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Separate waste collection system introduction in Russian educational institutions (by the example of Letovo School)

M. V. Pleshko[1], E. M. Pleshko[2]
[1]NUST MISIS (Moscow, Russian Federation)
[2]Letovo School (Moscow, Russian Federation)

Introduction. Environmental pollution by solid household waste is a serious ecological problem, as it causes degradation of natural ecosystems and alienation of territories. There is about 40,000 km^2 occupied by landfills in Russia, and this area is constantly increasing, as every year Russia throws out more than 300 kg of waste.

Problem Statement. To solve this problem, it is necessary to develop a system of separate waste collection, as well as the formation of an ecological outlook among young people and students and a thrifty attitude to the natural environment. A specific example of this approach is described in this article.

Theoretical Part. Main stages of organization of separate waste collection in school Letovo School, implemented by students, are considered as an example.

Conclusions. 5.6 tons of waste was collected and recycled during the year of operation. The project has received approval in the school environment and can be implemented with minimal costs in almost all Russian educational organizations.

***Keywords*:** waste, separate waste collection, recycling, rational consumption, resources, sustainable development, environment.

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Introduction. The problem of efficient disposal of municipal solid waste (hereinafter referred to as waste) for Russia as a whole and the city of Moscow, as its capital and the largest agglomeration in particular, remains very serious today. In Russia, about 40,000 km^2 of territories are occupied by landfills, and this area is constantly increasing, as every Russian throws out more than 300 kg of waste every year [1]. In a number of cities in the Moscow region (Klin, Kolomna, Troitsk, Balashikha, etc.), an active protest movement of local residents against the landfills and dumps has been launched. The environmental situation in the surrounding areas is constantly deteriorating, and there are cases of mass poisoning of children and adults.

Incineration of waste, despite the constant improvement of the technologies used, does not completely solve environmental problems. This is, in particular, due to an increase in the share of the polymer component in the waste, the combustion of which leads to the formation of supertoxic substances. This approach is also not justified from an economic point of view [2].

The most promising areas include the organization of separate collection and recycling of waste. In particular, one of the tasks of the national project "Ecology" is to bring the level of municipal waste sent for recycling up to 60% in 2024 [3]. According to the adopted amendments to article 114 of the Basic law, the government of the Russian Federation is obliged to implement measures aimed at creating favorable living conditions for the population, reducing the negative impact of economic and other activities on the environment, creating conditions for the development of the system of environmental education of citizens, and fostering environmental culture [4]. Separate waste collection is also linked to the sustainable development goals adopted by the UN General Assembly back in 2000 [5]. The introduction of modern waste processing technologies also has a strong economic potential, both in the material and energy sectors [6].

Separate waste collection — selective collection of waste for further processing in order to avoid environmental pollution [7]. Throughout the world, it is mostly voluntary, but its promotion can also be based on targeted economic incentives, as evidenced by the positive experience of South Korea and a number of European Union countries [8].

In many cities and regions of Russia, steps are being taken to organize separate waste collection such as plastic bottles, metal cans, glass containers, waste paper and cardboard. These wastes can be easily processed using modern production technologies. Ballpoint pens, markers, toothbrushes, and other polymer products of mass consumption are also effectively processed [9].

It is much more difficult to recycle Tetra Pak packaging (for juices, dairy products, etc.), oversized and small plastic bags. Tetra Pak packaging is difficult to recycle, as it consists of several layers, which must first be separated from each other and thoroughly cleaned. Oversized plastic and bags are difficult to sort, but the latter can be crushed and added, for example, to road blocks to improve their performance.

The problem is also complicated by the lack of scientifically based classification of household waste, the need to use complex technological equipment and economic justification for each specific type of waste [10].

Certain mass categories of household waste in Russia today are practically impossible to recycle. These are foil wrappers and packages, paper cups, tea bags, diapers, etc. To reduce the volume of such waste, it is necessary to change the culture of consumption, to form an ecological worldview and a thrifty attitude to the natural environment among the population and, above all, among young people and students. A specific example of this approach is described in this publication.

Problem statement. In September 2018, Letovo School for gifted children was opened in Moscow. Its distinctive feature is training of students on individual educational trajectories in the format of day, week or full board education. Most of the time during the year, students spend time at school, where they develop not only educational, but also personal competencies.

Separate collection of waste in the facility was initially planned, but for a number of reasons it was postponed indefinitely. The initiative group, consisting entirely of school students, drew attention to this problem, and then developed and implemented a project for organizing a separate collection system in the institution, aimed at solving the following main tasks:

1. Examination of readiness of students and school staff to separate waste collection by sociological methods.

2. Interaction with the school administration and the recycling company on the gradual introduction of a system of separate collection and disposal of waste.

3. Development of schemes and places for bins for separate waste collection on school grounds.

4. Promotion of the importance of separate waste collection through various tools.

A description of the solution to these problems is presented in the theoretical part of the publication.

