ASEE 2016
INTERNATIONAL FORUM
NEW ORLEANS, LOUISIANA / JUNE 25, 2016

Paper ID #17495

Comparison of Surveying Engineering Education in USA and Turkey

Dr. Esra Tekdal Yilmaz, Pennsylvania State University, Lehman

Dr. Tekdal Yilmaz is an assistant professor of surveying engineering at Penn State Wilkes Barre Surveying Engineering program. Her research interests include; Terrestrial laser scanning, deformation measurements and building information modelling

Comparison of Surveying Engineering Education in USA and Turkey

Abstract

Engineers with their creative, researcher and knowledgeable identities play an important role for the quality of life and welfare of the society. However the skills listed above are highly correlated with the quality level of engineering education given. Country specific educational habits and opportunities affect the learning pattern of individuals enrolled in engineering programs and therefore have impact on the career and future. In this study, possible improvement suggestions for the engineering education in Turkey will be given while comparing the teaching methods and conditions of two Accreditation Board for Engineering and Technology (ABET) accredited surveying engineering education programs in Turkey and USA.

1. Introduction

Engineering education in Turkey and USA are given with different number of total credits, curriculum, degree and program names which vary depending on the schedule, resources, usability of technology and course content. However there is one common thing in engineering education all around the world, to teach the individual how to reach the required knowledge using or finding correct information. In this way the students can gather vital and sound knowledge during their education life gradually and creatively.

The definition of engineering given by ABET is "Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind."

Criteria, compatible with definition of engineering, prepared by ABET for accrediting engineering programs, 2016 – 2017 define the general program evaluation criteria as follows: [1]

1) Students
2) Program Educational Objectives
3) Student Outcomes
    (a) an ability to apply knowledge of mathematics, science, and engineering
    (b) an ability to design and conduct experiments, as well as to analyze and interpret data
    (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
    (d) an ability to function on multidisciplinary teams
    (e) an ability to identify, formulate, and solve engineering problems
    (f) an understanding of professional and ethical responsibility
    (g) an ability to communicate effectively
    (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
    (i) a recognition of the need for, and an ability to engage in life-long learning
    (j) a knowledge of contemporary issues
    (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

4) Continuous Improvement
5) Curriculum
6) Faculty
7) Facilities
8) Institutional Support

The goal of engineering education is to give the creativity, research ability and ability to solve problems on their own in addition to the criteria defined under student outcomes of ABET.

2. Widely used accreditation programs in Turkey and USA

There are two widely used accreditation programs MUDEK (Association for Evaluation and Accreditation of Engineering Programs) in Turkey and ABET in USA.

2.1 MUDEK

MUDEK, is a non-legislative organization working for enhancing the quality of engineering education in Turkey by means of the accreditation and providing information services for engineering education programs in different disciplines. It is currently comprised of 73 individual and 2 organizational members.[2]

It was initially established with a name Engineering Evaluation Board as an independent, non-governmental platform in 2002 by the Engineering Deans Council (MDK), which is formed by the deans of faculties administering engineering education programs in Turkey and Turkish Republic of Northern Cyprus (TRNC), to prepare and conduct a comprehensive program for the evaluation of engineering undergraduate programs run by these faculties.

On 26 November 2006 became a member of ENAEE (European Network for Accreditation of Engineering Education) and authorized by ENAEE to award EUR-ACE Label to undergraduate engineering programs starting from January 21, 2009 and authorization is renewed on October 16, 2013 until December 31, 2018.

In 2007, after becoming an association, on November 16, 2007 recognized by the Higher Education Council (YÖK) of Turkey as the National Quality Assurance Agency in accrediting engineering programs for five years and this recognition is renewed for another five years on February 01, 2013.

On June 25, 2010 became a Provisional Signatory of Washington Accord of IEA (International Engineering Alliance) and on June 15, 2011 became a full member signatory.

In Turkey there are 18 public and 2 private university offering normal education (day classes), 7 public university offering second education (evening classes) in surveying and similarly named engineering programs. 8 of them seen in table 1 are accredited by MUDEK and only one program in Turkey seen on table 2 is accredited by ABET.

