

Updates in Public Health and Preventive Medicine

Research Article

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Awareness-Raising on Air Quality and Health Effects in Primary School Children by Using MAPEC_LIFE Study Educational Package: Preliminary Data [Version 2, Approved]

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Original Submission

Received: July 18, 2017

Accepted: August 17, 2017

Published: October 10, 2017

Open Peer Review Status: Approved

How to cite this article: Marco Verani, Annalaura Carducci, Gabriele Donzelli, Giacomo Palomba, Beatrice Casini, Elisabetta Ceretti, Claudia Zani, Elisabetta Carraro, Sara Bonetta, Francesco Bagordo, Tiziana Grassi, Milena Villarini, Umberto Gelatti, the MAPEC_LIFE Study Group. Awareness-raising on air quality and health effects in primary school children by using MAPEC_LIFE study Educational Package: preliminary data [Version 2, Approved]. *Updates Public Health Prev Med.* (2017) 1: 11.2

Acknowledgments: This work has been funded by the European Commission Directorate General Environment in the LIFE+ programme for 2012, Environment Policy and Governance (grant number: LIFE12 ENV/IT/000614).

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Abstract

Air pollution is a global health problem for its relation to acute respiratory infections, cancer, chronic respiratory and cardiovascular diseases. Many studies suggest that environmental education on pollution should be started as soon as possible to prevent the onset of negative behaviors, to develop positive habits and skills and to create awareness, so it is easy to understand how the role of the school is fundamental for this education. In recent years video games have increasingly replaced traditional games, so the use of a teaching approach accompanied by technology tools could be very efficient for children learning activities. The Educational Package, realized in the context of MAPEC_LIFE project (Monitoring of Air Pollution Effects on Children to support public health policies, LIFE12 ENV/IT/000614), after the phases of validation, represented a useful tool for environmental education regarding air pollution, as confirmed by preliminary data obtained by its utilization. More than half of teachers (57%) considered it effective, understandable, simple and useful, confirming the importance of videogames in stimulating children's interest.

Keywords

Educational Package; Children; Air Pollution; Environmental Awareness

Introduction

The impact of pollution, in terms of human health and economic costs in industrialized countries, is increasing dramatically and, in this regard, the European Environment Agency (EEA) declared that air pollution is the major risk for environmental health in Europe. In fact, in 2013 Particulate Matter 2.5 (PM_{2.5}) caused 467000 premature deaths from exposure to long-term, while the NO₂ and NO₃ produced 71000 deaths 17000 respectively [1]. The International Agency for Research on Cancer (IARC) has classified outdoor air pollution and PM in outdoor air pollution as carcinogenic to humans, based on sufficient experimental evidence and strong support by mechanistic studies [2]. Recently the interest in the study of exposure of the pediatric population to environmental pollutants is increased [3-6]. In fact, children may be more susceptible than the adult to the adverse effects caused by air pollutants for a variety of reasons, among which: to spend more time outdoors, to have an immature immune system and to intake more air [4,7,8]. Children have also a capacity of metabolism xenobiotics less than adults and, in addition, have different DNA repair systems and control cell proliferation [9]. In this context, the European Union (EU) has financed MAPEC_LIFE project (Monitoring of Air Pollution Effects on Children to support public health policies, LIFE12 ENV/IT/000614) that aimed to evaluate the early effects on children's health using two biological damage indicators (micronucleus and comet test) [10]. In addition to the scientific objective of the study, an activity in schools was planned to raise awareness among children and their teachers on the main

air pollutants, their effects on health and healthy lifestyles to be taken to counter them. For this purpose, a didactic package composed of three video games, five educational cards and a cartoon was created and validated [11]. The aim of this study was a preliminary evaluation of the Educational Package efficacy in terms to raise children awareness on air quality and its health effects.

Material and Methods

The Educational Package (EP) was created during MAPEC_LIFE Project by a focus group composed by six primary school teachers' and three researchers of the project. Audio-visual aids and games, with specific didactic leaflets for adults, were chosen considering the children's age and published experiences.

The EP was composed by a storyboard, five lesson plans and three videogames (Figure 1). The storyboard was an introductory video of three minutes that illustrated the main educational contents of the video games. For the video games, three key messages were chosen: air pollution and health hazards, healthy lifestyles, and effects of pollutants at the cellular level and positive action of vitamins (e.g. fruits and vegetables). Finally, were five the important topics described into teachers' leaflets: I) source and characteristics of the most important air pollutants, II) effects of air pollution on health, III) policies to reduce exposure to air pollution, IV) lifestyles V) information about the effects of air pollutants on cells.



