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Laboratuvar Teknolojisi Programı Öğrencilerinin Teknik Gezi ile Çevre Analizleri Hakkında Farkındalıklarının Arttırılmasına Yönelik Çalışmanın Değerlendirilmesi

Melek Gökmen Karakaya[1 *]

Öz

Laboratuvar Teknolojisi Programı ikinci sınıf ders müfredatında yer alan çevresel analiz ve birinci sınıf ders müfredatında yer alan örnek alma metotları dersleri kapsamında teknik gezi planlanmıştır. Bu çalışmada çevrede analiz edilen parametreler hakkında teknik gezinin öğrencilerimizin farkındalıklarına etkisini belirlemek amaçlanmıştır. Öğrencilerimiz, sürekli emisyon ölçüm sistemleri, dış ortam hava kalitesi ölçümleri, hava kalitesi modellemesi, su analizi, su analizi modellemesi, saha çalışmalarında iş sağlığı ve güvenliği, saha çalışmalarında iş hijyeni, çevresel gürültü seviyesi incelemeleri, toprak analizlerinin üretim ve sağlık ile ilişkisi ve yaprak analizleri ile ilgili farkındalıklarının arttığını gezi sonrası yapılan ankette ifade etmişlerdir. Anket SPSS programı kullanılarak değerlendirilmiş ve Cronbach Alpha güvenirlik katsayısı 0,927 olarak hesaplanmıştır.

Anahtar Kelimeler: Teknik gezi 1, çevre analizleri 2, örnekleme 3, emisyon 4

Evaluation of the Study of Increasing Awareness of Laboratory Technology Program Students on Environmental Analysis with Technical Trip

Abstract

A technical trip was planned within the course of environmental analysis in the second-class curriculum and sampling methods in the first class curriculum of the Laboratory Technology Program. In this study, it was aimed to determine the effect of technical trip about awareness of our students about the parameters analysed in the environment. Students attended this technical trip stated in the survey conducted after the trip that their awareness increased about environmental analyses. They are continuous emission measurement systems, outdoor air quality measurements, air quality modelling, water analysis, water analysis modelling, occupational health and safety in field studies, occupational hygiene in field studies, environmental noise level examinations, the relationship of soil analysis with production and health and leaf analysis. The questionnaire was evaluated using the SPSS program and Cronbach Alpha reliability coefficient was calculated as 0.927.

Key Words: Technical trip 1, environmental analysis 2, sampling 3, emission 4.

[1**]**Corresponding Author:** Dr. Öğr. Üyesi, Uşak Üniversitesi, Uşak, Türkiye, melek.karakaya@usak.edu.tr, ORCID: 0000-0001-7178-6790, Telefon: 536 410 41 52

Introduction

Some natural events and anthropological activities for example volcanic eruption and earthquake and forest fire and sera gas emission are negatively affect the natural structure of the earth. Environment is mean that "Plants, animals and human live in the land, water, air." according to Cambridge Dictionary. Countries have started various studies to determine the present situation and to predict the future situation related to environment and many scientists have conducted and are conducting studies that show the relationship between the environment and human health. These studies require a various data especially derived from laboratory.

Ambient air

The data obtained from the results of laboratory studies have spread too many areas in our daily life. One of them is air quality. The first thing that comes to mind with the term sustainability is the carbon dioxide emission into the air. It is among the policies of the countries to collect information about the emissions released into the air as a result of laboratory measurement studies. In Türkiye, air quality is measured in every province by Republic of Türkiye Ministry of Environment, Urbanization and Climate Change and published on the sim.csb.gov.tr website instantly (T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı website). Advanced technology devices and data management system are used for continuous emission measurement system. Republic of Türkiye Ministry of Health vision is that Türkiye where a healthy lifestyle is adopted and everyone can access his or her right to health easily and with high service quality. A healthy environment and indirectly healthy air are important for a healthy lifestyle. What makes air quality measurements important is their effects on environmental health and therefore human health (Jones, 1999; Kinney, 2008; Mabahwi et al., 2015; Taghizadeh-Hesary and Taghizadeh-Hesary, 2020).

Air quality easily is effected by meteorological variables such as wind speed and direction, temperature, humidity, altitude. To determining air quality emissions, transformation of chemicals for example nitrogen monoxide to nitrogen dioxide, transport, dilution, and deposition of air pollutants subjects are investigated.

In the curriculum of Laboratory Technology program, in the Department of Chemistry and Chemical Processing Technologies, at Banaz Vocational School in University of Uşak Environmental Analysis Course and Sampling Methods Course are available. These courses contexts also include national and international legislations subjects. One of the most important strategic goals of our country is to become a member of the European Union. Türkiye has the status of candidate countries in the EU enlargement policy. For this reason in Türkiye, Air quality Assessment And Management Regulation has been prepared in parallel with Council Directive 96/62/EC, 99/30/EC, 2000/69/EC, 2002/3/EC and 2004/107/EC (mevzuat.gov.tr). According to Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management Member of States are required to assess air quality throughout their territory. Preliminary assessment in air quality situation cover methods for obtaining in an area in which prior measurements is not available. The methods to be used in measurement in environmental analysis are determined according to the parameters to be measured and the reasons for the measurement. Setting up continuous air quality monitoring system in environmental analysis depend on air pollution level and nature of area for example volcanic land. In Türkiye Long Range Transboundary Air Pollution, measurement station (EMEP station) is located in Cubuk district of Ankara, Capital of Türkiye. European Monitoring and Evaluation Programme (EMEP) is scientifically based and policy driven programme. This TR001R numbered EMEP CUBUK II Station carried out the following measurements between 1993 and 2004. In the aerosol matrix ammonium, nitrate, sulfate-total cadmium, lead, vanadium were measured. In the air matrix ammonia, nitric acid, nitrogen dioxide, sulfur dioxide were measured. In the air + aerosol matrix sum ammonia and ammonium, sum nitric acid and nitrate were measured. In the precipitation matrix

ammonium, calcium, chloride, magnesium, pH, potassium, sodium, conductivity, nitrate, precipitation amount, sulfate corrected, sulfate total, acidity were measured. EMEP/CORINAIR, which is then called EMEP/EEA, atmospheric emission inventory guidebook includes methodology for various sectors such as energy, combustion, agriculture, forestry, transport. The latest version of EMEP/EEA was published in 2023; it is a technical guidance to prepare national emission inventories (EMEP/EEA, 2023).

