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ASSESSMENT AND DEVELOPMENT OF BEHAVIORAL MOTIVATION OF SCHOOL STUDENTS IN URBAN ENVIRONMENT

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Abstract

The study of a representative population of students of Moscow schools determined the level of awareness and motivation of school children in the matters of urban environment. The scientifically based and methodically supported content was elaborated and used to develop the interactive mobile application Ecology in Questions and Answers. The degree of students' awareness is determined based on the results of the review of the questionnaire array. The students' motivation was detected based on the test questions that reflected the school students' usual behavior. The tests are structured into the following topic units: I am at school, I am on the street, I am in the apartment, I am in nature, I am a buyer, I am a passenger, and I am a woke. The answers helped elaborate the scientifically and methodically proper content for an interactive mobile application. The application envisages the stage-by-stage painting of the drawn urban environment on the gadget's screen according to the correct answers to the tests. If the answers are erroneous, the application enables a student to receive additional consultations and re-enter answers. Thus, the application is used as an educational resource. The interactive nature of the application supports a school student's interest in discussing complex and ambiguous matters of the urban environment quality. The recourse to personal experience implemented during questioning enables us to understand to what extent some particular respondent is motivated to reasonable, environmentally conscious daily behavior.

Keywords: Education for sustainable development, ecological education of school students, environmental problems individualization of education, sustainable city

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1. Introduction

New problems the human society has already and will come across force to change the approach to ordinary life. In particular, the need for reasonable consumption, reduction in man-made impact on the environment is being realized. It is especially urgent in the conditions when the population became concentrated in large cities. The environment quality is one of the main criteria of well-being as such problems as poverty, epidemics and hunger go to the background. The relative comfort of living, at first, of urban residents, and now, of a majority of the rest of population in the developed nations is supported by enormous consumption of resources, the abundance of diverse goods and offer of services. However, such well-being has its reverse side: the growing pressure on the environment. These problems cannot be addressed without the appropriate education of the young generation and education of the population in general. That's why the ecological education is now an essential dimension of school students' education. It is regarded as a separate aspect and a component of education for sustainable development (ESD) (Dzyatkovskaya, 2018). The education for sustainable development and the education for climate changes have become very popular in the school education recently (Berdin et al., 2018; Kopnina, 2020; Mogren, et al., 2018; Müller et al., 2021; Saúde et al., 2021; Tibola da Rocha V. et al., 2020). School students are actively involved in studying the environment at the school level, in school environmental monitoring (Ryzhov, 2017), estimate their impact on the environment. The global school projects are illustrated by The Eco-Schools Green Flag, Sustainable Schools, counting of one's environmental trace, which are being implemented in Russia, too (Eco-Schools, n.d.; British Columbia Ministry of Education, n.d.). All these aspects are connected to some extent with the city sustainability problem. In Russia, the environmental education of school students have long-lasting traditions and is now regarded as ESD component (Zahlebnyi & Dzyatkovskaya, 2017). The need for its implementation is also recorded in the official documents, in particular, the Federal Educational Standards of the Basic School Education (FGOS, n.d.).

Upgrading the education, meaning, in particular, the approach from the knowledge paradigm to the activity paradigm is a significant component of education for sustainable development. It means giving up the simple remembering and reproduction of knowledge, training school students during different activities; change in the teacher-student relations (partnership, updating their knowledge, support to initiative and independence); emphasis on shaping the knowledge to independently look for, summarize information, etc. An important objective is now an integration of EDS ideas, including 17 Goals, (Rieckmann at el., 2017) and, first of all, environmental component into the field of education. The environmental component of education for sustainable development must be implemented in activities, so the teacher is required to use interactive training methods. As experience suggests, school students may make their contribution to implementation of the Sustainable Development Goals (Ryzhov & Ryzhova, 2020). To this end, they must understand that the environmental status depends on their behavior in daily life too, and conduct their own research, which improves the training motivation and enables the environmental education to be individualized. The educational motivation may become the first step to the shaping of behavioral motivation (Hawthorne, 2021).

