Environmental protection – changes in educational system

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Abstract – Environmental education is a part of the efficient implementation of the environmental protection policy in the European Union. As the joining of the EU is coming closer, the area of environmental education is becoming more significant for the Republic of Croatia. That is why paper authors have, starting from the legislative strategic frame, researched the basic characteristics of environmental education at different levels of educational system in Croatia. The level of application of contemporary information and communication technology as the specific educational instrument was especially analyzed. The authors concluded that the level of their application within the educational framework concerning the protection of environment in Croatia is markedly low. That is why they are proposing concrete measures and possibilities of applying new, modern technologies in the field of environmental education. Their implementation will surely contribute to the quicker and better acquisition of the required knowledge.

I. INTRODUCTION

Economic growth and development which has been based for the last two centuries on the neo-classical doctrine has led to the ecological problems of global proportions. The consequences of the anthropogenic effects on the environment have been noted when the nature, because of the impossibility of self-regeneration, has begun to have negative impact on the whole life on Earth.

International experiences show that raising the ecological conscience of the society and the implementation of the environmental protection into everyday life is a complex long term process. Prerequisite of this process is certainly modification and adaptation of educational systems aiming at adopting the basic knowledge concerning the problems of environmental protection. The environmental education is also essential for development of critical thinking on ecological questions and acquiring ability in individuals for responsible decision making. Due to the general directives, but also specific EU documents, themes with ecological and environmental problems are becoming significant part of educational programs in Croatia. However, successful implementation of modern environmental programs at all levels of educational system require among others, application of adequate informational technology.

II. LEGISLATIVE – STRATEGIC FRAMEWORK

Environmental education is a part of the efficient policy implementation for the protection of environment which has been developed for the last three decades in the EU. In the initial phase, the environmental protection policy was directed towards different forms of eco-system pollution. However, through the recognition of the significance of social, economic, and cultural dimensions of the environment, today the EU environmental protection policy is founded on the concept of sustainable development [2].

The environmental protection policy is important instrument of development in the EU which is confirmed by numerous legal regulations and strategic documents for implementations of activities with objective to improve the status of environment but also for realization of sustainable economic development in the EU.

In contrast to the environmental protection policy, the EU does not have a joint educational policy. Education is in domain of national states and that is why each member state maintains full responsibility for the content and quality of its educational system [13]. Despite this, the EU in all important strategic documents underlines the role of education as a key instrument in the implementation of environmental protection policy.

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A. Legislative and strategic framework in the EU

Role of education in the environmental protection policy is explicitly designated in the Resolution which was in 1988 enacted by the Council of Ministers. The Resolution stated that the purpose of ecological education is to increase the public conscience about contemporary ecological problems and possible solutions, and to put the foundations for rational and sustainable use of natural resources and active participation of individuals in environmental protection [2].

In 1993 the European Parliament additionally elaborated this approach to the Resolution which calls upon the member states and the EU Commission to include environmental dimension in all aspects and levels of education and underlines the fundamental role of educational institutions and their lecturers in development and implementation of environmental protection policy [2].

In 1972 The Programs for environmental protection in the EU were initiated, which helped in integration of ecological aspects and aspects of environmental protection in all areas of Union's policies. The 5th Environmental Action Program (1993-2000) requested the integration of environmental dimension into four priority fields: preservation of quality of life, stable approach to natural resources, avoidance of environmental degradation and sustainable development. Within the framework of this program, education was highlighted as an important component which complements the legal and marketing instrument for environmental protection in order to

stimulate sustainability and suppress ecologically irresponsible and harmful behavior [14].

The 6th Environmental Action Program (2002-2012), under the title "Environment 2010: "Our future, our choice" implies a wide span of measures and instruments that could influence the decisions of the economic subjects, consumers and politicians connected with environmental protection. For this purpose, the program proposes five key approaches for advancement in the question of environmental protection. Within the fourth approach "Assisting people to make ecologically acceptable choice" is stated that the EU will continue to promote ecological education and rising of ecological conscience. For example, the EU will promote use of web contents and educational programs for motivating people to adopt the new ecologically acceptable way of life [15].

