

ENVIRONMENTAL HIGHER EDUCATION IN HUNGARY*

By

I. SZEBÉNYI and Gy. PÁLMAI

Department of Chemical Technology, Technical University, Budapest

Received February 14, 1981

It has been recognized by mankind that one limit of its growth and development is the environmental pollution, stressing the importance of environmental protection and nature conservation. Since protection and development of our environment depend mostly on the attitude of people, environmental education coping with the new demands has to be gradually organized.

According to the *national conception and system of requirements in environmental protection*, the tasks of environmental education are:

The basic environmental knowledge has to be taught on the proper level and incorporated into the different subjects. The exemplary behaviour of teachers makes the nature- and environment-minded education more effective, therefore the continuous training of teachers is necessary. We think it proper to plan the environmental education in the framework of managerial training and of organized post-graduate education of environmental specialists. At the same time environmental specialists have to be qualified in the number required by the actual demands.

The Government in 1980 confirmed the educational conception that as soon as in the primary school the pupils have to be made acquainted with the proper environmental attitude which has to be enhanced in the secondary education. In higher education, the subject matter of environmental protection has to be incorporated mainly into the special subjects. Of course, also environmental specialists (e.g. bioengineers) have to be trained, but the education of specialists belongs to post-graduate education.

The aim of environmental education is to form a proper attitude and to provide sufficient knowledge enabling harmonic development of man and his environment in all spheres of human activity. Of course, this principle is valid for all levels of education but here only the present state of environmental higher education in Hungary will be dealt with.

* Based on a lecture delivered at the Faculty of Chemical Technology of Split University on 10th December, 1980.

Environmental education of teachers

The decisive factor in environmental education in schools of all levels is the teacher. The extent to which the goals of environmental education are gradually achieved mainly depends on his education, pedagogical mastery and on his own attitude to environmental problems. The teacher cannot be a mere source of information but he must be a model the pupil is willing to understand and follow. For this reason the environmental *education of teachers* is of great importance.

The purport of teachers' training must always comprise comprehensive, integrated information on ecological laws, interrelations between man and his environment, possibilities and methods of solving environmental problems. In this country the teacher students of natural sciences obtain environmental education in the following subjects: biology, geography, chemistry and physics. Very important are various types of independent study and an active investigation of environmental problems, discussions with environmentalists, the use of various audio-visual media, especially films, and mainly, direct contact with the environment on excursions and in practical field work.

Recycling of practicing teachers for environmental education is carried out at the National Institute of Pedagogy in Budapest, and at the County Centers for Post-Graduate Education. Attention has to be paid to the continuous updating of environmental information through literature, exhibitions, films and mass media.

Environmental education in professional training

The changes in professional training of *biologists* at *universities* involve that in the near future this training can provide a knowledge enabling to observe, explain and design the state of the environment in a complex manner. Many subjects offer a detailed discussion on the interactions of the human environment already during the basic training. "Ecology" and "Biology of ecosystems" are important subjects but the material of knowledge of "Applied environmental biology" is of the same importance. The subjects "Environmental microbiology" and "Human environmental biology" afford good possibility to learn and practise the necessary knowledge.

The environmental aspects of *geologists'* training are enhanced by the environmental importance of "Hydrogeology": within the framework of this subject the physical, chemical and biological values of water resources, water management and features of utilization are taught.

In the training of *chemists* the applied chemical subjects such as "Colloidal and Radiochemistry", as well as "Chemical plants" give much knowledge from the point of view of environmental interactions. The chapter on water technology and waste water treatment is of great importance.

In the professional education of *meteorologists*, stress is laid on the new subjects "Air chemistry" and "Environmental meteorology" introduced into the curriculum because of their natural and human environmental contents. "Theoretical climatology" deals with the problems of climate changes, the possible reasons of these changes and the role of human activity. "Hydrology" and special subject "Physical Oceanography" present the interactions between hydrosphere and atmosphere from the point of view of environmental protection. In the subject "Cosmic meteorology" analytical methods for the distribution of air pollution are offered on the basis of pictures made by meteorological satellites.