Another trend in modern education, including school education, is digitalization and active use (in particular, in environmental education) of online products (Ilomäki & Lakkala, 2018; Lonka et al., 2015;

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Ministry of Education of the Russian Federation; 2021). Gadgets make an integral part of a modern school student's life. That's why the mobile application, with the content developed on the basis of school student's interests, has been chosen for the environmental education as part of ESD for school students in the cities. As the studies were carried out in a mega-city, they may be regarded as a contribution to addressing the objectives of Goal 11 of the Sustainable Development, “Sustainable Cities and Population Centers” (Global goals, n.d.).

2. Problem Statement

The modern environmental education and the education in the interests of sustainable development, though diverse, is still mostly theoretical. It is not sufficiently associated with the daily behavior of school students, does not target some particular circumstances of the city, community, block, where young city residents spend all of their lives. The comfort of the municipal environment is often evaluated from the adult's point of view (Petrina & Stadolin, 2018). The school students' interests are not virtually taken into account. Our study focused on the urban environment perception by children between 10 to 14 years, which does not fully coincide with that of adults. The principles and content of environmental education were worded by adults, teachers and experts, which is natural and correct. But the personal interests and preferences of a particular student, his/her individual social experience are beyond the learning practice. To fill this gap, the express research was carried out intended to reveal the real interests of students in their relations with the urban environment. The school students' priorities in environmental problems (as they are understood by children) were determined. The obtained data was used when developing the content of the Ecology in Questions and Answers mobile application.

3. Research Questions

To develop the content for the mobile application, the actual level of the school students' perception of the urban environment, in particular, its environmental aspects, was to be found out. The idea was to determine if there is any gender or age specific features of the data array of the students' answers. To create the mobile application, it was necessary to structure the array of answers according to the planned sections that reflect the key aspects of school students' behavior in the megacity (I am at school, I am on the street, I am a passenger, etc.).

4. Purpose of the Study

The study goal is the analysis of the school students' perceptions of the city environmental problems and creation of the My City mobile application on that basis. For adequate reflection of the school students' perception of the municipal environmental problems, it was necessary to develop the questionnaires and conduct the questioning. The obtained data was reviewed to create the scientifically based and methodically proper content for the mobile application: a modern educational product that is attractive for children.

4.1. Study Relevance

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The relevance of the Ecology in Questions and Answers mobile application project development is driven by several factors. Firstly, the implementation of educational principles for sustainable development and the need to shape a modern system of values, including the environment, including urban one, in the new generation of residents. Secondly, the need for the students to study global problems on the example of the closest environment, their city (implementation of the sustainable development principle: Think Globally, Act Locally!). Thirdly, the shaping of the woke position in students (according to the Moscow Government Policy). Fourthly, the need to support the school students' initiative, the use of the dialogue form of communication between children and adults (Federal State Education Standards implementation). Fifthly, the need to find new forms of education for children, in particular, related to use of information and computer technologies (ICT), which attracts modern school students. The integration of all indicated approaches resulted in creation of the entirely new unique mobile application that can be (and is already) used not only by school students but also by their families, teachers and university students, university professors and even kindergarten teachers, and not only in Moscow.

4.2. What does the mobile application give to school students?

The data of recent sociological surveys held by the All-Russian Public Opinion Research Center indicate a steadily high interest of Moscow residents in the environment quality issues. The choice of research projects by Moscow school students in the Moscow Young Ecologists competition demonstrates the popularity of such categories as My City, My Natural Park (Ryzhov & Ryzhova, 2016). However, the absence of the Environmental Studies in school curricula necessitates filling the information and conceptual gaps in environmental education.

This project was implemented with involvement of volunteers and included the target groups' opinion survey, their schooling in workshops and lessons, their stimulation to take reasonable and correct efforts. The project focuses on filling the gaps in informing the school children on urban ecology issues. The approach to such target audience as students when developing schooling and methodical aids is not a popular practice so far. As early as in the first project stage, the mere approach to each participant in the sociological survey enhances the respondent's motivation. Unfortunately, the standard education practice in school does not provide a sufficient opportunity to school students to express their own opinion, in particular, on socially significant issues. It is important for shaping the personality who is capable of making independent judgments and, hence, of taking conscious actions. The mere use of a particular school student's opinion in development of the educational mobile application, Ecology in Questions and Answers, makes people more responsible for its content and wording while improving the students' self-evaluation.

