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Current Status of Occupational Health and Safety Education in Engineering Departments of Earth Sciences at Universities

Üniversitelerin Yer Bilimlerine Ait Mühendislik Bölümlerinde İş Sağlığı ve Güvenliği Eğitiminin Güncel Durumu

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ABSTRACT

In this study, Occupational Health and Safety (OHS) education in Geological Engineering, Geophysical Engineering, Mineral Processing Engineering and Mining Engineering departments, which are categorised as "earth sciences" departments, is examined. Earth sciences, which is one of the significant industries of our country, is one of the leading business lines that require expertise, experience, knowledge and constant surveillance due to the risks it contains by its nature. The reason why occupational diseases and work accidents are encountered more frequently than in other sectors is that it is a labour-intensive line of work. In adjunct to this, the truth that there is still not sufficient and necessary realisation on OHS and that the significance is not at the level it should be is is also of fundamental relevance in occurence of occupational diseases and accidents. OHS, which is a methodical and scientifically orientated set of studies carried out to protect workers and third parties from conditions that may be harmful to safety and health such as physical, chemical and psychosocial reasons during work in workplaces, has been improving since the beginning of the programme. Although OHS has increasingly become more important in our country in the last few years, there are still deficiencies in OHS education. The demand for qualified human resources in the field of OHS has a tendency to rise further with the entry into force of Law No. 6331. In Earth Sciences Engineering departments, which are in the category of high-risk occupations, a good education is required in order to shape OHS awareness in students in the right way. In this work, the present situation of OHS courses was investigated by analysing the curricula of Mining Engineering in 23 universities, Mineral Processing Engineering in 1 university, Geological Engineering in 33 universities and Geophysical Engineering in 12 universities in Turkey. On the basis of the data acquired, solution suggestions for the improvement of OHS education are presented.

Keywords: Geological engineering department, Geophysical engineering department, Mineral processing engineering department, Mining engineering department, Occupational health and safety education

ÖZ

Bu çalışmada "yer bilimleri" bölümleri olarak kategorize edilen Jeoloji Mühendisliği, Jeofizik Mühendisliği, Cevher Hazırlama Mühendisliği

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ve Maden Mühendisliği bölümlerindeki İş Sağlığı ve Güvenliği eğitimi incelenmiştir. Ülkemizin önemli sektörlerinden olan yer bilimleri doğası gereği içerdiği riskler nedeniyle uzmanlık, deneyim, bilgi ve sürekli denetim gerektiren iş kollarının başında gelmektedir. Meslek hastalıkları ve iş kazaları ile farklı sektörlere göre daha sıklıkla karşılaşılmasının nedeni emek yoğun bir iş kolu olmasıdır. Bununla beraber, iş sağlığı ve güvenliği (İSG) hususunda halen yeterli ve gerekli farkındalığa ulaşılamaması ve önem derecesinin olması gereken ölçüde olamaması da meslek hastalıklarının ve kazaların oluşmasında oldukça büyük önem teşkil etmektedir. İş yerlerinde çalışma esnasında fiziksel, kimyasal, psikososyal nedenler gibi güvenliğe ve sağlığa zararlı olabilecek şartlardan çalışanları ve üçüncü kişileri korumak için yürütülen metodik ve bilimsel yönü olan çalışmalar bütünü olan İSG, programın başlangıcından bu yana gelişme göstermektedir. İSG ülkemizde son yıllarda giderek önem kazanmış olsa da, hala İSG eğitiminde eksiklikler bulunmaktadır. İSG alanında nitelikli insan kaynağına olan talep 6331 sayılı Kanunun yürürlüğe girmesi ile daha da artma eğilimindedir. Yüksek riskli meslekler grubunda olan Yer Bilimleri Mühendislikleri bölümlerinde İSG bilincinin öğrencilerde doğru bir biçimde şekillenebilmesi için iyi bir eğitim gerekmektedir. Bu araştırmada Türkiye'de 23 üniversitede bulunan Maden Mühendisliği, 1 üniversitede bulunan Cevher Hazırlama Mühendisliği, 33 üniversitede bulunan Jeoloji Mühendisliği ve 12 üniversitede bulunan Jeofizik Mühendisliği bölümlerinin müfredatları incelenerek İSG derslerinin mevcut durumu incelenmiştir. Elde edilen verilere dayanarak İSG eğitiminin iyileştirilmesi için çözümler önerilmiştir.