"Transboundary air pollution by Sulphur, nitrogen, ozone and particulate matter in 2020, Turkey." report prepared by Klein and his group at 2022 (Klein et al, 2022). The report includes air concentrations according to meteorological variables between 1990 and 2020 for Türkiye. The air quality model is calculated with emission data obtained from internet address WebDab in this report (WebDab, EMEP). Different models in air concentrations between years are due to both emission and meteorological factors. Emission data and model versions are constantly updated, thus, differences occur between annual reports. The data dealing with chemicals on air generated by emission source and emission receptor calculations. In these calculations, emissions for each emitter are reduced by 15%. The results obtained in the results of measurements and calculations are scaled which represent all emissions from an emission source. In this report prepared by Klein and his group at 2020 and 2022 (Klein et al, 2020 and 2022), in the comparison with observation section a sufficiently consistent set of daily ozone, wet deposition and air concentration observations in TR for 2020 are not available for these analysis.

Particulate matter in the ambient air is collected from the air by filters at various air quality stations in Türkiye and then metal analyzes are routinely performed (Çelen et al., 2023). A study related to an inventory of emissions emitted by ships passing through the Istanbul Bosphorus in 2015 showed that the amount of emissions was above the negligible level (Tokuşlu ve Burak, 2021).

World Health Organization publishes global air quality guideline with various parameters (WHO, 2006, 2021).

Water

According to The United Nations World Water Development Report 2022 Groundwater makes up 99% of the earth's liquid freshwater (United Nations, 2022). Groundwater participates in an important role in sustaining life. The United Nations report is intended to contribute to properly under-stand the groundwater processes.

For public health protection, drinkable water is essential. For this reason, World Health Organization published last Guidelines for drinking-water quality: fourth edition incorporating the first and second addenda (WHO Edition F., 2011; WHO Edition F., 2022). This last Guideline for drinking water consist of general consideration and principles, which are specified as framework for safe drinking water. Supporting information for this framework is chemical aspects, microbial aspects, disinfection, radiological aspects, and acceptability aspects: taste, odour and appearance. The aim of Guidelines provide safety of drinking water for the protection of public health. The Guide defines safe drinking water in a way that does not pose a risk to people's health related to water in any phase of their life where they consume water, including in sensitive situations (WHO Edition F., 2022). Hygienic working practices codes are essential elements in supporting the drinking water supply programme (WHO Edition F., 2022). The standard operating procedure in the guideline also covers personal hygiene (WHO Edition F., 2022).

Microbial Aspect

There is a widespread health risk associated with contaminated drinking-water. It can cause diseases. Infants and the elderly are most affected by these diseases. Quality drinking water provide

great benefits for health. The Guidelines aim to development and implementation of risk management strategies for safety of drinking water supplies (WHO Edition F., 2022). Ingestion of water contaminated with excreta, which can be a source of pathogenic bacteria, viruses, protozoa and helminths, is the greatest risk for microbial contamination (WHO Edition F., 2022; Pitkänen, 2013).

In the Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda, published by WHO on March 21, 2022 pathogens that are definitely transmitted by water are listed in the figure "7.1 Transmission pathways for and examples of water-related pathogens" on page 133 (WHO Edition F., 2022). The list of pathogens is shown in Figure 1.

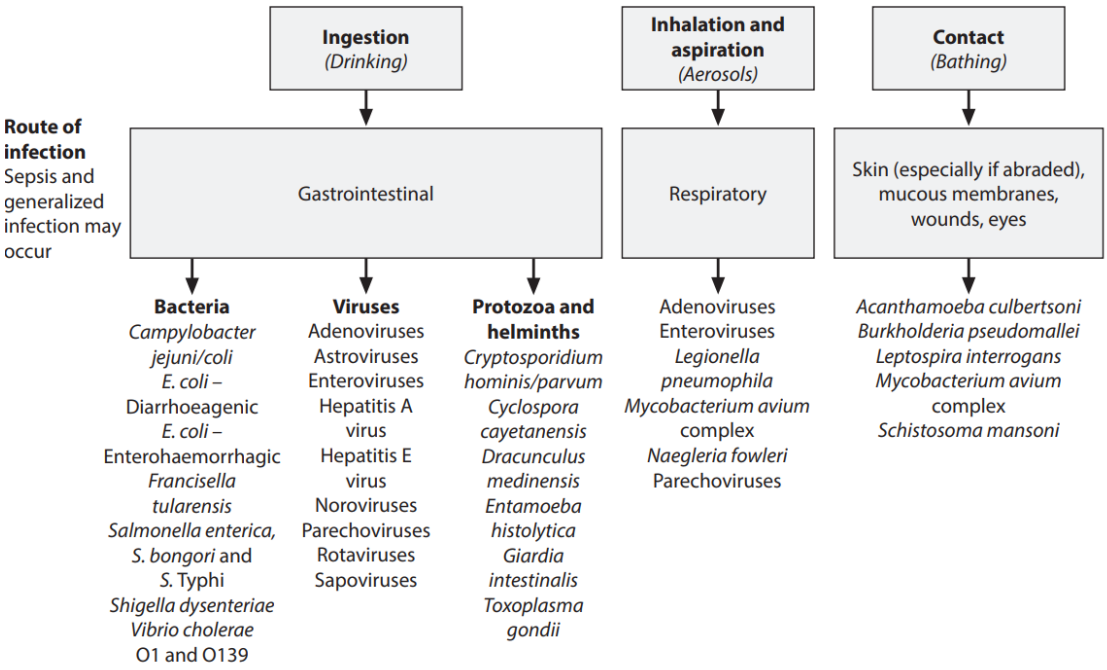


Figure 1. The list of pathogens, which are definitely transmitted by water (WHO Edition F., 2022).