The implementation of the personality-based approach is reflected in the fact that, when fulfilling the assignments (passing the tests, study of reference materials), the students review their daily, personal behavior rather than abstract situations and behaviour of an abstract city resident. This personality-focused approach in education has been recognized as extremely important; however, it is rarely implemented in practice.

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We proceeded from the assumption that the project product will be not only a game for students but a new training aid type (and this mobile application can be surely regarded as an aid), which enables approaching the student personality as the information and educational resource user.

4.3. Study Assignments

The following assignments were set to achieve the study goals:

- to determine the range of problems that are important in terms of environmental education in the interests of sustainable development and sustainable development of Moscow;
- to determine the content taking into account students' interest and age;
- to develop the methods of involving school students into drafting questions for the application;
- to elaborate questionnaires for students;
- to enroll volunteers for questioning and to train them;
- to conduct questioning;
- to process the collected questionnaires, to analyze and summarize answers;
- to classify answers in order to use them in development of the mobile application content;
- to determine which important areas in environmental education in the interests of sustainable development are not addressed in the students' responses and to supplement the application content;
- to elaborate the structure of the mobile application, i.e. to designate blocks in the content;
- to draft recommendations to the interface developers;
- to conduct a requestioning, analyze and summarize answers to assess the performance.

4.4. Individualization of environmental education

When structuring questions, we proceeded from the assumption that these questions should, first of all, pertain to the student and his/her closest entourage. That's why the behavioral content of the known Self-Concept was taken as the basis (Burns, 1982), which enabled us to individualize the school students' answers. Several sections that reflect different aspects in the students' life: I am in apartment, I am at school, I am on the street, I am in the shop, I am in transport, I am in nature, and, finally, I am a woke, are emphasized in the application. All of the above situations also directly relate to the rest of citizens, in particular, the school students' families, which enabled us to interest them in the mobile application. The application content touches upon all principal issues of the municipal environment and all three areas of the sustainable development (environmental - the problems of live nature in the city and its protection, interrelations in nature; economic - resources rational usage; social - human behavior in the city given the need to preserve the environment, and relations with the society). Such approach enabled rather complex problems to be visualized for the mobile application in the context of setting the current trends in information products.

5. Research Methods

5.1. Arranging for Questioning

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As part of the objective to create the Ecology in Questions and Answers mobile application, questioning was carried out in 11 Moscow schools to clarify the volume and level of awareness of 4-7 grade school students on the urban environmental problems. Each group of questions refers to some particular aspect in a school student's life in the megacity, and the focus is on the participant's personal standpoint. We deemed it appropriate to confine ourselves to seven above mentioned question groups (I am at school, I am on the street, etc.), three questions in each. An open question was additionally asked to the study participants: "What would you like to learn about ecology?", to which approximately 1500 meaningful answers were received.

The questioning was preceded by addressing respondents:

"To create the content of the Ecology in Questions and Answers mobile application, the developers are willing to find out what you (the school students) are already aware of, what you are interested in and what you would like to learn. Thanks to your answers, we will understand what questions should be included into the mobile application that you will be able to use. We neither check nor assess your knowledge."

In the questionnaires, the survey participants indicated their gender (boy/girl) and age (grade) and, optionally, their name (not surname!). By the gender parameter, the respondents were allocated rather evenly: 895 boys and 879 girls. By the age parameter, the distribution was as follows: 4th grade school students (10-11 y.o.) - 373; 5th grade school students (11-12 y.o.) - 394; 6th grade school students (12-13 y.o.) - 492, and 7th grade school students (13-14 y.o.) - 515. The total number of respondents was 1774.

Tests were elaborated based on the review of the response array. They were adapted for the interactive mobile application, e.g. a small set of test questions, short lines, so that they could fit into the telephone's screen without additional scrolling. Similar requirements were applied to writing answers for the reference book.

