility of a large earthquake in the near future.

Our stepwise approach to earthquake education with school students has been demonstrated as an effective method for dissemination of science-based earthquake information to young people. Our activities have enabled students to understand and use appropriate scientific concepts and terminology when describing earthquakes and related physical processes. The hazards activities have increased students‟ awareness and empowered them with knowledge and skills necessary for utilization of all resources for their protection before, during, and after an earthquake. As a result of theese training, some students have started to think critically when sharing and receiving earthquake information. One of the most significant and exciting outcomes is that most of the participating students developed an innate interest, particularly earthquake science and hazards. What becomes clear from the above is that there are several dimensions to the knowledge base that are necessary for reducing uncertainty and improving risk assessment: knowledge specific to the field of the risk itself, knowledge imported from various related scientific disciplines, and knowledge of the wider context in which the risk is analysed. These requirements point to the need for enlarged databases, as well as the capacity to generate synergies from linking and/or sharing those databases both nationally and internationally. Significant advances are expected in the coming decades in information processing and in the gradual diffusion of "ubiquitous" computing, which should make a considerable contribution to expanding databases. Interfacing with and sharing information – within government administrations, between Ministry of education and the private sector, among companies or between countries – is an area that holds great promise, but which is fraught with institutional obstacles as well as proprietorial and privacy problems.

Although it is not possible to eliminate man-made disasters completely, it is fairly possible to reduce the effects to a minimum. This could be done by taking the following precautions:

- Improvement in the education and training systems.
- Improvement in the technologies to ease and secure the lives of human beings, and in the intellectual use of these technologies.

To sum up, entire mitigation of risks and hazards of man-made and natural disasters is almost impossible, however, it is fairly possible to mitigate the effects significantly to a certain extend. It is the sole responsibility of human beings, nothing and no one else as the major source of environmental problems, to pay utmost attention to the issues of environmental pollution, global warming, and man-made disasters before we lose the features of a maintainable world.

What is important in this life is not only what we gain for ourselves, but something much more beyond that what is important is that we work all together to ensure the safety of our people's lives and properties.

RECOMMENDATIONS

During an Earthquake

Keep calm and keep others calm. Do not panic, it will never help. The best thing to do as soon as you are aware of the fact that you are in the midst of a quake is to rush to an open space quickly.

- If you are at home or inside a building or auditorium crouch under big tables, the frame of an inner door, in the comer of a room or even under a bed. Never use the lifts. Keep well away from windows, mirrors, chimneys and furniture. Stand next to a solid object only, which can withstand any fall and not likely to get crushed easily.
- If you are in the street, walk towards an open place, in a calm and composed manner. Do not run and do not wander round the streets. Keep away from buildings especially old ones, tall or detached buildings, electricity wires and poles, slopes and walls that are liable to collapse.
- If you are driving, stop the vehicle immediately but take care not to park close to a building, wall, slopes, electricity wires, and cables. Stay inside the vehicle.

After an Earthquake

- After an earthquake, keep calm, switch on the transistor radio or TV set for latest information on the quake and obey any instructions you hear on the radio or TV.
- You might feel after shocks, which are lesser in intensity, than the original quake, so be prepared for that. Turn off the water, gas, and electricity. Do not smoke and do not light matches or use a cigarette lighter if you are inside a building or a closed place. Do not turn on electrical switches as there may be gas leaks or short-circuits that can cause fire. Use a torch if you can reach one.
- If there is a fire, try to put it out. If you cannot, call the fire brigade. If people are seriously injured, do not move them unless they are in danger. Immediately clean up any inflammable products that may have spilled (alcohol, paint, petrol, kerosene etc.)
- If you know that people have been buried, tell the rescue teams. Do not rush and do not worsen the situation of injured persons or your own situation. Avoid places where there are loose electric wires and do not touch any metal object in contact with them
- Do not drink water from open containers without having examined it and filtered it through a sieve, a filter or an ordinary clean cloth. Eat something so that you feel better and more capable of helping others.
- If your home is badly damaged you will have to leave it. Collect water containers, food ordinary medicines and, if you are a person with heart complaints, diabetes hypertension, etc., special medicines also. Do not re-enter badly damaged buildings and do not go near damaged structures.

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