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The Role of Architecture Education in Natural Disaster Mitigation

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***Abstract*:** *Natural Disasters are unusual and unexpected events that bring about economic and social loss and affect human activities by destroying or damaging buildings or other structures. On a global scale, it is the natural disaster that has the most significant and the most diverse effect on human beings. The resulting technical, economic and sociological impact can have a long-term effect on a community.*

Turkey is potentially an extremely hazardous place due to its geological state, topographic position and climate. Turkey is one of those countries that frequently experiences different crises such as natural disasters, terrorist attacks, and immigration caused by war and instabilities from neighboring countries. Turkey is also located on the Alp-Himalayan Fold Belt with 99 percent of the population, 96 percent of industrial areas, and 75 percent of the power stations in Turkey situated in places accepted as seismically risky. Thus, Turkey is economically vulnerable in terms of earthquake risk; for example, the financial impact on the Turkish economy from the Kocaeli earthquake in 1999 was estimated at $9 to $13 billion. Architects play important role in disaster mitigation and recovery after hazard events. Architectural design might prevent or decrease destructive consequences of disasters on structures. However architect must have enough background for disaster mitigation. This can be succeeded during BSc education of architects. As part of the disaster preparation of architects, they must be fully aware of their responsibilities and liaison with relevant disciplines must be defined and properly organized.

In this study, the disaster preparedness policies of the architecture education in Turkey are analyzed based on theoretical and field investigations. Architectural education system in Japan, USA and Italy is investigated from disaster mitigation point of view. Existing properties of the educations systems of under graduation are compared and assessed in order to understand and compare disaster awareness of architects. To understand existing architecture education system in Turkey and its effectiveness for disaster mitigation, three different surveys are prepared for BSc students and professional architects to measure their disaster mitigation background as a result of their education. The results are analyzed and discussed at the end of study.

Keywords: *Natural Disasters, Mitigation, Architectural Education, Damage, Awareness, Preparedness*

1. Introduction

Natural disasters such as earthquakes, landslides, forest fires, hurricanes, oil spills, and floods are a source of high economic, environmental and human impact. Every year, thousands of human lives are lost, millions of people bear the destruction of their homes and an invaluable economic harm is made. It has been estimated that a new big disaster arises every three days, whereas local and regional authorities must manage the thousands of emergencies that take place every year [1]. These two definitions encompass both man-made and natural disasters including hurricanes, war, floods, civil disturbances and riots, nuclear accidents, landslides, economic depression or disinvestment, plane crashes, and even some urban renewal projects. In a more basic sense, a disaster is an event that causes destruction to the built environment—the places in which humans live, work, and recreate. Just as quickly as people build roads, buildings, and parks, there are forces such as wind, hail, economics, and political conflicts that destroy them.

Obviously, emergency management focuses on saving human lives and decreasing economic losses. Nowadays, these objectives are reachable due to the technological revolution that has taken place during the

recent years in research areas like computing, telecommunications, computer networks, remote sensing and global positioning. In particular, the appearance of the sensor web enables the sharing of a wide variety of observations from spatially referenced sensors into a distributed computing network [2]. As a result of the integration of these technologies, quick and automatic alert and characterization of disasters is now achievable.

The lack of preventive planning and design—both before the disaster and afterward—is a critical problem with which the design world has only slowly been facing. Following the Indian Ocean tsunami in 2004, which killed more than 200,000 people, the first questions were asked about the role and responsibility of architects in disaster risk management. A succession of disasters like the 2008 earthquake in Sichuan province, China, and the 2010 earthquake near Port-au-Prince, Haiti, have offered urgent reminders that professional architects—whether in the developing or developed world—are generally absent from efforts to protect people from disaster. They have had no sustained role in shaping policy or leading best practices in disaster prevention, mitigation, and recovery. There is still no career path that prepares students to work as urgentistes—design professionals who intervene at a crucial moment in the recovery process to produce enduring solutions. Architects have been slow to respond to the needs of disaster management but there is a growing engagement. In recent years, a handful of professionals in small agencies or scattered through larger firms have helped to introduce innovative and sustainable building methods, land-use planning, and environmental stewardship to disaster zones. A common ideology has emerged on how to bridge the gap between short-term emergency needs and long-term sustainable recovery. In the most successful cases, three of which are presented here, the project is rooted in the profound belief that the local community is at the center of the process leading to pertinent and sustainable solutions, and that culture and architecture are inseparable allies. [3].