School Name	Location	Validity Period of MÜDEK Accreditation	*Validity Period of EUR-ACE Label*
Karadeniz Technical University Faculty of Engineering, Normal Education (NE)	Trabzon, Turkey	01.05.2010-30.09.2017	*01.05.2010-30.09.2017*
Karadeniz Technical University Faculty of Engineering, Secondary Education (SE)	Trabzon, Turkey	01.05.2015-30.09.2017	*01.05.2015-30.09.2017*
Bulent Ecevit University Faculty of Engineering	Zonguldak, Turkey	01.05.2015-30.09.2020	*01.05.2015-30.09.2020*
Selcuk University Faculty of Engineering (NE)	Konya, Turkey	01.05.2008-30.09.2018	*01.05.2010-30.09.2018*
Selçuk University Faculty of Engineering (SE)	Konya, Turkey	01.05.2008-30.09.2018	*01.05.2010-30.09.2018*
Yildiz Technical University Faculty of Civil Engineering (NE)	Istanbul, Tukey	01.05.2007-30.09.2016	*01.05.2009-30.09.2016*
Yildiz Technical University Faculty of Civil Engineering (SE)	Istanbul, Tukey	01.05.2007-30.09.2016	*01.05.2009-30.09.2016*
Kocaeli University Faculty of Engineering	Kocaeli, Turkey	01.05.2014-30.09.2016	*01.05.2014-30.09.2016*

Table 1. MUDEK accredited surveying and similarly named engineering programs[3]

2.2 ABET

ABET founded in 1932 as the Engineers' Council for Professional Development (ECPD), committed to education, accreditation, regulation, as well as professional improvement of engineering professionals and students.[4]

ABET is not comprised of individuals but 35 professional and technical organizations specialized in the areas or professions which are eligible (highly qualified) to represent fields ABET accredits in applied computer science, computing, engineering and engineering technology.

ABET encourages alumni of accredited programs and other instructively qualified people who work or practice in the applied science, computing, engineering, and engineering technology professions to make progress toward expert acknowledgment by improving their individual qualifications through licensure and certification.

ABET's accreditation activities are led by four commissions that are in charge of reviewing educational programs and settling on the final accreditation decision for each program. These commissions are Applied Science Accreditation Commission, Computing Accreditation Commission, Engineering Accreditation Commission and Engineering Technology Accreditation Commission.

In USA almost all surveying and similarly named engineering programs are accredited by ABET spread all over the country as seen on table 2.

School Name	Location	Accreditation Dates	Date of Next Comprehensive Review
Alfred State College	Alfred, NY, US	10/01/1992-Present	2018-2019
East Tennessee State University	Johnson City, TN, US	10/01/1992-Present	2019-2020
Ferris State University	Big Rapids, MI, US	10/01/1989-Present	2017-2018
Idaho State University	Pocatello, ID, US	10/01/2004-Present	2017-2018
Michigan Technological University	Houghton, MI, US	10/01/2011-Present	2017-2018
New Jersey Institute of Technology	Newark, NJ, US	10/01/1992-Present	2017-2018
New Mexico State University	Las Cruces, NM, US	10/01/1999-Present	2018-2019
Pennsylvania State University	Lehman, PA, US	10/01/2004-Present	2018-2019
Polytechnic University of Puerto Rico	San Juan, PR, US	10/01/2006-Present	2019-2020
St. Cloud State University	St. Cloud, MN, US	10/01/2004-Present	2017-2018
The University of Akron	Akron, OH, US	10/01/2010-Present	2016-2017
Troy University	Troy, AL, US	10/01/2010-Present	2016-2017
University of Maine	Orono, ME, US	10/01/2005-Present	2020-2021
California State University, Fresno	Fresno, CA, US	10/01/1979-Present	2018-2019
Florida Atlantic University	Boca Raton, FL, US	10/01/2010-Present	2020-2021
Nicholls State University	Thibodaux, LA, US	10/01/2008-Present	2015-2016
Oregon Institute of Technology	Klamath Falls, OR, US	10/01/1985-Present	2018-2019
University of Alaska Anchorage	Anchorage, AK, US	10/01/1995-Present	2016-2017
University of Florida	Gainesville, FL, US	10/01/1986-Present	2018-2019
California State Polytechnic University	Pomona, CA, US	10/01/1992-Present	2017-2018
Kennesaw State University	Kennesaw, GA, US	10/01/2004-Present	2017-2018
Istanbul Technical University	Istanbul, Turkey	10/01/2009-Present	2016-2017

Table 2. ABET accredited surveying and similarly named engineering programs[5]

2.3 Comparison of MUDEK and ABET criteria for surveying and similarly named engineering programs

In both accreditation criteria there are general and program specific measures. General criteria, consisting of 8, defined in ABET are the same with general criteria of MUDEK. But in addition to those MUDEK has one more criteria about organization and decision making stating that all decision making process between the organizations of higher education institution, chancellery, faculty, department and other sub units (if there are any) should be designed to support the achievement of educational objectives.[2]

Discipline specific evaluation criteria for MUDEK states that graduates should prove to be enough for at least one of the following topics: boundary and / or land surveying, geographic and / or land

information systems, photogrammetry, cartography, geodesy, remote sensing and other related topics. [2]

Under discipline specific evaluation criteria for ABET for surveying and similarly named engineering programs National Society for Professional Surveyors and American Society of Civil Engineers are listed as lead society and cooperating society respectively. [1]

There are two criteria defined. "The curriculum must prepare graduates to work competently in one or more of the following areas: boundary and/or land surveying, geographic and/or land information systems, photogrammetry, mapping, geodesy, remote sensing, and other related areas." And "Programs must demonstrate that faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure or by educational and design experience."

