SMART EDUCATION FOR HEALTH – ESTABLISH

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Abstract

We are now crossing a period in which we are facing both the increase of the high medical costs and the impact of diseases on the whole population. Although the slogan “it’s cheaper to prevent than to treat” may sound unfashionable, we strongly believe it’s true than ever. It’s necessary to educate for health and to promote health in Romania in deep accordance with international standards, especially those of the European Union. The active involvement of the young people is essential mostly to encourage them in adopting a healthy living style based on the regular practice of physical exercises, this being the best way of keeping fit and of body self-defense, the reduction of stress symptoms and the prevention of the appearance of heart and of circulatory diseases, of diabetes problems, overweight and osteoporosis.

On the other hand, the transdisciplinary approach of education for health, within the international project ESTABLISH (Environmental Sensing for a better quality of Life: Smart Health) motivates the involved students. ESTABLISH will enable to go from monitoring the indoor and outdoor environment and traffic to managing the environmental conditions on a personal level and thus improving the quality of life, reducing health costs and supporting vulnerable groups such as the elderly or patient.

The involved students discover the influence of the parameters of air quality and of the weather to maintain health and they learn how to monitor these parameters with the help of sensors. By using sensors, devices can collect data from the environment, connect to each other, exchange data obtained and corroborated information thus reach the user, it can make decisions and control how devices work. The teachers explain the functioning principles, then to join the technical team for their usage. The physiological and behavior parameters are monitored with special bracelets which record the heartbeat, the jogging pace and the distance. Students learn how to correlate these bracelets with mobile phones then they analyze these recorded data.

Keywords: Education, health, sensors.

1 INTRODUCTION

The right to health is a fundamental human right. According to the World Health Organization, an individual's health is defined as “a state of well-being, mental and social as well, and not just the absence of disease or infirmity.” From a public perspective, health is, due to its huge individual, but also social and demographic implications, one of the most relevant elements of government policies and strategies around the world. To this end, in 1977, the World Health Organization (WHO) member states (including Romania) unanimously decided that “the main social goal of governments and WHO in the coming decades should be to achieve a health condition for the entire population of the globe, to allow all people to lead a productive life from an economic and social point of view [1].

1.1 Health education - a necessity of our day

School health education is one of the main ways to promote good knowledge of different health issues and also to train attitudes and skills that are indispensable for responsible and healthy behavior. In many countries, health education is compulsory in schools, starting from the first to the twelfth grade, using age-appropriate programs and materials for each development cycle.

According to Global Accelerated Action for the Health of Adolescents (AA-HA!) guide, in 2014, the WHO report Health for the World’s Adolescents showed that considerable gains from investments in maternal and child health programmes are at risk of being lost without corresponding investments in adolescent health. The latest data show that more than 3000 adolescents die every day from largely...
preventable causes, and that many key risk factors for future adult disease start or are consolidated in adolescence. Adolescent mental health and well-being are often overlooked [2].

There are a number of arguments that can be put forward in favor of delivering health education within educational establishments.

First of all, one of the goals of the educational activity itself is to inform children and adolescents about the different fields of culture and science, in parallel with the development of practical skills. In this respect, health education, as part of the medical sciences, aims not only at delivering scientifically correct information to students, but also creating healthy behaviors and attitudes that correspond to the educational ideal.

A recent definition of the World Health Organization states that "health education is a set of efforts to foster the development of knowledge, attitudes and behaviors designed to improve the individual's and community's health." [3]

Health education can also be considered as the process of acquiring and applying facts, knowledge, and behavioral norms that favorably influence the attitudes and hygienic practices of the individual, family, community.

Health education represents, in educational terms, the process of information, training and development of a human being – young and adult - in the field of health, the process of endowing the individual with knowledge, attitudes and habits about health.

The school is an ideal place for disseminating this knowledge among the masses of young people; no other institution has the ability to encompass and address over time such a high percentage of the population [4].

One of the essential elements for developing the desired impact is to initiate and implement health education programs for students as young as possible. Preventive conduct becomes a behavior that is built over time alongside educational development. Such activities always have a lower impact on adults than similar actions carried out with students at earlier ages.

2 METHODOLOGY

The ESTABLISH pilot project in Romania will propose the prophylaxis of obesity and spinal cord diseases/ keeping in a good physical shape for adolescents aged 14-18 years. The selected students perform kinetotherapy procedures to combat a sedentary lifestyle and to address any problems that may arise from this lifestyle. We choose adolescents thinking that around 1.2 billion people, or 1 in 6 of the world’s population, are adolescents aged 10 to 19. Most are healthy, but, according to the World Health Organization, there is still substantial premature death, illness, and injury among adolescents. Illnesses can hinder their ability to grow and develop to their full potential. Alcohol or tobacco use, lack of physical activity, unprotected sex and/or exposure to violence can jeopardize not only their current health, but also their health as adults, and even the health of their future children. Promoting healthy behaviors during adolescence, and taking steps to better protect young people from health risks are critical for the prevention of health problems in adulthood, and for countries’ future health and ability to develop and thrive [5].

The pilot implementation will be attended by medical recovery physicians and therapists from specialized units who:

- will decide on the set of exercises to be performed;
- will monitor the correct practice of these exercises;
- will monitor and analyze the influence of environmental factors on the vital parameters of the subjects;
- will analyze the evolution of the subjects during the course of activities in these cases of use.

