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School's contribution to prevention of earthquakes

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Abstract

Greece is a highly seismogenic country. To be more specific, it is the 6th most seismically active country worldwide, as well as the most earthquake-prone country in Europe. Undoubtedly, earthquakes are natural phenomena that people can't prevent, or forecast. What we can do, is take appropriate measures to be shielded against this phenomenon. We should try to be informed enough and be active to protect ourselves. **Prevention** is the key word to this venture. Prevention of earthquakes is a set of measures taken at the individual and community level to minimize the effects of an earthquake. And what can school do to make a difference? Of course, act as a linking point between research, education and local communities, so that students and teachers can start figuring out ways to contribute to the prevention of earthquakes. Due to the fact that the prevention of earthquakes is a field of constant studies and controversy, youths should not only be aware of information, but also be able to do research, think critically, make best use of provided knowledge, assess their options and make decisions. After all we, students, are the future citizens of our world.

Keywords

Prevention ; school ; earthquakes ; education ; measures ;

Body text

Background, motivation and aims

Due to the high seismicity of Greece, there has been much attention drown to the field of earthquake prevention, mostly by the EPPO (Earthquake Planning and Protection Organisation), the Geodynamic Institute, as well as other organisations . Even though Greek people have been much informed about the phenomenon and how they should act in case of an earthquake, they are still afraid of it. Information has mainly been achieved by the EPPO

institute, which organizes events and talks, broadcasts television campaigns and takes part in exercises regarding earthquakes [1]. Motivated by the theme of the 2018 Greek Student Parliament of Science [2], the STEM club of my school studied earthquakes, interacted with other students and came up with innovative methods to strengthen the Greek community and prepare it for when an earthquake is about to happen.

Writing this article, I'm aiming to communicate to the world, how the school can play a significant role in earthquake prevention. Should these proposals come to reality and be embraced by the society, the new generation will be noticeably better informed about this phenomenon, hence way less afraid of it. It is highly important that the knowledge we gained will one day be available to everyone.

Measures that should be taken

It is crucial that **research** is done, following the applicable legislation (Greek Seismic Design Code of 2003 [3] and Eurocodes [4], in order to have a greater number of detailed data about earthquakes. What will make the difference is the wide usage of **open data**. Open data refers to free access to data, such as statistics and other research results, for all people. School can play a role by providing this kind of data in school libraries or official school nets, so that students can reach them, whenever they feel like. It would also be helpful if schools collaborated with research centers or individual researchers. Such collaboration can make it easier for students and non-scientists to understand the given information better, not to mention that participation in real research work will give students a taste of how research is done as well as stimulating their interest in science. Especially in the field of earthquake prevention, school can organize drills to train both students and local community about safe ways to act during earthquakes, might organize seminars and workshops open to the public, launch student inspired projects and create a school newspaper.

Construction of buildings, is one of the first things that come to our minds when we hear "earthquake prevention". Indeed, the way we build our houses, and other buildings plays a major role in our protection. We have all heard the phrase "**Antiseismic Design**" [5]. But how many of us know what it means and how we can achieve that? The seismic resistance of a structure, in other words the way the building behaves during an earthquake and the damage caused to it, depends on four factors: 1) location of the building; how far the building is from the focus of an earthquake, affects the severity of the wave that hits it, 2) characteristics of the ground; softer or tilted ground makes seismic waves harsher and longer lasting, thus increasing the damage made to the buildings, whereas horizontal and tough ground helps contradict the effects of such waves, 3) structural traits such as the mass of the building, symmetry, the foundation, the number of floors as well as more detailed characteristics of each structure play a main role in each building's response to an earthquake, as they define the quality of the structure, and 4) material used; each material, like wood, stone or concrete has its own advantages and disadvantages which should be taken much into account and