In the curriculum of *law students* the water and land protection and the agricultural law are closely and inseparably related to the legal aspects of environmental protection. Some parts of international law are connected with environmental protection.

In the professional training of *economists* the most important problems of man-environment interaction are discussed in the subject "Economic aspects of environmental protection". Environmental protection is an important part of the subject "National economic planning".

In the field of professional education of *health*, there is a significant environmental tendency in the training of general practitioners, dentists and pharmacists at medical universities. The especially important subject of public hygiene-epidemiology comprises chapters on hygiene of air and drinking-water, soil hygiene, hygiene of disposal of sewage and solid wastes, labour hygiene and food hygiene.

Professional training in *agricultural sciences* emphasizes environmental questions in directly concerned subjects.

The training in *stock-breeding* pays increased attention to environmental protection because of the serious environmental pollution due to large-scale animal husbandry at state and collective farms. In addition, ecological balance and preservation of certain species are important topics.

The training in *plant production* is faced by similar problems, namely the land of agricultural utilization may seriously suffer from increasing physical and chemical impacts.

The position of environmental education is the most favourable in the field of *plant protection*: plant protection hygiene is taught within the subject "Agricultural hygiene".

The training of *agricultural mechanical engineers* underwent favourable changes: subjects "Architecture" and "Equipment for the food industry" involve environmental aspects.

In the professional education of students in *forestry engineering* the relation between man and its environment is stressed in the subjects of biological character, e.g. in "Forest management". In this field, in addition to the pro-

duction-centered attitude developed earlier, the aspects of environmental protection are stressed.

Veterinary training has to do with manifold environmental problems in connection with large-scale animal husbandry and foodstuffs of animal origin and the subject matter was supplemented by environmental protection parts in the following fields:

- harmful environmental factors influencing the production (breeding and keeping)
- harmful environmental factors directly endangering human health
- the tasks of veterinarians in preventing the mentioned damages.

In the field of *horticulture*, environmental problems (chemical plant protection, irrigation and meliorisation) are discussed in connection with different technologies of the industrial-scale production of crops of high biological value (fruit, grapes, vegetables).

In the professional training of *food conservation* mainly the subject "Hygiene" is stressed as special knowledge of environmental protection in the field of conservation of foodstuffs.

Professional training in *higher engineering education* considers environmental interactions occurring in all technical branches. The water protection has great traditions, but in the last decade also air and soil protection and noise reduction have been developed and transformed.

According to this development in the specialized training of *water management* such topics as the protection of water resources, the methods of water purification and waste water treatment, the keeping of ecological balance in natural waters provide significant environmental motivation in future specialists. In the training of *technological branches*, the reduction of environmental polluting effects of technological processes forms an important part of special subjects: how to reuse, reduce or perhaps eliminate the by-products and wastes of technological processes.

In the professional training of students in *architecture* and in *civil engineering* important parts of the subject matter are the protection of man from harmful environmental effects and the aesthetic architectural design providing optimum living conditions.

Several branches are interested in questions relating to the energy production, the optimum energy consumption and the environmental balance connected with energy problems.

The training of *transport engineers* is completed by subjects of "Measurement of noise and air pollution" and of "Environmental protection in transport".

In the professional training of *chemical engineers*, certain chapters of "Chemical technology" and of "Biological industrial operations" and some optional subjects help developing the environmental knowledge.

Recently some *subjects* have developed in certain training lines the content of which is *composed of specific environmental knowledge matter*. For example, in the specialized training of mechanical engineers, subjects of this type are, "Air and water quality protection" and "Hydrodynamical acoustics". In the training of architects the subjects "Building acoustics" and "Environmental protection" can be mentioned.

Environmental protection and deeper specialization

In relation to the specialization we have to mention the optional subjects which satisfy the provisional demands of national economy or the interests of future specialists. These subjects provide usually deeper knowledge in one part of the body of knowledge determining the branch and therefore, they afford possibility for deeper specialization to an extent.

