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Ocena poziomu wiedzy i świadomości studentów na temat gospodarki „elektrośmieciami”

Streszczenie

Wprowadzenie. „Elektrośmieci” są odpadami bardzo groźnymi dla środowiska naturalnego i zdrowia ludzi. Rosnąca ilość zużytego sprzętu elektryczno-elektronicznego (ZSEE) staje się problemem globalnym występującym również w Polsce.

Cel. Celem badania było poznanie stanu wiedzy i świadomości studentów Wyższej Szkoły Biznesu i Nauk o Zdrowiu (WSBiNoZ) w Łodzi na temat gospodarki „elektrośmieciami” oraz zagrożeń dla środowiska naturalnego i zdrowia człowieka wynikających z niewłaściwego ich składowania.

Materiał i metody. Materiałem do badania były dane pochodzące od 250 studentów WSBiNoZ w Łodzi. Metodą badawczą, którą zastosowano w badaniu, był sondaż diagnostyczny z wykorzystaniem walidowanej, anonimowej ankiety.

Wnioski. Wiedza i świadomość studentów pochodzących z miasta jak i ze wsi na temat gospodarki „elektrośmieciami” jest na podobnie niskim poziomie mimo, że Ustawa o zużytym sprzęcie elektrycznym i elektronicznym (ZSEE) obowiązuje w Polsce już niemal pięć lat. Ankietowani podobnie jak polskie społeczeństwo rzadko segregują i oddają ZSEE do specjalistycznych punktów odbioru; wciąż często spotykaną praktyką jest wyrzucanie „elektrośmieci” wprost do śmietnika, zwłaszcza wśród mieszkańców miasta. Studenci nie znają programów edukacyjnych, w których mogliby uczestniczyć oraz przesłanek prawnych w kontekście właściwego gospodarowania „elektrośmieciami”. Niski poziom wiedzy i świadomości badanych na temat postępowania z „elektrośmieciami” może zmienić tylko solidna edukacja prowadzona zarówno wśród uczniów, studentów, jak i dorosłego społeczeństwa.

Słowa kluczowe: „elektrośmieci”, zdrowie człowieka, środowisko, studenci, świadomość, edukacja.

Assessment of knowledge and awareness of the waste electrical and electronic equipment among the higher school students

Abstract

Introduction. The Waste Electric and Electronic Equipment (WEEE), e-waste – constitutes refuse that remarkably menaces the environment and human health. The increasing amount of e-waste is becoming a global threat, including the territory and the population of Poland.

Aim. The aim of the study, conducted among students of the Higher School of Business Administration and Health Sciences (HSBAHS) in Lodz, was to evaluate the respondents' knowledge and awareness of the e-waste management, and threats for the environment and human health that issued from unreflective e-waste disposal.

Material and methods. The material encompassed empirical data gathered form 250 students of the HSBAHS in Lodz. The research method was based on an anonymous and previously validated questionnaire.

Conclusions. The surveyed individuals' knowledge and awareness of the subject-matter – considering the urban versus the rural area – is low, albeit the Act on the Waste Electric and Electronic Equipment (WEEE) Management has been in force for about five years. Regrettably, Polish society, and the surveyed students alike – seldom segregate and deliver the waste electric and electronic equipment to the specialistic salvage points; on the opposite, one still meets with such a scheming when citizens throw their e-waste directly on the scrap-heap (in particular it bears on townspeople). The respondents know neither educational programmes they could participate in, nor legal premises in connection to the rational e-waste disposal. The observed low level of knowledge and awareness of the WEEE management among the students is liable to be altered by sound education, accomplished both among pupils, students, and adult society.

Key words: "e-waste", human health, environment, waste disposal, students, awareness, education.

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INTRODUCTION

„E-Waste" is a common name denoting waste electrical and electronic equipment (WEEE), which includes all old and used electrical and electronic appliances, i.e., running on current, storage batteries, or electric piles. Increasing amount of waste electrical/electronic equipment constitutes a global-range problem, observed in Poland, as well. In this day and age, in each homestead there are several electrical and/or electronic devices that, sooner or later, will get damaged or will be trucked for unused ones. Undoubtedly, the major part of those old and superfluous devices will be thrown on a scrap-heap, along with other communal garbage, or will be set aside in cellars with a persuasion: "they will come in handy".