Anahtar Sözcükler: Jeoloji mühendisliği bölümü, Jeofizik mühendisliği bölümü, Cevher hazırlama mühendisliği bölümü, Maden mühendisliği bölümü, İş sağlığı ve güvenliği eğitimi

INTRODUCTION

The phenomenon of work, which emerged with the beginning of humanity, has an indispensable importance for human beings to survive in nature. The human being, who uses its body to fulfil its needs, has to take care of its own health and safety in order to survive. Although the importance given to occupational health is limited to the periods when mining started, the phenomenon of work can be brought back to the ancient times of humanity. At first, the deterioration of people's health was not given much importance. However, in the following years, when the mining works were replaced by underground mining and the works started to require skilfulness, it became important to be healthy in these works. Employee health, which was previously not taken into consideration and not recognised as a fundamental human right, has started to be approved as a fundamental human right with the necessity and continuity of work. Occupational health should ensure that the physical, mental and social welfare of workers is raised to the highest possible level, health problems arising from working conditions are prevented, workers are protected from risks related to their work that are harmful to their health, and workers work in occupational environments suitable for their physical and biological capacities. In order to ensure health and safety, some laws have been enacted that include working conditions in working environments. However, over time, it has emerged that the OHS issue should be approached not only from legislation but also from different perspectives. As a consequence of these actions, it was realised that the concept of OHS should be handled scientifically (Akkaya, 2007; Yılbaşı, 2017; Ünver Emrem, 2018).

The term OHS has been chosen to describe a scientific and professional field for analysing working conditions, its effects on health and welfare of workers, proposing solutions to reduce occupational hazards and risk factors and measuring their effectiveness. In accordance with the report of the joint commission established by the World Health Organization (WHO) and the International Labour Organization (ILO), occupational health is a branch of science that purposes to preserve and enhance the physical, psychological and social welfare of employees in every profession at the highest level and to ensure the harmony of work and employees in physical and psychological terms. The notion of OHS includes not only the prevention of occupational accidents and occupational diseases, but also the protection of the physical and mental health, personal rights and social environment of the employee. Occupational health is broadly defined as "maintaining the physical, mental and social wellfare of workers in all professions, ensuring that workers are protected from risks arising from working conditions, preventing deterioration of their health, placing them in suitable jobs and ensuring the harmony of work to man and man to work". The aim of occupational safety studies; to protect employees, to ensure that they work in a comfortable and safe environment, to eliminate dangerous situations by ensuring operational safety. The subject of OHS is the search for ways to eliminate or reduce the hazards arising from the performance of work and the provisions introduced in this way. OHS is an issue that affects and covers all processes of work. It is affected by many disciplines and many disciplines are working on this subject. OHS, which is a set of methodical and academic studies carried out to protect employees and other third parties from conditions that may harm health and safety arising from various causes (physical, chemical, biological, mechanical, ergonomic, psychosocial) during the implementation of the work in workplaces, has been developing continuously since it has been on the subject. When the researches on occupational accidents and occupational diseases occurring in the world and in our country are examined; deaths, permanent incapacity for work, material and moral losses arising from occupational accidents and occupational diseases reveal the importance of the issue in terms of public order and society. Although the concepts of OHS are concepts that have developed based on different knowledge, it is inevitable that both concepts are used together and always evaluated on the same platform since both concepts are aimed at protecting the mental and physical intactness of the employee. In Turkey, OHS issues were for-

malised with the OHS Law No. 6331 put into action in 2012. It is a fact that in parallel with the regulations made in the field of OHS in Turkey, there has been a reduction in the formation of OHS culture and the number of occupational accidents. However, in Turkey, OHS is still understood as the use of individual safety equipment by employees. This is a fact that indicates that there is clearly still a long path to be travelled for its implementation and progress of OHS culture in Turkey. Since this issue is still relatively new, although there are exceptions, the significance of this subject has not been fully realised by many employers and employees (Sarıkaya et al., 2009; Yılmaz, 2009; Güler, 2011; Arezes and Swuste, 2012; Tülü, 2014; Sivrikaya, 2016; Doğan et al., 2017; Çıtak, 2018; Yar, 2018; İlter, 2019; Koçak and Koray, 2018).