If an architect can be part of disaster management team, great alertness and sensitivity can be applied at the design level. For example Frank Lloyd Wright designed hotels in Japan in his early career keeping earthquakes in mind and they are very good examples even today.

Design professionals and the construction industry have a significant role in the health and safety of the environment and in disaster management (Figure 1). Their role includes a range of activities designed to maintain control over emergency situations, providing a framework for helping those who are at risk to avoid or recover from the impact of the disaster (Kelly, Limitations to the Use of Military Resources for Foreign Disaster Assistance, 1996). FEMA recognizes both as unfilled roles, stating "the literature on natural hazard mitigation directed toward the architectural profession is scarce in spite of the fact that architects can make a significant contribution to hazard risk reduction" [4]. As a first priority, the American Institute of Architects has been advocating for architects to engage with local building departments and state emergency management agencies to perform building safety assessments when needed. This community engagement reduces the need for temporary housing and prevents further injury or loss of life by ensuring that structures are safe to occupy.

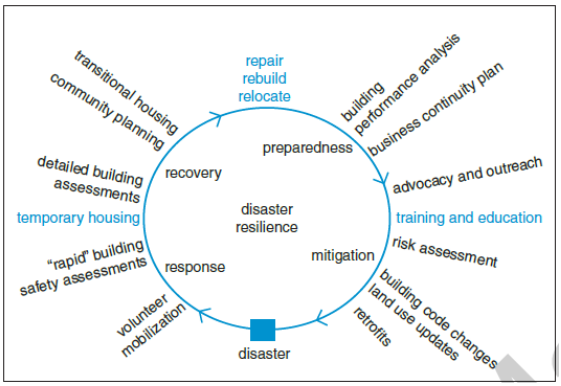

Fig. 1 Disaster Resilience Cycle and the Role of the architect [5]

Communities can prepare themselves for potential disasters and mitigate or reduce the impact of hazards so that they will not have to rebuild their homes and businesses. When risks are addressed ahead of time, the potential for damage will decrease. As expressed by FEMA, “mitigation has long been perceived and practiced as an essential tool for helping to save lives, reduce property damage, and decrease the money spent on disaster recovery efforts.” Informed and trained architects can be advocates for increased public education and awareness by conveying the risks owners face and demonstrating how those risks can be reduced through specific building mitigation methods [5].

Architectural education has a long experience in Turkey. Formal education in Western terms goes to the beginning of 19th Century, while the presence of an architectural education goes back to the 15th Century. After the proclamation of the' Republic, architectural education has shown an ever improving line. The schools of architecture have always been the focus of prevailing architectural ideologies and after 1960 the social developments in the country have motivated the new searches in architecture. Due to the research done in the universities, these institutions today function on the leadership role of innovations in building technology. Turkey with her almost 15,000 architects, is a pool for architectural education and building construction for the Middle East. As architectural education has always been developed in accordance with the architectural movements, it is unavoidable to briefly review the architectural developments in the country. Today there are nine Faculties of Architecture in different Universities of Turkey. Some of them are still in the foundation stage. Istanbul Technical University, Mimar Sinan University (former D.G.S.A.) and M.E.T.U. retain their influential positions [6].

2. Disaster Management System in Turkey

Turkey is in a region that is politically vulnerable and prone to natural disasters. it is at risk from a range of complex emergencies. Statistically, a large-scale disaster happens every seven to eight years (Table 1). in Turkey, disasters are both natural and human made, causing serious disruption of normal daily life, causing widespread human, material or environmental losses that exceed the ability of the affected populations and the government to cope using its own resources. In general, the country is subjected to earthquakes, floods, landslides, avalanches and forest fires, with earthquakes having by far the greatest impact on population and infrastructure.