In the presented test questions, we sought to formulate all alternatives in the same format and similar contents, so that the school students would not choose by guessing (i.e. when the correct answer differs from wrong ones significantly, e.g., by the extent of detail). The position of correct answers in tests is changed randomly (from the 1st to the 4th position) for the same purpose: to minimize the possibility of correct guessing. We did not include two or more correct alternatives in the test questions. Unlike the testing, during the questioning the questions didn't necessarily require a single answer (there could be several correct answers, at the respondent's own choice). Answers could be selected not only from the set of alternatives but one's own answer could have been worded. Below are the examples of questions from different topical modules.

"I'm at school" module

Do you know where the garbage is carried to from schools,

and what happens to it later?

I know, ...

Heard/read something

I don't know but I would like to know

I'm not interested

If there is a section of "wild" vegetation at the

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school territory it means that <...>
There was no time to mow it down or to make a lawn or a flowerbed
There is a winter hiding place for insects and spiders
There is a reserve of natural food for birds
Other.....
Do you know where the heat comes from to school?
I know, ...
Heard/read something
I don't know but I would like to know
I'm not interested

"I'm on the street" module*
Fallen leaves are removed from the urban lawns in autumn
After that the following will be ...
Clean and beautiful
Soil fertility will deteriorate, the roots of plants will freeze through
Leaves will not get to the highway and cars will not slide on them
Small soil-living animals will be deprived of the winter hides
Other.....

"I'm a buyer" module*
I usually go shopping
With a plastic bag
With a fabric bag
With a large paper bag
I buy a bag from the cashier
Other.....

"I'm a passenger" module*
To cover a distance of 1-2 km
in the city in our family we ....
Take the subway
Take a car
Walk
Go by bicycle
Other.....

"I and nature" module*
Do you know that there are
"insect hotels" in the city?

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I know, ...
Heard/read something
I don't know but I would like to know
I'm not interested

* Just a few questions from each group are featured

"I'm a woke" module
On the International Earth Day, on April 22, I'm going to...
Watch a movie on animal protection
Draw the Protect the Earth slogan and post it in social media
Go out for a walk with friends
Learn about environmental campaigns and select one of them for participation
Other.....
In spring, galanthuses are being sold in the city
I don't buy them because ...
They are expensive
They wilt quickly
There is a few of them left in nature
I don't buy flowers at all
Other.....
Do you know that there is hazardous garbage
that must be collected separately?
I know, ...
Heard/read something
I don't know but I would like to know
I'm not interested

5.2. Participation of school students in question formulation

The children's participation in formulating questions for the application is extremely important from the point of view of upbringing. Such approach has been rarely met in our practice. The usual practice is that adults, the authors, determine the content of the aids for children. In our case, the mobile application enabled us to involve school students in formulating the questions, which was extremely important for them. Moreover, most questions in the reference book (200+ questions and answers to them) were worded as a result of the large-scale questioning of Moscow school students. Thanks to volunteers (mostly senior school students at schools where the questioning took place), almost 1800 questionnaires were collected and processed, each containing two dozens of questions. The questioning demonstrated, which questions aroused the greatest interest in school students, what they already knew relating to these issues, and what they would like to learn. It means that the content of the mobile educational aid reflects the students' real needs and enables the modern "subject-subject" approach to be implemented.

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5.3. Requestioning

When the mobile application was tested at the final stage, the requestioning of the school students was performed. The requestioning was organized at a smaller scale than the initial one but the schools and grades that took part in the first questioning were involved in the second one, too. The final questionnaire questions were also structured in seven groups with the same names. But the wordings varied (so that the students would not repeat their previous answers). Nonetheless, the meaning of the questions remained the same. Thus, the received material allows to evaluate to what extent the understanding of the modern urban ecology issues by school students changed (if it changed at all), and how the study of the Ecology in Questions and Answers mobile application helped in it (if it helped).

Matching answers to virtually the same questions, e.g. on heat supply to schools, attitude to wild animals in the city, prospects of using electric cars and resource saving suggested that the correct answers ratio increased by approx. 20-25%. Naturally, the competence level varied widely depending on the question. We believe that the reduction in "I don't know" and "I'm not interested" answers is a positive result. It means that even the one-off attracting of the students' attention to a new modern information resource, which, we believe, the mobile application is, encourages high interest in the challenges of the urban environment and the ecology as science.

