

Exchanges and Orientations at Surveying and Geomatic Engineering Education in Turkey

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SUMMARY

21st. century changes and transforms so many things. All over the world as well as in Turkey, along with the impact of globalization, significant changes and developments have been taken place in engineering education, particular to Geomatic Engineering education, in a period of which the free movement of people and knowledge have become increasingly common and intensive efforts in order to membership of European Union studies have been spent.

As a bridge between Europe and Asia, Turkey, which plays an important role in an important geographical region include the Middle East and has geo-strategic and geopolitical importance, has been celebrated its 60. year at Geomatic Engineering education in 2009. Without doubt, during this 60-year period, some factors such as rapid changes and developments in technology, new models used and became common in the educational system, and the changes of the sectoral expectations have provided the formation of new orientations.

Therefore, in Turkey, in order to improve the quality in Geomatic Engineering education, to follow up the current (modern) course plans, to increase the mobility, to improve e-learning system, to adopt the European Credit System (ECTS), to conduct national and international accreditation activities, studies are being executed on such these important topics. Accreditation studies (ABET, EUR-ACE, MUDEK etc.) in particular conducted in national and international fields, have been completed in several Geomatic engineering departments in Turkey, and become sustainable. In the other departments, accreditation studies for national and international aspects are continuing.

However, especially at a time when the Geomatic Engineering departments have been started to close in Europe and reduced the number of students at that departments, in Turkey it is contrary to this situation. The increasing number of departments and depends on this, increasing number of students in Turkey, brings specific problems in term of sustainable quality of education. Therefore, selecting the educational models, which have certain standards and integration with the world, is very important.

Although the studies mentioned on titles have been completed or are still conducting at some departments, these studies related to accreditation activities have not begun yet at the others. Besides this, serious differences between these departments in terms of the physical infrastructure, equipment and hardware capacity, lecturer staff, divisions, students' quota, affects educational quality in a whole view in Turkey. New opened departments without analyzing the sectoral expectations are in a position that may make problems in near future in a view of our country and our profession. Especially in terms of the above-mentioned criteria,

the occurrence of serious differences between departments, affects qualified and certain standard graduates across the country.

Therefore, this paper includes an investigation of a process from the beginning to this date of Geomatic engineering changes and developments and mentioned the studies done for the integration of the developing world. In this process, as well as especially the positive developments of the system, also failing sides of engineering education in our country, and contradictions of the system will be highlighted. In this context, the growing importance of interdisciplinary studies of our profession in our country will be cited about in changes and trends.

ÖZET

21. yüzyıl pek çok şeyi değiştirmekte ve dönüştürmektedir. Tüm dünyada olduğu gibi Türkiye’de de küreselleşmenin etkisiyle birlikte, serbest dolaşım unsurunun giderek yaygınlaştığı, Avrupa Birliği’ne üyelik çalışmalarında yoğun çabaların harcandığı bir dönemde, mühendislik eğitimi ve özelinde Harita Mühendisliği eğitiminde önemli değişim ve gelişmeler yaşanmaktadır.

Avrupa ve Asya arasında bir köprü olan, Ortadoğu gibi önemli bir coğrafyada önemli bir rol üstlenen, jeostratejik ve jeopolitik önemi olan Türkiye, 2009 yılında Harita Mühendisliği eğitiminde 60. yılını kutlamıştır. Hiç kuşkusuz, bu 60 yıllık süre içerisinde teknolojiye yaşanan hızlı değişim ve gelişim, eğitim sisteminde kullanılan ve yaygınlaşan yeni modeller ve sektörel beklentinin değişimi, Harita Mühendisliği eğitiminde yeni yönelimlerin oluşmasını sağlamıştır.

Bu nedenle Türkiye’de, Harita Mühendisliği eğitiminde kaliteyi arttırmak, güncel (modern) ders planlarını takip etmek, eğitimde mobilitayı arttırmak, e-öğrenme sistemini geliştirmek, Avrupa Kredi Sistemini (ECTS) benimsemek, ulusal ve uluslararası akreditasyon çalışmalarını yürütmek gibi önemli başlıklarda çalışmalar yürütülmektedir. Özellikle ulusal ve uluslararası alanda yürütülen akreditasyon çalışmaları (ABET, EUR-ACE, MUDEK etc) Türkiye’deki Harita Mühendisliği eğitimi veren bölümlerimizin bir kısmında tamamlanarak, sürdürülebilir hale gelmiştir. Diğer bölümlerimizde ulusal ve uluslararası akreditasyon çalışmalarına hızla devam etmektedir.

