



INTE 2014

## Problems of mining education at Turkish universities: past, present and future

Vedat Deniz\*

*Hitit University, Engineering Faculty, Çorum, 19030, Turkey*

---

### Abstract

In this paper, the history of modern mining engineering education at Turkish universities from 1924 until today is briefly explained. So far, the number of departments of mining engineering adds up to 28 and second program is provided by 12, and the number of programs of mining engineering in total have been 40. Consequently, the problems these departments are facing in mining engineering education are mentioned, as well as some researches carried out and work opportunities for mining engineers.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the Sakarya University

*Keywords:* Education; Mining Engineering; Mining Education; Turkey

---

### 1. Introduction

As the application of technology expands throughout the world, the demand for qualified engineers in all fields is increasing rapidly. With the growth of the global economy, the demand for mobility of engineers has also increased. Information on engineering programs at training institutions throughout the world is important to students and universities as well as to employers and the various engineering societies and licensing and accreditation bodies.

Mining Engineering includes elements of geology, chemistry and physics as well as civil, mechanical and electrical engineering and the social and environmental implications of mineral development. Students apply

---

\* Corresponding author. Vedat Deniz. Tel.: +90-364-2274533; fax: +90-364-2274535.  
*E-mail address:* [vedatdeniz@hitit.edu.tr](mailto:vedatdeniz@hitit.edu.tr)

scientific theory and modern technology to the development, evaluation and recovery of mineral resources from the earth as well as to areas such as the construction of roads, tunnels, underground waste disposal chambers, etc. Subjects in the mining curriculum include *inter alia* principles and techniques of mineral exploration, mining methods, mine planning, mine design, surface and underground operations, rock mechanics, rock fragmentation, materials handling, safety, environmental impact analysis, mineral or coal processing, mine surveying, mine valuation and mine rehabilitation (McDivitt, 2002).

On the other hand, mining engineering education has been in trouble for almost thirty years. Many historical mining schools have terminated their minerals programs. As seen in Figure 1, the number of U.S. programs in the field dropped from 25 to 15 between the years 1982 and 2007 (McCarter, 2007). Today, the numbers of the active departments are continuing 7 of them. Over the past decade the number of mining engineering programs in the UK has fallen from 10 to 2, Leeds and Camborne School of Mines, so far survive. The number of programs that offer a degree still continues to drop. A decline in the numbers of students studying mining engineering over the last few years has led to the closure of many university courses and departments in all first world countries around the world.