Chemical Aspect

Drinking water containing a few chemical contaminants for example lead or aluminium or arsenic causes adverse health effects after prolonged drinking. Long-term lead expose can cause neurodevelopmental sequelae. Reduced educational attainment means costs to society for special education and remedial support (Prüss-Üstün et al., 2004; Levallois, et al., 2018). Infants' and children's exposure to lead can cause irreversible neurodevelopmental effects (WHO, 2010; Lanphear et al., 2016). There are positive relationship between aluminium in drinking-water and Alzheimer disease (WHO Edition F., 2022; Edzwald, 2020). Arsenic in drinking water has large number of different damaging effects on human health (Hopenhayn, 2006).

A few chemical contaminants for example mercury or cyanide in drinking water can cause health problems after a single use. (WHO Edition F., 2022). Mercury expose can toxically effect mainly in the kidney in human (WHO Edition F., 2022; Morgan et al., 2021). From four suicide case-studies, lowest fatal absorbed dose was per kg of body weight / 0.54 mg hydrogen cyanide (Gettler and Baine, 1938; Arbabi, Masoudipour, and Amiri, 2015).

Source of chemical compounds are categorized as naturally occurring (rocks, soils, and the effects of the geological setting and climate; eutrophic water bodies), industrial sources and human dwellings, agricultural activities, water treatment or materials in contact with drinking water, pesticides used in water for public health (WHO Edition F., 2022)

According to Guidelines for drinking-water quality (WHO Edition F., 2022), chemicals from industrial sources and human dwellings are spread organic and inorganic. Inorganic compounds are bromide, chloride, calcium, magnesium, hydrogen sulphide, iron, molybdenum, pH (very important water quality parameter), potassium, sodium, sulphate, total dissolved solids. Organic compounds are anatoxins. Naturally occurring chemicals are spread organic and inorganic chemical compounds. Inorganic chemical compounds are arsenic, barium, boron, chromium, fluoride, manganese, selenium, and uranium. Organic chemical compounds are cylindrospermopsins, microcystins, and saxitoxins. For some industrial sources and human dwellings compounds, guidelines value are not appointed because they are rarely found in drinking water and their concentrations below health concern. They are beryllium cyanide, 1,3-dichlorobenzene, 1,1-dichloroethane, 1,1-dichloroethene, di(2-ethylhexyl)adipate, hexachlorobenzene, methyl tertiary-butyl ether, monochlorobenzene, nitrobenzene, organotins, petroleum products, trichlorobenzenes, 1,1,1-trichloroethane. Health significance chemicals related to industrial sources and human dwellings, which has established guideline values, in drinking water are divided into organic and inorganic chemicals. Inorganic chemicals are cadmium and mercury. Organic chemicals are benzene, carbon tetrachloride, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethene, dichloromethane, di(2-ethylhexyl)phthalate, 1,4-dioxane, edetic acid, ethylbenzene, hexachlorobutadiene, nitrilotriacetic acid, pentachlorophenol, styrene, tetrachloroethene, toluene, trichloroethene, xylenes. Health significance chemicals from agricultural activities, which has established guideline values, in drinking water are divided into non-pesticides and pesticides chemicals. Non-pesticides chemicals are nitrate and nitrite. Pesticides chemicals are alachlor, aldicarb, aldrin and dieldrin, atrazine and its chloro-striazine metabolites, carbofuran, chlordane, chlorotoluron, chlorpyrifos, cyanazine, 2,4-dichlorophenoxyacetic acid, 2,4-dichlorophenoxybutyric acid, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane, 1,2-dichloropropane, 1,3-dichloropropene, dichlorprop, dimethoate, endrin, fenoprop, hydroxyatrazine, isoproturon, lindane, mecoprop, methoxychlor, metolachlor, molinate, pendimethalin, simazine, 2,4,5-trichlorophenoxyacetic acid, terbuthylazine, trifluralin. Health significance chemicals from water treatment or materials in contact with drinking water, which has established guideline values, in drinking water are divided into disinfectants and disinfection by-products chemicals. Disinfectants chemicals are chlorine, monochloramine, and sodium dichloroisocyanurate. Disinfection by-products chemicals are bromate, bromodichloromethane, bromoform, chlorate, chlorite, chloroform, dibromoacetonitrile, dibromochloromethane, dichloroacetate, dichloroacetonitrile, monochloroacetate, N-nitrosodimethylamine, trichloroacetate, 2,4,6-trichlorophenol, and trihalomethanes. Water treatment contaminants, which has established guideline values, are acrylamide and epichlorohydrin. Contaminants from pipes and fittings for drinking water, which has established guideline values, are antimony, benzo[α]pyrene, copper, lead, nickel, are vinyl chloride (WHO Edition F., 2022).

Radiological aspects

Radioactivity is energy loses by radiation from unstable atomic nucleus via alpha decay, beta decay, and gamma decay (U.S.NRC, 2020). According to The United Nations Scientific Committee on the Effects of Atomic Radiation, it is estimated that one person receives radiation from radiation sources in the environment 3.0 mSv (millisieverts) per year (UNSCEAR, 2008). Expressed effective dose is called sieverts (Sv) in The International System of Units (SI). The term "effective dose" was developed to directly determine the biological effect of radiation received on the body. These radiation sources are divided into 4 main groups consist of artificial source 0.59 mSv (medical), artificial source 0.0122 mSv (others), natural source 1.26 mSv (radon), and natural source 1.16 mSv (others) (UNSCEAR, 2008). It is estimated by UNSEAR (UNSCEAR, 2008) that radiation uptake into the body through drinking water 0.05 mSv annual average. 100 mSv and above protracted radiation exposure through drinking water increase cancer risk at human (Brenner et al., 2003; UNSCEAR, 2012, Rühm, Laurier and Wakeford, 2022). There is no threshold related to radiation exposure and cancer risk (UNSCEAR, 2010; Verbiest et al., 2015; Rühm et al., 2022). Source of natural radiation is uranium

decay series or radium series. This series end with lead-206. Radiation is released naturally in this radioactive decay series to the environment.