At the ministerial conference "Environment for Europe" held in Kiev in 2003, the statement by the ministers of United Nations Economic Commission for Europe (UNECE) region was adopted concerning the education on sustainable development. At this occasion the UNECE strategy draft for education on sustainable development was supported in order to carry out the concept of sustainable development and environment protection [16].

B. Legislative and strategic framework for environmental protection in Croatia

Environmental protection in the Republic of Croatia was determined by the process of Croatia's accession to the EU. In accordance with this, numerous international agreements, directives and guidelines related to the environmental protection have been transferred and adapted into Croatian legislation. Apart from the new Environmental Protection Act in 2007, the field of environmental protection in Croatia is covered by the National Environmental Strategy and National Environmental Action Plan, enacted in 2002, in which was, among others, determined the importance of education in the implementation of the policy for the protection of environment.

The Environmental Protection Law is a basic legal act in the field of raising the conscience and education in environmental protection. It prescribes that the basic aims of the environmental protection are achieved by developing conscience for the need to protect the environment in the upbringing and educating process. According to this law upbringing and education related to the protection of environment and sustainable development represent the component element of the general policy for the protection of environment. Within this element it is stated that the state ensures implementation of environmental protection education and sustainable development within the educational system and the Ministry responsible for environmental protection in cooperation with Ministry for education determine the guidelines for the educational program in accordance with the Sustainable Development Strategy of the Republic of Croatia [5].

The National Environmental Strategy was made within the project of development strategy "Croatia in 21st century" from 2000 beside the general principles and priorities, the strategy defines guidelines for complying economic, technical, scientific, educational, organizational and other measures for the protection of the environment. This strategy especially emphasizes the need for development of education in the field of protecting environment and states that the rising of conscience on environmental protection and education in the field of environment is one of the main priorities in implementation of environmental protection policy. The strategy of environmental protection recognizes the importance of efficient educational system for strengthening total infrastructure in the field of environmental protection. Among others, the task of strategy horizontal measures is to raise the general level of knowledge and technical education in the field of the protection of environment. This is intended to achieve by the introduction of the subject the environmental protection into secondary and university education which would form a wide base of future experts [7].

On the basis of the Environmental Protection Law and guidelines from the National Environmental Strategy, Government of Republic Croatia has enacted the National plan of activities concerning environment which proposes wide span of different instruments for implementation environmental protection policy. Education is in the national plan emphasized as the key instrument for the process of developing conscience and critical thinking concerning ecological problems. For example, one of the main aims of environmental education are inclusion and connecting the contents concerning environment and sustainable development within the school programs at all levels of educational system, and the strategic orientation on the realization of this aim requires the development of integral educational systems concerning environment and development for different social groups [6].

III. STATUS ANALYSIS OF ENVIRONMENTAL EDUCATION IN CROATIA

During the preparation of the National environmental action plan a detailed analysis was made of the filed status of environmental education in the Republic of Croatia [6]. Results of the analysis for different educational levels follow.

A. Preschool and school systems

In the program of upbringing and education of preschool age children are included the objectives and tasks of upbringing and education concerning environment. In the elementary and secondary schools there is no special teaching subject within which the education concerning environment would be carried out but this area is dealt with within different subjects and in the complete activities of the school.

From the subject curriculums of the elementary and secondary schools it is visible that there are mainly generally programmed syllabus contents related to the environmental problems. However the different subjects are insufficiently connected and they follow the traditional division into scientific disciplines which prevents inter-disciplinary work and through this integral understanding of environmental problems. Subject syllabus often lack

topicality of the issues and they insufficiently acknowledge the concept of sustainable development.

B. Science and higher education

At the state level there is no integral program of scientific research on different aspects of environmental protection, and the existing research on environment is mainly disciplinarily directed. Systematic education policies on ecological programs and on sustainability of development for the higher level of education do not exist. In natural scientific and technical oriented studies there is visible lack of cultural-scientific and socio-economic dimensions and in the social and humanitarian oriented studies, the natural-science dimension is insufficiently represented. At the faculties for natural science and at technical faculties, ecological syllabus is taught within the framework of different courses. But for the field of environmental protection and sustainable development it is required to initiate inter-disciplinary and inter-faculty studies at the post graduate level.

