INFO-2065 UDK: 37:543:502
Primljeno / Received: 2012-01-16 Stručni rad / Professional Paper

# NEW EDUCATION MODEL FOR INFORMATION MONITORING OF ENVIRONMENT WATER FLOWS

# NOVI MODEL OBRAZOVANJA ZA INFORMACIJSKI MONITORING OKOLIŠA VODENIH TOKOVA

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*Abstract*
Water is not a commercial product, but the legacy that we must honor and protect. The global water problems led the European Parliament to adopt a coordinated water policy in the EU Member States. On December 22nd 2000 entry into force of the European Parliament and Council n.2000/60/EC establishing a framework in the field of water policy, called the Water Framework Directive. The Directive provides a legislative framework for the introduction of a single water policy in the EU. According to the requirements of the Directive member states must make the identification of anthropogenic impacts on the status of surface waters and introduce monitoring programs for surface water. Teachers and students at the Catholic University are actively involved in monitoring streams. As part of ongoing learning project where students learn the methodology used for monitoring rivers.

*Sažetak*
Voda nije komercijalni proizvod, već naslijeđe koje moramo poštivati i zaštititi. Globalni problem vode doveo je do usvajanja koordinirane politike o vodi u državama članicama EU. 22. prosinca 2000. Stupila je na snagu direktiva n.2000/60/EC kojom se uspostavlja okvirna politika voda, nazvana Okvirna direktiva o vodama. Direktiva daje zakonski okvir za uvođenje jedinstvene politike voda u EU. Prema zahtjevima Direktive države članice moraju utvrditi antropogene utjecaje na stanje površinskih voda i uvesti nadzor programa za površinske vode. Nastavnici i učenici na Katoličkom sveučilištu aktivno su uključeni u praćenje tokova vode. Kao dio projekta u tijeku učenja, studenti uče metodologiju za praćenje rijeka.

**Introduction**
Environmental education started to develop in the 70s of 20th century in North America and in Western Europe in connection with the discussion on problems of the environment. On the International Conference which was held in 1977 in Tbilisi (Georgia), environmental education has been defined as follows: *"Environmental education is an educational process that increases knowledge and awareness of people about the environment and related issues, develops the skills and expertise necessary to the solution of the tasks. It supports the attitudes, motivation, and, in particular, the responsibility for the state of the environment."* Environmental education is one of the cross-cutting themes that are the content of education according to the State educational programme. Cross-cutting themes are an important element in education and participate in shaping and developing core competencies particularly in the attitudes and values, which can be integrated into content areas and learning in individual subjects. Shall be implemented as a separate subject in the elective hours or as a project or course. The state school environmental education program is seen as a means to some extent, can influence the environmental behavior and feelings of students.

The goal is generally a positive contribution to the development of personality. The student should understand and evaluate the relationship between man and his environment based on knowledge of the regularities governing life on earth. Environmental education leads students to a comprehensive understanding of the interrelationships between organisms and man's relationship to the environment. This is especially the development and understanding of the necessary transition to sustainable development of society, which allows you to watch and be aware of the dynamically developing relations between man and environment.

In the framework of the national education programme ISCED2, for the implementation of environmental education are involved in several educational fields: cross-sectional topics

- Educational Area **Nature and Society** - provides a comprehensive elementary view of the surrounding nature and environment. They learn to observe, evaluate and sensitive to people's conduct in relation to the environment. The maximum use of direct observation of students surrounding environment, which significantly affects the emotional personality of the individual site.
- Educational area **Man and Nature** emphasizes understanding the objective of the basic natural laws. The status of man in nature and function of complex ecosystems in relation to human society /**1**/.

The Department of Biology and Ecology, Faculty of Education at the Catholic University students while studying biology address several environmental projects. In this paper we present one of the project, which focuses on chemical and biological monitoring of small water flows in Slovakia. Monitoring was carried out on the river Revúca.

**Methodology**

The objectives of monitoring are:

- understanding the current state of water systems in terms of quantity, quality, and their distribution in space
- determine the trend of the characteristics of water systems, protection and utilization of their forecasts.

Implementation monitoring is divided into several phases:

Phase 1 - selection of water flow and subsequent selection of sampling points for water flow.

Phase 2 - field sampling methods prescribed.

Phase 3 - Processing and analysis of samples in the laboratory.

Phase 4 - evaluation of data and their interpretation.

Within the monitoring methodology, students combine chemical analyzes and biomonitoring methods. The advantage of chemical analysis is accurate detection of the current state of pollution and the contents of individual elements in the waters. The advantage of biotic monitoring compared with chemical analysis of the long-term monitoring of water quality and changes made as concise picture of the ecological state of flux. Living organisms respond sensitively to the extremely wide range of pollution, therefore the biological indices reflect the average biological condition of water flow.

