Cukurova Medical Journal
ÇUKUROVA ÜNİVERSİTESİ TIP FAKÜLTESİ

Cukurova Med J 2019;44(1):101-109
DOI: 10.17826/cumj.440498

ARAŞTIRMA / RESEARCH

Electronic waste awareness among students of engineering department

Mühendislik fakültesi öğrencilerinin elektronik atık farkındalıkları

Pınar Özdemir Deniz[1], Çiğdem Yılmaz Aydın[1], Emine Didem Evci Kiraz[1]

[1]Adnan Menderes University, Medical Faculty, Department of Public Health, Aydın, Turkey

Cukurova Medical Journal 2019;44(1):101-109

Abstract

Purpose: Increased number of electronic equipment used as a result of technological developments in recent decades and their relatively short economic life has resulted in the addition of electronic waste (e-waste) concept in the environmental health issues. This study intended to evaluate the level of awareness on e-waste and environmental issues among engineering students, whose main line of work is technology.

Materials and Methods: This is a cross sectional study conducted with first and final year students in the Departments of Food Engineering, Civil Engineering, Electrical-Electronic Engineering, Mechanical Engineering and Computer Engineering in Adnan Menderes University in the academic year of 2016-2017.

Results: No statistically significant difference was observed for students' awareness about environmental issues and e-waste regulations between departments and whether they are in the first or the last year. However, a correlation was noted between two awareness types.

Conclusion: Students in this study were found to have low level of knowledge about e-waste recycling and regulations. There fore awareness of consumers about e-waste should be improved. Manufacturers and municipalities should be more active and involved in recycling, and stricter regulations should be implemented to reduce and manage e-waste.

Keywords: electronic waste, recycling, waste management, engineering, students

Öz

Amaç: Günümüzde teknolojik gelişmelerle beraber kullanılan elektronik cihazların sayıca artması ve ömürlerinin hızlı dolması elektronik atık (e-atık) kavramının çevre sağlığı konularının içinde yer almasını sağlamıştır. Çevre sorunlarının oluşmasında ve çözüm üretimi konularında kişilerin çevre duyarlılığı ve çevre eğitimi arasında doğrudan bir ilişki olduğu görülmektedir. Araştırmada çalışma alanı teknoloji olan mühendislik fakültesi öğrencilerinde e-atık ve çevre sorunlarına yönelik farkındalık düzeylerinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Bu çalışma kesitsel bir çalışma olup; Adnan Menderes Üniversitesi Mühendislik Fakültesi 2016-2017 döneminde eğitim gören Gıda, İnşaat, Elektrik-Elektronik, Makine ve Bilgisayar Mühendisliği bölümleri 1.ve son sınıf öğrencileri ile yapılmıştır.

Bulgular: Öğrencilerin çevre sorunlarına yönelik farkındalık ile e-atık düzenlemeleri farkındalık durumları arasında bölümler arası ve sınıflar arası istatistiksel olarak anlamlı bir fark gözlenmemiştir. Ancak her iki farkındalık durumu arasında korelasyon olduğu görülmüştür.

Sonuç: Katılımcıların e-atık geri dönüşümü ve mevzuatları açısından bilgi düzeylerinin düşük olduğu tespit edilmiştir. Bu nedenle tüketicilerin konu ile ilgili farkındalıklarının arttırılması sağlanmalıdır. Üreticiler ve belediyeler, geri dönüşüm konusunda daha aktif çalışmalı,e-atığın azaltılması ve uygun şekilde yönetilmesi için daha sıkı düzenlemeler yapılmalıdır.

