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The Role of Higher Education in Developing Awareness about Water Management

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Abstract. The Faculty of Civil Engineering as a component of the University of Rijeka is contributing to the promotion of sustainable development principles and awareness about environmental protection problems in the local community with organizing different types of activities. These activities mostly include lectures and workshops held by teachers and students that involve education and raising the awareness about sustainable development and environmental protection especially in the important area of water resources management. The involvement of students in these activities helps in developing students' professional knowledge and skills but also their generic and transferable skills, which are very important especially for those students that will on day become experts in water management.

Keywords: Water resources, sustainable development, education, public participation

1 Introduction

Water is one of the limiting factors for life on Earth therefore it is necessary to manage it conscientiously for ensuring enough reserves of good quality water for the future. It is an imperative that awareness of the value of water and water management is developed through all generations starting from pre-school age.

Sustainable development includes the integrated water management approach that can not be accomplished without public participation. The importance and the obligation of public participation in the water resources management, as well as guidelines on methods for successful public participation are published in many international and national documents and incorporated into legislation [4],[6],[7],[8],[9],[10]. From

these documents it is obvious that the education of the public about water related issues and its preparation for the water management is necessary to assure its active participation in the water management in everyday life. This should also prepare them to take participation in more complex activities like creation of complex plans and projects such as river basin management plans, water supply or sewage systems projects, irrigation plans etc.

The University of Rijeka in its Strategy for the period 2007-2013 has made a commitment to make a contribution to sustainable development principles promotion and raising awareness about environmental protection problems in the local community [5].

The Faculty of Civil Engineering supports the University Strategy and contributes to the accomplishment of these aims. In line with the University Strategy, the Faculty of Civil Engineering has independently implemented many different types of activities (mostly lectures and workshops) in last ten years. Through these activities teachers and students are involved in educating the public about sustainable development and environmental protection importance especially in the area of water resources management. These activities of the Faculty of Civil Engineering in Rijeka will be presented in the paper as examples of good practice for developing public awareness about water and water management.

2 Education of the Public about Water and Water Management- Examples from the Faculty of Civil Engineering in Rijeka

Universities were traditionally primarily recognized as places of research and production of knowledge. In the last decades the focus of the Higher Education is not only on the knowledge but also on the recognized need for students to develop transferable skills in the process of learning.

Civil engineers must be educated in a way that assures the development of different skills. These are the understanding of the interaction between technical and environmental issues and ability to design and construct environmental friendly civil engineering constructions, take care of the safety of their structures and understand the impact of their solutions in a global and social context [11].

At Civil Engineering Faculties in Croatia, students are educated in different aspects of water management and engineering and some of them after graduation become experts in this area. In the last few years the Faculty of Civil Engineering of the University of Rijeka has been very active in this area through curricular and extra-curricular activities for teachers and students. These promote the importance and value of water resources as the foundation of sustainable water management through different levels of education from pre-school and elementary school to higher education, and also to the wider public. The activities include: organizing workshops related to water management problems (water characteristics, the water cycle, water usage, water resource protection etc.) by students and teachers for pre-school and elementary school children. Also popular public lectures are given by teachers during important public events (e.g. University of Rijeka Science Festival) and specific dates like World Water Day on 22nd March or Earth Day 22nd April.

2.1 Education of Pre-School Children – Workshops in Pre-School Institutions

The Civil Engineering Faculty of Rijeka organises different programmes for pre-school children with the aim of developing children's conscience about importance of water and water protection. At workshops children are involved in different activities and games in the way that they can recall what they already knew about water and than be able to learn more about it. Workshops are organized and conducted in collaboration with pre-school teachers on the basis of their own initiative or on the initiative from Faculty teachers.



Fig. 1. Workshop in a pre-school institution in 2005/06: a) the team, b) sewage system and waste water treatment plant model, c) the inflow of the *waste water* (water with sand and earth) in the model, d) part of the model showing the disposal of water after treatment in the *sea*, e) and f) showing picture-books to children

During the academic year 2005/06 students from the hydrotechnical engineering study programme prepared different educational materials and organized a workshop in one of the pre-school institutions (*Sea gull*) with the aim to: develop children's

awareness of the importance of responsible water usage in every day life, teach them about water supply and sewage systems and waste water treatment plants (Fig. 1).