In the universities many environmental topics can be mentioned in the subject group of the *so-called special courses*. For example, in the training of chemists the subjects "Analysis of environmental protection", "Air and water pollution", "Protection of natural environment", "Application of atomic absorption spectroscopy in environmental protection" afford possibility for deeper specialization.

This tendency is present in the optional subjects of legal, economical, hygienic, agricultural as well as technical professional training.

In addition to the optional subjects, branches or special lines in the final period of the training (in the last terms) represent another possibility for deeper specialization.

The terminology of these branches is not uniform but an essential characteristic feature is that they are connected with a certain profession and give deeper knowledge in a narrower field (e. g. branch of welding technology within the speciality of machine construction in mechanical engineering). There exists a branch of environmental protection within the profession of plant cultivation since several years.

The education of ecologists at the Kossuth Lajos University, Debrecen is of great importance.

The *branch of environmental protection in bioengineering education* delivered in cooperation between Technical University of Budapest and Eötvös Loránd University of Budapest is a very special one, its characteristic subjects are: "Air and water purification", "Analysis of environmental protection", "Hydrobiology and ecology", "Urbanistics and environmental protection", "Legal and hygienic aspects of environmental protection".

The importance attributed to environmental protection is increasing in the diploma works (theses) and projects where the future specialists solve complex problems.

The proportion of environmental protection grows increasingly in the themes studied in the framework of scientific circles of students. As a result, a separate section is introduced into the conference programs of these scientific circles of students.

Environmental protection in post-graduate education

Although self-education is extremely important in every field, organized forms of post-graduate studies are spreading all over the world. The increasing demands for continuous training are satisfied mainly in two ways and all institutions of higher education are interested in these forms.

1. Environmental protection in the programs of refresher courses

The institutes for post-graduate education at the universities have organized refresher courses in environmental protection. For example, special legal and economical aspects of the environmental protection are subjects of different refresher courses in post-graduate education of lawyers and economists.

The refresher courses for agricultural specialists deal e.g. with the problems of pesticide residues, the effects of intensive fertilization, the treatment of liquid manure and so on.

The main subjects of the refresher courses at technical universities offer a complex approach to environmental problems and involve special fields such as air and water purification, noise and vibration damping, dust separation, distribution of air pollutants, measurement of solid particle emission and possibilities of noise reduction in regional planning.

These courses give no qualification.

2. Environmental protection in the training of specialists (specialist-engineers)

The other form of post-graduate education is the two-year *specialist-engineer* training, rather popular among specialists.

In the training of agricultural specialist-engineers ecology has an important role, and a predominant part in the curriculum of plant protection specialist-engineers is the elimination of environmental damages.

In the training of specialist-engineers in the technical field a great number of subjects contain environmental aspects: in the course "Water resource management and hydrobiology" the subjects "Water quality management" and "Industrial water management", in the program of the course "Water supply-canalization-hygiene" the subjects "Water purification" and "Waste water treatment", in the course of "Motor vehicles" the subject "Ergonomics and environmental protection", in the program of "Nuclear power stations" the subjects "Radiation protection and dosimetry", "Treatment of radio-

active wastes" and "Environmental effects of nuclear power stations" can be mentioned.

In addition to the integration of environmental protection into the higher professional education, the urgent solution of environmental problems made it imperative to train out of turn specialists having a perfect knowledge of environmental problems. This was solved by organizing *specialist-engineer courses in environmental protection*. The social demand emerged mainly in the productive spheres, for this reason the solution belonged to the competency of higher agricultural and engineering education.

The training of *agricultural* specialist-engineers in environmental protection was launched in January 1974. In the field of forestry engineering the training of specialists has started in 1976.

In the *technical* universities the training of specialist-engineers started in February 1974 at two technical universities (Technical University, Budapest; Veszprém University of Chemical Engineering) and one year later at the third one (Technical University of Heavy Industry, Miskolc). The training lasts four terms in form of evening or correspondence courses.