5.4. The mobile application structure

The analysis of gaps in school students' awareness in urban environment and the array of responses to the open question resulted in the need to elaborate the reference section in the mobile application. Its structure coincides with that of the questionnaire, i.e. it contains seven sections, almost thirty questions and answers in each. When working with the mobile application, school students can always make a recourse to this information resource. As an example, let's quote the reference material from the "I'm on the street" module, the questions of which are mostly borrowed from school questionnaires.

Examples of questions of "I'm on the street" module

Where is dirty snow transported to after clearing the streets? Snow from the streets contaminated with sand, fuel oil, gasoline and other substances, is removed to snow-melting facilities, snow melters. There it is melt under the impact of sewerage waters and then all water is transferred to urban treatment facilities.

Why is it much warmer in the city than in the countryside in winter? In a big city, air is additionally warmed up by the heat produced by cars, heated houses, enterprises and offices. Bitumen or concrete surface gets heated more than snow-covered fields or forests. And urban air contains more dust than rural air. That’s why dusty air is heated by the sun more than clean air. As a result, the temperature in the city center may be by 4-5 degrees higher than in the countryside in winter in calm weather.

Why do dandelions blossom in long rows in some places? It is due to a higher soil temperature over heating network pipes. It is the place where snow melts, green grass sprouts and dandelions start blooming first. And they stop blooming there first, too.

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How many times can paper be recycled? To obtain good-quality paper from waste paper, it can be recycled five or six times, not more. Otherwise, paper fibers become too short, and paper gets too frail. Such paper can be used, for instance, for napkins.

What is done when there is no free space in a dumping site anymore? When the place selected for waste dumping is used up, a new territory is selected. A waterproof clay "cushion" is made up on it, with laying down a system of pipes to collect the emitted gases. Then the thick waste layer is compacted and interspersed with soil. Another soil layer is spread on top, with the grass and bushes planted there.

Why do certain items not decompose in soil for a very long time? It depends on the composition of disposed items. For instance, glass does not almost interact with air, water and soil, so it can stay there for thousands years. On the other hand, it does not lead to chemical pollution, either. The substances artificially created by humans decompose for a very long time. There are no processes of relatively quick decomposition of them in nature. These include, for instance, different plastics and rubber.

Can ordinary chewing gum be recycled? Chewing gum base is made of a resin substance, from which rubber is made. It took a lot of time to establish the chewing gum recycling process. Now some enterprises use it for the manufacturing of telephone cases, toys and tyres.

Why are heating network pipes wrapped into shining material? Thick and shining aluminum foil reflects the heat from hot-water pipes inside. Thus, the heat losses into the environment are minimized, meaning the energy saving for heating water at thermal power plants. It also minimizes the noxious gas emissions to the environment.

Where do collected leaves go? Fallen leaves are often gathered into plastic bags and transported to the dumping site. The bare soil freezes through more, and there becomes less winter shelters for insects, spiders, slugs and other animals. On the other hand, there becomes less larvae of tree and bush pests. That's why, the question about collection of fallen leaves should be decided on the case-by-case basis, taking into account all circumstances.

Why do street sweepers disperse reagents and collect fallen leaves? It is the responsibility of street sweepers to make the territory they are in charge of clean and easy to walk and drive on. So reagents accelerating ice melting are dispersed on the pavement in the ice-slick conditions. For this purpose, chipping started to be used recently. It is harmless for soil and water and prevents sliding of walkers and cars. Fallen leaves on roads and pavements in the rainy weather also complicate movement. But it is better to leave them on lawns for the winter.

6. Findings

6.1. Analysis of the information array of answers

What did the review of the obtained information array of answers show? As expected, most answers were stereotypical. Many school students understand the word of "ecology" as an environmental status, not science. Less than one percent of respondents understand the difference between the ecology and the environment only. Schoolchildren are pretty well aware of where the garbage from school is sent to. One third of respondents answered confidently and specifically; one third "has heard something", even though the reasoning often ended with the "delivered to the dumping site" or "burned" wordings. 20% of

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the school students "would like to learn", and one tenth "is not interested". As an example, let's point to the degree of school students' awareness of heat supply issue. Just a small number of respondents has a broader idea of heat supply, which goes beyond the classroom radiators. But there is a high interest in this issue. However, nobody thought of the connection between the consumed heat and the volume of the fuel burnt at power plants.