Anahtar kelimeler: elektronik atık,geri dönüşüm,atık idaresi,mühendislik,öğrenci

INTRODUCTION

With the rapid developments in technology, electrical and electronic equipment tend to have a shorter economic life and today people are faced with a new type of waste called electronic waste (e-waste)[1]. Urbanization and industrialization in many developing countries leads to an increasing number of electrical and electronic devices and thus higher e-waste amounts[2]. The definition of electrical and electronic equipment (EEE) as stated in the "Waste

Yazışma Adresi/Address for Correspondence: Dr. Pınar Özdemir Deniz, Adnan Menderes University Medical Faculty, Public Health Department, Aydın, E-mail: pinar.ozdemir@adu.edu.tr
Geliş tarihi/Received: 04.07.2018 Kabul tarihi/Accepted: 04.09.2018 Çevrimiçi yayın/Published online: 07.10.2018

Electrical and Electronic Equipment Directive" is equipment which is dependent on electric currents or electromagnetic fields in order to work properly and equipment for the generation, transfer and measurement of such currents and fields falling under the categories set out in Annex IA and designed for use with a voltage rating not exceeding 1000 Volt for alternating current and 1500 Volt for direct current[3]. When e-waste is not disposed as required, it becomes one of the most important and growing problems for the health of both people and the environment[4]. There were 44.7 million metric tons (Mt) of e-waste in 2016 in the world and only 20% of this waste was recycled using appropriate methods and procedures. E-waste laws and regulations bind 66% of the world's population and only 41 countries collect international statistics on e-waste[5]. In Turkey yearly average for e-waste is 539 thousand tons and only 20 thousand tons of e-waste is recycled using correct and healthy methods[5]. Disposal and recycling procedures without taking necessary safety measures can have negative and hazardous impact on the people processing first degree waste, on the soil and underground water in the processing area and on the air with halogenated chloride and bromides released with the incineration of waste. In developed countries, e-waste is recycled using automated systems with minimum human intervention and high level of precious metals are gained as a result of these processes[1]. Recycling processes contribute significant added value to a country's economy[6]. When we look at the studies on e-waste in the literature; e-waste plays an important role in the management of environmental health of countries due to recycling methods, and effects of heavy metals released into the environment. There is no activity to emphasize the importance of e-waste and to create awareness in people in Turkey. The objective of this study is to evaluate the awareness of engineering students about e-waste, who are believed to use electrical and electronic equipment more actively in their lines of work.

MATERIALS AND METHODS

This is a cross-sectional study and the study population consists of first year students and third year students (as engineering departments opened three years ago they are considered as final year students) in the Departments of Food Engineering, Civil Engineering, Electrical-Electronic Engineering, Mechanical Engineering and Computer Engineering in Aydın Adnan Menderes University in the academic year of 2016-2017. There were a total of 294 students 157 of whom were in the first year and 137 of whom were in the third year. No sample groups were selected; questionnaire forms distributed by the deans' office were filled out by respondents. 54% of the first and third year students responded to participate in the study (n=159). Ethical approval was obtained from the Dean of the department of Engineering in Adnan Menderes University and from the Ethical Committee for Non-ınterventional Studies in Adnan Menderes University in Aydın.

Questionnaire

Participants were asked to fill out the questionnaire consisting of 46 questions in three parts between the dates of November 1-5, 2016. Sociodemographic characteristics were asked in the first part; questions about awareness on environmental issues and e-waste were asked in the second part and consumer trends for electrical and electronic equipment waste were questioned in the third part. This study's questionnaire questions were based on Öztüre G's study, "Determination of Awareness Levels of Information Technologies Teachers about Electronic Waste - A Sampling from the City of Izmir"[7] (questions 23-43, question no46); Doğan İ's study, "Determination of Environmental Awareness Levels and Environmental Behaviour of Social Service Workers" [8] (questions 5-16) and Aydin B's study " Recovery of Electrical and Electronic Equipment Waste"[9] (questions no 17-22, 44 and 45)

When awareness on environmental issues was scored, each 'correct' answer in the statements/questions in the second part with 12 questions was given 2 points and each incorrect answer or no answer was given 1 point. Questions about consumer trends for electrical and electronic waste in the third part were given no scores and they were evaluated based on whether correct answers were given. When awareness on e-waste regulations was scored, each 'correct' answer in the 22 questions was given 2 points and each incorrect answer and no answer was given 1 point.

Statistical analysis

SPSS software program was used to analyse the data in this study. Number, percentage, median and 25-75 percentile values were used in descriptive tests. Kolmogorov-Smirnov test was used to determine

whether sample data was normally distributed and data was analysed with histograms. Kruskal-Wallis and Mann-Whitney U tests were used to evaluate continuous data and chi-square test was used to analyse categorical data. Spearman correlation analysis was used to evaluate the correlation between the scores for awareness on environmental issues and awareness on e-waste regulations. Type 1 error level is set at 5 % for statistical significance.