Table I. Summarized Table of Natural Disasters in Turkey from 1900 to 2009 [7]

Type of Disaster	No. of Events	Killed	Total Affected	Damage (000 US$)
Earthquake	71	88.538	6.874.596	22.941.400
Epidemic	8	613	204.855	
Extreme temperature	7	100	8.450	1.000
Flood	35	1.274	1.743.386	1.645.500
Dry mass movement	1	261	1.069	
Wet mass movement	1	135		
Avalanche landslide	7	269	13.275	26.000
Storm	9	100	13.639	2.200
Forest fire	5	15	1.150	

Disaster Management system of Turkey is highly centralized and hierarchical . Responsibility for DM goes bottom-to-up, from district to province and to national level depending on the scale of the event. Small scale disasters can be handled first at district level. If the disaster surpasses the capacity of district level the provincial governor, who heads the “provincial rescue and relief assistance committee” (known as a crisis committee) involved response and recovery activities. If a major event occurs that requires central government intervention, the “Central Coordinating Committee for Disaster” coordinates the response efforts for the disaster. These structures were installed in 1959 through Law No: 7269 (Disaster Law). Law No.7269, “Measures and Assistance to Be Put Into Effect Regarding Natural Disasters Affecting the Life of the General Public” sets forth the fundamental components of disaster management in Turkey. The basic

principle of the law is to enable government to cope with disasters at the provincial level through what is designated as the Provincial Committee [8].

Crisis management arrangements were developed in early 1990's in Turkey. Crisis Management Center in the office of the Prime Ministry is a nationwide general coordinating body that includes:

• Crisis Coordination Board;
• Crisis Monitoring and Assessment Board;
• Secretariat.

Crisis Management Centre carries out the missions and responsibilities in accordance with the procedures in national legislations and in national plans. CMC in the office of the Prime Ministry is activated by the PM upon the proposal of the National Security Council, Board of Ministers, or State of Secretary who is responsible for CM or Secretary General of NSC, if there are some clear indications of crisis. According to its regulation, it has been established with core personnel in peace time. After it has been decided to activate in times of crisis, according to the type of crisis, it is augmented by the members of related ministries and institutions. If crisis management failed and in the case of escalation of the crisis, it may be proposed by CCB to competent this bodies in order to declare state of emergency, martial or mobilization and war.

Turkey's Disaster Management System was focused mainly on the post-disaster period and there were no incentives or legislations to encourage risk analysis or risk reduction approaches before the 1999 two major earthquakes. After these events with big impact the main concepts of Disaster Management System has been changed. Many new laws, regulations and other instruments on planning and implementations in all phases of disaster (mitigation, preparedness, response, recovery and rehabilitation) were accepted. But the disaster risk reduction system of Turkey is still mainly centralized. Unlike the central government, local governments are not given any real responsibility with respect to disaster management. The current legal regulations do not specify any administrative role for the municipalities, NGOs, professional organizations, headmen (muhtars) and citizens, but holds them responsible for carrying out the duties assigned by the central authority. Moreover, these parties are not given any discretion neither for planning, nor for mitigation stages. Local governments and non-governmental organizations are not given opportunities to play a sufficient role in these issues. There is still lack of knowledge of modern disaster risk factors, therefore, that results in lack of action and weak awareness of population and institutions. Education about disaster risk is offered in primary and high schools, but there is no systematic educational program for the general. public. Development of standards for public education and community organizations, reaching the public at large, active participation of public, training the trainers and production of training materials has not been considered. Although the educational efforts underway so far are valuable and have reached a large number of people, the current situation can be summarized as a pervasive state of un-preparedness. The educational work done so far focused solely on "what and how to do". Information on earthquakes is presented, non-structural mitigation is demonstrated, what to do during an earthquake is shown and a trial is made. This focus is certainly important. Yet, clearly another focus is required; which is to find the mechanisms to get the public to take action. [9].

3. Disaster Mitigation in Architectural Education at Undergraduate Level

In order to understand better disaster mitigation system, three leading country and Turkish architectural education system have been analysed. These leading countries are USA, Japan and Italy. These countries are also having efficient disaster management systems.