Ancak, özellikle Avrupa’da Harita Mühendisliği bölümlerinin kapatıldığı ve giderek öğrenci sayılarının azaldığı bir dönemde, Türkiye’deki bölüm sayılarının artması ve buna bağlı olarak öğrenci sayılarının artması sürdürülebilir kaliteli eğitim açısından belli sorunları da beraberinde getirmektedir. Bu nedenle belli standartları içeren ve dünya ile entegrasyon sağlayan modellerin seçimi çok önemlidir.

Bahsedilen bu başlıklarla ilgili çalışmaları bazı bölümlerimiz tamamlamış ya da yürütüyor olmasına karşın, bazılarında da bu faaliyetlerle ilgili çalışmalar henüz başlamamıştır. Bunun yanı sıra bu bölümler arasındaki fiziki altyapı, alet ve donanın sayısı, eğitim kadrosu, anabilim dallarındaki farklılaşmalar, öğrenci kontenjanları gibi başlıklardaki ciddi farklılaşmalar da ülkemizdeki harita mühendisliği eğitimini bütünsel çerçevede etkilemektedir. Sektörel beklentinin analizi yapılmadan her geçen gün açılan yeni bölümler mesleğimiz ve ülkemiz açısından ileride sorun yaşatabilecek niteliktedir. Özellikle yukarıda belirtilen kriterler açısından bölümler arasında ciddi farklılıkların oluşması, ülke genelinde nitelikli ve belli standartlarda mezunların verilmesini etkilemektedir.

Bu nedenle bu bildiri de Türkiye'deki Harita Mühendisliđi eğitiminin başlangıcından bugüne kadar geçirmiş olduđu deđişim ve gelişim süreci incelenerek, gelişen dünyaya entegrasyonu için yapmış olduđu çalışmalardan bahsedilecektir. Bu süreçte özellikle sistemin olumlu gelişmelerinin yanında, ülkemizdeki harita mühendisliđi eğitiminin aksayan yönleri ve çelişkileri de vurgulanacaktır. Bu çerçevede disiplinlerarası çalışmalarda önemi giderek artan mesleđimizin ülkemizdeki eğitiminde deđişim ve yönelimlerinden bahsedilecektir.

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1. INTRODUCTION

With 5000 years of history, surveying engineering, which is in the focus of changing and developing technological advancements, has been one of the major engineering disciplines. By rapid scientific developments affect directly to the surveying engineering application fields, our profession has begun to play a key role in interdisciplinary studies (Öcalan, 2010). To sustain this fore front role with an increasing importance and responsibilities and to educate the engineers with certain standards are directly related to the educational programs and models conducted by departments.

The undergraduate engineering education of surveying engineering in Turkey has been started in 1949, and 60 years have passed since its inception. More than half a century, in our country, approximately 12000 surveyors have trained. The large part of the gains during the process of the birth and developments of the surveying sector until this moment has been achieved by our universities' undergraduate and graduate education (Tunalioğlu and Öcalan, 2009). Definitely, by the help of new models that became widely used in education system and the changing expectations of industry, the significant changes and the formation of new orientations has proved in engineering education, particularly in surveying engineering education, into this 60-year period. In addition, the globalization affects the process and progress. Therefore, into such important titles as written: to increase the quality in surveying engineering education, to follow the current course plans, to improve the e-learning system, to increase the educational mobility, to conduct national and international accreditation works; studies are being carried out in the departments of universities in Turkey.

However, a query that has to be here is that departments, which give surveying (Geomatic/ geodesy and photogrammetry) engineering education in Turkey is to perform these constructive efforts in coordination. The number of the current departments in undergraduate education has increased by the establishment of the state and private universities with growing number in Turkey. In the last five years with the newly opened departments, there has been 21 surveying (geomatic/ geodesy and photogrammetry) engineering departments. While 11 of these departments have continued education activities actively, the rest 10 departments, opened legally, are still prepared for educational activities. In addition to these departments, graduated degree education in four universities is given in the related institutes and departments.