RESULTS

The total number of students in the study was 159; 74.8% (n=119) were male and 25.2% (n=40) were female. First year students were 52.2% (n=83) of all the students and 47.7% (n=76) of them were third year students in engineering departments. The students' age ranged between 18-23. Scores of the students in the part with which their awareness on environmental issues was evaluated and in the part with which their awareness on e-waste regulations was evaluated are shown in Table 1.

When we evaluate the answers to the questions about awareness about environmental issues, 92.5% of the students (n=147) believed that "the solution to environmental issues is possible through increased environmental awareness and environmental education" and "wrong mindset, insensitivity towards environmental issues and lack of education lead to serious environmental issues over time". Among all the students 72.3% of them (n=115) told that "environmental issues impose a change in the consumption habits of people".

When we evaluate the answers to the questions about awareness about e-waste regulations, awareness about the content of e-waste and responsibilities for recycling of e-waste was under 30%. The percentage of students who did not know that use of lead, mercury, 6+ chromium and cadmium in electronic equipment is prohibited was 67% (n=106) and the percentage of students who though that disposal of e-waste in landfills is a proper way of disposal was 60% (n=90). Among the respondents 40% of them (n=65) reported that they did not know that incineration of CDs, DVDs and Blu-ray discs causes release of toxic gases and broken, cracked CRT, LCD, plasma TV and monitors are harmful for people.

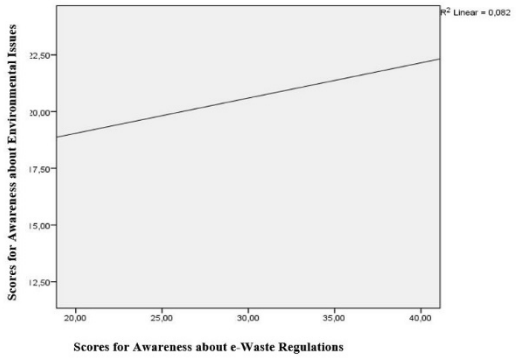
Table 1. Awareness scores for environmental issues and e-waste regulations based on department and year of education

	Awareness scores for environmental issues			Awareness scores for e-waste regulations		
	Median	25-75%	p	Median	25-75%	p
Gender						
Female (n=40)	21	20-22	0. 65**	30	28-32	0. 88**
Male (n=119)	21	19-22		30	28-32	
Departments						
Computer (n=29)	21	19-21	0. 65*	30	29-31	0. 84*
Food (n=10)	20	19-22		27. 5	26-33	
Civil (n=7)	21	20-22		30	29-32	
Electric-Electronic (n=39)	21	20-22		31	28-33	
Mechanical (n=74)	21	20-22		29	27-33	
Year						
1. Year (n=83)	21	19-22	0. 36**	30	28-32	0. 15**
3. Year (n=76)	21	20-22		29	26-32	

* Kruskal-Wallis test **Mann-Whitney test

Among all the students 65% of them (n=104) did not know that manufacturers and municipalities are responsible for collection of e-waste from houses, ensuring recycling of e-waste and accepting the old product when a new one is purchased. E-waste was classified as hazardous waste by 17.6% of the students (n=28). Correct answer about the presence of laws and regulations on these issues in Turkey was given by 17.0% of the students (n=27). 64.2% of the students (n=102) reported that municipalities are responsible for providing information about e-waste to consumers. Nevertheless 70.0% of the students (n=109) were aware that recycling contributes to the conservation of natural resources and needs to be done using proper methods.

A positive, low level statistically significant correlation was found between the awareness scores for environmental issues and for e-waste regulations of all respondents (r=0.237, p< 0,01). (Graph 1).



Graph 1. Chart for correlation between the scores for awareness on environmental issues and awareness on e-waste regulations

The percentages of correct answers of students about metals and other materials used in electrical and electronic products are shown in Table 2. The percentage of correct answers about the use of gold, arsenic, glass and platinum in these products was lower than 50%.