Undergraduate level architectural education programs are based on university background and their architectural concept. Four famous and institutional architectural departments in USA are examined. They are University of South California, Cornell University, California Polytechnic State University, University of Texas. They have developed their own architectural trends in USA therefore these universities education programs and the relations between education program and disaster management are studied. [1]. The total number of the courses, and number of compulsory courses and the contents of the courses have been studied according to those selected universities. Based on content of the courses, the relations between disasters and disaster management concept are investigated and illustrated at Figure 2.

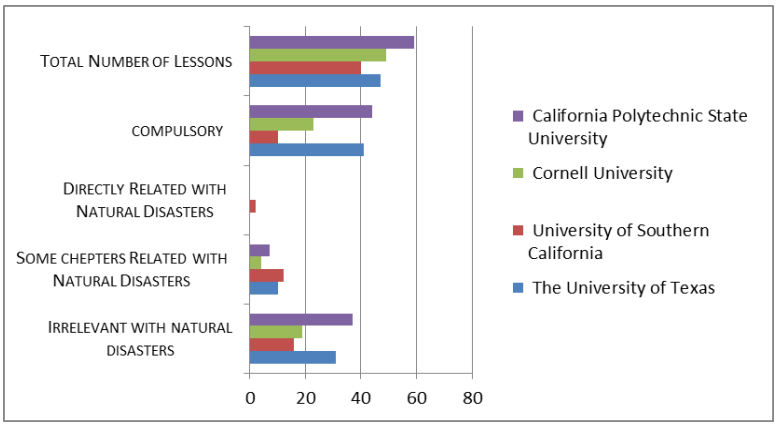

Fig. 2: U.S.A Architecture School's Curriculum Content Chart

Japan has a deep experience for disaster management since they have experienced many types of destructive natural disaster for centuries. Therefore architectural education system and their content of courses in Japan reflect their background in this field. Based on this disaster management concept, the education of architect in Japan is too difficult and authority for professional architects is based on qualify exams and professional experiences. An ordinary architect student gets enough knowledge and information about disaster management during his/her design studios and other courses. Most of compulsory and elective courses have enough subjects in their content. The first qualify exam after graduation and other grade promotion exams contains disaster mitigation and management topics. Because of special conditions of Japan, architects has to know detailed information about earthquake, tsunami, hurricane, flood resistant design. Four famous and institutional architectural departments in Japan are examined. They are Chiba, Kyoto University, Tokyo University, Waseda University. They have institutional background with skilled and experienced academic staff therefore the relations between education program and disaster management are studied for these universities. Based on content of the courses, the relations between disasters and disaster management concept are investigated and illustrated at Figure 3. Compared with US universities, Japan universities have much more courses related with disasters.

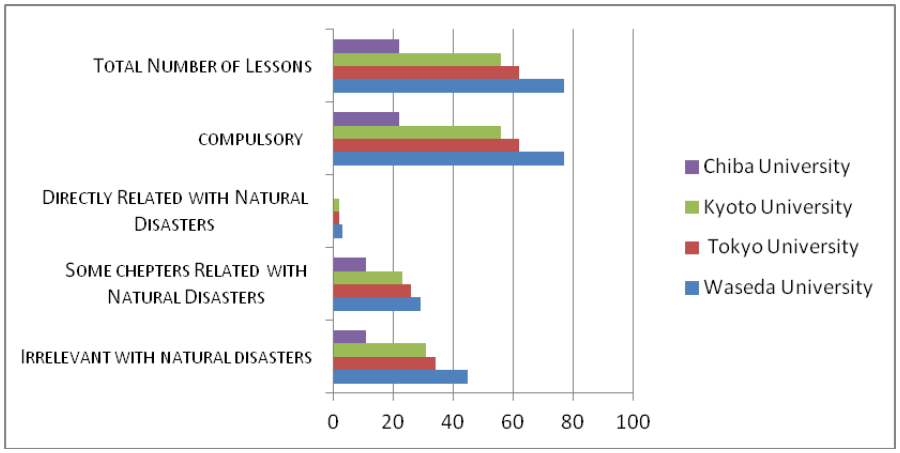

Fig. 3: Japan Architecture School's Curriculum Content Chart

Italy also has a significant background for disaster management and disaster resistant design. They have serious experience against earthquakes, volcano eruptions, landslides, avalanches. The duration of architectural education in Italy is 5 years. They still discuss about duration of architectural education as 3+2 years. Four famous and leading architectural departments in Italy are studied. They are Sapienza Universita di Roma, Universita Degli Studi Firenze, Politecnico di Milano, Politecnico di Bari. According to courses and their contents, it is difficult to find courses directly related with disasters. However partially related (some parts of the content) with disaster courses are satisfactory.