In Poland, since the 21st of October, 2005 – the Act on the WEEE Management has been laying down laws and duties of all Polish citizens in terms of proper e-waste disposal [1]. However, the Polish people's ecological awareness – and acquaintance with the above- mentioned Act – remains inconsiderable. The "e-waste" becomes a more and more weighty problem, threatening significantly human health and life, and also the environment. Polish people are not aware of impendences that ensue from inappropriate WEEE disposal, and do not realize that, in this case, next generations will bear the consequences of "our" blunders. The „e-waste", which citizens place in refuse dumps or in a wood, pollutes the environment and, as a result of this, causes various diseases in the population, with regard to a range of toxic compounds being found it the used electrical and electronic equipment. The WEEE, discarded in a place that is not appropriate for that purpose, undergoes dissolution, and its ingredients – chemical compounds and elements – penetrate into the environment and thereby become hazardous for people, animals, and plants.

Mercury is present in some fluorescent lamps. This is a very noxious metal. After having pierced the human body, it brings about renal damage, vision and hearing defects, jumbled speech, incoordination of movements, deformation of bones, and is likely to promote neoplastic transformation.

Lead is useful for electronics specialists as an alloying element and a constituent of kinescope glass. It has toxic and carcinogenic properties. When imbibed by the human body, at first it is conveyed to the liver, the lungs, the heart and the kidneys, where after it accumulates in the skin and in the muscles. Ultimately, the lead gets to the bones and destroys the bone marrow.

Chromium is applicable to cladding metal element in order to shield them against corrosion. It can be found in the luminophor of kinescope lamps. The chromism manifests itself by circulatory disturbances and dyspnoea, by diseases of the skin, and allergy.

Cadmium is an ingredient of electric piles. It disturbs functions of the kidneys and the reproductive system, causes arterial hypertension, evokes neoplastic transformations, disturbs the metabolism of calcium, what leads to the skeleton deformation.

Nickel, after having penetrated into the human body, injures severely the mucous membranes, reduces the level of magnesium and zinc in the liver, leaves lesions in the bone marrow, and contributes to the neoplastic transformations.

Bromine and its compounds are used in the production of personal computers. After having infiltrated the environment, the compounds cause diseases of the reproductive system and neurological ones (among people and animals).

PCBs (polychlorinated biphenyls) perform refrigerating, lubricating and isolating properties in a variety of electrical/electronic appliances. After having penetrated to the organism, they are retained in the adipose tissue, and cause, among the others, hepatocellular damage, reproductive anomalies, immune deficits, along with neurological and hormone maladies.

R-12, or Freon is a synthetic gas that is found in air-conditioning units and in refrigerators; it performs cooling duties. Freon is harmful for the ozone layer particularly. Since 1998, no one has been allowed to adhibit this gas in the electrical equipment, yet one can find it in some refrigerating devices.

Asbestos is used in electrical and electronic equipment principally due to its isolating properties. However, the asbestos tends to cause a number of grave diseases, e.g. asbestosis, pulmonary carcinoma and pleural mesothelioma. These illnesses are characterized by a long incubation period and, hence, are likely to reveal themselves 30 years after the absorption of asbestos fibres [2-8].

In order to protect the environment and the human health, one ought to manage the "e waste" in a proper manner. It is very important to edify the citizens „from the cradle"; to build and reinforce their – the children's, young people's (including students'), and adults' – awareness of a large number of threats for the ecosystems on the Earth that do spring from the inadequate WEEE management [9-13].

AIM

The aim of the study, conducted among undergraduates of the Higher School of Business Administration and Health Sciences (HSBAHS) in Lodz, was to evaluate the respondents' knowledge and awareness of the e-waste management, and threats for the environment and human health – that issue from unreflective e-waste disposal.

MATERIAL AND METHODS

The research material encompassed data gathered from 250 HSBAHS undergraduates, i.e., individuals who studied: Dietetics, Public Health, and Cosmetology.

The research method was based upon an anonymous questionnaire (which had been previously validated during the pilot survey in a random sample of 30 individuals). The questionnaire contained 35 items, including four questions that referred to personal details, and 31 ones that aimed at testing the respondents' knowledge and awareness of the WEEE management (14 single-choice and 17 multiple-choice questions).

The surveyed students completed the questionnaire themselves, after having read a short instruction which was part and parcel of the questionnaire. Duration of the inquiry

amounted to 30 minutes. The questions aroused no reservation among the respondents.

Answers to the questionnaire were encoded and entered into an electronic data base in Microsoft® Excel® 2007 datasheet. Afterwards, in order to perform a statistical analysis, the data entries were transposed to a spreadsheet under Stata®/SE edition 11.1 for Windows®. Missing data were case-wise deleted.