The most important of the activities related to health and safety that positively affect the safety culture of workplaces is undoubtedly OHS trainings. OHS training is the education organised to teach the hazards related to the workplace and work, the precautions to be taken, the the instructions that must be followed for the purpose of the work correctly and safely, and to ensure that employees reach an adequate level of health and safety. At the same time, training can guide workers on how to obtain the necessary information about potential hazards. The role of education in ensuring occupational health and safety has become more understandable in the society with the effect of OHS studies carried out today. OHS training helps people to realise that they have a personal responsibility for preventing occupational accidents and to be more willing to do something to ensure their safety. This training provided to employees also functions as a risk control in the workplace. Therefore, occupational safety training is a preventive mechanism against occupational accidents and the associated costs. Occupational safety training has become even more important due to today's rapidly changing high technology and workplace demands. For this reason, employees should receive appropriate and adequate occupational safety training in order to improve their awareness of occupational safety against the hazards and risks they may encounter during their daily work in the workplace. Occupational safety training makes employees competent enough to take OHS into account during work, gives them a positive attitude, improves their skills and increases their knowledge. Due to the safety culture that develops positively with the effect of OHS education together with other elements, positive changes are experienced in the knowledge, thoughts, attitudes and behaviours of individuals regarding health and safety in workplaces. These changes lead to an increase in awareness and concerns about health and safety during the work carried out, thus leading to an increase in the taking of health and safety measures by individuals and in compliance with the measures taken and the rules set (Koçak and Koray, 2018, Aktay, 2014; Sünbül, 2015).

The most important objective of the principles and standards set in the field of OHS is to ensure that work is carried out in safe and healthy environments. One of the routes to reaching this aim is to give the necessary importance to training with the co-operation to be provided between the parties. Training is of vital importance for safe and healthy working environments. At the same time, it constitutes an important application step of the preventive approach, which is accepted worldwide in order to protect against health and safety hazards. It also has an effective role in raising awareness and sensitivity, establishing a safety culture and facilitating the implementation of OHS policies. Despite the fact that engineers are educated in a wide variety of departments and programmes, the possible common responsibility that can be given to them in the sector is the field of occupational safety. Although the work risks in the sectors where these engineers will work are different, they need a certain standard of OHS training. Education is also important in reducing occupational accidents. For this reason, they are expected to have received adequate training on occupational safety during formal education (Bodur et al, 2011; Kılkış and Demir, 2012).

One of the major industries of our country and provides raw materials for the industry, the mining sector, is one of the sectors that requires specific knowledge, work experience, and specialisation as well as constant supervision due to the risks inherent in its nature. The fact that each work involves its own risks and that each individual is unique, reveals the necessity to determine the nature of health surveillance according to the features of the work, the enterprise and the employee. Mining is one of the business fields where the necessity of planning health surveillance not only according to the "main branch of work" but also according to the "enterprise" and the "worker" comes to the forefront. Because mining is an industry where different professions are together. As a matter of fact, as stated in the Annex of the Communiqué on Workplace Hazard Classes of OHS No. 6331, mining is in the category of "very dangerous class". Some pits in our country are still not sufficient from the point of view of OHS. The reason why occupational accidents and occupational diseases are encountered more in the mining sector than in other sectors is that it is a labour-intensive business sector. In addition, the truth that there is still insufficient awareness on OHS and that the measures taken are not at the level they should be is of major significance in the occurence accidents and occupational diseases. OHS, which is a sequence of methodical and scientifical studies carried out to protect workers and third parties from conditions that may harm health and safety such as physical, chemical, and psychosocial causes during the performance of work in workplaces, has been continuously improving since the beginning of the programme. There are several OHS rules in open pit mining, underground mining, ore preparation and beneficiation plants. These rules, which have come to the present day with years of accumulation and experience, have ensured that many risks and hazards have been significantly reduced (MMO, 2011; Ceylan, 2012; Yıldız, 2017; Yıldız and Haner, 2017, ISGIP, 2019).