Figure 1: EP component's.

At the first, a series of training sessions following by a practical demonstration of the use of the EP for 200 teachers by academic researcher were performed. The teachers and pupils involved were chosen for convenience by those already participating in the MAPEC_LIFE project.

The followed preliminary study, to assess the effectiveness of the EP, interested 50 teachers of 200 that used the EP to a total of 1048 primary-school children attending 2nd, 3rd and 4th grade classes, in particular 340 (32.4 %), 360 (34.4%) and 348 (33.2%) pupils respectively. Children of 1st and 5th classes were not involved because corresponding teachers were not

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available in this preliminary phase. To evaluate the improving of awareness, the teachers filled a questionnaire with five-points Likert scales. A Likert scale is a psychometric scale commonly involved in research that employs questionnaires and it is the most widely used approach to scaling responses in survey research [12]. The original Likert scale used a series of questions with five response alternatives.

The questionnaire was composed by the following questions:

- Do you consider effective the educational package?
- Do you consider understandable the educational package?
- Do you consider simple the educational package?
- Do you believe that children had fun?
- Have the children shown that they have acquired new knowledge after the learning activity?

The possible answers to these questions were:

- Very much
- Very
- Enough
- Little
- Anything

To evaluate the possible statistical significance between classes Chi-square test was used for each question.

Results and Discussions

The survey results are presented in Table 1 and Figure 2.

The usefulness of the tools to promote new knowledge was evaluated positively by all teachers and videogames were greatly appreciated by the majority of children. In fact, adding “very much” and “much” answers, 72%, 54% and 62% of teachers considered the educational package effective, understandable and simple respectively. Meanwhile 72% and 54%, respectively, expressed as positive perception in terms of enjoy ability and usefulness (Figure 2), confirming the importance of a game-based learning approach, demonstrated in many studies [13,14].

Table 1: Survey results by number of teacher’s answers.

Question	Anything	Little	Enough	Very	Very Much	Total
a)	0	0	14	30	6	50
b)	0	1	22	14	13	50
c)	0	3	16	20	11	50
d)	0	1	13	25	11	50
e)	0	0	23	25	2	50

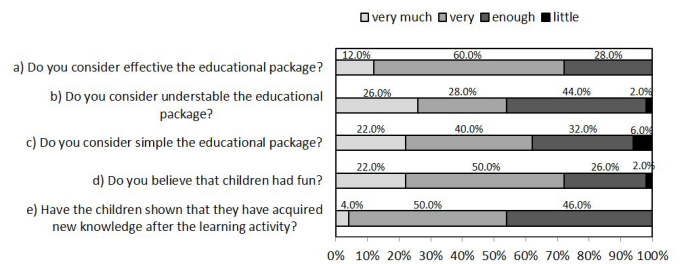


Figure 2: Teachers’ answers to the questionnaire administered after educational activities.

Considering the results by school classes and only the answer “very”, the data revealed more frequency replies for 2nd grade classes for understanding and children feedback (Table 2). Nevertheless, statistical analysis does not make in evidence significant differences, for $p < 0,05$, between classes: the EP seems to be appreciated by all the teachers and pupils. Play, in its diverse forms, constitutes an important part of children’s cognitive and social development and computer games have increasingly replaced more traditional games as leisure activities. The use of traditional teaching approaches appears to be insufficient, and the use of information technology tools may increase student motivation. Audiovisual tools and videogames have been recognized as being very efficient and promising for motivating children to actively participate in learning activities [15,16].

Table 2: Percentage survey results by answers-school classes.

Question	Little			Enough			Very			Very Much		
	2 nd grade	3 rd grade	4 th grade	2 nd grade	3 rd grade	4 th grade	2 nd grade	3 rd grade	4 th grade	2 nd grade	3 rd grade	4 th grade
a)	0	0	0	26	28	31	63	50	62	11	22	8
b)	5	0	0	42	39	54	37	39	8	21	22	38
c)	5	6	8	37	33	31	47	33	31	11	28	31
d)	0	0	8	21	28	38	68	39	38	11	33	15
e)	0	0	0	37	44	62	63	44	38	0	11	0

Conclusion

The intervention of environmental education and health literacy, approaching children with tailored messages and tools, appeared to be very useful, improving children knowledge and stimulating their interest. Our preliminary results confirmed prior evidence of the beneficial effects of combining traditional lessons with computer games as instructional tools; computer games are able to strengthen and support the motivation to learn because they are attractive to students.

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