Biomonitoring by the BISEL method:

In Belgium, in 1978, the Ministry of Health called. Belgian biotic index (Biotic Index at Secondary Education - BISEL) for determining water pollution through the representation of certain species of invertebrates in the samples taken, which allows you to monitor the status of long-term clean water, while chemical analysis can detect only the current state. As the program became the base for all European Union countries that the results of bioindication flowing waters of comparison. Trent England is a combination index (1964) and French biotic index of diversity (1968). By combining the advantages of both indices was just the Belgian biotic index, which is also supported by non-governmental organization Green Belgium.

Sampling of biological material is carried out by standard methods of Hydrobiology. To achieve comparable results, the sampling time set for the cover 10 to 20 meter stretch of stream. Established, standardized sampling time is 5 to 10 minutes. We used a hand network on a metal frame (Fig.1).

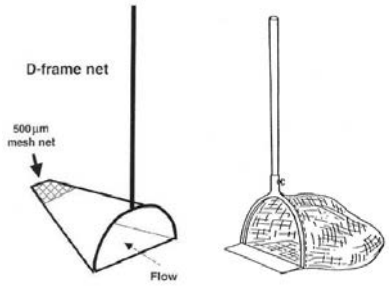


Fig.1: The network for sampling benthos.

The calculation of the biotic index is done by BISEL resulting table (Tab.1). The vertical columns in the table is given the sensitivity of taxa present (II.) and number of taxa present (III.). The horizontal distribution of tables, individual rows can be found in bioindication groups ranked from 1 to 7, according to their decreasing demands on the environment, respectively. increased resistance to pollution of their environment. The most sensitive group of Plecoptera, Trichoptera and Ephemeroptera found in the upper table rows (1, 2, 3). Species with greater tolerance to environmental pollution Tubificidae, Syrphidae; Eristalinae find the bottom line of the table. Column IV. - Total number of taxa, we evaluate the diversity of taxa present in the sample. The field in the table which penetrate corresponding column (the total number of taxa found) and the corresponding line (for the presence of the most sensitive indicator) gives us the final biotic index for flow sampling site. We coose the table row according to the most sensitive indicator of the presence of animals found in our sample.

Tab.1. *Values for BISEL*

| I Indicator goup | II Body | III quantity | Number of taxons | | | | |
|---|---|---|---|---|---|---|---|
| | | | 0 - 1 | 2 - 5 | 6 - 10 | 11 - 15 | ≥ 16 |
| Plecoptera, Heptageniidae | 1 | ≥ 2 | - | 7 | 8 | 9 | 10 |
| | | 1 | 5 | 6 | 7 | 8 | 9 |
| Trichoptera v schránke | 2 | ≥ 2 | - | 6 | 7 | 8 | 9 |
| | | 1 | 5 | 5 | 6 | 7 | 8 |
| Ancylidae, Ephemeroptera | 3 | ≥ 2 | - | 5 | 6 | 7 | 8 |
| | | 1 - 2 | 3 | 4 | 5 | 6 | 7 |
| Aplexocherus, Mollusca, Gammaridae, Odonata | 4 | ≥ 1 | 3 | 4 | 5 | 6 | 7 |
| Hemiptera, Sphaeriidae, Asellidae, Hirudinea | 5 | ≥ 1 | 2 | 3 | 4 | 5 | - |
| Tubificidae, Chironomus thummi-plumosus | 6 | ≥ 1 | 1 | 2 | 3 | - | - |
| Syrphidae-Eristalinea | 7 | ≥ 1 | 0 | 1 | 1 | - | - |

Biotic index values range from 0 to 10, with higher biotic index values indicate the presence of more sensitive taxa in the sample. The highest number of biotic index (10) shows a very good water quality, respectively. for absence of contamination. As the biotic index value decreases, thus reducing the water quality. For comparability of the resulting biotic indices to the standard classes of water quality, biotic index values are color-coded table. Ten biotic index values can be divided into five classes of water quality (Tab.2). If the biotic index value is 0, then it is a dead water, which is called the black color code. This value shows an absolute lack of bioindication groups.

Tab.2: *Classes of water quality.*

| **Class of water quality** | **Verbal assessment of water quality classes** | **Colour coding classes in map output** | **Suitability for use** |
|---|---|---|---|
| **I. class** | very clean water | light blue | usually suitable for versatile use, water use, food, recreational use, farming of salmonids, has a large landscape feature |
| **II. class** | clean water | dark blue | usually appropriate for most uses, water uses, fish, water sports, a landscape feature |
| **III. class** | polluted water | green | usually appropriate only for industrial water supply, conditionally usable for the purpose of water supply in the absence of better water quality (need a multi-treatment), a small landscape feature |
| **IV. class** | heavily polluted water | yellow | usually suitable only for limited purposes |
| **V. class** | very heavily polluted water | red | usually not suitable for any purpose |

Determination of pollution by chemical analysis

Chemical analysis of water shows how the chemical composition of the examined water samples taken at some time in a certain place. At each sampling point we measured the pH, salinity, dissolved oxygen, conductivity and collected water samples of 1 l. The samples are then processed in the laboratory. Emphasis was placed for rapid processing of samples. Each sample was processed within 48 hours.