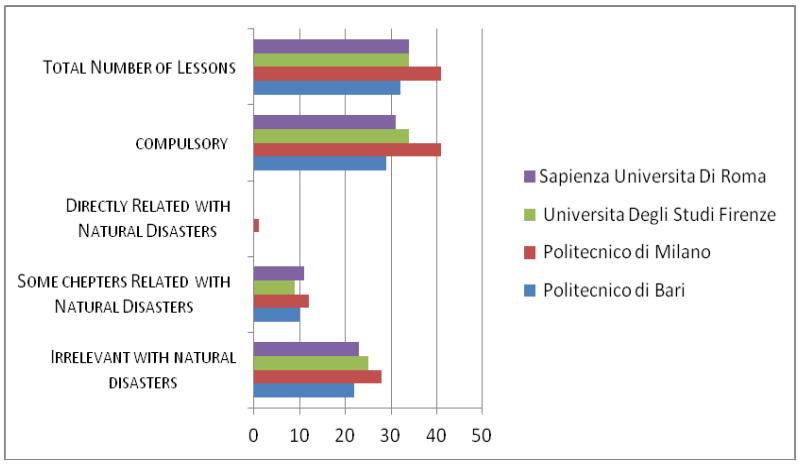

Fig. 4: Italian Architecture School's Curriculum Content Chart

Turkey is under the risk of both natural and human made disasters. In general, the country is subjected to earthquakes, floods, landslides, avalanches and forest fires, with earthquakes having by far the greatest impact on population and infrastructure. Especially earthquake is very destructive natural disaster for Turkey. Earthquakes (17.08.1999 Marmara and 12.11.1999) in 1999 caused more than 20.000 life losses and billions of dollars. In this study 5 leading and famous universities programmes are studied. They are Middle East Technical University (METU), Istanbul Technical University (ITU), Yıldız Technical University (YTU), Karadeniz Technical University (KTU) and Dokuz Eylül University (DEU) since their programs clearly reflect architectural education standards in Turkey [1] According to courses and their contents of studied universities, it is difficult to find courses directly related with disasters. In addition to this partially related (some parts of the content) with disaster courses are very limited.

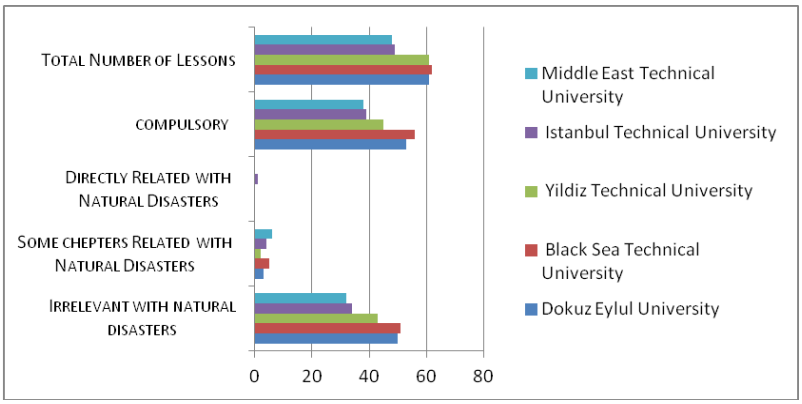

Fig. 4: Turkey Architecture School's Curriculum Content Chart

The comparison graphic between country averages is given in Figure 5. As shown in the graphic, Japan has the best value for courses directly or partially related with disasters. This result shows Japanese disaster management and disaster resistant design background. However Turkish ratio is the lowest for courses directly or partially related with disasters.