In order to verify statistical hypotheses, the Chi-squared test of independence was carried out (for categorical data in case of single-choice and multiple-choice questions). There was assumed a level of significance at $p<0.05$.

RESULTS

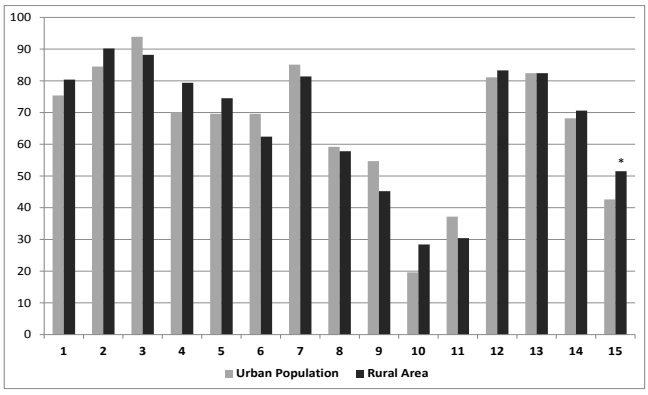
The present study was conducted in 2010 among students of the Higher School of Business Administration and Health Sciences in Lodz. The project embraced 250 individuals, including 7 males (2.8%) and 243 females (97.2%). The respondents' mean age amounted to 22.7 (±SD=4.06) years. The surveyed undergraduates studied: Dietetics – 33 persons (13.2%), Public Health – 18 persons (7.2%), Cosmetology – 199 persons (79.6%). From an urban population there stemmed 148 persons (59.2%), and in a rural area – 102 respondents (40.8%) (Table 1).

Taking into consideration a small number of the students at Dietetics and Public Health, and considering a large discrepancy by gender in the study sample, statistical analyses of the study outcomes were carried out, making allowance for the participants' domicile (the urban population versus the rural area).

The results of the questionnaire are presented in Figure 1 and Figure 2, comparing frequencies (in per cent) of the respondents' correct answers to single-choice questions and percentage of most frequent answers to multiple-choice questions.

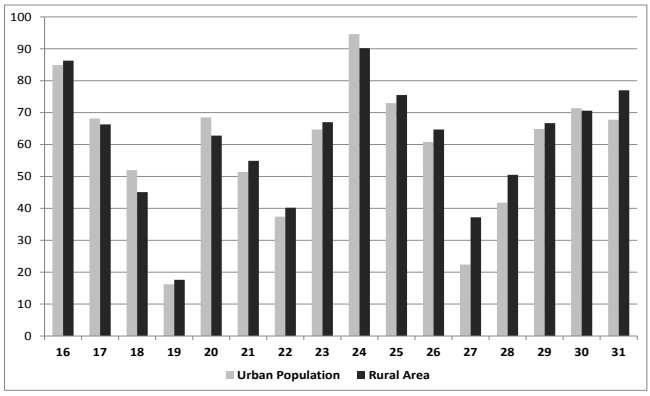
In the block of questions (from 1 to 15), assessing the respondents' knowledge of the „e-waste" management, its contents along with influence on the environment and human health, the WEEE disposal – the level of knowledge was satisfactory. In case of five out of 15 questions within this section, one observed from 81.1% to 93.9% of correct or most frequent answers (to questions 2,3,7,12,13). In question 2: „What signs and additional pieces of information do you find in packages of the electrical/electronic equipment, e.g. electric piles?", 84.5% out of the surveyed students stemming from the urban population and 90.2% out of the participants living in the rural area indicated „crossed-out basket". The „e-waste" negative impact upon the environment they emphasized explicitly in 93.9% and 88.2%, respectively (question 3). According to 85.1% out of the respondents from the urban population and 81.4% out of the individuals living in the country, „the electrolyte from electric piles/storage batteries that people throw on «wild dumps», and that infiltrates into the soil through atmospheric precipitation" causes „accumulation of inimical chemical compounds in grain-growing and garden-stuff" (question 7). The major part of the respondents – i.e. 81.1% and 83.3%, respectively – was aware that when purchasing brand-new electrical/electronic equipment, they should have been provided with information of the WEEE management as regards its wearing away (question 12). Factors that were conductive to an increasing amount of the „e-waste" were perceived in today's development of technologies by 82.4% out of the surveyed undergraduates, irrespective of their domicile (question 13).