Even though OHS has acquired significance in our country in the last years, education is still insufficient at all education stages. As a result of Law No. 6331 coming into force, qualified workforce requirements in the field of OHS is increasing day by day. On 23 April 2015, with the amendment made to the Higher Education Law No. 2547, OHS course has become a

compulsory course that must be given at least two semesters in engineering, architecture, science-literature and technical education faculties that train graduates who can be occupational safety specialists. OHS is a multidisciplinary science that utilises many branches of engineering such as construction, electricity, mining, petro-chemistry, as well as various disciplines such as medicine, education and law. This makes OHS relatively complex and difficult to learn. In addition, this discipline requires more intensive practical training than most other disciplines and requires a longer period of time to learn the basic subjects. In this context, it is not acceptable to say that OHS training in Mining Engineering, Geological Engineering and Geophysical Engineering departments is sufficient in terms of both time and content. Education in earth sciences is perhaps more important than any other occupational group. The qualifications of the technical staff trained directly affect OHS, and for this reason, especially the staff in universities, the education system and the content of education should be reorganised as necessary, and the required number of technical staff should be trained in a more equipped manner so as not to overcome the requirements of the profession. At this point, the primary problem of earth sciences engineering is not the number of technical staff but the lack of sufficient knowledge of these staff (Ceylan, 2012; Korkmaz and Avsallı, 2012; Yaşar et al., 2015; Özgüler et al., 2016; Birgören and Yılmaz, 2016).

Since mining activities are intertwined with a number of natural conditions that cannot be changed, they involve high-risk processes. Despite the advancing technology, mining workplaces are still one of the industries with the highest number of fatal and injury work accidents in the world. When work accidents in Turkey are analysed, it is seen that the highest number of deaths per accident occurs in mining workplaces. Mining workplaces constitute one of the working areas of the field of occupational health not only in respect of occupational safety but also in relation to the incidence of occupational diseases such as pneumoconiosis, which is much higher especially in underground coal mines (Toygar, 2018; Denek, 2019). Therefore, it is essential to ensure a good education on OHS and OHS culture in Earth Sciences Engineering departments which are required by the industry. In this study, the contemporary status of OHS courses in the departments of Mining Engineering in 23 universities, Mineral Processing Engineering in 1 university, Geological Engineering in 33 universities and Geophysical Engineering in 12 universities in Turkey was analysed. Suggestions for solutions depending on the data received for the improvement of OHS education are presented.

PURPOSE, IMPORTANCE and METHOD of the RESEARCH

According to the Higher Education Council (HEC) 2023 data, Mining Engineering is currently being taught in 23 universities, Mineral Processing Engineering in 1 university, Geological Engineering in 33 universities and Geophysical Engineering in 12 universities in Turkey. Table 1, Table 2 and Table 3 provide knowledge about OHS courses at the universities in Turkey that provide education in Mining Engineering, Mineral Processing Engineering, Geological Engineering and Geophysical Engineering.

When the contents, names, semesters and status of the OHS courses in the curricula of the universities in Turkey that provide Mining Engineering, Mineral Processing Engineering, Geological Engineering and Geophysical Engineering education are examined, it is seen that there is no standard for all departments. The main reason why the contents of the courses are so different from each other is that OHS consciousness is still not fully established in the society. In this study, the contents of the two-semester OHS course and one-semester (for Mining Engineering and Mineral Processing Engineering departments) OHS in Mining courses to be offered in Earth Sciences Engineering departments were prepared based on the curriculum accepted by the Ministry and the curricula of the OHS courses currently offered at universities. It is foreseen that it would be more appropriate for students to complete their basic engineering education in the first two years and to take OHS courses in the 3rd and 4th year when the department courses are more predominant. Therefore, in this study, it is aimed to determine a common curriculum in universities, to convey OHS culture and OHS issues, and to explain OHS in mining in detail.

CONCLUSIONS and SUGGESTIONS

The curriculum for obtaining OHS Expertise certificate in Turkey is determined by the Ministry of Labour and Social Security General Directorate of OHS (MBS, 2023). While determining this curriculum, the Ministry conducted research in many countries and received opinions from universities and various public institutions. According to the Regulation on the Procedures and Principles of OHS Training of Employees, the table of educational subjects is given in Table 4.

As can be seen from the table, in order to provide the entire curriculum determined by the Ministry, OHS courses should be given as compulsory for two semesters, and one semester (for Mining Engineering and Mineral Processing Engineering departments) should be added to the curriculum in which OHS in mining can be covered in detail in order to ensure that OHS culture and education is provided to students.

Within the scope of “Occupational Health and Safety I” course, with the subjects given in Table 5, it can be aimed that students have basic knowledge about OHS culture, OHS definition, purpose, OHS legislation and risk factors. In this way, students are expected to adopt the safety culture and have knowledge about the factors that may be risky. Lessons can be made more effective with applied courses on the subjects given in the table.