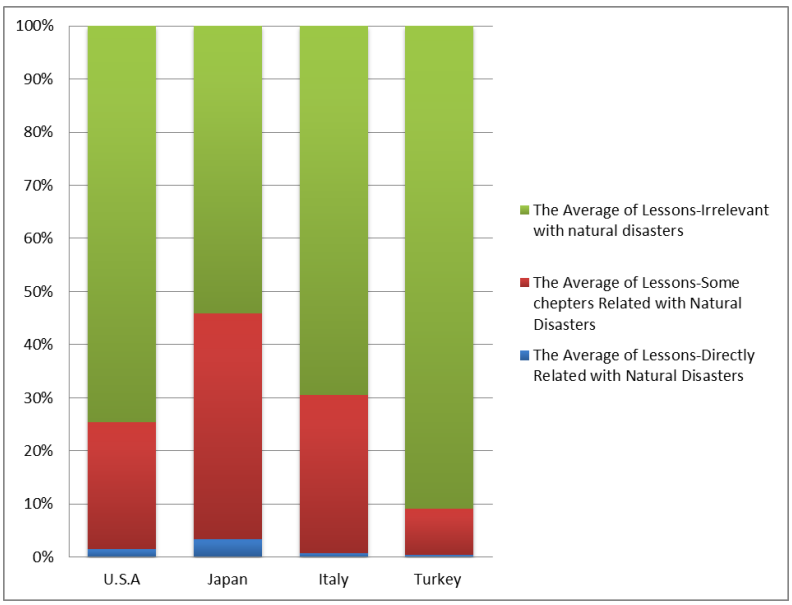

Fig. 5: Comparison Chart of Different Countries' Architecture School's Curriculum Content

4. Survey Studies

Two surveys were prepared in order to understand and measure evaluation of disaster preparedness of students, alumnus and academic staff based on architectural education. Survey for students contains 27 questions; survey for active professional architects has 22 questions. These surveys were prepared, applied and evaluated as execution part of MSc thesis study.

4.1. Survey Study for BSc Architectural Students

Survey for students has 27 evaluation questions and 59 architectural students were surveyed. This survey has three basic parts. First part of the survey based on personal and professional point of view, second part of the survey based on evaluation of under graduation education, third part of the survey based on evaluation of expectations for professional life from point of this concept. Participants can answer to the questions as totally agree, neutral and disagree. Participants can show their agreement to the survey statements from 1 to 5. 1 means totally disagree, 5 means totally agree (* 1-Totatlly Disagree / 2- Disagree / 3-Neutral / 4-Agree / 5-Totally agree). The aim of this survey is to measure and learn student's personal evaluations. The content of the survey and results are given in Table 3 [1].

TABLE II: Survey Result of Bachelor Student Participations

	1	2	3	4	5
I've knowladge about natural disasters' type/frequency/effects in Turkey.	0%	5%	37%	51%	7%
Architecture is directly efficient to natural disaster reduction.	2%	3%	8%	34%	53%
Architecture education contributes me to follow last news about natural disaster.	2%	10%	31%	37%	20%
Not only archtitects, but also all disiplins are responsable for building damages caused by natural disasters.	0%	0%	0%	24%	76%
Earthquake is the only natural disaster that can be taken precautions.	73%	20%	3%	3%	0%
I may have enough information about buildings getting over earthquakes with minimum damage.	0%	8%	22%	49%	20%
I think, architecture curriculum s are busy and sufficient enough for professional competence.	5%	8%	37%	34%	15%
I took/will take at least one elective lesson about natural disasters.	5%	7%	24%	49%	15%
There isn't enough time for natural disaster in architecture education because so many other topics take place during education.	7%	12%	32%	29%	20%
Lecturers of design lessons give ideas on design against natural dis.s effects.	5%	19%	36%	36%	8%
In design lessons, related regulations, laws about dis. reduction are mentioned	12%	15%	39%	32%	2%
Visiting disaster regions with lecturers would help me to improve awareness on professional life.	0%	2%	2%	40%	56%
Total period of architecture education is proper in Turkey.	12%	17%	37%	20%	14%