The school students demonstrated good awareness of power savings lamps. More than a half of respondents correctly named the type of such lamps, about 20% "have heard something" and "would like to learn more". Interestingly, less than three percent, which is a very low level, chose the "I'm not interested" option. On the contrary, the question about the energy labelling of electrical appliances demonstrated that school students are not aware of the energy performance assessment or the labelling with a color strip set and respective alphabetical indices. One fifth of respondents "heard something", but did not specify. Exactly two thirds would like to know what it is, and just 4% gave the correct answer. It is worth noting that 10% were "not interested" (unknown realities repulse the respondents).

Let's note that the cognitive motivation of school students who answered any question was estimated as a major positive motivation when they gave a detailed answer in the "I know" and "I don't know but would like to know" categories. Answers in the "Heard something" and "I'm not interested" categories were interpreted as weak or zero motivation. In general, a bit more than a half of respondents (53.6%) would like to know "everything" or "many things".

Shopping with a plastic bag was pointed by one fourth of respondents, with a fabric bag - by 18%, and with a paper bag – only by 4% of respondents. A majority (40%) buys a plastic bag from the cashier. The consequences of daily consumer behavior are not associated by the students with the growth in plastic waste in garbage containers and dumping sites. The explanation of this seemingly obvious link should be emphasized. During the subsequent training, it is necessary to demonstrate the recycling of different plastic types, take into account costs and show the need for separate collection of plastic and other waste.

The reaction of students (of any age) to the question about taking pictures with wild animals in the city streets was unexpected. More than 70% pointed to the danger for themselves, and just one-tenth paid attention to the danger for animals. Obviously, education does not provide sufficient information on catching and husbandry of such "street" monkeys, birds, boas, etc. to give rise to the respondents' concern and shape the negative attitude to taking such pictures.

When asked about the role of motor vehicles in air pollution, the number of responses was much higher than average. "Exhaust" emissions and their transfer with wind were noticed by the total of three fourths of students, but as low as 5% respondents linked that with the fuel quality. We have to state that school students in general do not see any connection between the air pollution by motor vehicles and the operation conditions of the vehicles. Electric cars, of which two thirds of respondents "know" or "heard something", are seen as an alternative to the conventional motor vehicles in the future. The same one third of respondents noted a high price, low capacity and insufficient mileage between recharges and the virtual absence of charging stations for electric cars. The students are rather well aware of drawbacks of electric cars but extremely poorly aware of their advantages. The issue about auxiliary power sources is ignored by the respondents.

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The awareness of hazardous garbage and the need for its separate collection is rather high. 38% of respondents know and specifically mention what exactly they know about that (though not always correctly). 48% "heard something" and 10% would like to learn more. Such level of awareness and motivation seems to be a good starting point for installation of separate household garbage collection facilities in yards and communities. However, the insufficient availability of necessary equipment and transportation and processing infrastructure may bring such motivation to nothing very quickly.

In the "I'm a woke" module, just one fifth of respondents selected the option of participation in an environmental campaign on the Earth Day, i.e. stated their active position. However, 37% selected the option of passive information support as movies on animal protection or drawing an environment-preservation slogan and its posting in social media. Perhaps, it is these first 20% respondents that represent one of the main questioning parameters reflecting the declared (not real yet!) readiness to personal actions. These and other examples of school students' answers suggest which topics should be dwelled upon when developing the mobile application.

6.2. Answers to the open question

Besides the test questions where one or more ready answers should be selected, the open question "What would you like to learn about ecology?" was proposed to the school children. 1500+ array of meaningful answers has been reviewed. Let's quote just a few examples grouped into topical modules. Of course, they do not reflect the entire diversity of answers. But the array of answers is representative, to a certain extent. We did not edit the school students' answers but only corrected some grammar and lexical mistakes. Based on the analysis of the array of answers, the content of the referential materials of the mobile application was elaborated. The expert's specific answers to the students' questions were given.