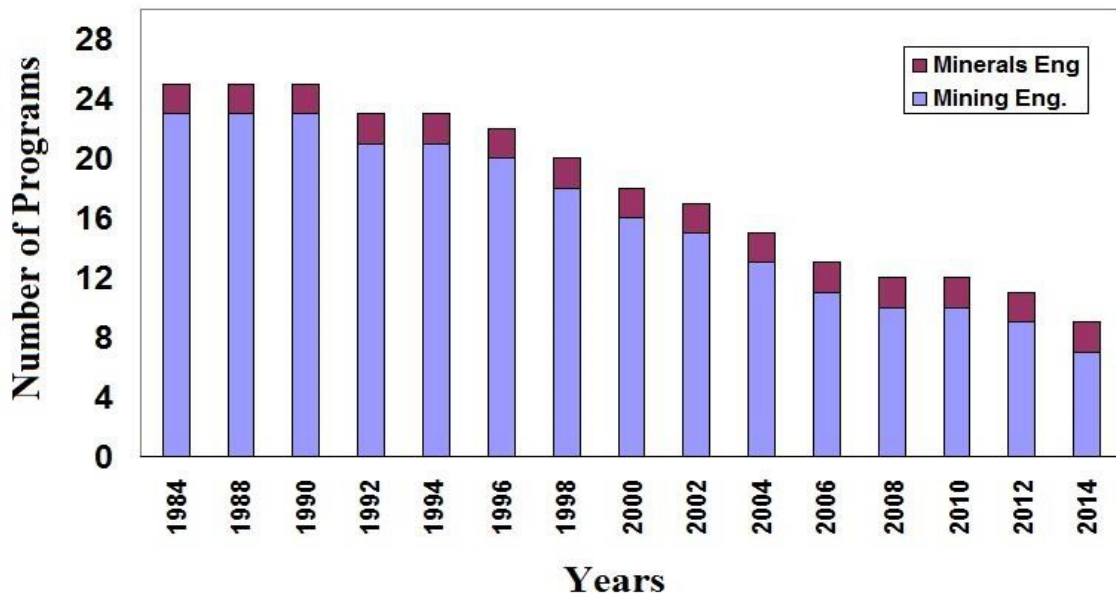


Figure 1. Mining and minerals engineering department in past 30 years in USA

The situation varies from country to country, but the trend is clear. In most industrial countries where mining is no longer a dominant industry (England and Japan would be examples), mining engineering as a discrete field of study is in decline. In many cases it has been absorbed back into general engineering or become an option in civil engineering or part of a resources or environmental engineering program. In Japan, where 20 years ago there were mining engineering departments at many of the major universities, mining is now taught in a series of courses in resource engineering or environmental engineering departments. This trend is also apparent in Europe and America, where mining schools, once relatively common, are now a rarity, or exist in name only as with some of the French Ecoles des Mines (McDivitt, 2002).

Consider how this trend is evidenced at some of the famous American mining schools. At the Henry Krumb School of Mines at Columbia University, the first to be established in America, mining engineering is now taught under the title of Earth and Environmental Engineering with a very limited enrolment. At the Pennsylvania State University, mining engineering is still taught, but in the Department of Energy and Geo-Environmental Engineering. At Michigan Tech the Department of Mining and Materials Processing Engineering is in the process of being dismantled, with mining going to geology and materials processing to chemical engineering (McDivitt, 2002).

Mining engineering education in Europe is in a critical situation. Students enrolments keep decreasing and established study programs are closed. Financial funds to faculties and institutes, particularly to mining, have been cut down in the latest years.

The study of mining engineering in Turkey, like most other engineering studies, such as metallurgy, geology and geophysics engineering is in crisis. The interest of young generations is directed towards tourism, history, economy and banking, which can easily be understood when we know that scientific and technological achievements at our parts are almost daily present in the media. Mining, geology and or geophysics engineering are very seldom the subject of discourse and if so, in the con-text of various economic, social, ecological or other problems. Such situation is not a specific one for our country. Degree granting educational institutions in many European countries, in the USA and Canada are confronted with similar problems, but due to the relatively complex situation in Turkey that has been actual for more than 10 years; the problem is even more difficult. The study of mining engineering is in some way specific for its problems, not only because of the bad economic situation but also because of the public standpoint that mining does not exist in Turkey anymore and that a great part of ecological problems is to be imputed to mining. The worldwide attitude towards mining is not better either. It is regarded as being useless, damaging nature and causing ecological problems.

The mining education in Turkey is generally based on a traditional, passive, lecture-based learning. According to the arrangement of core courses in mining engineering programs the 1<sup>st</sup> and 2<sup>nd</sup> years are largely identical. As for 3<sup>rd</sup> and 4<sup>th</sup> year contents, although they are quite similar in general, there are still some diversities between them. The differences between the programs resulted in serious deviations from the basic philosophy of the mining engineering. Such differences may also create problems in the national or international accreditation evaluations. The integration of new additional courses to programs, without monitoring their overall effect thoroughly, resulted in excessive loads on students (Özbayoğlu, 2011). For example, the curriculum of Hacettepe University has been focused on mineral processing since its beginning; METU mining engineering curriculum has been mainly interested in rock mechanics in certain periods of time. In İTÜ, mineral processing was separated from mining engineering department in 2007 and the new department was established with the name of mineral processing. In 2003, Dokuz Eylül University revised their undergraduate mining engineering curriculum with a radical change which was based on problem based student learning, to form modules to increase the learning and teaching effectiveness. This interactive system had continued up to 2009, and then a return to the passive system was experienced (Onargan et al., 2004).

## **2. An Overview on Mining Engineering Education in Turkey**

According to developments which have taken place since 1924 in the education of mining engineering, four periods can be distinguished. The first period covers the years between 1924 and 1953. This is accepted as the ‘foundation’ period of the education of modern mining engineering in Turkey. The second period covers up to the years between 1953 and 1982, the Department of Mining Engineering at Istanbul Technical University (İTÜ) was the only establishment active in this field. After, the Department of Mining Engineering at METU (Ankara) in 1960, Dokuz Eylül University (İzmir) in 1971 and Osmangazi University (Eskisehir) in 1975 were opened and started offering education in the same year. Within this second period, theoretical lectures were given in these five departments, as well as collections of mining data related to Turkey. Both national and foreign (European) experts lectured during these years and carried out substantial research in mining education, in parallel with fields of expertise. Addition, within this second period starts with the Scientific and Technical Mining Congress of Turkey in 1969 and with the Turkish Coal Congress of Turkey in 1978 with contributions of the Turkish Mining Engineering Society, the foundation in 1958.