C. Problem identification

Knowledge on environmental protection represents resources for rational activities as the lack of knowledge on social and natural processes can become the generator of varied ecological problems. Failure to connect causes and consequences of environmental degradation and the lack of incentives to takeover individual responsibility are the main reasons for irresponsible behavior of the society towards environment.

Different research carried out in Croatian schools and faculties have shown that there is inadequate knowledge on environment and insufficient engagement of students and pupils in the protection of environment [3]. Such results point at the inefficiency of educational programs for raising general level of ecological conscience and necessity to apply the new teaching models. Planning of modern teaching methods and contents requires previous understanding of the reasons due to which the existing system for education and upbringing is not capable to prepare the young population for making ecologically acceptable decisions.

On the basis of the analysis of the status in the field upbringing and education on environment were identified the main problems in the Croatian educational system. Reasons for which there is no continuity of the program course in the process of upbringing and education are as follows: Insufficient new knowledge and expertise of teachers at all levels in implementation of upbringing and education on environment; Disconnection between different segments and sectors of upbringing and education on environment and sustainable development; Insufficient presence of contents concerning environment and sustainable development; disconnection and non-topicality of the existing contents in the teaching syllabus at different school levels; Inadequate level of public perceptiveness in the matters concerning environment, etc [6].

Due to the above stated problems the educational system cannot "produce" sufficient number of future protagonists for the protection of environment and sustainable development. Without changes in the educational basis and modifications of educational process, preschool children, pupils and students will not be motivated for personal participation in the solving the environmental problems. Pupils and students have to through the educational system develop ecological culture which they will apply and transfer to others, and as the future youngest generations can learn easier, the main task is to form their ecological views, opinions, interests and habits.

IV. CHARACTERISTICS OF PRESENT PUPIL AND STUDENT GENERATION

If the educators in Croatia wish to encourage new living habits and behavior which would contribute to the protection of nature and environment they have to adapt their methods of teaching to the pupils and students requirements as well as to the contemporary trends in the methods of knowledge transfer. Because of that it is important to recognize joint properties and characteristics of the present generation of pupils and students.

A. Computer literacy in Croatia

In the contemporary society the ability to use computer technology represent a part of general literacy of each individual. During last decade with the implementation of computer education into educational system, the computer literacy developed in Croatia. Defining and determining teaching contents has been worked on systematically with the tendency of increasing pupils and students capabilities in applying basic tools and skills in the field of computer technology. Computer use, Internet, computer applications and processing data in certain areas and segments of education has resulted in greater level of computer literacy in Croatia.

In December of 2009, the GfK[1] agency in Croatia carried out the research on computer literacy in Croatia [8]. The presentation of some results and insights of the research follow.

In Croatia today approximately half the citizens older than 15, the use of Internet has become a constituent part of life. Functions such as communication, information, services are becoming unthinkable without this media and are making life much easier. Almost 1,3 million of citizens rely on surfing Internet, using electronic mail and around 850 thousands of citizens are users of social networks.

According to data in Table 1 in December 2009, 66% or 951 thousand households have a computer. During the period the number of households owning computer has grown at average rate of 11.9%. In the Central and Eastern European Countries, in front of Croatia is Slovenia with 76%, Austria 72% and Estonia 69%, and then follows Latvia with 65%, Serbia 59%, Lithuania 55%, B&H and Slovakia with 54%, Hungary 51%, Czech Republic 45%, Romania 41%, Ukraine 34%, Bulgaria 31% [8].

[1] Gesellschaft für Konsumforschung (eng. Society for Consumer Research)

TABLE I
CROATIA – COMPUTER OWNERSHIP IN HOUSEHOLDS

Year	%
2000	24
2002	29
2008	54
2009	66

In the population age 15+ the use of Internet has been followed since 1999. Data from Table 2 says that in 1999 Internet was used by only 5% of the population age 15+, and in 2009 the share of the population using Internet has grown by 44 percentage points to 49%. Croatia with its 49% users of Internet in the population older than 15 years is among the average of the CEEC. Internet is mainly used at home, sometimes at work and in the places such as colleges, public institutions and internet coffee places [8].