Among all the students 89.3% of them (n=142) considered batteries as e-waste in the question asking which should be considered as e-waste. The percentage of correct answers for the question about whether lighting products and coin or token operated vending machines should be classified as e-waste was statistically significantly high in first year students. (Table 3).

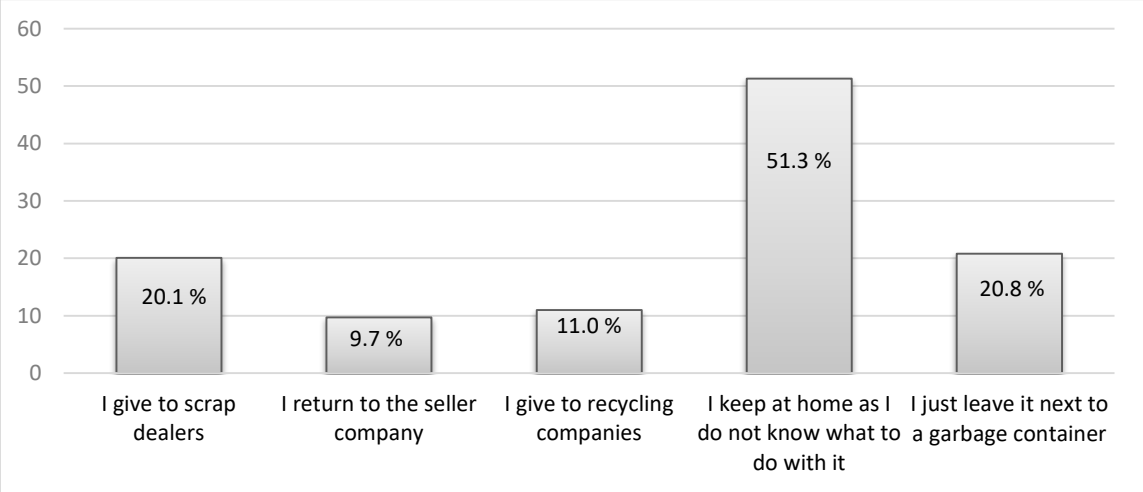
When the students were asked about how they handled unusable, old electrical and electronic products; 51.3% (n=79) answered that they kept them at home since they did not know what to do. When the students were asked about disposal methods for electrical and electronic waste in Turkey, 34.4% (n=56) believed that the waste was dumped in landfills and 31.2% (n=48) reported that they had no idea. (Graph 3).

Table 2. Metals and other materials used in electrical and electronic products, 2016, Aydın

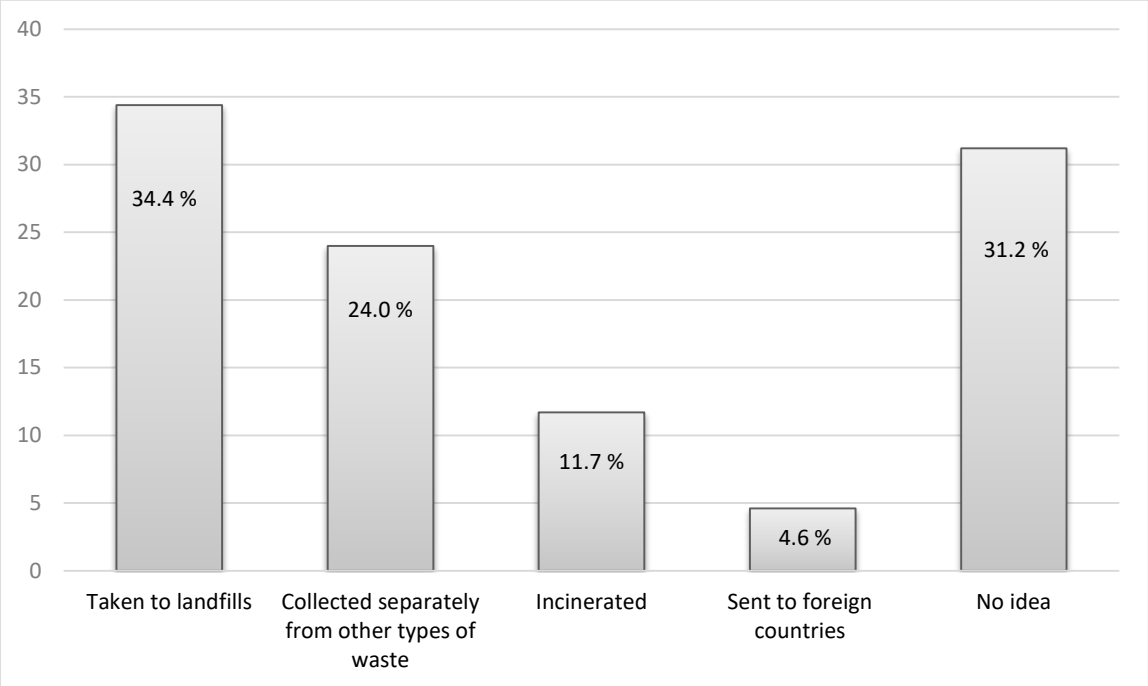
Metals and other materials used in electrical and electronic products	Correct answer		Incorrect answer	
	n	%	n	%
Plastic	93	58.5	66	41.5
Gold	49	30.8	110	69.2
Arsenic	25	15.7	134	84.3
Glass	42	26.4	117	73.6
Copper	126	79.2	33	20.8
Platinum	44	27.7	115	72.3