The third period covers 20 years (from 1982 to 2002), and can be called as the period of ‘development’ of the science of mining engineering. This period starts with the Mineral Processing Symposium in 1982 and the foundation of the Turkish Mineral Processing Society in coordination with the Universities. Addition, third period starts also the National Rock Mechanic Symposium in 1986 with contribution of the Turkish National Rock Mechanic Society (1969). Towards the end of the same period, the number of departments of mining engineering increased to seventeen. A department of mining engineering was opened at Karaelmas Bülent Ecevit Univ. (Zonguldak), Cumhuriyet Univ. (Sivas), Süleyman Demirel Univ. (Isparta), Karadeniz Technical Univ. (Trabzon), Çukurova Univ. (Adana), Istanbul Univ. (Istanbul), İnönü Univ. (Malatya), Dicle Univ. (Diyarbakır), Selçuk Univ.

(Konya) and Dumlupınar Univ. (Kütahya) belonging to Engineering Faculties. Besides, second program is provided by eleven departments. Program of Mining engineering in Turkey was reached 28 in total. Turkish mining engineers of the period followed the developments in Western nations, participated in international meetings and wrote articles and textbooks in Turkish. Research in the mining of Turkey increased rapidly.

The last and forth period is from 2002 until today. With the establishment of new departments, the number of mining engineering departments in the country increased. By the year 2002, there were 11 departments of mining engineering and second program was by one program in mining. The distribution of these departments is shown in Table 1. Consequently, this has meant fewer employment opportunities for graduates of departments of mining engineering. The estimated demand for mining engineers is around 800 graduates per year in Turkey surveyed.

In this period, Departments of Mining Engineering provide academic education at undergraduate and graduate levels, including doctorates. Studies are based on theoretical and on field research.

Table 1. The numbers of quota and preference years for 2013 year and Turkish universities' established and start years

No	City	University Name	Establish Year	Start Year	Closed Year	Quota 2013	Preference 2013	Exp. Academic Staff 2013
First Period								
1	Zonguldak	Zonguldak Mining School	1925	1925	1931	--	--	---
Second Period								
2	İstanbul	İstanbul Technical University*	1953	1953		41	41	31
3	Ankara	Middle East Technical University (METU)*	1960	1960		62	62	11
4	Ankara	Hacettepe University*	1969	1969		72	72	17
5	İzmir	Dokuz Eylül University	1971	1975		82	82	
6	İzmir	Dokuz Eylül University (2 <sup>nd</sup> Educ.)		1993		82	82	28
7	Eskisehir	Osmangazi University	1975			72	72	
8	Eskisehir	Osmangazi University (2 <sup>nd</sup> Educ.)		1997		72	35	25
Third Period								
9	Zonguldak	Karaelmas Bülent Ecevit University	1982	1982		41	10	20
10	Sivas	Cumhuriyet University	1986	1987		52	8	
11	Sivas	Cumhuriyet University (2 <sup>nd</sup> Educ.)		1997	2011	----	----	14
12	Isparta	Süleyman Demirel University	1987	1987		41	8	
13	Isparta	Süleyman Demirel University (2 <sup>nd</sup> Educ.)		1997	2012	----	----	12
14	Trabzon	Karadeniz Technical University	1990	1991		52	52	
15	Trabzon	Karadeniz Technical University (2 <sup>nd</sup> Educ.)		1997	2012	----	----	14
16	Adana	Çukurova University	1991	1991		52	22	
17	Adana	Çukurova University (2 <sup>nd</sup> Educ.)		1997	2012	----	----	9
18	İstanbul	İstanbul University	1991	1991		62	62	
19	İstanbul	İstanbul University (2 <sup>nd</sup> Educ.)		1993	1998	----	----	15
20	Malatya	İnönü University	1992	1992		41	15	
21	Malatya	İnönü University (2 <sup>nd</sup> Educ.)		1997	2011	-----	-----	9
22	Diyarbakır	Dicle University	1992	1992		52	21	
23	Diyarbakır	Dicle University (2 <sup>nd</sup> Educ.)		1997	2009	-----	-----	12
24	Konya	Selçuk University	1992	1992		62	28	
25	Konya	Selçuk University (2 <sup>nd</sup> Educ.)		1997		62	1	5
26	Aksaray	Aksaray University	1992	2011	2013	41	0	
27	Kütahya	Dumlupınar University	1993	1993		52	15	
28	Kütahya	Dumlupınar University (2 <sup>nd</sup> Educ.)		1997		41	2	17
Forth Period								
29	Afyon	Afyon Kocatepe University	2002	2003		41	8	11
30	Van	Van 100. Yıl University	2003	2012		21	1	4
31	Niğde	Niğde University	2005	2008		21	2	5
32	Niğde	Niğde University (2 <sup>nd</sup> Educ.)		2010	2012	---	----	
33	Erzurum	Erzurum Technical University	2008	----	2013	40	0	3
34	Gümüşhane	Gümüşhane University	2009	-----		----	----	3
35	Muğla	Muğla Sıtkı Koçman University*	2009	2010		41	20	5
36	Uşak	Uşak University	2011	2012		21	5	4
37	Çanakkale	Çanakkale 18 Mart University	2012	2012		41	13	3
38	Şırnak	Şırnak University	2012	2013		41	4	3
39	Konya	Necmettin Erbakan University	2012	-----		----	---	1
40	Adana	Adana Science & Technology University*	2013	2014		----	----	4