Theoretical part. Stage one. Sociological research. The stage was implemented between October and November 2018. The purpose of the examination is to assess the readiness of the school community to accept the idea of separate waste collection. The survey was conducted among the students and employees of the institution. A total of 171 people took part in the survey, which was about 60% of all students and employees at that time. The survey was conducted remotely using a form developed by Google. This made it possible to reduce the duration of the survey and eliminate unnecessary paper consumption. The questionnaire included three simple questions that help achieve the stated goal of examination and focus the attention of the school community on one of the most pressing problems of lean consumption (the use of paper for educational purposes).

The results of statistical processing of examination data of representatives of the school community are shown in Fig. 1.

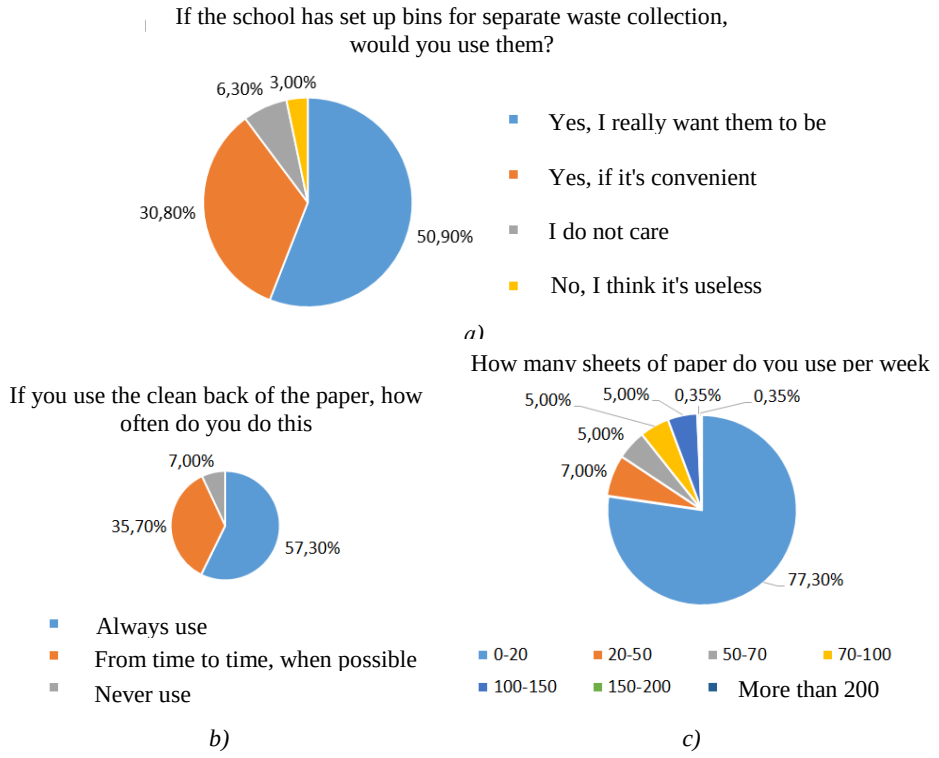


Fig. 1. The results of examination of the school community representatives

It was found that 50.9% of respondents wanted the trash bins to be installed, another 39.8% would use them if it was convenient, 6% said they did not care, and only 3% were against it (Fig. 1A).

77.8% of respondents used less than 20 sheets of paper per week, 7% — from 20 to 50 sheets, 5% of respondents used 50-70, 70-100 and 100-150 sheets, respectively, and less than 1% of respondents used over 150 sheets per week (Fig. 1b).

57.3% of respondents used the back side of a used piece of paper from time to time, 35.7% used it constantly, and 7% never used it (Fig. 1c).

The obtained results allowed us to draw a conclusion about the timeliness of the project implementation and the readiness of the school community for it. In addition, an important problem of lean consumption was revealed, which was very relevant from the point of view of the organization of the educational process and required a comprehensive approach to its solution.

Stage two. Organizational. The introduction of separate waste collection is possible only with the consent of the administration of the educational institution. After the presentation of the project concept and the results of the sociological research to the school management, the project was approved and received broad support. The institution has signed a contract with the processing company "EcoTechnologies" for separate waste collection. The company provided the school with 27 separate collection sets with three sections, free of charge:

1) for paper and cardboard;