3. Comparison of surveying engineering education in Turkey and USA

Although surveying engineering education is different in various universities in Turkey most of the problems they are facing are usually common.

In most of the universities grading curves are used for grading. Depending on the average level of the class, students sometimes pass the class by chance without obtaining proper knowledge. Also the idea of competing with each other limits the knowledge and material share between the students.

Surveying engineering education is mostly Turkish however there are some programs with %30 or %100 English as teaching language. Foreign language education in universities are not sufficient enough for engineering education. In addition to that there is a lack of Turkish literature for engineers. Lack of resources and language forces the students to memorize the information given directly by the instructor without judging or considering. This behavior effects the learning pattern badly and therefore affects the future performance of surveying engineers.

The classes are usually crowded compared to most of the classes in USA, this effects the teaching and evaluation performance of the instructor during class and when grading exams. There aren't enough high quality instructors and the wages are low according to the economic conditions of Turkey. These factors affect the motivation of instructors and have a huge impact on students learning abilities.

Research budget and potential are low and cooperation between industry and university is not encouraged and supported. Main authorities in surveying engineering do not share the knowledge and material throughout their web sites as some of the important authorities in USA for surveying engineering like NOAA (National Oceanic and Atmospheric Administration) and NGS (National Geodetic Survey) does.

Second education (night classes), are given by the same academic staff who is in charge of normal education (day classes). This effects the concentration and efficiency of academic staff thus quality of education and graduates.

There is a lack of accreditation in surveying engineering programs only 1 program is accredited by ABET and 8 of 27 are accredited by MUDEK. This also effects the after graduation education of surveying engineers. In most of the USA states graduates of surveying engineering programs take a test to become a licensed surveyor and join classes even after graduation to keep their licenses.

4. Recommendations for improvement

In order to increase the quality of graduates and surveying engineering programs in Turkey some precautions should be taken.

There should be a passing grade criteria for grading system. Students who cannot satisfy the minimum criteria should fail to ensure quality.

Prior to starting engineering education students should increase English, as a foreign language to an adequate level to keep up with the developing technologies all around the world. While doing that number of lecture and research resources should be increased in the libraries to encourage the students for research.

Due to various factors throughout the education life, engineering education has become a know by heart learning system which decrease the ability to think and develop practical solutions for engineering problems. To avoid that, classes should be based on up to date discussion topics about new technologies encouraging the students to attend, gather and share knowledge.

To ensure the affectivity of universities in the country's development, financial resources transferred to the universities should be increased. To keep up with technological improvements, invent new technologies and to accelerate the development of the country, collaboration between universities and industry should be encouraged by developing new cooperation models.

Researches should be supported by raising funds and financial support should be provided to faculty engaged in research.

Majority of the engineering programs are accredited by MUDEK. However discipline specific evaluation criteria of MUDEK is not well defined as in ABET and in addition to that MUDEK mostly consists of individuals instead of organizations. The most important things in engineering education are curriculum, faculty, leading and cooperating supporting organizations. Well defined curriculum together with qualified faculty and supporting organizations specialized in surveying engineering ensures high quality education to students and post-graduation support to graduates.

Final and most important recommendation is to set accreditation for engineering education as mandatory. For Turkey MUDEK, after fixing the weaknesses defined in the previous paragraph, and/or ABET should be acknowledged as accreditation authority.

5. Conclusion

In our developing world rapid technological changes, conditions and needs, forces universities to give education compatible with the rules of changing world. Conditions in engineering education shows that know by heart technical education without forcing students to think and create is not enough for today's competitive circumstances.

In conclusion surveying and similarly named engineering programs in Turkey are in need of accreditation to build the necessary infrastructure for graduating knowledgeable, problem solving, leading, creative and self-confident engineers and to ensure continuous improvement of graduates.

References

1. ABET, Accreditation Board for Engineering and Technology, Criteria for Accrediting Engineering Programs, Baltimore: ABET, Engineering Accreditation Commission, 2015. Available online at: http://www.abet.org/wp-content/uploads/2015/10/E001-16-17-EAC-Criteria-10-20-15.pdf

2. MUDEK, http://www.mudek.org.tr/en/belge/doc.shtm accessed March 11, 2016.

3. MUDEK List of Accredited Programs, http://www.mudek.org.tr/en/akredit/akredite2015.shtm accessed March 11, 2016.

4. ABET, http://www.abet.org/about-abet/, accessed March 11, 2016.

5. ABET accredited program search, http://main.abet.org/aps/Accreditedprogramsearch.aspx, accessed March 11, 2016.