Table 3. Correct answers to the question about products that are classified as electrical and electronic product waste based on year in university

	Correct answer		Incorrect answer		X^2	p
Electrical and Electronic Waste	n	%	n	%		
Cell phones						
1st year	55	55.6	28	46.7	1.183	0.270
3rd year	44	44.4	32	53.3		
Batteries						
1st year	6	35.3	77	54.2	2.181	0.140
3rd year	11	64.7	65	45.8		
Coin or token operated vending machines						
1st year	45	61.6	38	44.2	4.823	0.028
3rd year	28	38.4	48	55.8		
Lighting products						
1st year	60	61.9	23	37.1	9.292	0.002
3rd year	37	38.1	39	62.9		
Computers						
1st year	48	55.8	35	47.9	0.980	0.322
3rd year	38	44.2	38	52.1		



Graph 2: Handling of unusable electrical and electronic products, n=159



Graph 3. Disposal methods for electrical and electronic waste,n=159.

Recycling containers for electrical and electronic products and components had seen by 27.3% of the students (n=42). When the question, "Would you dispose your electrical and electronic products and components if there were dedicated recycling containers for these?" was asked, 96.8% (n=149) answered that they would. 4 out of 5 people who reported that they would not use recycling

containers gave the following reasons: 'It is not something that becomes waste suddenly so I will not be carrying it around, if I have it with me, I may dispose it in containers', 'I think they can be stolen because they are valuable products', 'I do not trust people because they do not have an awareness', and 'I am too lazy to carry the waste to recycling container'.

DISCUSSION

There is no significant difference in the environmental awareness score and score for awareness about e-waste regulations between male and female students (table 2). In the study of Edumadze et al although the awareness of women about environmental impact of e-waste was significantly higher than men, there was no significant difference in awareness about e-waste regulations[10]. There are articles in the literature claiming that environmental awareness is higher among women[11]. For example Tikka et al. associates higher environmental awareness in women with women's need to help their offspring survive and leave a clean and habitable environment to their children[12]. However aside from such traditional approach, no significant difference should be expected between genders since environmental issues have reached to such a level that it affects everyone regardless of their age, gender or sociodemographic background [13,14].

The highest possible score for awareness about environmental issues was 24 and the median score of the respondents were 21 leading us to the conclusion that the awareness levels of the students in this study are high. The highest score for awareness about e-waste regulations is 44; however the highest median score of the respondents in all questions was 31. Awareness on environmental issues is lower than awareness on e-waste. The awareness percentage of the respondents about hazardous waste classification of e-waste and regulation on the collection of e-waste in Turkey was 17%. Chen et al. reported 30% of the students studying information technologies in their study had e-waste awareness[15]. Kwatra et al. found 4% awareness on e-waste concept in their society based study and the people who had awareness were those who worked in the environmental industry[16]. Bala et al. evaluated the difference in e-waste hazards, regulations and management between the people who worked in the environmental industry and who did not and found that both groups did not have sufficient information[17]. This shows that the concept of e-waste has not been understood well by the general public. Even those working in the environmental industry do not have sufficient information about e-waste and associated problems.