\* Departments of providing education in English

The Turkish Scientific and Technical Mining Congress and the Turkish Coal Congress were organised each two year. The Turkish Mineral Engineering Society published one journal namely the *Journal of Ore Dressing*, in foreign languages (English). Another journal was also published by the *Bulletin of Rock Mechanic*, in Turkish, with contribution of the Turkish National Rock Mechanic Society with an emphasis on current research.

Mining engineering education has been in trouble for almost five year. In the same to the world trend, especially second programs of mining engineering programs in Turkey continue to decreases in number considerably fast and there is a decreased supply of graduates whose number is same down the demand. The reason of this situation, young people are not willing to choose the field as it lost its dignity. The number of active mining engineering programs in the field dropped from 35 to 26 between the years 2009 and 2013. The number of programs that offer a degree still continues to drop (Table 2).

Table 2. The numbers of preference at between 2009-2013 years in Turkish universities

No	City	University Name	2009	2010	2011	2012	2013
First Period							
1	Zonguldak	Zonguldak Mining School	----	---	---	---	---
Second Period							
2	İstanbul	Istanbul Technical University*	72	72	72	82	82
3	Ankara	Middle East Technical University (METU)*	57	57	57	62	62
4	Ankara	Hacettepe University*	62	67	67	72	72
5	Izmir	Dokuz Eylül University	72	77	77	82	82
6	Izmir	Dokuz Eylül University (2 <sup>nd</sup> Educ.)	---	---	77	82	82
7	Eskisehir	Osmangazi University	72	77	77	82	72
8	Eskisehir	Osmangazi University (2 <sup>nd</sup> Educ.)	72	77	77	54	35
Third Period							
9	Zonguldak	Karalmas Bülent Ecevit University	72	77	77	21	10
10	Sivas	Cumhuriyet University	72	77	54	14	8
11	Sivas	Cumhuriyet University (2 <sup>nd</sup> Educ.)	72	52	7	----	---
12	Isparta	Süleyman Demirel University	72	77	77	22	8
13	Isparta	Süleyman Demirel University (2 <sup>nd</sup> Educ.)	67	77	30	4	----
14	Trabzon	Karadeniz Technical University	52	57	57	62	52
15	Trabzon	Karadeniz Technical University (2 <sup>nd</sup> Educ.)	52	57	57	17	----
16	Adana	Çukurova University	72	77	77	41	22
17	Adana	Çukurova University (2 <sup>nd</sup> Educ.)	72	77	57	4	----
18	Istanbul	Istanbul University	52	52	52	67	62
19	Istanbul	Istanbul University (2 <sup>nd</sup> Educ.)	----	----	----	----	----
20	Malatya	Inönü University	52	57	57	14	15
21	Malatya	Inönü University (2 <sup>nd</sup> Educ.)	---	57	23	4	----
22	Diyarbakır	Dicle University	52	57	57	36	21
23	Diyarbakır	Dicle University (2 <sup>nd</sup> Educ.)	---	----	----	----	----
24	Konya	SelçukUniversity	62	67	67	70	28
25	Konya	Selçuk University (2 <sup>nd</sup> Educ.)	62	67	67	2	1
26	Aksaray	Aksaray University	----	----	---	0	---
27	Kütahya	Dumlupınar University	72	77	77	29	15
28	Kütahya	Dumlupınar University (2 <sup>nd</sup> Educ.)	72	72	43	8	2
Forth Period							
29	Afyon	Afyon Kocatepe University	62	67	67	18	8
30	Van	Van 100. Yıl University	----	----	----	---	1
31	Niğde	Niğde University	41	57	48	6	2
32	Niğde	Niğde University (2 <sup>nd</sup> Educ.)	----	---	7	----	----
33	Erzurum	Erzurum Technical University	----	----	---	0	---
34	Gümüşhane	Gümüşhane University	----	----	---	----	----
35	Muğla	Muğla Sıtkı Koçman University*	---	47	47	44	20
36	Uşak	Uşak University	----	----	---	---	5
37	Çanakkale	Çanakkale 18 Mart University	----	----	----	---	13
38	Şırnak	Şırnak University	----	---	---	---	4
39	Konya	Necmettin Erbakan University	----	---	----	----	---
40	Adana	Adana Science & Technology University*	----	---	----	---	----