Professional competence for architecture (bachelor's degree) is proper in Turkey.	8%	17%	32%	39%	3%
I want to learn and practice the regulations and laws about natural disaster reduction during my undergraduate education.	0%	3%	8%	51%	37%
Lessons about natural disasters should be in master degree curriculum, not in undergraduate.	14%	37%	32%	10%	7%
I would like my lecturer to give advises about nat. disasters in design lessons.	0%	3%	3%	49%	44%
Laws and regulations about natural disaster mitigation should be evaluated in design lessons.	0%	3%	17%	53%	27%
Lessons with other diciplines would be useful to learn design criterias of natural disaster mitigation.	2%	2%	17%	61%	19%
Related lessons with natural disaster should be increased during undergraduate to mention natural disasters in studio lessons.	0%	3%	22%	58%	17%
In Turkey, lessons about relationship between architecture and natural disasters should be given in undergraduate architecture education.	2%	3%	22%	54%	19%
I think that I 'll find a chance to work on nat. disaster mitigation in business life.	2%	3%	25%	58%	12%
In business life, only electical and mechanical engineers are reponsable for fire security in a project.	44%	36%	12%	7%	2%
Only civil engineers are responsable for earthquake resistance in business life.	53%	31%	8%	7%	2%
I would prefer to learn design precautions of natural disasters in case of necessity.	20%	31%	27%	19%	3%
I would prefer to learn laws and regulations about natural disaster mitigation in case of necessity in business life instead of undergraduate education.	22%	32%	15%	25%	5%
In business life, my knowladge by means of undergraduate education will be useful and enough for me.	2%	3%	17%	54%	24%

4.2. Survey Study for Active Professional Architects

Survey for active professional architects has 22 evaluation questions and 90 active professional architects were surveyed. This survey aims to measure and evaluate personal awareness, professional awareness (using this awareness during design works) for disasters and professional experience from this point of view.

Participants can answer to the questions as totally agree, neutral and disagree. Participants can show their agreement to the survey from 1 to 5. 1 means totally disagree, 5 means totally agree. The aim of this survey is to measure and learn student's personal evaluations. The content of the survey and results are given in Table 3 [1]. %1.11 of the participants are just graduated (0-1 year experience), %56.66 of the participants (professional arch.) have 2-5 years professional experience, %30 of the participants (professional arch.) have 6-10 years professional experience, %12.22 of the participants (professional arch.) have 11 years or more professional experience. %11.1 of the participants works for state, %84.4 of the participants works private sector, %3.3 of the participants don't work (searching for job), %1.11 of the participants are retired.

Participants can show their agreement to the survey statements from 1 to 5. 1 means totally disagree, 5 means totally agree. The aim of this survey is to measure and learn professional architect's disaster and disaster resistant design awareness and their knowledge level, how they use this background during their projects and designs, personal evaluations about this subject. The content of the survey and results are given in Table 4. (Grading : * 1-Totatlly Disagree / 2- Disagree / 3-Neutral / 4-Agree / 5-Totally agree.)

TABLE III: Survey Result of Professional Architect Participants

	1	2	3	4	5
I've knowladge about natural disasters' type/frequency/effects in Turkey.	3%	5%	34%	44%	12%
Architecture is directly efficient on natural disaster reduction.	5%	7%	10%	44%	32%
Architecture education contributes me to follow last news about natural disaster	5%	20%	30%	30%	14%
Earthquake is the only natural disaster that can be taken precaution.	66%	17%	8%	3%	3%
Architectural design mistakes are effective on buildings damage after a natural disaster.	1%	11%	20%	42%	25%
Engineering mistakes are effective on buildings damage after a natural disaster.	1%	2%	12%	36%	47%
Laws and regulations related with natural disasters should be introduced in detail during architecture undergraduate education.	0%	0%	10%	31%	58%
I took lesson(s) about one of natural disasters or all of them during undergraduate.	32%	12%	11%	20%	24%

