BIO-ENVIRONMENTAL EDUCATION THE LITHUANIAN EXPERIENCE

Dr. Vitalij Denisov
Department of Applied Mathematics
Klaipéda University
Lithuania

Dr. Sergej Olenin
Centre for Systems Analysis
Klaipéda University
Lithuania

Lithuania, one of the three Baltic States that recently gained independence, is on the way to deep, cardinal reforms in its economic, social and political life. Perhaps the first priority in this process of fundamental change should be given to reforming the educational system. The new educational system currently being developed is oriented both toward common European cultural values and to the education system practised in democratic Lithuania. It is based on its national background and traditions but, also seeks to join the modern European cultural environment.1

Bio-environmental education starts in the early school years. Creating environmentally-educated students is one of the priorities of school reform. This is to be achieved by integrating all types of biology and scientific subjects and field projects throughout the school years.2 Three stages in the formation of an ecologically-minded mentality may be differentiated here:

- Grades 1-4 are developing an awareness of the natural environment by means of the introductory subject "The World Around Me," literature, excursions, field work on school grounds.
- Grades 5-9 receive more detailed understanding of the environment when studying fundamental subjects such as botany, zoology, geography, biology and chemistry. A new course called, "The Earth as Man's Home," for grades 5 and 6 was introduced in 1993. It provides an eco-geographical orientation and plays a key role in teaching ecologically-minded behaviour.
- Grades 10-12 study the rational behaviour concept. The new ecology course for grade 10 offers a methodological background to understanding the interaction of civilisation and biosphere, the co-evolution concept, anthropogenic factors and pollution, and ecological status assessment. The new syllabus for general biology, genetics and chemistry deals with these concepts as well.

Information technology (IT) in the school curriculum. By the end of the 1980's a special information-technology course was introduced in grades 10-12. The course starts with basic principles of computer arithmetic and logic, gives an introduction to computer elements and devices, and covers algorithm construction methodology and programming. Because only a small number of schools are now equipped with computers, the course is theoretical rather than applied.

Environmental studies in higher education. All Lithuanian universities are currently training students in environmental sciences. They offer three categories of graduate degrees. It takes four years to receive the Bachelor's Degree and one more year for a Master's Degree. The Ph.D. programme usually takes at least three more years. As a rule, undergraduate courses include the fundamentals of biology, mathematics, physics, humanities and pedagogical psychology courses. The content and structure of the curricula, however, tend to vary according to the university.

Vilnius University, founded more than four centuries ago, preserves the old traditions in teaching biology. Environmental studies there are all biology-based. At Kaunas Vytautas Magnus University, a similar model of environmental education is adopted. At the biology facility of the Vilnius Pedagogical University, students major in one area of science and minor in another. The interdisciplinary environmental approach joins biology with one other closely related science such as chemistry or agriculture. The Technical University of Kaunas also offers a specialisation in industrial ecology. Biology and ecology students of the universities mentioned are provided with an introductory computer science course. The course, however, does not deal directly with bio-environmental studies.

Curriculum Development at Klaipéda University

The University of Klaipéda is the newest higher education institution in Lithuania. It commenced educational activities in 1991. The University became the leading academic institution in Western Lithuania from the very start, as it was formed out of local departments of other higher educational and research institutions. As a result of the successful implementation of the computerisation program, the University is comparatively well-equipped with computers for educational purposes. Currently, the University of Klaipéda is the only institution of higher education in Lithuania where the group of compulsory subjects for students of all specialisation's also include computer science and an initial

course in ecology.

Table 1. Typical tasks and supporting actions for a specialist in environmental sciences

Activity Stages (typical tasks)	Traditional Way	Computer - oriented Approach	Required Skills and Experience
examining the situation and defining the problem	literature search	dialogue with information system and model formulation	basic knowledge in computer science
framing the system studied	verbal description	model construction	mathematical modelling, programming
experimenting	experimental set-up and control, data interpretation	scenario construction, automatic computer simulation	mathematical statistics, biometrics, simulation
data processing	simple methods	complex statistical methods	mathematical statistics
data storage, access	paper	database with user friendly interface	database
interpretation of results	literature search	dialogue with informational system, model validation	mathematical methods
discussion and documentation	oral presentation, written documentation	text and graphic processor, tele-communications	computer operation
decision making	consultations	expert systems, simulation	basic knowledge in mathematics

Development of the Bio-Environmental Specialist Model. As the newest higher education institution in Lithuania, the University of Klaipéda provides a good opportunity to adapt up-to-date education technologies to the conservative, rather than flexible, natural science curricula described above. In 1991, after the new Faculty of Natural Sciences was inaugurated, the process of bio-environmental curriculum development was initiated. In order to set up the aims and content of the curriculum, a model of the future specialist was formulated.