\* Departments of providing education in English

In future, this is accomplished mining engineering education into only five programs such as: ITU, METU, Istanbul, Dokuz Eylül and Osmangazi universities. In so much that most of the programs will be merged into other departments. As a result, closing mining programs not only decreases the rate of unemployment in the country, but also increases the respect of the mining engineering field.

### 3. Discuss on Mining Engineering Education in World and Turkey

Presently, about 800 mining engineers graduate annually in Turkey. In many of those universities active in mining education, have started offering second mining programs in recent years, hence had quite output up to year 2009. The graduates of these departments will soon impose another jump on the already ascending curve of mining graduates (Figure 2a).

Comparisons of the state of mining education in Turkey with selected countries, from different continents, reveal some interesting points.

About 90 universities on the European continent and 30 universities in EU countries are offering mining engineering education. The annual mining graduates of EU universities, is estimated to be about 450-600 (SMP 12, 1998). With the introduction of new mining technologies and reduction of mining activities in recent years, the number of mining departments is gradually decreasing in EU countries. For example in the UK, after a period of merging some departments, only 4 universities are active in mining education in 1998 (Shaw, 1998). In the academic year 1999-2000, these departments had 176 undergraduate students, a number of whom were from other countries. In recent years, two major pitfalls of mining education in UK have been the declining number of new students as well as the absence of government founding and the minute amount of funds from industry (SMP 15, 1999).

In South Africa two universities and two other higher education institutes are offering mining education. In the past decade, about 38 students graduated annually from these two universities (Phillips, 1999).

And finally, the example of Turkey is presented in this article. Comparing the statistics of mining education in Turkey with the above examples shows that the total number of active mining engineering departments of Turkey (26), 22 programs in the normally education and 4 programs in the second education, is more than combined number (23) of mining engineering departments in Canada, Australia, UK and South Africa (Figure 2a). Similarly, the number of annual BSc graduates from Turkey mining departments (800) is more than the total of graduates (613) of US, Canada, Australia, and UK combined (Figure 2b).

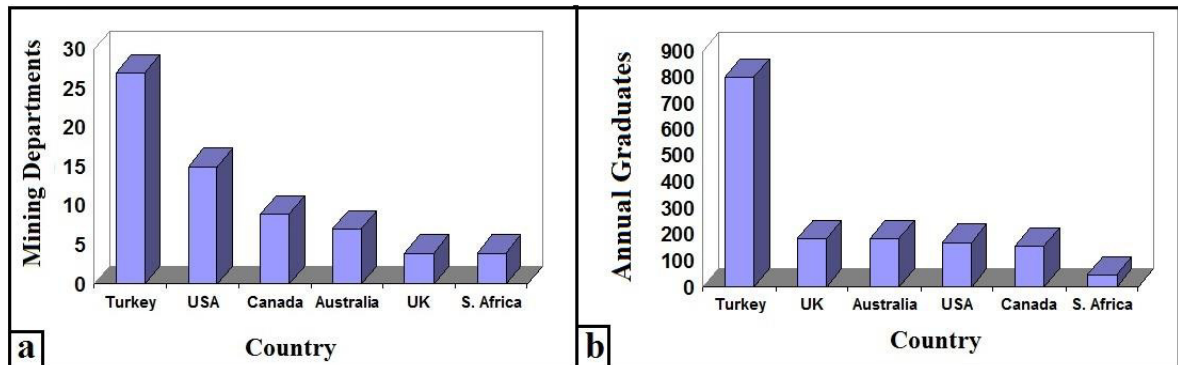


Fig. 2. a) Comparison of institutions in mining education in some countries; b) Comparison of the number annual in mining engineering graduations in some countries

### 4. Problems of Mining Engineering in Turkey

The problems faced by mining engineering education in Turkey can be grouped in two categories (1) academic problems and (2) problems related to employment opportunities.