In three out of 15 questions in this block, the respondents encountered difficulties in terms of matching a correct answer (questions 10,11,15). Hardly 19.6% out of the indi-



* - means a difference being statistically significant

FIGURE 1. Percentage of correct answers to single-choice questions, or most frequent answers to multiple-choice questions – delimiting knowledge and an awareness level in surveyed students by domicile.



* – means a difference being statistically significant

FIGURE 2. Percentage of correct answers to single-choice questions, or most frequent answers to multiple-choice questions – delimiting knowledge and an awareness level in surveyed students by domicile.

TABLE 1. Characteristics of surveyed students, divided by domicile, specialization and gender.

Domicile	Specialization												Count	
	Dietetics				Public health				Cosmetology					
	[n]		[%]		[n]		[%]		[n]		[%]		[N]	[%]
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀		
urban population	1	21	0.4	8.4	2	6	0.8	2.4	0	118	0.0	47.2	148	59.2
rural area	2	9	0.8	3.6	2	8	0.8	3.2	0	81	0.0	32.4	102	40.8
count	3	30	1.2	12.0	4	14	1.6	5.6	0	199	0.0	79.6	250	100.0
together	33		13.2		18		7.2		199		79.6			

viduals stemming from the urban population and 28.4% out of the participants living in the rural area knew organizations that were engaged in the WEEE salvage (question 10). Only 37.2% and 30.4%, respectively, were aware that manufacturers of the electrical and electronic equipment took an additional charge for the "e-waste" recycling (question 11). The surveyed students were at a loss while assessing an amount of „e-waste" that felt on an average Polish citizen, only 42.6% out of surveyed townspeople circled the faultless answer, and 51.5% out of the students living in the country underestimated the above- mentioned amount (question 15). A statistically significant difference by domicile was found only in answers to question 15: „Are you conscious how much WEEE does an average Pole produce yearly?" In reply, 42.6% out of the surveyed townspeople quoted that the average Polish citizen produced yearly up to 50 kg of "e-waste", whilst 51.5% out of the respondents living in the rural area maintained that the Poles did less than 20 kg *per capita*. (Figure 1).

In the second block of questions (from 16 to 31), investigating the HSBAHS students' knowledge of the „e-waste" disposal, segregation and recycling, along with legal regulations in this domain, one ascertained that the respondents presented a low level of knowledge. Most satisfactory was the frequency of correct answers to questions 16,24,31. From amongst the surveyed students stemming from the urban population versus residing in the rural area, 67.8% and 77.0%, respectively, declared that their participation in the present study did dispose them „to consider the preservation of nature from the «e-waste» deluge" (question 31).

In 6 out of 16 questions in this section (questions 18,19,21,22,27,28) the surveyed undergraduates produced evidence of a low level of cognizance. In question 18 „Is there in your neighbourhood a specialistic salvage point for the «e-waste»?", 52.0% out of the respondents stemming from the urban population and 45.1% out of the participants living in the country knew about such a specialistic salvage point. In question 19, hardly 16.2% and 17.6%, respectively, were acquainted with educational programmes devoted to the WEEE management issues. Only 51.4% out of the surveyed students from the urban population and 54.9% out of the individuals from the rural area were aware that in conformity with the Polish law they could deliver their WEEE gratuitously to a shop or to a parish salvage point (question 21). Also about 37.4% and 40.2%, respectively, knew that „throwing used electrical/electronic supplies along with the other communal scraps is finable" (question 22). To question 27: „In your opinion, do Polish people deliver a large amount of «e-waste» to the salvage points" the affirmative answer was matched by 22.4% out of the surveyed townspeople and 37.2% out of the participants living in the country, whereas the respondents themselves did declare that they delivered their used electrical/electronic appliances to the local salvage points in 41.8% versus 50.5%; unfortunately, 39.0% and 30.3%, respectively, threw their "e-waste" on the scrap-heap (question 28).

A statistically significant difference by domicile was found only in question 27. The respondents residing in the rural area tangibly more frequently, i.e. in 37.2%, indicated delivering a large amount of «e-waste» to the salvage points by the Polish citizens, comparing this with 22.4% out of the students stemming from the urban population. (Figure 2).