The first stage of the model specialist's development is confined to a description of the basic abilities and skills necessary to solve typical problems, forming the basis of the specialist's future professional activities (Table 1). These typical tasks were identified and formulated, analysing specialists' work in the field of environmental protection and ecological monitoring, environmental education and research.3

Having identified the basic skills and knowledge required to undertake these typical problems, it was possible to formulate the requirements that the modern bio-environmental specialist must meet. It was concluded that a graduate, in addition to possessing the fundamental knowledge, is supposed to:

- have good and up-to-date knowledge in the field of computer science
- be able to use database, information and telecommunications systems
- read information while the experiment is going on
- master the biometrics methods
- be able to use and work out simulation models

However, the identification of skills and abilities was only the first step in the model development. The second stage included a development of the basic curricula by introducing the courses that teach the abilities and skills identified at the first stage. Although the university's computerisation programme began at the same time, the following essential problems appeared that made it difficult to realise this ideal model:

- methodological. Even among groups of experienced teachers and scientists the lack of experience in the field of computer application makes it difficult to support and enhance the learning process.
- technical and financial. The hardware needed is very expensive. The modern educational software items require PC's compatible with IBM's 386 or higher models, and presuppose a Windows 3.1 environment.
- availability. The educational software market is not formed yet in Lithuania and the number of educational programmes translated into Lithuanian is next to none.

Upon analysing the situation, it became clear that intensive curricular use of Information Technology would only be made possible through international co-operation with the appropriate universities and institutions of the European Union.

Computer-based Environmental Studies in Lithuania: a TEMPUS-Project

The Trans-European-Mobility Scheme for University Studies (TEMPUS) is one of the programmes introduced by the European Union to assist in the development of Central and Eastern Europe. It was the above curriculum model that generated the intention to develop a TEMPUS project like Computer-Based Environmental Studies in Lithuania.4 The European Union-funded project began in 1993. The project proposal was based on the curriculum model mentioned above and on the organisational structure already proven in Bulgaria within the framework of the COBES-Bulgaria project (JEP 1674). Co-operation takes place between ten partners from five countries; the management partners are: Orfeus, Denmark (contractor); the University of Klaipéda, Lithuania (co-ordinator); King's College London; UK; and IPN, Kiel, Germany. This project links up with TEMPUS and other European and world-wide projects, such as GREEN,5 CoastWatch and CERESDATA.4 The project aims to:

- improve the interdisciplinary environmental curricula for both secondary schools and universities
- establish support centres at Klaipéda and Kaunas Technological Universities (the second Lithuanian partner)
- organise a national educational network for environmental data exchange, and link the national network to an international network of educational specialists who have expertise in environmental issues
- adapt educational materials, both textbooks and software, that are relevant to environmental studies
- develop new courses nationally
- increase student awareness of environmental issues and link theoretical study with practical monitoring, particularly of river and marine water environments

Thus, the end products of the project range from improved curricula and teaching materials - leading to more qualified specialists in environmental sciences - to establishing training centres and environmental data networks. All the project activities are organised according to the following three main tasks of curriculum change, software development and river monitoring (Table 2). The key elements, in the process of project implementation, are working conferences. As the area of investigation is interdisciplinary, the project team involves both staff and students from different traditional disciplines. That is why apart from the activities within the tasks mentioned, the main objective of these conferences is to establish effective relationships between partners and participants, to bring together their ideas and experience in order to form a common vision of the project goals and to link the project by common efforts.

Information technologies are used to facilitate monitoring, data-handling and exchange. Practical introduction of IT into environmental curricula includes: a) an introductory course in computers, as a practical tool, for basic everyday tasks such as word processing, data representation and calculations, and drawing; b) the use of database and data exchange software tools; c) an optional course in problem solving with practical PASCAL programming; d) modernisation of the specialised courses, such as Environmental Monitoring, Biometrics and Meteorology, based on the relevant software.