Various metals (iron, aluminium, copper, gold, silver, platinum, arsenic etc) and hazardous substances and compounds (lead, mercury, brominated flame retardants etc.) are used in electrical and electronic equipment[9,18.] The percentages of correct answers of respondents about metal and other materials used in electrical and electronic products were found to be low; the percentage of correct answers about the use of gold, arsenic, glass and platinum in these products was lower than 50.0%. The correct answer percentages were 22.0% for gold, 24.0% for arsenic, 37.0% for glass, 33.0% for platinum, 82.0% for copper, 64.0% for plastic. Results in the study of Aydın B. and these findings were similar to those of our study [9]. As reported in the study of Nath et al. 5.7% of respondents knew e-waste can generate precious metals such as Gold, Nickle and Copper etc. About 30.0% of the respondents were aware of hazardous effects of e–waste. About half of the respondents (45.7%) were unaware of the hazardous effects[19]. In the study of Candidate et al., 50.1% of the respondents reported that there were precious metals in e-waste[20]. There fore recycling of electrical and electronic equipment is important both for the disposal of waste and recovery of precious metals contained in such waste. The energy consumed during recycling of precious metals is lower than the energy used in extraction of such metals. As reported in the study of Hagelüken C, when metal components of computer printed circuit boards were compared with metal components of copper and gold ore; it was found that printed circuit boards had 25-250 times as many gold compared to gold ore and 20-40 times as many copper compared to copper ore[21]. Therefore, e-waste that will be recycled with the increasing individual awareness in e-waste recycling will allow energy saving and conservation and effective use of national resources[20]. Students were asked about products that are classified as electrical and electronic product waste and correct answers were evaluated based on their year in university. Although batteries are not classified as electrical and electronic products, respondents reported them as electrical and electronic products. Similar results were obtained in

the study of Aydın B. The reason why the students in this study considered batteries as e-waste could be that they saw recycling containers for batteries in many places leading to their conclusion that batteries are electronic waste[9]. In our study, the percentage of correct answers for coin or token operated vending machines was higher in the first-year students and the difference was statistically significant (p=0.028, p=0.002, Table 3).

Among all of the students 51.3% of them did not know how to handle old and unusable electrical and electronic products and that's why they kept them at home and 20.1% of the students told that they gave them to scrap dealers. 9.7% of the students reported that they returned it to the seller company and 11.0% reported that they gave to recycling companies. In the study of Nath et al 77% of the respondents didn't know about the ways of disposing the e-waste[19], In the study of Okoye et al. 54.0% of the respondents reported that they kept unusable equipment at home; 36.0% reported that they disposed in trash and 9.0% reported that they sold to scrap dealers to earn money[22]. In the study of Kwatra et al. 74.0% of the respondents reported that they sold such products, 16.0% reported that they stored them at warehouses and 10% reported that they disposed them in trash[16]. In the study of Afroz et al. 27% of the respondents kept e-waste at home, 30.0% disposed in trash and only 2.0% sent e-waste for recycling[23]. When these people were asked whether they would give e-waste for recycling if there was any recycling means provided by the government, the majority of them told that they would. In the dissertation paper of Aydın B. about recovery of electrical and electronic equipment waste it was reported that 5.0% of the respondents returned waste equipment to the seller company and 8.0% gave it to recycling companies[9]. Although disposal methods of e-waste vary depending on the region and culture, recycling percentage is low and the most popular method is to store e-waste at home.

When we asked a question about the disposal methods for electrical and electronic waste, 34.4% of the students thought that electrical and electronic waste is disposed in landfills and 24.0% of the students thought that e-waste is collected separately. Similary the majority of the participants in the dissertation paper of Aydın B. thought that e-waste was disposed in landfills[9]. When we look at the education level of the people included in the dissertation paper, 77.0% had associate, bachelors and master's degree and this similarity in education levels might have been effective in getting similar results.