Within the scope of “Occupational Health and Safety II” course, students are expected to have knowledge about technical issues in the field of OHS with the subjects given in Table 6. In this way, it is expected that students will have more detailed information about the machines and the working conditions, and will be able to ta ke the necessary precautions by seeing the dangers they may encounter in working life. Lessons can be made more effective with applied courses on the subjects given in the table.

Table 1: Information on OHS courses in universities studying Mining Engineering in Turkey

University	OHS Course Title	OHS Course Semester	OHS Course Status
Adana Alparslan Türkeş Science and Technology University	Occupational Health and Safety in Mining I-II	7/8	Compulsory
Afyon Kocatepe University	Occupational Health and Safety I-II	2/7	Compulsory
Aksaray University	Occupational Health and Safety I-II	3/4	Compulsory
Çanakkale Onsekiz Mart University	Occupational Health and Safety I-II	3/4	Compulsory
Çukurova University	Occupational Health and Safety I-II	3/8	Compulsory
Dicle University	Occupational Health and Safety I-II	7/8	Compulsory
Dokuz Eylül University	Occupational Health and Safety I-II	7/8	Compulsory
Eskişehir Osmangazi University	Occupational Health and Safety I-II	5/8	Compulsory
Hacettepe University	Occupational Health and Safety in Mining/ Occupational Health and Safety I-II	4/5/6	Compulsory
İnönü University	Occupational Safety	7	Elective
Istanbul Technical University (Mining Engineering Department)	Occupational Health and Safety in Mining	8	Compulsory
Istanbul Technical University (Mineral Processing Department)	Occupational Safety in Mineral Processing	6	Compulsory
Istanbul University-Cerrahpaşa	Occupational Health and Safety	1	Compulsory
Karadeniz Technical University	Occupational Health and Safety	8	Compulsory
Konya Technical University	Occupational Health and Safety I-II	3/4	Compulsory
Kütahya Dumlupınar University	Labour Health and Occupational Safety	6	Elective
Muğla Sıtkı Koçman University	Occupational Health and Safety I-II	1/2	Compulsory
Niğde Ömer Halisdemir University	Occupational Health and Safety I-II	1/2	Compulsory
Middle East Technical University	Occupational Health and Safety I	1	Compulsory
Süleyman Demirel University	Occupational Health and Safety	7	Compulsory
Şırnak University	Occupational Health and Safety	6	Compulsory
Uşak University	Occupational Health and Safety in Mining	4	Compulsory
Zonguldak Bülent Ecevit University	Occupational Health and Safety	4	Elective

Table 2: Information on OHS Courses In Universities Studying Geological Engineering in Turkey

University	OHS Course Title	OHS Course Semester	OHS Course Status
Afyon Kocatepe University	Occupational Health and Safety I-II	2/7	Compulsory
Akdeniz University	Occupational Health and Safety	7	Elective
Aksaray University	Occupational Health and Safety I-II	3/4	Compulsory
Ankara University	Occupational Safety and Health I-II	7/8	Compulsory
Balıkesir University	Occupational Health and Safety I-II	7/8	Compulsory
Batman University	None OHS course in the curriculum	-	-
Çanakkale Onsekiz Mart University	Occupational Health and Safety I-II	7/8	Compulsory / Elective
Çukurova University	Occupational Health and Safety I-II	7/8	Compulsory
Dokuz Eylül University	Occupational Health and Safety I-II	5/8	Compulsory
Eskişehir Osmangazi University	Occupational Health and Safety I-II	7/8	Compulsory
Fırat University	None OHS course in the curriculum	-	-
Gümüşhane University	None OHS course in the curriculum	-	-

Table 2: Cont.