The educational material mostly made by students consisted of picture-books, PowerPoint presentations, as well as a hand-made model of a simplified waste water treatment plant constructed with materials that children use every day and also recycled materials. The project was beneficial for both children and students. It showed that generational boundaries and differences can be removed easily when dealing with common problems and interests. It also showed that students can easily transfer their knowledge to others. Students succeeded in teaching children about water supply and waste water systems, waste water treatment plants, the importance of water rational usage and protection, and in the same time they developed some very important generic and transferable skills and competencies like: capacity to adapt to new situations, simple description of complex engineering problems, ability to work in a team, interpersonal skills etc. At the end of the project the students felt particular satisfaction with participating in a project with an additional social value and expressed willingness to participate in similar programmes again in the future.

During the academic year 2007/08 collaboration with another pre-school institution (*Dolphin*) in Rijeka city was established. As a part of the project, Faculty professors and assistants in coordination with pre-school teachers conducted an educational workshop about water and its importance. The first part of that workshop was a short presentation which showed different types of water resources (rain, lakes, rivers, sea) and explained the importance of water through educational pictures and films. In the second part a different material, like coloring-picture-books and funny labyrinths (all about water), were used to apply what they have learnt before.

2.2 Education of Elementary School Children–Workshops in Elementary School Institutions

Workshops related to water in elementary schools include short lectures given by Faculty teachers and showing a short film about water as a habitat for many animals, the importance of preserving clean waters in lakes, rivers and seas. All this aimed to stimulate children interest for this problematic so that they start to ask questions, discuss, find and suggest solutions for preservation of clean water and environment. These kinds of workshops were held in local elementary schools Ravna gora (2001), Srdoci (2003) and Fran Frankovic (2009) usually in connection with the World Water Day date.

Students of the hydrotechnical engineering study programme at the Faculty, in the academic year 2007/08, motivated by success of workshops in pre-school institutions given by earlier generations decided to get involved in the *Science festival 2008* in Rijeka that was devoted to the topic of *water*. Their participation included organizing a workshop in a local elementary school *Podmurvice* for 10-year old children [1]. Workshop topics were: hydrologic cycle, water properties (experiments about water density, surface tension, etc.), rational use of water, water and environmental protection (Fig. 2).



Fig. 2. Workshop in an elementary school 2007/08: a) the team with the poster in the back, b) classroom during the workshop, c) experiment (water density), d) hydrologic cycle, e) solid waste sorting, f) waste water treatment (filtration)

A big part of the workshop was organized through experiments with water using materials that are used in everyday life (water, salt, colour, paper, eggs, etc.). The problematic of water and environment protection from pollution was elaborated through examples of solid waste sorting and disposal in appropriate containers, making of simple filters for waste water treatment etc. Also a computer simulation of the hydrologic cycle was used. Students prepared a poster about the things that they did during the workshop and donated it to the class. They also donated all the material and instructions used for the experiments so that elementary school teachers could repeat all that was done in the workshop with other classes in the future.

The result was the same as for the generation before: satisfaction that they did something important for the others. Importantly, they also developed new skills and competences themselves.

The Faculty of Civil Engineering was also involved in creating a hand-book about water that includes many information about water resources in general and also about

water resources in the surrounding area (local rivers, lakes, the Adriatic sea), hydrologic cycle and water protection, with instructions for many experiments with water that can be done at home, guidelines to preserve the quantity and quality of water, links to interesting web-pages etc. [3].

2.3 Developing Public Awareness – Public Lectures

Primarily task of university teachers is to teach undergraduate and graduate students. However, they can use their knowledge and teaching skills to educate pre-school children, elementary-school and high-school pupils and the public in general, all at different levels.