Acquaintance with software available in the European educational market is followed by selection of the potential packages, and their adaptation and modification. The experience gained should be used for producing original Lithuanian educational software items. The task for the final phase is to form the kernel of an educational software development team in Lithuania. The river monitoring activities are planned as an action research programme which covers the main phases of any ecological investigation, namely:

- familiarisation with the matter, defining the environmental problem
- field work in the natural environment, sampling and data collection
- presentation of results, their interpretation, identification of possible causes
- establishment of an action strategy and understanding the changes needed in a local society to turn it toward sustainable development

Table 2. The main tasks of the TEMPUS project

	Task 1	Task 2	Task 3
	Curriculum change	**Software development**	**River monitoring**
Year 1	Analyse and improve curriculum	Look at existing software	Pilot monitoring
Year 2	Try out new curriculum	Adapt/convert software	Establish support centre and environmental network
Year 3	Internationally accepted degree	Produce new software	Pilot sea water monitoring

Initial Results and Perspectives

There is no doubt that the COBES-Lithuania project has had a significant influence on the curricula and educational activities at the two Lithuanian universities. In its first year of implementation, more than 20 teachers and students were trained abroad. A number of courses were analysed and improved, relevant software packages and teaching materials were selected and are being adapted to local conditions, and river monitoring began. However, it is our intention that the project, like COBES, should also be relevant outside the universities and must have long-term consequences for the whole educational system of Lithuania.

International relations should be strengthened as well. The results and data of the Lithuanian project are to be shared internationally by projects such as GREEN, CoastWatch and the UGIS (University Geographical Information Systems) Network. To enlarge the currently small market for educational software in Lithuania and, therefore, to stimulate the process of software development, there are plans to join the EPES (European Pool of Educational Software) project, supported by the European Union Task Force programme. Project partners will also continue the joint software development mentioned above.

A support centre was established at Klaipéda University to serve as a base for the project tasks. Its first objective was quite pragmatic: to share the limited amount of equipment. The support centre plays an essential role in training teachers and supporting river monitoring. It is in charge of the production of diskettes and CD-ROM's, as well as the printing of teaching materials and manuals. It also offers some other pedagogical and technical services in order to ensure quality, common standards and the compatibility of both software and hardware to be purchased and used at schools. However, the centre also soon became a place where undergraduates, lecturers and researchers of various specialities, could communicate in an informal, friendly atmosphere, i.e. it began to play the role of a club of sensitive "new-minded" people with fresh thoughts and conceptions.

The bios theory, with its ideas of biocentric values and its innovative approach to the educational and pedagogical system,6 fits in well with the creative milieu of the centre. So, starting from computerised innovations in the teaching of environmental sciences, centres like ours, established at Klaipéda University, may turn to the promotion of new courses in Bio-Environment and Bio-Communication.

References

1. Ministry of Education and Culture of Lithuania (1992) The Lithuanian educational concept. Vilnius, 44 pp. (Lithuanian)
2. Ministry of Education and Culture of Lithuania (1992) Programme of ecological upbringing in university educational programmes. Vilnius, pp. 45-61 (Lithuanian)
3. Denisov V. (1994) Models of environmental education in the higher educational system of Lithuania. In: Modelle zur Umwelterziehung in der Bundesrepublik Deutschland. Band 5: Umwelterziehung in den neuen Ländern. Kiel DGI/IPN, pp. 183-199
4. Bosler, U., Denisov, V., Dillon, J., and Hojsholt-Poulsen, L. (1994) Computer based environmental studies in Lithuania. Proceedings from the Initial Working Conference, Klaipéda. Orfeus, Skaering Skolevej 202, DK-8250 Egaa, Aarhus, Denmark
5. Prigge, S. and Tissler, B (1994) Nearby rivers. Kiel IPN and Hamburg. Amt für Schule. IPN, Olshausenstrasse 62, D-24098, Kiel
6. Vlavianos-Arvanitis, A. and Oleskin A. (1992) Biopolitics, the bio-environment, bio-syllabus. Biopolitics International Organisation, Athens, 180 pp. (Russian)

Dr. Vitalij Denisov is a Senior Lecturer in the Department of Applied Mathematics and Computer Science at Klapeida University, Lithuania

where he is also a co-ordinator of the TEMPUS project. From 1992 to 1993 he was head of the computer centre at the same university. His holds a M.Sc. degree in Computer Science and a Ph.D. in the Technical Sciences. His specialist research areas are mathematical modelling, information technology and education. He is a member of the Lithuanian Mathematical Society.

Dr. Sergei Olenin has been a research scientist at the Centre for Systems Analysis, Klaipeda University, Lithuania since 1992, specialising in marine and freshwater ecology and nature conservation. Prior to this, he was Head of the Hydrobiological Group in the Environmental Control Laboratory of the Klaipeda Hydrometeorological Observatory. He is currently a member of the European Marine Interdisciplinary Network, a member of the Baltic Marine Biologists (BMB) Steering Committee, and of the World Wide Fund for Nature/BMB Joint Working Group on Nature Conservation and Bio-Diversity in the Baltic Sea Area. He has an M.Sc. in Biology, and his Ph.D. was on the benthic ecology of the Baltic Sea.