Table 1. Surveying/Geomatic/Geodesy and Photogrammetry Engineering Departments in Turkey

No	University	Department	City	State
1	Yıldız Teknik University	Dept. of Surveying/Geomatic Engineering	İstanbul	Open-Active
2	Karadeniz Teknik University	Dept. of Surveying/Geomatic Engineering	Trabzon	Open-Active
3	İstanbul Teknik University	Dept. of Geomatic Engineering	İstanbul	Open-Active
4	Selçuk University	Dept. of Surveying/Geomatic Engineering	Konya	Open-Active
5	Zonguldak Karaelmas University	Dept. of Geodesy and Photogrammetry Engineering	Zonguldak	Open-Active
6	Ondokuzmayıs University	Dept. of Surveying/Geomatic Engineering	Samsun	Open-Active
7	Afyon Kocatepe University	Dept. of Surveying/Geomatic Engineering	Afyonkarahisar	Open-Active
8	Erciyes University	Dept. of Surveying/Geomatic Engineering	Kayseri	Open-Active
9	Kocaeli University	Dept. of Surveying/Geomatic Engineering	Kocaeli	Open-Active
10	Gümüşhane University	Dept. of Geodesy and Photogrammetry Engineering	Gümüşhane	Open-Active
11	Aksaray University	Dept. of Geodesy and Photogrammetry Engineering	Aksaray	Open-Active
12	Hacettepe University	Dept. of Geodesy and Photogrammetry Engineering	Ankara	Open-Passive
13	Cumhuriyet University	Dept. of Geodesy and Photogrammetry Engineering	Sivas	Open-Passive
14	Niğde University	Dept. of Geodesy and Photogrammetry Engineering	Niğde	Open-Passive
15	Gediz University	Dept. of Geodesy and Photogrammetry Engineering	İzmir	Open-Passive
16	Okan University	Dept. of Geomatic Engineering	İstanbul	Open-Passive
17	Harran University	Dept. of Surveying/Geomatic Engineering	Şanlıurfa	Open-Passive
18	Gaziosmanpaşa University	Dept. of Geodesy and Photogrammetry Engineering	Tokat	Open-Passive
19	Fırat University	Dept. of Geodesy and Photogrammetry Engineering	Elazığ	Open-Passive
20	Korkut Ata University	Dept. of Geodesy and Photogrammetry Engineering	Osmaniye	Open-Passive
21	Çanakkale Onsekiz Mart University	Dept. of Geodesy and Photogrammetry Engineering	Çanakkale	Open-Passive

Table 2. Surveying/Geomatic/Geodesy and Photogrammetry Engineering Graduate Schools in Turkey

No	University	Institute - Department	City	State
1	Middle East Technical University	Natural and Applied Sciences Institute Geodetic and Geographic Information Technologies Division	Ankara	Open-Active
2	Gebze Institute of Technology	Faculty of Engineering Dept. of Geodetic and Photogrammetric	Kocaeli	Open-Active

Engineering				
3	İstanbul Kültür University	Natural and Applied Sciences Institute Division of Civil Engineering - Geomatic Program	İstanbul	Open-Active
4	Boğaziçi University	Kandilli Observatory and Earthquake Research Institute Geodesy Department	İstanbul	Open-Active

As of 2009, in the process of 1140 surveying engineering undergraduate students have right to education in each year, different teaching programs are being implemented by universities. Considering certain specializations into our profession, the differentiations among educational programs can be normal. However, educational staff and infrastructure deficiencies in newly opened departments are greeted at once. Particularly, as a result of educational activities made in departments where have insufficient physical infrastructure, tools and equipments, laboratory and teaching staffs, engineers differ from in view of educational quality.