During 2008 within the already mentioned *Science festival* in Rijeka teachers of the Faculty of Civil Engineering held two lectures *Water: the source of life* and *The Ecosystem of the Rijeka Bay* [1, 2]. Both lectures were held with the aim to raise public awareness about the importance of water and clean environment for the future, to stress everybody's responsibility for the protection of the environment and that all people can and should be involved in water and other natural resources management.

2.4 Internationalization of Water Management Issues-Collaboration with Geography Students from Lancaster University, UK

The Faculty of Civil Engineering of the University of Rijeka has for five years collaborated with the Lancaster University, UK in delivering a field course *Water and environmental management in Mediterranean context*. The emphasis of this field course is on the management of water-related resources. The course features a combination of field trips and visits to provide understanding of the socio-economic and environmental context of two counties (Istra and Primorsko-goranska), presentations and site visits by the Croatian water authority staff, research into environmental problems in and around water bodies and research on human aspects of water and environmental management.

During the eight day trip, students gain insight into the present water management challenges and how these might be addressed, appreciation of the influence of a Mediterranean climate on the water resources and changes that might be expected in the Northern Europe given the northward migration of climatic zones due to global warming. This course develops skills such as competence and confidence of using range of different fieldwork techniques, data collection, analysis and working and presenting in a teamwork environment. Most of all, students gain experience of the distinctive environmental, cultural and socio-economic nature of the Istrian peninsula by speaking to representatives from the water agency, water companies, pupils in schools and inhabitants of villages that they visit.

While during previous visits, students from the Faculty of Civil Engineering in Rijeka contributed passively to this field course by attending final presentations from Lancaster students on outcomes of their research, they took an active role during the last visit in April 2008. Five of final year students from Rijeka joined Lancaster students in interviewing inhabitants of village Lovranska Draga about their water usage

habits (Fig. 3). The village is still not connected to the main water supply system and households are using a traditional water supply from an underground storage of rain water called *cisterna*. They were also asked about their expectations and changes to their current water usage habits when they obtain water from the main water supply system. These social aspects are important to take into account when designing water supply systems and hence it was beneficial for the engineering students from Rijeka to learn about these different aspects related to water supply. At the same time, students from Lancaster could learn about engineering challenges in designing and providing water supply. Also, Lancaster students learned about traditional sustainable water supply that could be implemented as primary or additional sources of water supply in other areas. All of them learned that the water consumption increases with provision of water through pipeline systems and that this needs to be taken into account in design of water supply and management of water resources. All of students had a chance to practice their interviewing and team working skills, while students from Rijeka had also a chance to practice their English language skills.



Fig. 3. Geography students from Lancaster University interviewing pupils in the elementary school *Viktor Car Emin*, Lovran (left panel) and habitants of Lovranska Draga (right panel) in April 2008

3 Conclusions

Today we must all be aware that the sustainable development is the only possible way to live and work in accordance with the environment. In this sense it is very important to educate the public about it. Water resources management is just one part of the sustainable development. The Faculty of Civil Engineering of the University of Rijeka has found different ways to contribute to the development of the awareness about water issues, the importance of public participation in the water management in the local community and wider by educating the local population about this topics.

At the same time the changing conditions in which students will live and work are forcing universities and faculties to adjust and respond to different social needs instead of *just* teaching students their disciplines. These changes are influencing engineering higher education in different ways too. Besides developing engineering knowledge and skills engineering studies are obliged to develop student's social

awareness, awareness about environmental issues and understanding of the interaction between technical and environmental issues in order to assure sustainable development. These demands can not be answered without bringing changes in teaching and learning processes. The main change is that students have to be active participants in the learning process. The Faculty of Civil Engineering in Rijeka is trying to find different ways to assure this activity. Collaboration with pre-schools and elementary schools in which students and younger teachers are involved as well as active participation of professors in different public projects dealing with environmental protection showed good results.

At the end it can be concluded that participation in different projects helps students to develop professional competence in water and environmental management and also some of important generic and transferable skills. At the same time both students and teachers contribute to developing the awareness of the importance of water resources and sustainable water management (especially in the segment of water saving and protection), because only the active involvement of the public in water management can improve it in the future.

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