2.1 Pollution and its effects on the human body

Pollution is the modification of natural components by the presence of foreign components, called pollutants, as a result of human activity, and which by their nature, the concentration in which they are found and the time they act, cause harmful effects on health, create discomfort or prevent the use of some environment components vital for life.
Air influences health through both its chemical composition and its physical properties (temperature, humidity, air currents, radiation, pressure).

Pollutants in the atmosphere vary according to their nature, their concentration and the duration of their action on the human body, thus causing serious consequences. Specialists in medicine and ecology have established a direct link between environmental degradation and an increase in the number of people suffering from allergies, asthma, cancer and other diseases. The main pollutants that act negatively on the human body are: nitrogen oxides, sulfur dioxide, tropospheric ozone, carbon monoxide, formaldehyde, phenols, suspended particulate matter (PM10 and PM2.5).

2.2 Expected influences of main pollutants on people during physical activities

We are investigating the influences of some greenhouse gases and particulate matter on healthy students and young adults during physical exercises (jogging, for example). We already found that the expected effects are:

- Nitrogen dioxide is known to be a very toxic gas for both humans and animals (the degree of toxicity of nitrogen dioxide is 4 times higher than that of nitric oxide). Exposure to high concentrations can be fatal, and at low concentrations it affects the lung tissue. The population exposed to such pollutants can have difficulty breathing, respiratory irritation, lung dysfunction. Long-term exposure to even low concentrations can damage lung tissues resulting in emphysema. Children are the most affected by exposure to this pollutant.

- Carbon monoxide is a toxic gas, fatal in high concentrations (concentrations of around 100 mg / m3) by reducing the oxygen carrying capacity of the blood, with consequences on the respiratory system and cardiovascular system. At relatively low concentrations: it affects the central nervous system; it modifies the heart rate, thus decreasing the volume of blood distributed in the body; it reduces visual acuity and physical ability; exposure over a short period can cause acute fatigue; it can cause difficulty breathing and chest pain for people with cardiovascular disease; it causes irritability, headaches, rapid breathing, lack of coordination, nausea, dizziness, confusion, reduced ability to concentrate. The population most affected by carbon monoxide exposure is represented by: children, the elderly, people with respiratory and cardiovascular diseases, anemic people, smokers.

- Particulate matter is a complex mixture of very small particles and liquid droplets. An important problem is represented by the particles with an aerodynamic diameter less than 10 micrometers, passing through the nose and throat and penetrating into the pulmonary alveoli causing inflammation and intoxication. They affect mainly people with cardiovascular and respiratory diseases, children, the elderly and the asthmatics. Children younger than 15 years inhale more air, and therefore more pollutants. They breathe faster than adults and tend to breathe more through the mouth, practically bypassing the natural filters in the nose. They are especially vulnerable because their lungs are not developed and lung tissue which develops in childhood is more sensitive. Dust pollution worsens asthma symptoms such as cough, chest pain and difficulty breathing [6], [7].

- Exposure to a high concentration of sulfur dioxide over a short period of time may cause severe respiratory difficulties. In particular, people with asthma, children, the elderly and people with chronic airway diseases are affected. Exposure to low sulfur dioxide in the long term may result in respiratory tract infections. Sulfur dioxide can potentiate the dangerous effects of ozone.

- Increased ozone concentration at ground level causes respiratory tract irritation and eye irritation. High concentrations of ozone can cause reduced respiratory function.

2.3 Project architecture description

The sensor network will be deployed in the locations where physical therapy activities will take place, in this case the yard of the “Grigore Moisil” National College, from Bucharest.

Students will be initially evaluated by specialist doctors to determine their initial status. Based on this status and diagnosis, the exercises that they will constantly perform at the same time and under the same conditions during 5-10 sessions will be selected at the established locations. Following the monitoring using the system implemented within the ESTABLISH project the necessary
data to analyze the evolution of each student will be collected. On the other side students will participate in the phase of building and calibrating a weather and air quality monitoring sensor station.

Data and services are based on the collection of environmental parameters from both the outside and the inside environment [8]. Therefore, there are the following primary data sources:

- outdoor sensor stations installed in selected locations, which can provide data to users/subjects on air structure, meteorological conditions, etc. through mobile apps and web apps. Based on this information, the system helps make decisions about recovery and rehabilitation activities: it sets out what activities, when and how they will be performed by the subjects.

- indoor locations sensors, through the implementation and use of iBeacon wireless access points, collect and send data to mobile applications and web applications with real-time notifications. Thus, the system assists in making decisions based on information about the location of the subject in the chosen setting: activities to be carried out, instructions, program, and even socializing elements.

- monitoring the subject’s activity during programs by integrating easy-to-wear devices such as Fitbit with the above-mentioned system.

3 RESULTS

When we are writing this paper, the outdoor sensor station data are recorded on Beia (our partner) website [9]:

![Figure 1. Meteo live data (ADCON telemetry) from BEIA](image.png)
Students are familiar with FitBit Bracelets and they are able to use them.

Students participated in an activity of building and calibrating a home-made station for monitoring the weather and the air quality by using: MQ135, MQ6, MQ7 and BMP180 sensors. The registered data could be found on the school portal [10].
4 CONCLUSIONS

The school is an institution of great moral authority, providing the formal, informal and non-formal education framework, where the official school subjects acquire more importance at the individual’s psychological level. This is why we choose to work with students from high school in order to make them responsible in what regarding their wellness and health.

By using sensors, devices can collect data from the environment, connect to each other, exchange data obtained and corroborated information thus reach the user, it can make decisions and control how devices work. Our mission is to combine environmental sensor data with physiological and behavioral sensor data in order to improve the quality of life and to reduce health costs by prevention activities.

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