Among all of the participants 27.3% of them reported that they saw recycling containers for electrical and electronic products in their neighbourhood and 96.7% reported that they would use recycling containers if there were any. In Aydın B's study; 25.0% had waste containers nearby and 96% reported that they would use waste containers if there were any[9]. Considering the high percentage of awareness among the students about the contribution of recycling in the conservation of natural resources, the reason why they kept waste products at home could be their lack of knowledge about this subject and lack of e-waste collection services in the area they lived. There fore recycling containers should be made available to a wider public. There are several collection services provided by municipalities, most important of which is call for e-waste ("alo e-atık") service in Turkey[24]. How ever it should also be noted that many municipalities do not have e-waste collection service.

First of all, despite of rare studies in the world, there are no studies in students to raise awareness and to emphasize the importance of e-waste issues in Turkey and this study is one of the rare studies to raise awareness of e-waste in students. Secondly it is aimed to increase the collection of e-waste in e-waste collection containers with this awareness. How ever some limitations have to be mentioned. No sample groups were selected; questionnaire forms distributed by the deans' office. Despite the fact that all of the questionnaires were distributed, some students didn't want to fill out the questionnaire, some of the questionnaires were not fully answered and some of them didn't have signed affirmation form. They were excluded from the study. For all this reason, participation in the study was limited (54%). How ever first and third year students who participate the study have similar percentage.

Electrical and electronic waste classified as hazardous waste is a major environmental issue today. Consumers know that recycling contributes to the conservation of natural resources and recycling should be done using proper methods however the level of knowledge about e-waste concept and regulations is quite low. On the other

hand, they do not know how to handle unusable and old electrical and electronic product waste. A majority of the students reported that they did not see any recycling containers for electrical and electronic waste and therefore they kept these products at home or gave them away to scrap dealers. As a conclusion, e-waste that will be recycled with the increasing individual awareness in e-waste recycling will allow energy saving and conservation and effective use of natural resources. Manufacturers and municipalities should be more active and involved in recycling, and stricter regulations should be implemented to reduce and manage e-waste.

Yazar Katkıları: Çalışma konsepti/Tasarımı: PÖD, ÇYA, EDEK; Veri toplama: ÇYA, PÖD; Veri analizi ve yorumlama: PÖD; Yazı taslağı: PÖD, ÇYA; İçeriğin eleştirel incelenmesi: PÖD, ÇYA, EDEK; Son onay ve sorumluluk: PÖD, ÇYA, EDEK; Teknik ve malzeme desteği: -; Süpervizyon: EDEK; Fon sağlama (mevcut ise): yok.
Bilgilendirilmiş Onam: Katılımcılardan yazılı onam alınmıştır.
Hakem Değerlendirmesi: Dış bağımsız.
Çıkar Çatışması: Yazarlar çıkar çatışması beyan etmemişlerdir.

Author Contributions: Concept/Design: PÖD, ÇYA, EDEK; Data acquisition: ÇYA, PÖD; Data analysis and interpretation: PÖD; Drafting manuscript: PÖD, ÇYA; Critical revision of manuscript: PÖD, ÇYA, EDEK; Final approval and accountability: PÖD, ÇYA, EDEK; Technical or material support: -; Supervision: EDEK; Securing funding (if available): n/a.
Informed Consent: Written consent was obtained from the participants.
Peer-review: Externally peer-reviewed.
Conflict of Interest: Authors declared no conflict of interest.
Financial Disclosure: Authors declared no financial support