DISCUSSION

In Poland in 2006, „ElektroEko", was brought into being the first organization of Waste Electrical/Electronic Equipment salvage, uniting manufacturers and importers of household supplies, television/radio receivers, IT devices, and lighting materials. „ElektroEko" gets up a competent and cost-effective system of „e-waste" assembling, receiving it from the salvage points, and subjecting to transformation, salvage, recycling and neutralization processes. The „ElektroEko" conducts also a variety of educational activities, conceived on a wide scale, that aim at the whole society as regards purposefulness of proper (selective) "e-waste" disposal. All the activities do purpose to protect the environment against a deluge of the WEEE that, discarded and not subjected to the recycling processes, becomes hazardous for humans and animals. According to the report by the Inspector in Chief of Preservation of Nature in Poland, in the year 2007 there were assembled about 27.2 thousand tons of WEEE, while the very „ElektroEko" itself about 21.2 thousand tons (77.9%, respectively).

The SMG/KRC Research Institute, executing an order by the „ElektroEko", in 2006 and 2007 conducted a survey on Polish people's knowledge of the WEEE management (in representative samples numbering 1000 of respondents). The outcomes revealed a very low level of awareness in Polish society regarding the WEEE management. Only 19.0% out of respondents did deliver their WEEE to a shop or to a salvage point, 36.0% threw it on a scrap-heap, and 35.0% retained their "e-waste" at home, or handed it down to their relatives. Most of the people, i.e. 72.0%, did not know, as in the past, that in conformity with the Polish law they were capable to deliver the WEEE to the shop or to the specialistic salvage point. Inconsiderably more satisfactory were the answers of surveyed Varsovians among whom the „ElektroEko" organization since 2007 has been conducting a programme Elektrośmieci? Przynieś z mieszkania do punktu zbierania ("E-Waste"? Make its end-point at our salvage point). Owing to those educational activities, 34.0% out of the surveyed Varsovians were acquainted with a term „e-waste", 31.0% knew about a possibility of cost-free delivering it to the salvage points or shops (50.0%).

Likewise Nokia conducted in 2008 a survey among Polish people, focusing upon old and used cellular phones (being a part of the WEEE) disposal. Only 3.0% out of respondents delivered their old mobile phones to salvage (recycling) points, albeit the majority of them did possess superfluous ones at home. Very few old mobile phones, i.e. in 4.0%, were thrown on refuse dumps, and 44.0% remained useless in their homesteads. About 25.0% out of the respondents handed down their old cellular phones to kith and kin, and 16.0% sold the used devices (especially in outlets). Nearly 75.0% did not mention recycling of their mobile phones, and almost 50.0% did not realize that that was feasible [14-15].

The results of the study conducted among students of the Higher School of Business Administration and Health Sciences in Lodz demonstrate that only 19.6% out of respon-

dents stemming from an urban population and 28.4% out of individuals living in a rural area were cognizant of organizations which were engaged in the WEEE salvage. Only 37.2% out of the surveyed townspeople and 30.4% out of the respondents living in the country knew that manufacturers of electrical and electronic equipment had made an additional charge due to its recycling. The participants from the urban population in 52.0% vs. in 45.1% out of the respondents living in the rural area were aware of existence of any WEEE salvage points, and 51.4% vs. 54.9%, respectively, knew that in accordance to Polish law they were capable to deliver their "e-waste" gratuitously to a shop or to a specialistic salvage point. Merely 37.4% out of the surveyed townspeople and 40.2% out of the students living in the country realized that disposing the WEEE along with the other communal refuse was finable. Very few participants, i.e. 22.4% vs. 37.2%, respectively, considered that Polish society delivered their "e-waste" to the salvage points, whereas the respondents themselves declared that they did return their WEEE to the local salvage points – 41.8% out of the surveyed townspeople and 50.5% out of the students living in the rural area; 39.0% vs. 30.3%, respectively, threw their used electrical and electronic equipment directly on the scrap-heap. The low level of the surveyed students' awareness regarding the WEEE management is a result of the paucity of knowledge of educational programmes related to this topic. Only 16.2% out of the respondents stemming from the urban population and 17.6% out of the participants living in the rural area were acquainted with such educational activities.

CONCLUSIONS

1. In case of students living both in an urban, and in a rural area, their knowledge and awareness of the „e-waste" management remain at an equally low level, although the Act on the WEEE Management has been in force for over five years.

2. The respondents, similarly t the Polish society, rarely segregate and return the WEEE to the specialistic salvage points; one still meets with such a scheming when citizens throw their "e-waste" on the scrap-heap (it bears, in particular, on townspeople).

3. The surveyed students know neither educational programmes they could participate in nor legal premises in connexion with the rational "e-waste" disposal.

4. The observed low level of cognizance and awareness of the WEEE management is liable to be altered by the means of sound ecological education – addressed both at schoolchildren, students, and adult society.

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