Radionuclides come from rocks and soils for example uranium, radium and radon dissolved in groundwater. Dissolved radon in groundwater can easily be released into air, when groundwater waits on surface like lake water (WHO Edition F., 2022). According to UNSCEAR Report 2000, approximately 90% of radon in drinking water comes from inhalation rather than ingestion because radon is volatile radionuclide (UNSCEAR Report, 2000). For radon is volatile, radon is measured in air than in drinking water in dwells. Reference level determined by WHO for radon radionuclide concentration in indoor air is 100 Becquerel (Bq)/m^3 in dwells (WHO, 2009). Newly discovered drinking water sources should be determined for suitability in terms of radon concentration. Existing drinking water sources should be constantly monitored. The water sampling frequency is increased if the amount of radionuclide in the water is constantly changing or if there is a potential radionuclide contamination source around. Water sampling frequency should be developed according to source of drinking water (ground or surface water), population served, radionuclide concentration and type, and previous measurement results (ISO, 2006a; ISO, 2006b).

Acceptability Aspects: Taste, odour and appearance

Drinking water should be acceptable to the customer in terms of appearance, taste and odour. Acceptability regarding the appearance, taste, and odour of drinking water may accept different with consumers. If there has been a sudden and substantial change in the appearance, taste, and odour of drinking water, it must be investigated by the authorities (WHO Edition F., 2022).

Water Legislation for Human Consumption in Türkiye

In Türkiye, regarding drinking water 20 October 2016 dated and 29863-numbered Official Gazette Regulation on Amending the Regulation on Waters for Human Consumption has been published (T.C. Resmi Gazete, 2016). This regulation is the amended version of the Regulation on Water Intended for Human Consumption published in the Official Gazette dated 17/2/2005 and numbered 25730. The Regulation on Water Intended for Human Consumption which was published in the Official Gazette 17/2/2005 dated and 25730 numbered papered based on items Articles 235 and 242 of the Public Health Law No 1593 dated 24/4/1930, and Article 26 of the Law on the Amendment of the Decree on the Production and Consumption and Inspection of Foods 27/5/2004 dated and 5179 numbered, and 13/12/1983 Based on Article 43 of the Decree Law on the Organization and Duties of the Ministry of Health dated and numbered 181 and in parallel with Council Directive 98/83/EC (European Commission, 1998) on the quality of water intended for human consumption, and Council Directive 80/777/EEC of 15 July 1980 on the approximation of the laws of the Member States relating to the exploitation and marketing of natural mineral waters, and Commission Directive 2003/40/EC of 16 May 2003 establishing the list, concentration limits and labelling requirements for the constituents of natural mineral waters and the conditions for using ozone-enriched air for the treatment of natural mineral waters and spring waters. In 2015, Commission Directive (EU) 2015/1787 (Directive, 2015) amending Annexes II and III to Council Directive 98/83/EC on the quality of water intended for human consumption was published. Commission Directive (EU) 2015/1787 amending Annexes II Monitoring consists of four Part, they are Part A, Part B, Part C and Part D. Part A contains water monitoring programmes for human consumption to identify the mitigating the risk to human health from the catchment area of water to consumer human, who drink or use water. Part B contains water parameters to analysis and sampling frequencies. Part C contains risk assessment. Part D contains sampling methods of drinking water and sampling in the water distribution system. Commission Directive (EU) 2015/1787 amending Annexes III consists of four items. Item (1) has been replaced as an introductory paragraph. It is stated that the validation and documentation carried out according to EN ISO/IEC 17025 (ISO/IEC 17025: 2017) or other international standards should be used to monitor and demonstrate the compliance of water analysis methods with this directive. Item (2), where point 1 has

been amended, is related to microbial parameters. Item (3), where point 2 has been amended, is related to chemical and indicator parameters. Item (4), point 3 has been deleted.

Soil

Soil serves a wide variety of purposes. Soil is a habitat for diverse biological creatures, and it is used to purify water and store organic carbon (EEA Report, 2023). Shortly it has a lot of function, but it is not renewable. For sustainability, this is very important. For this reason, knowing how soil is degraded is very important for soil conservation (EEA Report, 2023; Johannes et al., 2017).

European Environment Agency has published a report, which synthesizes that knowledge included also soil monitoring and measurement, with the objective of identifying criteria for healthy soils across Europe (EEA Report, 2023). This report may prevent further soil degradation by sustainable management.

This report tells us various indicators are used to assess the types of soil degradation associated with land use. Soil organic carbon, nutrients (carbon, nitrogen, phosphorus), acidification, soil pollution (cadmium, copper, lead, zinc, arsenic, mercury, nickel, chromium), erosion, soil biodiversity, soil compaction, soil impermeability parameters are accepted as soil health indicators (EEA Report, 2023; Johannes et al., 2017; Verheijen et al., 2005; Zink et al., 2011). Soil health indicators have been monitoring for soil health assessment. For accurate soil sampling studies, soil-sampling tools, bags and transport containers must be clean (Estefan, Sommer and Ryan, 2013).

For protection soil health, in Türkiye there is also a regulation on laboratories where fertilizer analyzes are made and their fees for soil protection (T.C. Resmi Gazete, 2017). There is a Communiqué on Support Payment for soil analysis (T.C. Resmi Gazete, 2017).

Leaf

Leaf analyzes are performed to determine the type and amount of fertilizers required by the plants to be grown. Thus, undesirable situations (soil pollution, extra cost for excess fertilizer, low crop yield caused by the use of less fertilizer) that may arise due to the selection of too much, too little or wrong fertilizer are prevented (de Mello Prado and Rozane, 2020). Leaf sampling technique development studies are carried out for leaf analysis (Sun et al., 2015). For monitoring soil parameters sampling technique is very important. For correct plant sampling studies, it is important that the plant tissues to be sampled, the bags to collect the sample and transport containers are clean (Estefan, Sommer and Ryan, 2013). Sampling is included as 7.3 sampling under the 7th item of The International Organization for Standardization 17025 (ISO/IEC 17025: 2017). On 28/2/1978, in Türkiye, a one-off decision of the Council of Ministers was taken regarding leaf analyzers in Türkiye. In 1978, for one time reduction of customs duty rates to zero (0)were used for leaf analyzers (T.C. Resmi Gazete, 1978).