customized according to each situation and surroundings. Nevertheless, these are the factors, according to which buildings have been classified into categories of seismic vulnerability, by the EMS (European Macroseismic Scale) [6]. Except for constructing the new buildings in a way that has proven to increase seismic resistance, we should also check on older structures and retain or enhance them appropriately, keeping in mind that most buildings in Greece have been constructed in previous decades. How can school help with that? First of all, via communication with special scientists, such as architects and engineers, and through visits in manufactural industries, youths can receive better and more precise information about earthquake resistant construction of buildings. What our school encouraged us to do, was to go to our neighborhoods and take pictures of buildings [see Figure 1] in order to judge some superficial traits. In the figure provided, there are some buildings with problematic traits, such as too much weight put on the balcony by some plants, big number of floors and existence of garages and sheds. For about a month, students that were members of the STEM club of my school would always carry a camera, in order to take pictures of buildings we found interesting. There was not a specific area of research that we chose; we just kept our eyes on capturing a variety of structures to discuss in our weekly meetings [see Graph 1]. In this graph we briefly explain which characteristics we mostly payed attention to as well as how these traits affect the response of a building in case of an earthquake. This helped us understand the knowledge we had gained better, through a hands-on experience. On a local level, should this action take place in more schools, we could be the voice of the youth asking for more controls for flaws on buildings, better construction of them, and of course better information for the people. To understand the abovementioned factors better, we created some buildings out of clay and toothpicks, which manifested some basic characteristics, and then shook them to see which one would be ruined first [see Figure 2]. In order to shake them, we placed them all on a light table. The distance between them was such, that the falling of one building would not affect the condition of the buildings next to it. We then shook the table with medium force, which gradually increased until the buildings responded. The results of this simple experiment confirmed the theory we had studied [5]. The short building with the strong foundation did not fall, no matter how hard we shook the table, whereas the taller building with the weak foundation fell relatively easily, even though it was symmetrical. The building that fell with a minor shake of the table was the non-symmetrical one, which also lacked strong foundation. It only took us a few hours to create the constructions and do the experiments at almost no cost. Schools can easily use such methods, especially with younger children, for them to understand and remember the given information.

Another measure that could be taken is the existence of **shelters**, which are appropriately supplied with food, water and sleeping bags, where people can protect themselves in case of an earthquake can be proven crucial. In Athens there are several shelters, mostly in popular parks, squares and sport fields. What schools can do is to be themselves such shelters, prepared well enough. Apart from schools acting as shelters in case of emergency, they can

also inform students about local shelters and how to reach them as well as organizing events to collect supplies or raise money to keep already existing shelters equipped.

Furthermore, it is important that measures are taken for the **protection of ancient landmarks**, which consist the cultural heritage of our country. Given that these buildings have lasted for thousands of years, we can infer that they are already properly antiseismically designed. True as it might be, we should still put effort into retaining them. Schools can study this issue in order to examine which traits of those structures made them last so long. They can also probe the municipality to pay more attention to them and take extra measures for their protection.

Moreover, all houses should be supplied with an **emergency kit** [7], containing a torch, a whistle, medication etc. Also, we should all be very careful with the **placement of furniture** [7] in our houses. Heavy and breakable items must be placed lower, while shelves, bookcases and cupboard should be secured against the walls. School can contribute a lot, by informing the students the best way possible.

Finally, another measure that should be taken for prevention of earthquakes is the use of **technology** [8] to warn citizens in a legit and timely fashion, could come to reality, through usage of an application that warns people up to 15 seconds before an earthquake. Small as this time interval may seem, this time can be life-saving in many cases, as it has been proven in Japan, where this application is already in use. School can help raise awareness about such applications by recommending the students to use them and teaching them how they can make best use of these 15 seconds in order to protect themselves and their properties.

All in all, society and school, as an education provider, ought to **inform people** [7] about how they should act before, during and after an earthquake. This can be managed, via campaigns (television spots, wallpapers, flyers) talks by special scientists for the local communities, happenings, practice in seismologists' offices, contribution to the school newspaper and earthquake exercises.

Overall school's contribution

Given the fact that the 21st century is full of scientific and technological achievements, diversity, contradiction and rapid progress, it is highly important that school is not only about knowledge transmission, but also about achieving pluralistic information, building well-rounded and wholesome characters, and gaining traits that will help us adapt better to the requirements and needs of our era and make us active and responsible members of the society, thus enhancing our lives' quality. It's not only earthquakes, what this article is about. It's more about how school, as an "education beacon" can be more effective in order to solve major social and scientific problems. Through collaboration with special scientists, research centers and Universities, participation in writing of the school newspaper and practical exercise in actual workplaces, young citizens get puzzled, develop critical thinking, study innovative issues, suggest solutions, and make decisions, thus contributing a lot to the society.

Unfortunately, to my knowledge, not many schools have embraced such methods yet, but the best is yet to come.

Conclusion

It is important that education becomes a fertile collaboration between organizations connected or not to the school, in order for science and society to get closer. This way, the connection, interaction, and effective collaboration between them is achieved and the road to finding breakthrough solutions in modern issues gets easier. In the case of earthquakes, schools can embrace the abovementioned measures, to enhance peoples' response and, as a result, to make their lives better. School can play a major role in ensuring that everyone receives appropriate education, thus taking measures of prevention, resulting in correct and calm facing, when needed. Having been exposed to much related information, studied the issue a lot and experienced some of the Open School for Open Societies OSOS actions, I can sincerely say that I'm not afraid of earthquakes whatsoever anymore. The reason? My school ensured that I get the best education available. The goal is for everyone to receive equal education, so that our future society will face earthquakes and other problems the best way possible.

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