Table 3. Year 2009 Quotas of Surveying/ Geomatic/ Geodesy and Photogrammetry Engineering Departments in Turkey

No	University	Overall Quota	
		1.Education	2.Education
1	Yıldız Technical University	100	100
2	Karadeniz Technical University	80	80
3	İstanbul Technical University	70	-
4	Selçuk University	80	80
5	Zonguldak Karaelmas University	60	-
6	Gümüşhane University	40	40
7	Ondokuzmayıs University	50	50
8	Afyon Kocatepe University	50	50
9	Erciyes University	50	50
10	Kocaeli University	30	-
11	Aksaray University	40	40
Total = 1140		650	490

2. ORIENTATIONS AND THREATS IN SURVEYING AND GEOMATIC ENGINEERING EDUCATION in TURKEY

In Turkey, educational problem in surveying sector is an issue that must be addressed to secondary school education and spanning a wide range of undergraduate education, in-service training and certification programs (Köktürk et al., 2005). In this context, these issues should be considered seriously and should be conducted in a planned coordination. When the human resources needs in the sector are taken into consideration in Turkey, especially surveying engineering undergraduate education has become a special and vital importance.

It is necessary to monitor a holistic and healthy development process for our profession. A roadmap has to be determined by considering the sectoral expectations and needs, and employment of surveying engineers in middle and long terms. Especially at a time when the number of students in the European Union countries has reduced gradually and even the

departments have been closed, the number of departments and depending on this, the number of students have increased in Turkey. These increases bring certain problems in terms of both sustainable quality education and expectation of sector in Turkey. Therefore, selection of the educational models integrated with the world and with certain standards is very important.

Therefore, parameters that affect the undergraduate education in Turkey, such as; quality and accreditation, curriculum, teaching staff and newly opened departments must be carefully examined. The studies in these special issues constitute a special importance. Actually, in Turkey a large part of the gains from the birth of the surveying sector to this time has been achieved by our undergraduate and graduate educations.

2.1 Quality and Accreditation

The concepts of quality and accreditation in a process that show the impact of globalization on the world produce significant effects on surveying engineering education. Beside determination of both national and international principles and criteria for accreditation in different countries, different institutions and organizations; our universities have also begun to conduct their studies, and even some of them have been significant progress.

In Turkey, some of the surveying (geomatic/ geodesy and photogrammetry) engineering education departments have completed accreditation studies (ABET, MÜDEK etc...) at national and international areas, and they work to make sustainable developments. Although some of the departments have completed or are conducting the studies mentioned above, some of them have not begun studies related to these activities yet.

In this context, by selecting the accreditation studies as target especially "MÜDEK" accreditation studies forefront of national scale in our country and "ABET" accreditation studies forefront of international scale, some of our universities carry out various studies. ABET, among these accreditation studies, has been completed by Istanbul Technical University, and is being studied for make it sustainable (Çelik et al., 2006). In addition, Yildiz Technical University, Karadeniz Technical University and Selcuk University have completed the MUDEK accreditation facilities, and furnished the sustainability. Although, some of the other universities in Turkey have just started the accreditation studies, some of them have not started yet. The important points are to conduct these studies in coordination, to take into account of our departments given surveying engineering education a whole, and to ensure certain principles and criteria in education in all of our universities.

2.2 Curricula

In universities, the departments usually determine the profession courses except the basic engineering courses required by HEC (The Council of Higher Education). In this determination, it is not possible to mention the country needs are considered enough. It is seen that the curriculums are created in accordance with the structure of the existing educational staff in departments. Here, the basic idea is to give required and enough level of the scientific

courses, professional theoretical and practical courses, social and cultural courses required for the modern, scientific and engineering education by taking into account of day's conditions.

The most important tools for providing a standard of the curriculums at the growing number of departments are the national and international accreditation tasks. Especially in Turkey, in the upbringing of engineers in terms of certain standards and qualifications, the updating the curriculums and contexts of them are very important.

2.3 Teaching Staff

In Turkey, when we have a short look to the surveying engineering departments and the students, some of the deficiencies and imbalances about educational staff are to stand out. Especially, in the newly opened and started education newly departments, to make serious assessments become a necessary in terms of insufficient number of staff.

The effect of existing staffs in such areas: scientific research and development activities, specialization in different areas together with educational activities is undoubtedly very important. Therefore, taking precautions for the future probable coming problems in these departments should be needed from today. Not to be taken students to these departments will be an important decision on behalf of the future of the profession and educational quality where the teaching staff and facilities are insufficient.