Table 1j

Curriculum of the post-graduate "specialist-engineer" course in environmental protection at the Veszprém University of Chemical Engineering

Subjects	Hours per term in term			
	1	2	3	4
	lecture + tutorial + laboratory			
Man and his Biological Environment	32+0+0			
Air Pollution	12+0+0			
Air Quality Management	17+0+0			
Analysis of Environmental Protection	31+0+48	0+0+24		
Technical Microbiology		28+0+8		
Water Quality Management and Control		28+0+0		
Corrosion and Corrosion Prevention		16+4+4		
Environmental Protection and Radioactivity		20+0+8		
Aspects of Plant Protection and of Soil Science in Environmental Protection			34+8+24	
Treatment of Domestic Sewage			34+16+0	
Organisatory and Legal Aspects of Air Quality Management			12+0+0	
Treatment of Sludges and Wastes			12+0+0	
Air Quality Management in Heavy Chemical Industry				24+0+24
Water Quality Management in Heavy Chemical Industry				28+0+24
Legal Aspects of Environmental Protection				16+0+0
Special courses of lectures				24+0+0
Total of hours per term	92+0+48 140	92+4+44 140	92+24+24 140	92+0+48 140

Table 2

Curriculum of the post-graduate "specialist-engineer" course in environmental protection at the Technical University of Heavy Industry, Miskolc

Subjects	Hours per term in term			
	1	2	3	4
Fundamentals of Environmental Protection	36			
Organization and Legal Rules of Environmental Protection	6			
Physico-chemical Fundamentals of Methods used in Environmental Protection	32	13		
Analytical and Calculation Methods of Environmental Pollution	28	23		
Noise-measuring and Control Methods	6			
Methods and Equipment in Air Quality Management		23	21	
Methods and Equipment in Water Quality Management		23	21	
Methods and Equipment in Noise Reduction			21	
Disposal of Polluting Solid, Liquid and Radioactive Wastes			21	
Laboratory practice in Water Quality Management		15		
Laboratory practice in Air Quality Management			16	
Laboratory practice in Corrosion Prevention		15		
Noise Laboratory Practice			8	
Economic Aspects of Environmental Protection				8
Computer Methods	12	8	12	8
Subjects in the three Branches*				104
Total of hours per term	120	120	120	120

* The three branches are:

Environmental problems in mining
metallurgy
combustion technique.

Engineers having completed specialist courses in environmental engineering are expected to have a deep overall knowledge in international and national matters of environmental pollution and protection helping them recognizing and solving environmental problems, owing to the imparted correct environmental approach. However much stress is laid on the general, comprehensive environmental training, also special training is given them to do and direct design, execution and supervision work in their special fields.

At the three technical universities the structures of training are different. At the Veszprém University of Chemical Engineering the training is homogeneous and concentrates on chemical industrial problems (Table 1). At the Technical University of Heavy Industry the training deals with the environmental effects of heavy industry and three branches discuss the special problems of mining, metallurgy and combustion technique in the fourth term alone (Table 2). At the Technical University of Budapest, training in the first two terms is concentrated on complex, general problems. Subsequent training is given in four branches: air quality management, water quality management, noise reduction, soil conservation and regional planning (Table 3).

Table 3

Curriculum of the post-graduate "specialist-engineer" course in environmental protection at the Technical University Budapest