In the analysis of water, we focused for detection of pollution by organic substances. Given the parameters we investigated the conductivity method and determining the chemical oxygen demand manganometric by Kubela.

**Chemical Oxygen Demand (COD)** is defined as the amount of oxygen that under specific conditions and uses the oxidation of organic compounds in water, a strong oxidizing agent. It is measured as the weight of oxygen, which is equivalent to an oxidizing agent, for one liter of water, usually in mg.dm-3. It is therefore a measure of total organic compounds in water and thus an important indicator of organic pollution of water. The value of COD is an integral part of any analysis of all water types /**2**/.
Surface waters are classified into five classes of purity (Tab.3) /**3**/. According to our results of water from all sites can be classified into first class purity, which means that the water is very clear (Tab.4).

Tab.3: *Classes of purity of surface water for the oxygen content*

| | | | | | |
|---|---|---|---|---|---|
| purity classes | I<br>very clean water | II<br>clean water | III<br>polluted water | IV<br>heavily polluted water | V<br>very heavily polluted water |

| | | | | | |
|---|---|---|---|---|---|
| $COD_{Mn}$ ($mg.l^{-1}$) | <5 | <10 | <15 | <25 | >25 |

Tab.4: *Oxygen consumption of individual examined sites*

| number of samples | locality | * | $COD_{Mn}$ ($mg.l^{-1}$) |
|---|---|---|---|
| 0 | blank | 0,18 | 0 |
| 1 | Revúca | 5,46 | 4,224 |
| 2 | Revúca | 3,36 | 2,544 |
| 3 | Revúca | 3,16 | 2,384 |
| 4 | Liptovská Revúca | 0,92 | 0,592 |

* consumption of the solution $KMnO_4$ (ml)

**Conductivity** represents the amount of dissolved solids and is used to estimate the degree of mineralization. Cond is electroanalytical method, which determines the electrical conductivity or resistivity electrolyte. It is based for the relationship between electrical conductivity of the electrolyte and its concentration. The actual measurement of conductivity and salinity was held on 31st Nov. 2011 in the laboratory using a device INOLAB - Terminal 740 (Tab.5) /**4**/.

Tab.5: *Salinity and conductivity of water for localities*

| number of samples | locality | sample temperature (°C)* | salinity | conductivity 1(μs/cm) |
|---|---|---|---|---|
| 1 | Revúca | 11,1 | 0,1 | 274 |
| 2 | Revúca | 11,6 | 0,1 | 281 |
| 3 | Revúca | 16,3 | 0,1 | 318 |
| 4 | Liptovská Revúca | 15,4 | 0,1 | 312 |

* water temperature at the time of measurement

**Conclusion**

Environmental training urgently calls for broadening and deepening of direct contact of children with nature. The pursuit of maximum use of direct contact with nature, work with living products of nature and the direct observation for habitats should be a prominent feature of environmental education. Skills and habits acquired in field exercises and excursions with nature themes directly in the nature of the region is not an adequate substitute for a classical education in the interior of the school, but are an essential form of education, especially for knowledge concerning the natural elements, links and events in nature. Addressing the many teaching issues and problems is impossible without scientific investigation. The research work used the method of vital importance for a particular teacher's daily work. An important aspect of environmental education

and education is the inclusion of practical environmental activities into teaching. It is necessary that the teacher used the resources, which are based on children's curiosity and use their imagination and spontaneity, and also to create space for meaningful activities in which students have the opportunity to examine and evaluate the phenomena of the immediate environment /**5**/.

Project monitoring is based on the need to increase environmental awareness and the need to inspire future teachers to create and use effective environmental education in the learning process. It responds to the nationwide problem of inadequate links theoretical learning and practical experience. Within the solutions to the environmental project, the students at regular monthly intervals sampled and measured the basic ecological parameters of water flow and monitor illegal dumps. Students have learned during the project the methodology of monitoring water flows and methods of chemical analysis. They compiled the data map of pollution of water flow. The sampling location maps added are labeled and color-class water purity according to Tab.2. Pleasing is the fact that the entire flow of the river belongs to the second degree.

**Acknowledgements**

*Contribution was supported by scientific grants awarded by the Scientific Grants Agency of the Ministry of Education and the Slovak Academy of Sciences VEGA 2/0068/10*

*Notes*

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