Visiting disaster area with academicians would be helpful for students to be aware of importance of their prediction position.	1%	3%	4%	32%	58%
Architecture undergraduate education helped me to be aware of damages can be reduced by taking precaution in design .	12%	11%	27%	28%	20%
Related lessons with natural disaster should be increased during undergraduate to mention natural disasters in studio lessons.	2%	4%	11%	42%	40%
There isn't enough time in architecture undergraduate education to mention about natural disasters.	12%	17%	28%	28%	12%
Lessons with other diciplines would be useful to learn design criterias of natural disaster mitigation.	1%	1%	10%	42%	45%
Professional competence conditions are proper in Turkey.	26%	32%	31%	8%	1%
I have a masterdegree / certificate about natural disaster mitigation.	65%	16%	4%	8%	4%
I have used laws and regulations related with nat. disasters in working life.	14%	18%	20%	26%	20%
The company that I work, pays special attention to design and application that care about natural disasters.	11%	11%	27%	31%	18%
The company that I work, supports staff to have trainings about natural disaster mitigation	21%	20%	20%	26%	12%
I would like to have master degree/certificate about natural disaster mitigation.	3%	15%	15%	41%	24%
There is/are architect(s) who has/have master degree/certificate in the company that I work.	41%	24%	20%	8%	5%
The company that I work, has projects in an area where happened a natural disaster in the near future.	40%	20%	23%	8%	7%
I have worked at least in one company that cares about natural disasters.	34%	22%	16%	14%	12%

5. Conclusions

As shown in previous chapters, there is a strong relation between education and disaster preparedness&mitigation. Unfortunately there are currently a few lessons in architecture departments in Turkey include natural disasters, disaster response, disaster management, disaster risk-reduction and development in their undergraduate curriculum. Even though some lessons have natural disasters related subjects, their credits are inadequate to reach desired level. According to the analyses of architectural undergraduate curriculums of various countries which are exposed same natural disasters or pioneer in disaster management, those countries universities average rate (related courses credits/total credits) is more than Turkey. Examples from USA, Japan and Italy have highlighted that architecture education has an important role for smooth running disaster mitigation system. Especially Japanese system (details are given before) shows us quality of education system has a serious effect for disaster preparedness&mitigation.

The survey results for professional architects shows that much more experienced architects for disasters are required. Architects generally aware of importance of disaster preparedness&mitigation during the first 5 years of their professional life. Professional architects have to know national and international laws, regulations and codes for disasters. However the most basic part of this background can give during undergraduate education. The inclusion of the topic to the undergraduate curriculum could offer future architects the tools they need to design well prepared human settlements, against disasters which are resilient to such natural events whilst enhancing their overall academic experience.

Otherwise, even though participants to our study are aware of importance of disasters however both architecture students and architects believes that they don't have enough background and knowledge to work in professional life. Especially students don't feel ready to get into this subject. In addition to this architects wants to learn design criteria's of disaster resistant settlements.

As a result of this study, a new interdisciplinary field involving both architecture education and disaster management system in Turkey should be developed. Awareness, knowledge, and options for positive action can empower individuals to create resilient sustainable communities.

6. References

[1] F. Ozdogan, "The role of Architecture Education in Natural Disaster Mitigation," Unpublished M.S. thesis, Dept.Architecture., Yildiz Technical Univ., Istanbul, Turkey, 2015.

[2] Delin K, Shannon P, 2001, “The Sensor Web: A new Instrument Concept”. SPIE’s Symposium on Integrated Optics. San José, CA, USA, January 20-26.

[3] Aquilino, M., Gans, D., Cross, R., Galeazzi, F., Palleroni, S., 2011, Solutions Journals, Vol. 2 (5), pp.43-50.

[4] FEMA 454, “Designing for Earthquakes: A Manual for Architects”: http://www.fema .gov/library/viewRecord.do?id=2418.

[5] Minnery , Rachel, 2013, The Role of Architects in Disaster Response and Recovery, The Architect’s Handbook of Professional Practice, Wiley, pp.131-142.

[6] Sey, Y., Tapan, M., Architectural Education in Turkey: Past and Present , http://archnet.org/system/publications/contents/3924/original/DPT0429.pdf?1384777424.

[7] EM-DAT (2009) The OFDA/CRED International Disaster Database. http://www.emdat.be/Database/CountryProfile/ countryprofile.php .

[8] Sahin M., Karaman H., Erden T. (2006) Disaster and Emergency Management Activities in Turkey, Shaping the Change XXIII FIG Congress Munich, Germany, October 8-13, 2006.

[9] Taymaz M. (2008) Interim national progress report on the implementation of the Hyogo Framework for Action, An HFA Monitor update published by Prevention Web, http:// www.preventionweb.net .