REFERENCES

1. Akın, B., Kuru, A. Elektrikli ve elektronik atıkların (e-atık) zararları, yönetimi ve türkiyedeki uygulamalarının değerlendirilmesi. İstanbul Aydın Üniversitesi Dergisi (İAÜD) 2014;3:1-12.
2. Baldé CP, Forti V, Gray V, Kuehr R, Stegmann P. The Global E-waste Monitor – 2017. Geneva, United Nations University (UNU), 2017.
3. Atık Elektrikli ve Elektronik Eşyaların Kontrolü Yönetmeliği, T.C. Resmi Gazete, 28300, 22 Mayıs 2012.
4. Yaren MF., Taşkın MF, Uygun Ö, Alp A. Atık ekonomisi ve elektronik atiklarin değerlendirilmesinin önemi. Akademik Platform, 2014: 631-642.
5. İkinci ÖA. E-atık hem hazine hem tehlike. TÜBİTAK Bilim Ve Teknik Dergisi Haziran 2014:36-39.
6. Tunçer E. The selection of the best management technology to recycle precious metals from electric and electronic equipment (Yüksek lisans tezi). İstanbul, İstanbul Teknik Üniversitesi, 2014.
7. Öztüre G. Bilişim teknolojileri öğretmenlerinin elektronik atıklar konusundaki farkındalık düzeylerinin belirlenmesi İzmir ili örneği (Yüksek lisans tezi). İzmir, Ege Üniversitesi, 2015.
8. Doğan İ. Sosyal hizmet uzmanlarının çevresel farkındalık seviyeleri ile çevreye yönelik tutumlarının belirlenmesi, (Yüksek lisans tezi), Ankara, Ankara Üniversitesi, 2015.
9. Aydın B. Elektrikli ve elektronik ekipman atıklarının geri kazanımı (Yüksek lisans tezi). Isparta, Süleyman Demirel Üniversitesi, 2011.
10. Edumadze JKE. Electronic waste is a mess: Awareness and proenvironmental behavior among university students in Ghana. Applied Environmental Education and Communication. 2013;12:224-34.
11. Greenbaum A. Taking stock of two decades of research on the social bases of environmental concern. In Environmental Sociology: Theory and practice (Eds: MD Mehta, E Ouellet):125-52. Ontario, Captus Press, 1995.
12. Tikka PM, Kuitunen MT, Tynys SM. Effects of educational background on students' attitudes, activitylevels, and knowledge concerning the environment. J Environ Educ. 2010;31(3):12-19,
13. Aydin CY, Deniz PO, Kiraz EDE. Water use attitudes and behaviours of high-education students who do receive and do not receive environmental health trainıng. Journal of Envıronmental Protectıon and Ecology. 2017;18:690-9.
14. Alaş A, Tunç, T Kışoğlu M, Gürbüz H. An investigation on prospective teachers' conscious water consumption: Atatürk University sample. Journal of Education Faculty. 2009:11(2):37-49.
15. Chen LF, Yee HW. E-waste management: are we ready for it?: a study on the awareness of COIT students toward e-waste management. ICIMU 2011 : Proceedings of the 5th international Conference on Information Technology and Multimedia. 2011: 1-5. doi: 10.1109/ICIMU.2011.6122729
16. Kwatra S, Pandey S, Sharma S. Understanding public knowledge and awareness on e-waste in an urban setting in India: A case study for Delhi. Management of Environmental Quality: An International Journal. 2014;25:752-65.
17. Sindhu B, Goel S. A study of e-waste management in relation to awareness of college students. International Journal of Educational and Psychological Research. 2012;1:31-5.
18. Çevikel B, Elektronik atıklardan değerli metal geri kazanımı (Yüksek lisans tezi). Sakarya, Sakarya Üniversitesi, 2009.
19. Nath B, Kumari R, Gupta V, Vaswani ND, Lekhwani S. A community based study on e-waste disposal in Srinagar , Uttarakhand : assessment of awareness and practices. International Journal of Community Medicine and Public Health. 2018;5:3429-34.
20. Candidate AOT, Hobikoğlu EH, Candidate TH, Özdemir Z. Consumer behavior in the recycling of

electrical and electronic waste: the case of Istanbul. International Conference on Eurasian Economies. 2013,1018-26.
21. Yazıcı, EY, Deveci H. E-Atıklardan metallerin geri kazanımı. Bilimsel Madencilik Dergisi. 2009;48:3-18.
22. Okoye A, Odoh C. Assessment of the level of awareness of e-waste management and concern for the environment amongs the populace in Onitsha, Southeastern Nigeria. Journal of Environmental Protection. 2014;5(2):120-34.
23. Afroz R, Masud MM, Akhtar R, Duasa JB. Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur, Malaysia–a case study on household WEEE management. Journal of Cleaner Production. 2013;52:185-193.
24. Malkara Belediyesi. Malkara Şehir Sağlığı Profili 2017. Malkara, Malkara Belediyesi 2017.