Noise

Noise is an environmental pollution (Peris, 2020; Zaner, 1991). Noise has adverse effects on human health physically and mentally (Stewart et al., 2011; Correia et al., 2013; Hansell et al., 2013; Clark et al., 2020). Noise has auditory and non-auditory negative effects on health (Basner et al., 2014). Human are aware of sounds as potential sources of danger (Hughes and Jones, 2003). It has been reported that how much noise people are exposed to in Europe under the Environmental Noise Directive (END) (Peris, 2020). This report also contain measures taken to manage and reduce noise exposure and reviews progress towards achieving policy goals and describes inequalities in exposure to environmental noise and impacts on wildlife. In Türkiye, the purpose of the Environmental Noise Control Regulation "Çevre Gürültü Kontrol Yönetmeliği" is to prevent the negative effects of environmental noise on the environment and human health, to prepare noise maps and noise action

plans, to implement noise control measures to reduce environmental noise, and to inform the public about environmental noise management studies. (T.C. Resmi Gazete, 2022)

Occupational Health and Safety

Insect bites, stings and similar situations are encountered among those working in open fields and those who work in agricultural areas may be exposed to various zoonoses (Sert and Nazlıoğlu, 2016). Many injuries can occur due to falls and slips in open fields. Such situations can cause various health problems (Eğri et al., 2014). Therefore, protective clothing suitable for the climatic conditions should be worn during the open field study (Sert and Nazlıoğlu, 2016).

There were studies that mention the importance of awareness studies in education (Bilge ve Tennur, 2021). One of the aims and duties of higher education is to educate students in accordance with the state's science and future policy within the scope of their interests and abilities, in accordance with the education, general purposes and basic principles and future of the states (Gül, 2019). In this study, the effect of the technical tour carried out within the scope of the course curriculum of the laboratory technology students on the level of awareness about environmental analysis was investigated.

Methods

Ethics Committee Approval

Republic of Türkiye University of Uşak Science and Engineering Sciences Scientific Research and Publication Ethics Committee (T.C. Uşak Üniversitesi Fen ve Mühendislik Bilimleri Bilimsel Araştırma ve Yayın Etiği Kurulu) decided that the method to be applied in the research was ethically appropriate. Decisions Meeting Number: 02 Decision Date 08.03.2023 Decision 2023-09. Each participant signed the informed consent form.

Type of study

This is the study of evaluating the results of the survey, which was prepared for the purposes of the trip and applied to the participants of the technical trip after the approval of the Ethics Committee.

Cronbach Alpha Reliability Coefficient

Factor analysis of the scale items was performed. Cronbach Alpha reliability coefficient was calculated as .927 and given in Table 1.

Table 1. Cronbach Alpha Reliability Coefficient.

Cronbach's Alpha	N of Items
,927	11

If this value is greater than .70, the construct validity of the scale is ensured and shows that it is reliable. SPSS 20.0 programme, which is statistical programme developed by IBM, was used, the results were expressed as frequency (f) and percentage (%).

Data Collection Tools

In the research, a specially prepared questionnaire for the technical trip was used according to the course curriculum by this article author. A technical trip was organized to raise awareness about the pre-evaluation studies carried out before taking samples for environmental analysis for the 2nd year laboratory technology students who took the environmental analysis and sampling methods course and the 1st year laboratory technology students who only took the sampling methods course.

After the technical tour, the participants were applied a questionnaire. The questionnaire form consists of two parts. In the first part, there are three questions (gender, age, class) about the personal information of the students. In the second part, there are 10 questions prepared in 5-point likert type for the application of environmental analysis and 1 question (item) prepared in 5-point likert type about the school's website, a total of 11 questions. The survey questions were developed within the scope of the courses curriculum for this technical tour. Ten of them were specially prepared for this trip according to course curriculums and one of them with 11th question was about publishing this technical trip news on Banaz Vocational School's website. Totally, questionnaire consist of 14 questions also with personal information. With the questions prepared according to the course curriculum, it was aimed to determine the increase awareness level of the participants about environmental analysis. With the questionnaire about the website, the satisfaction levels of the students about the publication of the technical trip news on the school's website were determined.

Data Collection Process

The data collection process started with the approval of the Scientific Research and Publication Ethics Committee of University of Uşak (Ethics Committee Decision dated 08.03.2023 and numbered 2023/09). Participants signed the informed consent form between 20.3.2023 and 30.03.2023 with google forms and WhatsApp. The survey was applied to students between 20.3.2023 – 30.03.2023 with google forms and WhatsApp by Academician who participate in technical tour.

Data Analysis

Students group participating in the survey consisted of totally 25 volunteer University of Uşak, Banaz Vocational School (VS), Department of Chemistry and Chemical Processing Technologies, Laboratory Technology Program students, 8 in the 1st grade and 17 in the 2nd grade, who participated in the technical trip. Demographic information of the study group is shown in Table 2.

Table 2. Demographic Structure of the Study Group.

Variant	Gro	*f*	%
Gender	Fen	21	84
	Ma	4	16
Age	18-2	11	44
	21-2	14	56
Class	1. C	8	32
	2. C	17	68

According to Table 2, "84 % of the students who make up the study group are female" and "16 % are male". 44 % of the students are in the age range of "18-20" and 56 % are in the age range of "21-25". 32 % of the students participating in the technical trip are first class and 68 % are second-class. The basic demographic information of this survey study participants are summarized on the Table 2 regarding their gender, age, and class.

11 questions (items) prepared in 5-point likert type forming the second part of the survey were analyzed in the SPSS 20.0 program.

Travel

Departure: On 11.11.2022, Akkaşlar Tur by following the official program given by Banaz VS's picked up one Academician and eighteen students from the first stop in Banaz district of Uşak at 10.00 o'clock in the morning, and the second stop at 10.20 from the Garden of Banaz Vocational School. It

took them to Uşak (Mevlana Park) Air Quality Monitoring Station and from there to Ulubey Canyon. Return: The same group came to Uşak Center from Ulubey district of Uşak and free time was given for 2 hours. Later the same group arrived in Uşak Banaz District at 16.30 o'clock. Seven students participated in the trip with their own means. Technical Trip Participant, Banaz Vocational School, Uşak (Mevlana Park) air quality monitoring station, Ulubey Canyon Entrance and Trip Vehicle appear in Picture 1, 2 and 3.

Picture 1. Technical Trip Participant at the Air Quality Monitoring Station in Uşak (Mevlana Park).

Picture 2. Technical Trip Participant, Banaz Vocational School and Trip Vehicle appear.

Picture 3. Technical Trip Participant, Ulubey Canyon Entrance and Trip Vehicle appear.