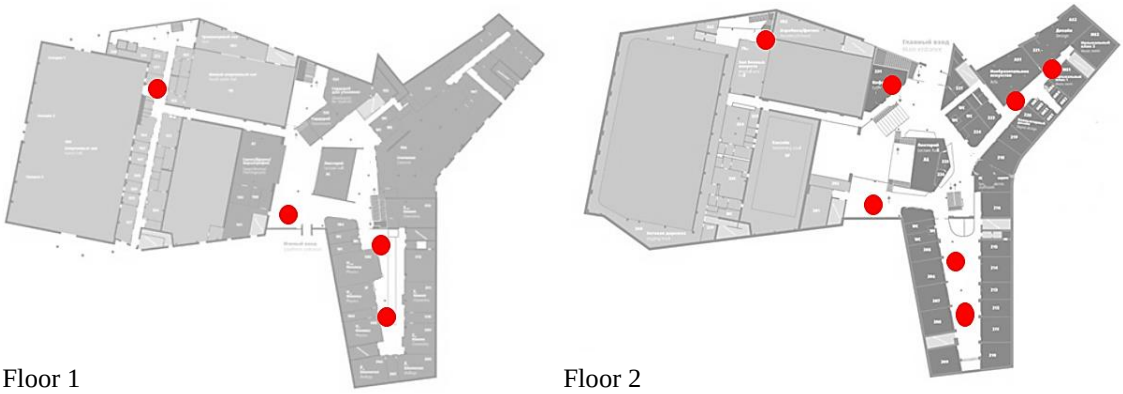
2) for plastic waste, glass bottles and metal cans;

3) for other waste.

Additionally, there are 15 bins for collecting paper, two containers for collecting plastic lids, three boxes for collecting sheets of paper used on one side, and two containers for batteries recycling.

Stage three. Integration. The school administration gave the initiative group the opportunity to choose themselves the places to install separate garbage collection sets. Based on the logistics analysis using brainstorming

elements, key locations were identified in the main building of the school, as well as in boarding houses, where the most intensive flows of movement of people, as well as sources of waste generation were identified (Fig. 2).



Floor 1 Floor 2

Fig. 2. Schemes for placing bins for separate waste collection in the main building of the school

The project was officially launched on March 1, 2019. On the same day, a meeting was held with the Director of the company "EcoTechnologies" Konstantin Rzaev, where he told students and employees about the current issues of organizing separate collection and recycling of waste.

Stage four. Popularization of the project. The stage was implemented in the following main areas:

1. Promotion of the project at various school events.

2. Promotion in the mass media of an educational institution.

2. Visual campaigning and individual work.

The following are specific examples of project promotion in the areas listed above.

On March 1, 2019, the project team presented the project at the school-wide assembly and prepared an article for the school newspaper.

In March–April 2019, design solutions were developed, visual agitation tools were produced and placed on the school grounds to promote the project (Fig. 3).

Fig. 3. Examples of design solutions for visual propaganda tools

On April 22, 2019 (Earth Day), the school held an environmental quest, including a quiz and sports events of the appropriate environmental orientation.

On February 8, 2020, an environmental event dedicated to the recycling of used containers was organized at the school's open day.

In December 2019, a note was published in the school newspaper about the first results of the project.

In February 2020, a master class on making crafts using plastic waste was organized in school social networks.

In May 2020, a short guide was prepared and distributed in the educational environment, dedicated to sustainable lifestyles and thrifty attitude to the environment.

Conclusion. To evaluate the results of the first year of the project implementation, a repeated survey was conducted among the school community using the method described above. The main results of statistical processing of the obtained data showed the following:

1. 92.8% of respondents were satisfied or partially satisfied with the implemented scheme for placing separate waste collection bins.

2. 81.1% of the respondents were satisfied or partially satisfied with the design and informative content of visual propaganda tools.

3. 14.5% of respondents used boxes for collecting sheets used on one side daily, and another 11.6% — two or three times a week.

In total, 5.6 tons of separately collected waste were collected and put into processing during the year of work under the project. The project required almost no capital investment from the school administration and was implemented by students.

Today in Russia there are more than 40 thousand educational institutions, while separate waste collection is implemented in no more than in 5% of them. The described example shows how to solve this problem with minimal material and time costs. At the same time, a much more important aspect is the involvement of students in environmental project activities, which will not only form general academic knowledge, skills and abilities, but will also contribute to the development of moral and volitional spheres of the student's personality, provide conditions for maximum self-expression, self-affirmation and self-realization.

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Authors:

Pleshko, Marianna V., Associate professor, Department of Construction of Underground Structures and Mining Enterprises, NUST MISIS (4, Leninskiy pr., Moscow, 119049, RF), Cand.Sci., ORCID: https://orcid.org/0000-0002-5879-6406, pleshkomv@yandex.ru

Pleshko, Elizaveta M., Student, Letovo School (3, Zimenkovskaya st., Sosenskiy settlement, Moscow, 108801, RF), lizapleshko@yandex.ru

Contribution of the authors:

M. V. Pleshko — scientific supervision, analysis of research results, revision of the text, correction of conclusions; E. M. Pleshko — formulation of the main concept, determination of the purpose and objectives of the study, research, preparation of the text, formulation of conclusions.