Table 4. Academic Staff in Surveying/Geomatic/Geodesy and Photogrammetry Engineering Departments in Turkey for 2009

No	University	Academic Staff					Total
		Prof.Dr.	Assoc.Prof.Dr.	Assist.Prof.Dr.	Lecturer	Res. Assist.	
1	Yıldız Technical Uni.	9	8	10	-	18	45
2	Karadeniz Technical Uni.	8	2	8	-	14	32
3	İstanbul Technical Uni.	17	10	7	1	19	54
4	Selçuk Uni.	2	1	13	-	18	34
5	Zonguldak Karaelmas Uni.	1	1	3	2	5	12
6	Gümüşhane University	-	-	2	1	2	5
7	Ondokuzmayıs University	1	-	5	1	-	7
8	Afyon Kocatepe University	-	-	4	1	3	8
9	Erciyes University	-	2	4	-	5	11
10	Kocaeli University	3	-	5	-	1	9
11	Aksaray University	-	1	8	-	-	9

2.4 Newly Opened Departments

In recent years, in our country, the number of the institutions, which give surveying engineering education, has increased with the newly opened departments. As mentioned

before, some of the departments have started to give education, and some of them have only opened and not given education. Each passing day newly opened departments without analysis the sectoral expectations may cause problems in terms of our profession and our country in the future (CSCE İstanbul Division, 2002).

Firstly, requirements of the country, then surveying engineers' needs of the geographical areas should be considered for making decisions to open new departments. Therefore, the requirement of new departments at undergraduate level should be determined multi dimensionally (Köktürk et al., 2005). The location and location selection of the departments should be examined carefully and seriously. The need of the teaching staff with minimal technological and spatial infrastructure should be ascertained. Newly opened departments without supporting required infrastructure, equipment and academic staff will reduce the quality of the engineers in the future and will give incapable of reparation damages both of our profession and our country.

In this context, newly opened departments should not be allowed to take students without completing academic staff needs and infrastructure requirements. It is necessary to be in a principle behavior to educate a qualified engineer. To open new departments with a correct and accurate strategic planning must be performed for educational activities.

3. CONCLUSION AND RECOMMENDATIONS

Even though the acceleration gained by the scientific and technological developments in our profession has increased its speed in every passing day, and has positive influence on engineering education and application areas, some basic problems have come to the fore in the educational sector of Turkey. Beside the positive progresses started with the accreditation and quality studies, problems such as especially lack of coordination, lack of collaboration, lack of participatory processes, the shortcomings experienced in the infrastructure facilities and etc. have threat the development of the engineering education and sector in our country.

Solution of these problems and eliminate the disruptions that will be occurred in the future, a strategic planning should be prepared up to now. "The Council of Geodesy and Photogrammetry Engineering Department Heads" created by the heads of 11 departments and actively conduct educational process, is an important component and stage for resolving these problems and making future-oriented strategic plans. However, approaching the issues with more inclusive models that formed by not only universities, but also our universities + our professional chamber (HKMO) + sector (public-private) components will provide more rational results in terms of our country and profession.

It is known that "*investments on education would not be taken in short term*". Therefore, the requirement of strategic and fast thinking becomes an emergency for developments (Köktürk et al., 2005). In this context, orientations in surveying engineering education should be done in a certain strategic plan for educating the engineers who will take a role in the development

of country and promotion of profession. The strategic plans should be prepared with an ability of eliminating the existing threats and should not be delayed.

The steps to be taken on education will be an indicator about what we designed for the future. We can design the future by the steps to be taken on education from now. The problem is so important and vital. At this point, each engineer candidate must/ should have the following qualifications as a result of engineering education with the all necessary plans (Aydın, 2005).

Candidates;

- should have a high level culture
- should carry love of human and nature
- should know advanced foreign language
- should be able to use the current professional software in advanced level
- should know the law related to our profession
- should learn the management of the human and knowledge resources, and have management tasks
- should be directed well not only in professional aspects but also in social aspects
- must own professional ethic
- should specialize in certain issues
- should know and follow current professional activities
- must detect and evaluate the global strategies
- can understand, project the professional problems, and must be able to do cost analysis

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BIOGRAPHICAL NOTES

Taylan Öcalan, graduated in 2005 with a degree of MSc at the Graduate School of Science and Engineering of Yildiz Technical University and the topic of his thesis was the investigation of relative point positioning accuracy based on permanent GPS stations. He works GNSS and related subjects in his PhD thesis. His study areas are Global Navigation Satellite Systems, terrestrial surveys. He has worked as a specialist in Yildiz Technical University since 2004.

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