Findings

Survey results after the technical trip were shown Table 3. Answers to the first "I gained awareness about continuous emission measurement systems" item in the questionnaire like this; one student has no idea, 13 students agreed and 11 students completely agreed. The student who chose the premise "No idea" for this question stated that she/he was undecided as to whether the technical trip had a contribution since she/he learned these subjects in the course curriculum. It was found that the technical trip increased the awareness of the students about outdoor air quality measurements. It was found that about the increase in awareness about air quality modelling, 1 student was undecided, 8 students agreed, 16 students completely agreed. It was found that about the increase in awareness about water analysis and water analysis modelling. One student was undecided about water analysis modelling. In field studies, it has been observed that students' awareness of occupational health and safety and occupational hygiene had increased. It was found that about the increase in awareness about environmental noise level, one student was undecided, five students agreed, 19 students completely agreed. Two students about soil analysis and four students about leaf analysis were undecided about increasing their awareness. The subject that received the most "no idea" opinions in the survey was about "I gained awareness about Leaf Analysis". However, it was still found that the awareness of other students about soil and leaf analysis increased. Because, it was seen that 8 students agree that their awareness about soil analysis and production had increased, and 15 students completely agree. Likewise, it was seen that 8 students agreed that their awareness of leaf analysis had increased, and 13 students completely agreed. There were no "I strongly disagree" or "I do not agree" answers in the survey.

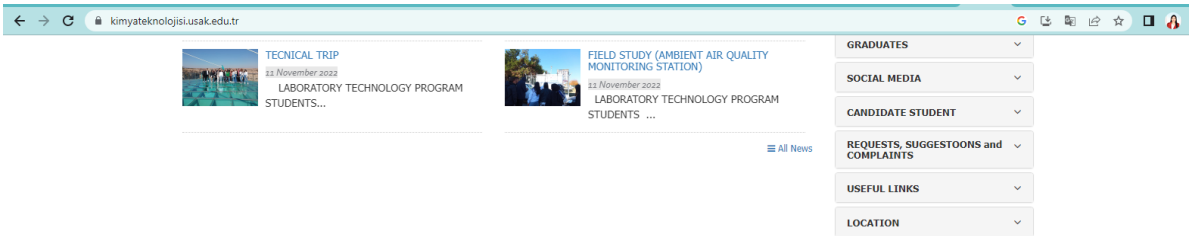
Pearson (point biserial) correlation analysis were performed separately for the 11 questions in the survey and it was calculated as $p > .05$ for each separately. For point biserial correlation analyzes, dichotomous variable was gender and metric variables were the 11 items in the survey.

Table 3. Survey Results after the Technical Trip.

Items	I strongly disagree	I do not agree	No idea % (*f*)	I agree % (*f*)	Absolutely I agree % (*f*)

		% (*f*)	% (*f*)	
1	I gained awareness about continuous emission measurement systems.	4 (1)	52 (13)	44 (11)
2	I gained awareness about ambient air quality measurements.		40 (10)	60 (15)
3	I gained awareness about air quality modeling.	4 (1)	32 (8)	64 (16)
4	I gained awareness about water analysis.		32 (8)	68 (17)
5	I gained awareness about water analysis modeling.	8 (2)	36 (9)	56 (14)
6	I gained awareness about the relationship between occupational health and safety and fieldwork.		24 (6)	76 (19)
7	I gained awareness about the relationship between occupational hygiene and fieldwork.		24 (6)	76 (19)
8	I gained awareness about environmental noise level measurements.	4 (1)	20 (5)	76 (19)
9	I gained awareness about the relationship between soil analysis and production.	8 (2)	32 (8)	60 (15)
10	I gained awareness about leaf analysis.	16 (4)	32 (8)	52 (13)
11	Before and after the technical trip, I am satisfied with the announcements and news on the Banaz VS website.		16 (4)	84 (21)

Answers to the last item in the questionnaire " Before and after the technical trip, I am satisfied with the announcements and news on the Banaz VS website." like this; it was found that the students were satisfied with the announcements and news about the technical trip published on the University of Uşak Banaz Vocational school's website. Announcements are given in picture 4 (EN) and 5 (TR).



Picture 4. https://kimyateknolojisi.usak.edu.tr/ English webpage

Picture 5. https://kimyateknolojisi.usak.edu.tr/ Turkish webpage

Discussion, Conclusion and Recommendations

In this study, it was planned to increase the awareness of the students participating in the technical trip by organizing a technical trip about environmental analysis and sampling methods.

This study was carried out in Uşak University Banaz Vocational School, Department of Chemistry and Chemical Processing Technologies, Laboratory Technology Program. Questionnaire study was applied to 25 students consist of 1st grade 8 and 2nd grade 17 laboratory technology programme students. Participants were first asked to fill in demographic information. In the second stage, it was aimed to measure the awareness of the students participating in the research on environmental analysis and modelling methods and the satisfy with the news in the Banaz Vocational school web site dealing with technical trip. All test results were evaluated in SPSS 20.0 analysis programs, and the obtained frequency analysis was evaluated by applying. The results of the research can be summarized as follows.

It was seen that the majority of the participants participating in the research are female students (21 participants, 84%), 16 participants (64%) are in the 21-25 age group, and 17 participants (68%) are 2nd grade students.

It has been revealed that the awareness of the students participating in the technical trip about environmental analysis increased.

It was observed that the students who participated in the trip were satisfied with proclaim of technical trip news on the school's website.

According to Pearson (point biserial correlation) analyzes, it was determined that there was no meaningful relationship between the answers given to the survey questions according to the gender of the students.

As a recommendation, in the next technical trip, it would be better if we use a one portable air quality measurement device or any portable environmental analysis device within the economically possibilities of our school or by collaborating with various institutions.

Araştırma ve Yayın Etiği Beyanı

T.C. Uşak Üniversitesi Fen ve Mühendislik Bilimleri Bilimsel Araştırma ve Yayın Etiği Kurulu 2023-09 sayılı ve 08.03.2023 tarihli karar çalışmada kullanılacak yöntemin etik açıdan uygun olduğunu onamıştır.