"On Ecology, Ecologists and School Subject" module

What is the keypoint of ecology?

How many persons are involved in it, if there is such science?

How does the person's attitude to the environment change after he/she becomes an ecologist and "plunges into" the ecology?

Are there any works of art (sculptures, etc.) on the Ecology created by famous authors or beginners, including children?

How to win the All-Russian Ecology Olympics?

"Waste Sorting and Processing" module

How is waste removed from dumping sites?

How can waste be processed at home?

How can waste be used for a good cause?

How can one collect waste on one's own, which packages to use and where to transport that waste?

"Conservation" module

What safe methods of electricity generation for the entire Earth are available?

How can we save water and electricity at school?

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Why do so few people use solar cells?

How many trees were used to make school textbooks?

How many liters of water are consumed when I take a bath?

How many silk worms are necessary for one dress?

"Behavior and Actions" module

About interesting environmental campaigns one can take part in the near future

How can my peers and I help the world from an environmental perspective?

About household trifles we have not thought about before.

Finally, to change the attitude of people to the environment, so that someone would value the Earth.

How can one help the nature without making hard efforts?

Can the help be provided with money?

Where is garbage sent and how do people help nature? I would like to help!

Why doesn't the humankind understand what they are doing to their planet (4th grade school children!)

6.3. Ecology in Questions and Answers mobile application

The new educational resource as the mobile application enables updating the students' knowledge in many subjects implicitly when a school student sees that he/she needs knowledge not to get a good mark but to achieve the goal, to win the game and "revive" the picture of the city. Not least important for the application user is the fact that he/she can see the result in the rating section. He/she is able to compare his/her performance with achievements of his/her classmates and any other user. The distinctive feature of the rating is its openness and dynamism, i.e. the application enables a student to improve his/her performance any number of times. In this case, the age specifics and the users' capacities were taken into account. For instance, the rating is calculated based on the age (to be more precise, taking into account the grade, from the first to the eleventh). The "no grade" category is allocated for adult users.

The information must excite strong emotions in schoolchildren to improve its perception. The mobile application as the game-based training and upbringing was created so that to incentivize the user to gain success. The initial city picture on the screen is grey and unappealing. By answering questions correctly the school student "animates" it. Colorful elements and city sounds (car noise, birds singing) appear in the city image with each accurate and complete answer to the questions in the group of tests.

The urban environmental problems are very multi-faceted and there are no unambiguous answers to questions related to them. That's why, when developing the reference section, we used problem-based training elements. The answers we suggest to the user in the application are not always obvious and are often ambiguous. For instance, fallen leaves are still removed from lawns and pavements in autumn in the city. Which consequences can these actions have? They are numerous, that's why a school student can independently determine his/her attitude to leaves removal. And it is the educational novelty of the project under review. When handling the reference section of the Ecology in Questions and Answers mobile application, the user realizes how complex, unambiguous, and contradictory the natural phenomena, envi-

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ronmental problems and situations arising in the urban environment are. This understanding is facilitated by the fact that the user is able to change his/her initial answer if he/she sees that the test results do not change the color on the city image.

7. Conclusion

The modern package of the environmental content as the mobile application, which is fully interactive, enables the Ecology in Questions and Answers application to be used as an additional information and educational source. The indirect attraction of the school children's attention to their own consumer behavior, use of energy, water, and transport, etc. includes the range of the urban ecology issues to the area of concern. As a consequence, the issue of raising the students' awareness of the modern city problems, of the role each resident's behavior plays in maintenance of the environment quality, is addressed.

The author hopes that they managed to create the unique mobile application that is simultaneously a training manual on environmental education for sustainable development and a game for school children, it reflects the real interests of children and allows to practically implement the subject-subject relations, the behavioral elements of the Self-Concept, the Federal State Education Standards of the fundamental school education, the personally-focused approach to education and upbringing of school students, to shape a new system of values and woke citizens interested in environment preservation in the city and of improving the environment situation, with the view to the environmental laws, involve other population strata to the environment education process (families of school and university students, tutors, etc.), engage school students into the environmental education process for sustainable development, i.e. link environmental, economic and social problems.

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