TABLE II
CROATIA – SHARE OF INTERNET USERS IN POPULATION AGE 15+

Year	%
1999	5
2000	12
2001	14
2002	15
2003	25
2004	34
2005	35
2006	36
2007	38
2008	47
2009	49

Internet access has 57% households. Mainly it is through broadband connections, while cca 19% households still use old dial-up connection. Although most users uses Internet for surfing, most often used Internet service is information concerning daily news and then follows the service of electronic mail and social networks such as Facebook, Twitter or MySpace. In 2008 internet was visited each day by cca 56 % citizens and now this number is higher than 70% [8].

TABLE III
PURPOSE FOR WHICH INTERNET IS USED IN CROATIA

Purpose	%
Information about daily events	28
Electronic mail	19
Use of social networks	19
Use of	14

B. Generation Y

Scientific-technological revolution has determined the contemporary cultural and civilizing environment in which multimedia, information technology and computers have become the component part of life. In such environment has grown up a generation that has specific cognitive ability and educational needs.

Generation Y was born in the period from 1980 to 2000 and represents the name for youth culture to which the use of new communication technologies has become non-omitting part of everyday activities [10]. Generation Y is up to now the most educated one and American statistics say that: 97% owns a computer, 94% owns a mobile phone, 76% uses instant messaging, 15% Internet users are logged 24/7, 34% uses web as the primary source of news, 28% has a blog, a 44% reads blogs, 49% downloads music through p2p service, 75% students has Facebook account, 60% owns some type of portable audio/video device [9].

Croatian generation Y due to the later introduction of Internet, lower standards of living, less content offers and other factors lags behind about ten years, but the basic elements of generation Y are also present in our country. In Croatia among users of Internet there are many pupils and students. In most households that have connection to Internet, online contents are approached mainly by younger population. Pupils and students use different social networks for exchange of information with peers or they use online chat. Some pupils use web for making personal online diaries, for example on web site blog.hr. Beside blogs they write, they also visit web portals, use vide contents available on portal YouTube or play collective games through Internet. Many pupils and students are equipped with MP3 and MP4 players, mobile phones with video-cameras and at home they have collections of computer games and films on DVD media. Unlike the multimedia contents and access to Internet that the young have at home, for tuition are still most often used books, chalk and blackboard or folios for overhead projectors and PowerPoint presentations and Internet/web are insufficiently used. That is why, it is justifiable to ask, what are the educational experiences of pupils and students like in schools and colleges in comparison with multimedia technology they have at their disposal at home?

C. Identification of problems

Although informatics industry advances in huge steps, educational institutions have not developed techniques of teaching that would use advantages of informatics technology development. One of the indicators of this unfulfilled task is the fact that far more space on one typical student's hard disc is taken up by musical data files then the materials connected to the lectures [11]. Students are in general far more safe and relaxed in accepting computer technology than lecturers and they already demand bigger and more sophisticated use of computer technology in teaching and it is to be expected that their needs will grow further. During this time the research institutions accept readily advanced use of computers which is not noticeable at all in the environment in which the knowledge is being acquired. As the education is one of the most important factors for development of ecological conscience of the society its adaptation to the changes that are brought by the new informative age is very important. In order that these adjustments are realized successfully it is not sufficient to change and update contents of the teaching but it is important to introduce the new model of teaching based on informative and communicational technologies. In Croatia have not yet been noted concrete breakthroughs in development of informatics-communicational skills as methodologies of work in gathering information and developing new processes of learning in the field of upbringing and education concerning environment.

V. APPLICATION OF IT IN ENVIRONMENTAL EDUCATION

In 2006, Constantine Aivazidis and Maria Lazaridou from Aristotle University and Gustav F. Hellden from Kristianstad University carried out the research on experimental student groups. In the research was analyzed efficiency of the traditional educational programs on environment and programs based on the application of ICT. Results of the study have shown that on-line approach is more effective than the traditional model of education on environment. Students who were educated by use of web contents have significantly surpassed their peers in knowledge and opinions concerning environmental problems. Research has established that additional use of informative and communicational technologies in educational process on environment can have benefits for the educational curriculum [4].