University	OHS Course Title	OHS Course Semester	OHS Course Status
Hacettepe University	Occupational Health and Safety I-II	5/6	Compulsory
Istanbul Technical University	None OHS course in the curriculum	-	-
Istanbul University -Cerrahpaşa	Occupational Health and Safety/Occupational Health and Safety	3/6	Elective
Kahramanmaraş Sütçü İmam University	Occupational Health and Safety	1	Elective
Karadeniz Technical University	Occupational Health and Safety	4	Elective
Kırşehir Ahi Evran University	Curriculum could not be accessed	-	-
Kocaeli University	Occupational Health and Safety I-II	7/8	Compulsory
Konya Technical University	Occupational Health and Safety I-II	3/4	Compulsory
Kütahya Dumlupınar University	Occupational Health and Safety I-II	3/4	Compulsory
Mersin University	Labour Health and Occupational Safety I-II	5/6	Compulsory
Muğla Sıtkı Koçman University	Occupational Health and Safety I-II	1/2	Compulsory
Nevşehir Hacı Bektaş Veli University	Curriculum could not be accessed	-	-
Niğde Ömer Halisdemir University	Occupational Health and Safety I-II	1/2	Compulsory
Middle East Technical University	Occupational Health and Safety I	1/5	Compulsory
Pamukkale University	Occupational Health and Safety I-II	7/8	Compulsory
Recep Tayyip Erdoğan University	Occupational Health and Safety	4	Elective
Sivas Cumhuriyet University	Occupational Health and Safety I-II	5/6	Compulsory
Süleyman Demirel University	Occupational Health and Safety	3	Elective
Van Yüzüncü Yıl University	Occupational Health and Safety I-II	1/2	Compulsory
Yozgat Bozok University	Occupational Health and Safety I-II	2/8	Compulsory
Zonguldak Bülent Ecevit University	Occupational Health and Safety	8	Compulsory

Table 3: Information on OHS Courses in Universities Studying Geophysical Engineering in Turkey

University	OHS Course Title	OHS Course Semester	OHS Course Status
Ankara University	Occupational Health and Safety I-II	7/8	Compulsory
Çanakkale Onsekiz Mart University	Occupational Health and Safety	7	Elective
Dokuz Eylül University	Occupational Health and Safety I-II	7/8	Compulsory
Gümüşhane University	None OHS course in the curriculum	-	-
Istanbul Technical University	None OHS course in the curriculum	-	-
Istanbul University -Cerrahpaşa	Occupational Health and Safety	6	Elective
Karadeniz Technical University	Occupational Health and Safety	3	Elective
Kocaeli University	Occupational Health and Safety I-II	7/8	Compulsory
Sakarya University	Occupational Health and Safety	4/6	Elective
Sivas Cumhuriyet University	Occupational Health and Safety I-II	5/6	Compulsory
Süleyman Demirel University	Occupational Safety in Disasters and Emergencies	4	Elective
Van Yüzüncü Yıl University	Curriculum could not be accessed	-	-

Table 4: Table of Topics of Training According to the Regulation on Procedures and Principles of OHS Trainings

General Topics	Information about the labour legislation Legal rights and responsibilities of employees Workplace cleanliness and layout Legal consequences arising from occupational accidents and occupational diseases
Health Topics	Causes of occupational diseases Principles of disease prevention and application of prevention techniques Biological and psychosocial risk factors First Aid Hazards of tobacco products and passive exposure
Technical Topics	Chemical, physical and ergonomic risk factors Manual lifting and handling Flammability, explosion, fire and fire protection Safely usage of work equipments Working with display devices Electricity, its hazards, risks and precautions Causes of occupational accidents and application of protection principles and techniques Safety and health signs The use of personal protective equipment General rules of occupational health and safety and safety culture Evacuation and rescue
Other Topics	Working at heights specific to the work of the employee Working in a closed area Working in areas with radiation risk Working with welds Working with special risk equipment Possible health risks caused by carcinogenic substances, etc.

Table 5: Proposed Lesson Plan for Occupational Health and Safety I Course

Week 1	OHS concept and history; purpose, importance and culture of OHS
Week 2	OHS in Turkey and in the world; OHS legislation; Labour law
Week 3	National and international organisations and conventions; Work accidents
Week 4	Working conditions and occupational hygiene; Occupational diseases
Week 5	Risk assessment; Physical risk factors; Chemical risk factors
Week 6	Biological risk factors; Psychosocial risk factors
Week 7	Midterm Exam
Week 8	Ergonomics; Emergency plans; First aid; Prevention policies
Week 9	Personal protective equipment; Safety and health signs
Week 10	Work equipment design; occupational health and safety in manufacturing and use
Week 11	Controls to be made in terms of occupational safety and documents to be prepared
Week 12	Special risk groups; Ethics in working life
Week 13	Applied course
Week 14	Applied course