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GENİŞLETİLMİŞ ÖZET

Laboratuvar Teknolojisi Programı Öğrencilerinin Teknik Gezi ile Çevre Analizleri Hakkında Farkındalıklarının Arttırılmasına Yönelik Çalışmanın Değerlendirilmesi

Giriş

Volkanik patlamalar, depremler, radyasyon ve orman yangınları gibi bazı doğal olaylar ve çeşitli çevre kirliliğine neden olan bazı insan aktiviteleri dünyanın doğal yapısını olumsuz etkilemektedir. Ülkeler çevre ile ilgili mevcut durumu belirlemek ve gelecekteki durumu tahmin etmek için çeşitli çalışmalar başlatmıştır. Birçok bilim insanı çevre ile insan sağlığı arasındaki ilişkiyi gösteren çeşitli çalışmalar yapmışlardır ve yapmaktadırlar. Bu çalışmalar özellikle laboratuvardan elde edilen çeşitli verilere ihtiyaç duymaktadır. Çevre analizleri hava, su, toprak, gürültü ve radyasyon gibi çeşitli alanlarda sürdürülmektedir. Türkiye'de dış ortam hava kalitesi T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı tarafından her ilde ölçülmekte ve anlık olarak sim.csb.gov.tr web sitesinde yayınlanmaktadır (T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı web sitesi). Avrupa Birliği genişleme politikasında Türkiye aday ülke statüsünde olduğu için Türkiye'de Hava Kalitesi Değerlendirmesi ve Yönetimi Yönetmeliği 96/62/EC, 99/30/EC, 2000/69/EC, 2002/3/EC ve 2004/107/EC sayılı Konsey Direktiflerine paralel olarak hazırlanmıştır (mevzuat.gov.tr).

Halk sağlığının korunması için içilebilir su şarttır. Bu nedenle Dünya Sağlık Örgütü, içme suyu kalitesine ilişkin son Kılavuz'u 21 Mart 2022 de yayınlamıştır (WHO Edition F., 2022). İçme suyuna ilişkin bu son Kılavuz, güvenli içme suyu için belirlenen genel hususlar ve ilkelerden oluşmaktadır. Kılavuzun amacı halk sağlığının korunması için içme suyunun güvenliğini sağlamaktır.

Toprak çok çeşitli amaçlar için kullanılmaktadır ve çeşitli biyolojik canlılar için yaşam alanıdır. Ancak yenilenemez. Sürdürülebilirlik için önemli bir durumdur. Avrupa Çevre Ajansı, sağlıklı topraklara ilişkin kriterleri belirlemek amacıyla toprak izleme ve ölçümünü içeren bilgileri bir rapor halinde yayınlamıştır (EEA Report, 2023).

Yetiştirilecek bitkilerin ihtiyaç duyduğu gübrelerin cinsini ve miktarını belirlemek için yaprak analizleri yapılır. Böylece çok fazla, çok az veya yanlış gübre seçimi nedeniyle ortaya çıkabilecek istenmeyen durumlar önlenmiş olur (de Mello Prado ve Rozane, 2004). Yaprak analizine yönelik yaprak örnekleme tekniği geliştirme çalışmaları yapılmaktadır (Sun vd., 2015). Parametrelerin izlenmesi için örnekleme tekniği çok önemlidir. Örnekleme, Uluslararası Standardizasyon Organizasyonu (ISO) 17025 Standartının (ISO/IEC 17025:2017) 7. maddesi kapsamında 7.3 örnekleme alt başlığı altında yer almaktadır.

Gürültü bir çevre kirliliğidir (Peris, 2020; Zaner, 1991). Gürültünün insan sağlığı üzerinde fiziksel ve zihinsel olumsuz etkileri vardır (Stewart vd., 2011; Correia vd., 2013; Hansell vd., 2013; Clark vd., 2020). Türkiye'de "Çevre Gürültü Kontrol Yönetmeliği'nin amacı, çevresel gürültünün çevre ve insan sağlığı üzerindeki olumsuz etkilerini önlemek, gürültü haritaları ve gürültü eylem planları hazırlamak, çevresel gürültüyü azaltacak gürültü kontrol tedbirlerini uygulamak ve gürültünün azaltılması ve çevresel gürültü yönetimi çalışmaları hakkında kamuoyunu bilgilendirmektir (T.C. Resmi Gazete, 2022)

Saha çalışmalarında temizlik ve güvenli çalışma önemlidir (Estefan, Sommer and Ryan, 2013; Sert and Nazlıoğlu, 2016).

Yöntem

T.C. Uşak Üniversitesi Fen ve Mühendislik Bilimleri Bilimsel Araştırma ve Yayın Etiği Kurulu, bu araştırmada kullanılacak metodu etik olarak 8 Mart 2023 de onamıştır. Bu onama kararından sonra Google formlar ve/veya whatsapp uygulaması üzerinden 11 Kasım 2022 de düzenlenen teknik geziye katılan öğrencilere 20.03.2023 tarihinde bilgilendirilmiş onam formu ve gezi sonrası anket formu gönderilmiştir. Tüm katılımcı öğrenciler gönüllü olarak onam formunu imzalamış ve formu doldurmuştur.

Bu çalışmada ders müfredatına göre teknik gezinin amaçları için özel hazırlanmış anket formunun sonuçlarının değerlendirilmesi yapılmıştır. IBM'in geliştirdiği istatistik programı SPSS 20.0 programı kullanılmıştır. Ölçek maddelerinin faktör analizi yapılmış, Cronbach Alpha güvenirlik katsayısı .927 olarak hesaplanmıştır. Sonuçlar frekans (f) ve yüzde (%) olarak ifade edilmiştir.

Araştırmada veri toplama aracı olarak kullanılan anket formu iki bölümden oluşmaktadır. Birinci bölüm öğrencilerin demografik verilerini kapsamaktadır. İkinci bölüm çevre analizinin uygulanmasına yönelik 5'li likert tipinde hazırlanmış 10 soru ve okulun web sitesi ile ilgili 5'li likert tipinde hazırlanmış 1 soru olmak üzere toplam 11 soruyu kapsamaktadır. Bu çalışmada anket sonuçları değerlendirilen teknik gezi, çevresel analiz ve örnek alma metotları derslerini alan 2. sınıf laboratuvar teknolojisi öğrencileri ile sadece örnek alma metotları dersini alan 1. sınıf laboratuvar teknolojisi öğrencileri için düzenlenmiştir. Bu çalışmada öğrencilerin, çevre analizleri ile ilgili ön değerlendirme çalışmaları ve çevre analizleri hakkında farkındalıklarını arttırmak amaçlanmıştır. Geziye ve dolayısıyla araştırmaya 21 kız öğrenci ve 4 erkek öğrenci olmak üzere toplam 25 gönüllü öğrenci katılmıştır. Öğrencilerden 8'i birinci sınıf, 17'si ikinci sınıftır.