Some concrete examples on the way in which computer technology can advance upbringing and education on environment follow.

A. Web contents

Internet offers many pages with ecological theme which each student according to his/her interest can select. Most pages motivate students on specific method of work as they contain inter-active contents, educational games, and expert and scientific literature. Internet at the same time represents the source of information and area of teaching as it enables application of different methods and contents. Lecturers must instigate the need for knowledge on ecological problems and promote independent study pointing their students to the appropriate web addresses. Dependant on the level of education there are different ecological-educational interactive pages that could be incorporated into the formal educational program.

For example, for pupils in elementary schools, Google Earth website is appropriate. This website gives pupils instructions on how to collect and analyze data on local ecosystems and natural characteristics of their localities. Pupils can share the results of their research with other pupils around the world or see what the other pupils were doing in the field of ecosystem research. As majority of schools is equipped with computer classes and connected to Internet, teachers can during lessons organize thematic electronic trips. Through participation on these trips pupils can, by using computer, learn about ecosystems, food chains, environment and ecological problems of different areas which they would not in the normal circumstances have opportunity to visit. Electronic trips are very practical as children that live in urbane conditions have rarely opportunity to visit natural parks and see the flora and fauna species in their natural habitat. Page that could be interesting to students and pupils of the secondary schools is www.global-vision.org as it offers a handful of educational material related to upbringing and education on environment. There are also links to different films, books and video spots with ecological themes as well as interviews with famous scientists, activists and ecologists.

B. Video conferences

In 1999, few professors at Washington University initiated the program titled Youth Network for Healthy Communities (YNHC). The aim of the project was to encourage professors to include their students in research on health implications of ecological problems and via video conferences to exchange the results of their research studies with experts proficient in the said problems. Professors that decide to participate in this project have to apply and register their group of students after which they are given the guide for participation in this project. Before the start of the research itself, professors and their group have to go through a cycle of training. Trainings are carried out by one hour video conferences during which students surmount research methodology and get to know the possibilities of video conference applications. After training students elect a local problem that they wish to study and they have six weeks available for research and preparation of presentation. At the finals a video conference is organized during which students present their research results to other groups of students and evaluation team which consists of university professors and ecological experts. The experiences up to now have shown that the students react positively to this form of integration of technology into educational process as all the teams are extremely motivated during the research and presentation of their work [4].

C. Vision of education on environment in 2020.

Dr. Colette Murphy (School of Education Queen's University) has suggested guidelines for development of the system of upbringing and education on environment. In her vision the potential of computer and communication technologies in resolving ecological problems is especially emphasized [1].

So Dr. Murphy forecasts that in 2020 each school will be organized as the center for the protection of environment. Local participants for the protection of environment will meet with teachers and pupils in order to resolve ecological problems. All schools will have sophisticated computer and communication technologies and computer literary pupils who will know how to transform their ideas into concrete actions. Each school will collect and keep data on different local projects which will be available to other schools and interested groups. Schools will integrate into unique whole network system which will represent the platform for detailed monitoring and testing of process in the environment. In today's educational system pupils and students feel helpless and discouraged to change their behavior but in 2020 the integrated students will through small local projects initiate positive effects and add to global changes.

VI. CONCLUSION

Environmental education develops and strengthens the ability of individual to critically asses and makes decisions in aid of preservation of natural and material environment in which we live. Education can speed up the progress in the method of thinking in pupils and students and instigate them to make our world safer, healthier and more advanced. In the world of global changes and technological advancement, the modern education on environment must be based on new, user accessible models of knowledge transfer which implies the implementation of modern computer and communication technologies. Although numerous researches confirms high efficiency of acceptance of knowledge through the use of modern educational technologies they are still not, in the educational system of Republic Croatia and therefore neither in education in the field of environmental protection, used sufficiently. Realization of objectives for the protection of environment and sustainable development in different educational program requires introduction of contemporary educational concept which is based on the new role of professors and students. Professors should organize and conduct distribution of educational materials, contents and new techniques of learning through the use of IT. Modern methods of education will encourage students to become active participants in environmental education.

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