Subjects	Hours per term in term			
	1	2	3	4
	lecture + exercises			
<i>Common subjects</i>				
Fundamentals of Environmental Protection	48+ 0			
Conservation of Nature	24+ 0			
Siting and Construction of Industrial Plants	12+12			
Town Planning and Reconstruction	24+ 0			
Computer Methods	12+12			
Man and his Environment		36+ 0		
Radioactive Pollutants and their Elimination		24+24		
Waste Treatment and Reutilization		24+ 0		
<i>Special subjects</i>				
Branch of air quality management				
Fundamentals of Biology		36+ 0		
Distribution of Air Pollution			24+ 0	
Measurement of Air Pollution			24+36	
Industrial Air Pollution Control			24+12	36+24
Combustion Products of Fuels			24+ 0	24+ 0
Legal Aspects of Air Pollution Control				24+12
Optional subject				24+ 0
Branch of water quality management				
Fundamentals of Biology		36+ 0		
Water Chemistry and Technology			12+12	
Technical Microbiology			12+12	
Water Quality Management and Control			24+ 0	
Water Analysis			24+36	
Waste Water Treatment			12+ 0	12+48
Disposal of Industrial and Agricultural Wastes				24+12
Optimization of Water Management Systems				12+ 0
Legal Aspects of Water Conservation				12+ 0
Optional subject				24+ 0
Branch of noise reduction				
Fundamentals of Acoustics		24+12	24+24	
Subjective Acoustics			24+24	
Noise Emitting Sources and Noise Reduction			24+24	24+12
Acoustical Measurements				24+48
Infra- and Ultraacoustics				12+ 0
Optional subject				24+ 0
Branch of soil conservation and regional planning				
Fundamentals of Biology		36+ 0		
Soil Science			24+ 0	
Regional Planning			48+24	
Soil Analysis			0+48	
Role of the Soil in Environmental Protection				24+ 0
Soil Conservation				48+ 0
Soil Conservation Planning				0+48
Optional subject				24+ 0
Total of hours per term	144	144	144	144

For being awarded the degree of specialist-engineer in environmental protection a final state examination has to be passed and in case of success the participant gets a specialist-engineer diploma.

In virtue of the specialist-engineer training, since 1974 more than 600 engineers have got profound environmental knowledge in their respective profession and use it in their everyday work.

The authors would like to thank Mrs E. SZALAY-MARZSÓ and dr. Gy. KONTRA for their valuable advices.

Summary]

The task of environmental education is to form a proper attitude and to provide sufficient knowledge enabling harmonic development of man and his environment in all spheres of human activity. Of course, this principle is valid at all levels of education but this study deals only with the present state of environmental higher education in Hungary: environmental education of teachers, environmental protection in professional training, deeper specialization and post-graduate training are discussed.

References

1. SZEBÉNYI, I.: Der Unterricht des Umweltschutzes an der Polytechnischen Universität zu Budapest, Umweltschutz, Wien 1974., p. 26
2. PÁRI, GY.—LENGYEL, Z.—RAPP, J.—SZEBÉNYI, I.: A környezet- és természetvédelmi felsőoktatás helyzete (State of higher education for environmental protection and nature conservation). Felsőoktatási Szemle 30, 72 (1981)
3. RAPP, J.—SZEBÉNYI, I.—NAGY, T.: Podgotovka spetsialistov po zashite okruzhaiushei sredi v vuzakh Vengrii (Training of specialists for environmental protection in Hungarian higher education). Sovremennaya Visshaya Shkola (Warsaw) 22, 37 (1978)
4. HEIL, B.: Környezetvédelmi szakmérnökképzés eddigi tapasztalatai a Veszprémi Vegyipari Egyetemen. Környezetvédelmi oktatási vitaülés kiadványa (The experiences of specialist-engineer courses in environmental protection at the Veszprém University of Chemical Engineering. Publication of educational debate in environmental protection). Budapest 1978., p. 149
5. BEREZ, E.: A környezetvédelmi képzés helyzete és irányai a Nehézipari Műszaki Egyetemen (State and tendencies of environmental education at the Technical University of Heavy Industry). Bányászat 108, 840 (1975)
6. PUNGOR, E.—SZEBÉNYI, I.: Környezetvédelmi szakmérnökképzés a Budapesti Műszaki Egyetemen (Education of environmental specialist-engineers at the Technical University, Budapest). Pedagógiai Közlemények 15, 25 (1977)

Prof. Dr. Imre SZEBÉNYI }
 Dr. György PÁLMAI }

H-1521 Budapest