11 Kasım 2023 tarihinde Akkaşlar Tur, Banaz MYO'nun kendisine resmi yazı ile verdiği programa uyarak, ilk durak Uşak'ın Banaz ilçesinden sabah saat 10.00'da, ikinci durak Banaz Meslek Yüksekokulu Bahçesinden toplam 1 Akademisyen ve 18 öğrenciyi alarak, Uşak (Mevlana Park) Hava Kalitesi İzleme İstasyonuna, oradan da Ulubey Kanyonuna götürmüştür. Yaklaşık 2 saatlik incelemeler sonrasında aynı grubu Uşak'ın Ulubey ilçesinden alarak Uşak Merkez'e getirmiş ve 2 saatlik serbest zaman sonrasında aynı grubu saat 16.30 da Uşak'ın Banaz İlçesi'ne geri getirmiştir. Geziye 7 öğrenci kendi imkânlarıyla katılmıştır.

Bulgular

Anketin ilk "Sürekli emisyon ölçüm sistemleri hakkında farkındalık kazandım." cümlesini 1 öğrenci Fikrim Yok, 13 öğrenci Katılıyorum, 11 öğrenci Tamamen Katılıyorum şeklinde yanıtlamıştır. Bu cümlede Fikrim Yok görüşünü seçen öğrenci ders müfredatında bu konuları öğrendiği için teknik gezinin katkısı olup olmadığı konusunda kararsız olduğunu ayrıca ifade etmiştir. Anketin ikinci cümlesi olan "Dış ortam hava kalitesi ölçümleri hakkında farkındalık kazandım." cümlesine verilen cevaplar ile teknik gezinin öğrencilerin dış ortam hava kalitesi ölçümleri konusundaki farkındalıklarını arttırdığı bulunmuştur. "Hava kalitesi modellemesi hakkında farkındalık kazandım." cümlesine verilen cevaplar ile öğrencilerin bu konuda teknik gezinin farkındalıklarını arttırdığı bulunmuştur. "Su analizleri hakkında farkındalık kazandım." ve "Su analizi modellemesi hakkında farkındalık kazandım." cümlelerine öğrencilerin verdikleri yanıtlardan farkındalıklarının arttığı tespit edilmiştir. "İş sağlığı ve güvenliğinin saha çalışması ile ilişkisi hakkında farkındalık kazandım." ve "İş hijyeninin saha çalışması ile ilişkisi hakkında farkındalık kazandım." cümlelerine öğrencilerin

verdikleri cevaplardan bu konularda farkındalıklarının arttığı bulunmuştur. "Çevresel gürültü seviyesi incelemeleri hakkında farkındalık kazandım." cümlesine öğrencilerin verdikleri yanıtlar bu konuda farkındalıklarının arttığı yönündedir. "Toprak analizlerinin üretim ile ilişkisi hakkında farkındalık kazandım." cümlesine verilen yanıtlar öğrencilerin bu alanda farkındalıklarının arttığını ifade etmiştir. "Yaprak analizleri hakkında farkındalık kazandım." cümlesine dört öğrenci Fikrim Yok şeklinde cevap vermiştir. Diğer öğrenciler yaprak analizleri hakkında farkındalıklarının arttığını ifade etmiştir. Ankette yer alan son cümle "Teknik gezi öncesi ve sonrası okulun web sitesindeki duyuru ve haberlerden memnunum." cümlesine verilen cevaplar ile öğrencilerin okulun web sitesindeki teknik gezi ile ilgili haberlerden memnun oldukları belirlenmiştir. Öğrencilerin cinsiyetlerine göre anket sorularına verdikleri cevaplar arasında anlamlı bir fark olmadığı bulunmuştur.

Tartışma, Sonuç ve Öneriler

Teknik gezinin güvenli bir şekilde planlanıp, sürdürülüp sonuçlandırılabilmesi için gerekli olan resmi yazışma işlemleri gerçekleştirilmiş ve gezi sırasında plan uygulanmıştır. Bu çalışma Uşak Üniversitesi Banaz Meslek Yüksekokulu Kimya ve Kimyasal İşleme Teknolojileri Bölümü Laboratuvar Teknolojisi Programında gerçekleştirilmiştir. Anket çalışması, 1. sınıf 8 ve 2. sınıf 17 laboratuvar teknolojisi programı öğrencilerinden oluşan 25 öğrenciye uygulanmıştır. Uygulama sırasında katılımcılardan ankette yer alan demografik bilgileri doldurmaları ve çevresel analiz ve modelleme yöntemleri konusundaki farkındalıklarına ve Banaz Meslek Yüksekokulu web sitesinde teknik gezi ile ilgili haberlerden memnuniyet düzeylerinin ölçülmesine yönelik düşüncelerini ifade eden ölçeği işaretlemeleri istenmiştir. Test sonuçları SPSS 20.0 analiz programlarında değerlendirilmiştir. Araştırmanın sonuçları şu şekilde özetlenebilir. Geziye katılan öğrencilerin çevre analizleri konusundaki farkındalıklarının arttığı ortaya çıktı. Geziye katılan öğrencilerin teknik gezi haberlerinin okulun internet sitesinde yayınlanmasından memnun oldukları görüldü. Öğrencilerin anket sorularına verdikleri cevaplar ile öğrencilerin cinsiyetleri arasında anlamlı bir ilişki olmadığı tespit edildi.

Öneri olarak daha sonraki böyle bir teknik gezide okulun ekonomik imkânları dâhilinde veya çeşitli kurumlarla işbirliği oluşturularak taşınabilir bir hava kalitesi ölçüm cihazı veya çevresel analiz ölçüm cihazı kullanılabileceği sunulabilir.