Those of the first category encompass problems related to teaching and training, as well as to the educating experts. Apart from the departments located in the main Turkish cities, the academic staff is insufficient in numbers.

Often academics are obliged to lecture in subjects outside their main fields of expertise and work long hours. Those who have well a command of a foreign language or those who have completed their doctorates abroad are few. Often laboratories are either non-existent or insufficient in equipment. The numbers of students of mining engineering are rather high, with the inevitable consequence that training is not accomplished up to the desired standards.

The second group of problems is that relating to employment opportunities. Whilst the numbers of graduates are high, areas of work are limited; graduates find it hard to settle in a job either in the public or in the private sector. However, with ever-increasing numbers of students, graduates find it less and less easy to obtain a job.

Mining engineering education has the worst position among other engineering fields with its lowest rank in the Higher Education Selection Exam Results (YÖK, 2013). Young people are not willing to choose the field as it lost its dignity. Numerous factors have contributed to this decline, such as terrible images of mine disasters, negative impact of mining activities on environment and human health, difficult working conditions, low salaries, pressure of the communities in mining areas, and consequently the limited recognition of the mining engineering field by the broad research and academic communities. Therefore, one should consider how to inspire young people to study mining engineering, how to engage and retain students in their studies and continue to train the mining engineers of the future professionally (Özbayoğlu, 2011).

## 5. Conclusions

Within the programmes of mining in Turkey, various aspects of the natural environment (geology, chemistry, environment and soils) are studied together with the various environments of the earth. The period of education covers a period of eight terms (or four years), and graduates are awarded the diploma of ‘mining engineer’.

The motivation of the country for development and the excessive number of high school graduates, which are the results of a bulb of high population growth in early 80's, are the two prime factors, influencing the significant expansion of mining engineering education in Turkey.

The number of active mining engineering programs in Turkey (26) is more than the sum of similar programs in Canada, Australia, UK and South Africa (23). Also, the annual mining graduates of Turkey (about 800) are more than the cumulative graduates of USA, Canada, UK and Australia (613).

Mining training at Turkish universities is still under constant development. Substantial differences can be noted between the characteristics of their academic staff as well as their programmes. To a great extent, developments in education are shaped by national economic conditions. While the education programmes diversify and increase in numbers, the population of students studying in mining is greater than the country needs. Consequently, work opportunities for mining engineer diminish.

- A declining image of the mining industry as a “career of choice”.
- The number of mining departments decreased from some 34 in the millennium to 22 in 2014
- At this moment a few are still under threat to be closed.
- While departments of mining engineering in Europe are closing due to decrease in prefers of students with reduction of mining potential, they are closed due to government's false policy in Turkey.

## References

- McDivitt, J. (2002). Status of education of mining industry professionals, Mining, Minerals and Sustainable Development, a project of the International Institute for Environment and Development(IIED) and World Business Council for Sustainable Development(WBCSD). No:38.
- McCarter, M. K. (2007). Mining engineering: Demand and supply. PowerPoint presentation to the Report Committee, *National Commission on Energy Policy – Coal Study*, 17 September.
- Özbayoğlu, G. (2011). Mining engineering education in Turkey, *22<sup>nd</sup> World Mining Congress & Expo, Istanbul-Turkey*, 3-7.
- Onargan, T., Cöcen, I., Yenice, H., Şafak, S., Batar, T. (2004). Active learning experience in mining engineering education of Turkey, [ftp://ftp.deu.edu.tr/muh/ftp/pub/aktif\\_egitim/MF\\_WEB\\_AE\\_1311.pdf](ftp://ftp.deu.edu.tr/muh/ftp/pub/aktif_egitim/MF_WEB_AE_1311.pdf)
- Phillips H.R. (1999). Mining education in South Africa past, present and future. *CIM Bulletin*, 92(1033), 98-102.
- Shaw, (1998). Society of Mining Professors, *Newsletter* No.13.
- SMP (1998). Society of Mining Professors. *Newsletter* No. 12. Editorial.
- SMP (1999). Society of Mining Professors, *Newsletter* No. 15.
- YÖK (2013). [www.yok.gov.tr](http://www.yok.gov.tr)