Table 6: Proposed Lesson Plan for Occupational Health and Safety II Course

Week 1	Ventilation and air conditioning principles
Week 2	Controls to be followed in terms of OHS; OHS in the design and use of work equipment
Week 3	OHS in welding works; OHS in electrical works
Week 4	OHS in lifting vehicles; OHS in motor vehicles
Week 5	OHS in hand tools; OHS in maintenance and repair works
Week 6	OHS in working with pressure vessels; OHS in working in confined spaces; OHS in working with screened vehicles
Week 7	OHS in manual lifting and handling works; OHS in working at height; OHS in construction workplaces
Week 8	Midterm Exam
Week 9	OHS in ateliers; OHS in workplace building electrics
Week 10	OHS in hazardous and dangerous work; OHS in shift work and night work
Week 11	Fire, Evacuation and extrication
Week 12	Adult education; OHS training at work
Week 13	Applied course
Week 14	Applied course

Table 7: Proposed Lesson Plan for the Occupational Health and Safety in Mining Course

Week 1	General status of OHS in mining workplaces; OHS legislation in mining workplaces
Week 2	Personal protective equipment in mining workplaces; Occupational diseases caused by mining
Week 3	Occupational accidents caused by mining; Accident prevention techniques; Chemical risk factors and precautions
Week 4	Gases affecting labour and work safety; dusts and methods of combating them
Week 5	Use of explosive materials; Regulations; Protection and intervention methods against pit fires and explosions
Week 6	Technical supervisorship and OHS Speciality; Responsibilities and obligations
Week 7	Midterm Exam
Week 8	OHS in open pit mines; Precautions
Week 9	OHS in underground mines; Precautions
Week 10	OHS in mineral processing plants and laboratories; Precautions
Week 11	Emergency plans and exits in quarries; Risk analysis and evaluation in mining
Week 12	Safety in construction machinery; OHS problems in mining sector; Human factor in OHS
Week 13	Obligations of employers and employees; Evaluation of mining law and labour law
Week 14	Applied course

Within the scope of the "Occupational Health and Safety in Mining" course, students are expected to have detailed information about OHS in mining workplaces, which are in the group of high-risk occupations, with the subjects given in Table 7. In this way, students are expected to have detailed information on issues such as personal protective equipment in mining workplaces, occupational diseases, occupational accidents, OHS and precautions to be taken in open and underground mining enterprises and to have OHS awareness, rules and protection methods when they start working life. The courses can be made more effective with applied courses on the subjects given in the table. In this practical course, OHS practices addressing both underground mining and mineral processing plants can be explained with examples.

The earth sciences sector is an industry where different professions work together and it contains many OHS threats and is in the group of high-risk professions. For this reason, earth sciences engineers are expected to master not only the OHS culture and knowledge related to mining, but also the entire OHS culture and knowledge. As a result of this study:

1. It is proposed that OHS courses should be made compulsory in Mining Engineering, Mineral Processing Engineering, Geological Engineering and Geophysical Engineering de-

partments of all universities. In departments that do not have OHS courses in their course plans, it is recommended that these courses be added to the curricula.

2. It is suggested that OHS courses be added to the curriculum after the first two years when students complete their basic engineering education.

3. It is obvious that one course is not enough to teach all OHS subjects determined by the Ministry. For this reason, it is offered that "Occupational Health and Safety I" and "Occupational Health and Safety II" courses should be given first to learn detailed information about OHS. It can be said that it would be more appropriate to give these courses in the 6th and 7th semesters.

4. For Mining Engineering and Mineral Processing Engineering departments, it is recommended that a separate course called "Occupational Health and Safety in Mining/Mineral Processing" should be given to the students who have successfully completed "Occupational Health and Safety I" and "Occupational Health and Safety II" courses in order to provide them with detailed technical knowledge about OHS in mining workplaces. It can be said that this course should be given in the 8th semester following the other two courses.

5. It is advised that OHS courses in Mining Engineering, Mineral Processing Engineering, Geological Engineering and Geophysical Engineering departments of all universities should be standardised in terms of course title, course period and course content.

6. In order to provide OHS education in a competent manner and to provide all the information the students need, it is suggested that certain criteria be taken into consideration when selecting the lecturers to be assigned in the courses. In this context, it is proposed that the academic staff should have "C-Class OHS Specialist Certificate" and "Training of Trainer Certificate". These criteria should be standardised for all engineering departments.

7. Within the scope of other vocational courses in the curriculum of the departments, it is recommended that the subject of the course in question be examined in terms of OHS. In this way, it can be ensured that the academic member teaching the relevant course conveys the OHS culture to the students through examples in the course subject.

8. Within the context of the internship, it can be suggested that a one-week OHS training should be compulsory before starting the internship, and students who successfully complete this training should continue the internship.

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