

Protection of the Environment - the Most Important Challenge for the Educational System

J. Namiesnik

Department of Analytical Chemistry, Chemical Faculty, Technical University of Gdańsk (TUG)
11/12 Narutowicz St., 80-952 Gdańsk-Wrzeszcz, Poland

Received 16 June, 1999

Accepted 17 July, 1999

Abstract

There is a need to change the curricula of university chemical faculties, to include proecological information into any and all specialized disciplines to the highest possible degree. Proecological education is particularly important in the case of educating future chemists and chemical engineers. The general statements are illustrated by the example of the Chemical Faculty, Technical University of Gdansk.

Keywords: Proecological education, classification, case studies, chemical faculty, Technical University of Gdansk (TUG).

Introduction

Solving environmental problems, both local and global, constitutes one of the basic challenges for humanity. Solving these problems requires enhancing and deepening our knowledge of the environment on one hand, and recognizing mutual, man-environment interactions on the other.

Solutions to numerous and diversified problems in the field of environmental protection may be achieved both through scientific research providing new information, and through knowledge already collected by different disciplines.

Academia has a key role in the field of accumulating, deepening and transferring the knowledge on the environment through the processes of scientific research and education of large numbers of students.

Sometimes, however, academic traditions may constitute an obstacle in the development of environmental science, which is chiefly due to the compartmentalization of knowledge into highly specialized branches and disciplines. If such an attitude towards this knowledge is reflected in education, it becomes a much unfavorable factor from the point of view of environmental science coherency and integrity.

A reconstruction of the existing systems of gathering information and creation of a complex, interdisciplinary system of proecological education, becomes a new challenge for contemporary universities. To achieve this goal, it is

necessary to combine knowledge from the traditional fields of science, human science and technology.

These general principles are illustrated by a description of a proecological education scheme as it is delivered at the Chemical Faculty, Technical University of Gdansk.

The Importance of Proecological Education

The turning point in seeing environmental problems was a report by the UN Secretary General, U Thant, entitled "Man and His Environment" published in May, 1969. It was prepared on the basis of opinions and expertise of 2200 scientists and specialists from all over the world. It was then that one so forcibly concluded that solving environmental problems was the key to preventing global catastrophe. Since then, one could observe many proecological propositions and initiatives arising. Among them, an important role belonged to those dealing with activities in the field of education and raising proecological awareness among wide circles of society.

Table 1 presents, in chronological order, major events which stimulated further proecological activities.

At that time, when numerous countries were paying more attention to replacing "dirty" technologies with clean ones, Poland still believed in production at any cost. Production costs, including environmental costs, simply did not count.

Table 1. Chronology of events stimulating further proecological activities.

No	Event	Actions taken and/or effects
1.	1969 Report "Man and His Environment" by UN Secretary General, U Thant	Presentation of the activities in the field of environmental protection as a priority, needed to avoid global doom. Report was stimulated by 2200 eminent scientists.
2.	1970 USA	Foundation of the EPA (Environmental Protection Agency) — the first Ministry of Environmental Protection (or rather an equivalent of a ministry)
3.	1972 1 st World Earth Congress, Stockholm, Sweden	Acting under the slogan " Only One Earth ", the congress worked out the basics of the concept of balanced development (ecodevelopment).
4.	1975 UNESCO Conference, Belgrade, Yugoslavia	Adoption of the International Charter of Education ("The Belgrade Charter") . It contains exact formulations of the aims of proecological education and indicates the need of its implementation in all educational systems.
5.	1975 HESC Congress, Kyoto, Japan	Devoted to similar problems as the Stockholm Congress.
6.	1977 UNESCO and UNEP Conference, Tbilisi, USSR	Adoption of so called "Tbilisi Declaration" . It obliges all the member countries to implement the programs of proecological education, both formal and informal, into their educational systems and to provide the necessary financial support.
7.	1987 Foundation of the UN World Commission on Environment and Development Chaired by Gro H. Brundtland ("Brundtland Commission")	Preparation of a comprehensive concept of sustainable development , put in print as " Our Common Future ".
8.	1989 International Symposium in Vienna organized by UNESCO and UNEP	Adoption of so called "Vienna Declaration" . A comprehensive character of all activities contributing to proecological education was stressed. Also, a necessity of cooperation of authorities and all circles of the society was accentuated.
9.	1992 2nd World Earth Congress, "Ecology and Development", Rio de Janeiro, Brazil	Adoption of the "Rio de Janeiro Declaration" . This declaration is a grand humanistic achievement – it relates all proecological activities to the human person, it determines, so to say, rules of human conduct toward the environment. The concepts of the AGENDA 21 and LOCAL AGENDA 21 were also formulated.
10.	1997 New York, USA	World UN Conference on the state of environment.
11.	11.12.1997. Kyoto, Japan	Greenhouse gases emission limitation (by 6%) agreement. Acceptance of trading emissions permits.

It was recognized that dilution of pollutants and waste storage are sufficient solutions to the very big anthropogenic emissions of many types of pollutants. One can state the notorious rule *DILUTION IS THE BEST SOLUTION TO POLLUTION* was followed rather strictly.

Under the circumstances, from the administrative point of view the problem disappeared when the pollutants were sufficiently diluted. Hence, in the case of the emission of gaseous pollutants to the atmosphere, for example, it was enough to build suitably high chimneys to achieve efficient dilution of these pollutants in the large volume of the air. Anyway, even at that time, the first signs of proecological sensitivity could be observed in Poland and its neighbors. These originated, of course, in scientific circles, but they were treated with contempt and neglected by the people responsible for political and economic decision making. An outstanding example of this sensitivity among scientists is the lifelong activity of Professor Walery Goetel - the rector of the Academy of Mining and Metallurgy in Cracow. He coined the saying, well known in many circles, "*WHAT THE INDUSTRY DAMAGED, THE INDUSTRY AND INDUSTRY ALONE MUST FIX*". In 1963, Professor W. Goetel proposed a name for the new branch of science - sozo-logy, and while this term was widely accepted, its author has almost been forgotten.

One can say that there were more and more proecological activities in accordance with another English proverb - *AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE*.

On the other hand, one must admit that the general attitude toward proecological activities has improved recently to a significant degree. One of the most significant directions of these activities is the trend toward deepening and enhancing ecological awareness.

A suitable level of proecological awareness among wide circles of society and carrying out scientific research are both necessary to achieve the state when making the right decisions regarding protection of the environment and proper management of environmental resources.

Figure 1 schematically presents basic interactions between the three spheres of human proenvironmental activities [1].

Figure 2 shows a general scheme of proecological education at different levels.

Proecological education may be accomplished at two levels [6]:

- general proecological education, whose goal is raising awareness and general knowledge about the environment at all levels of education (from elementary school up to university level), and

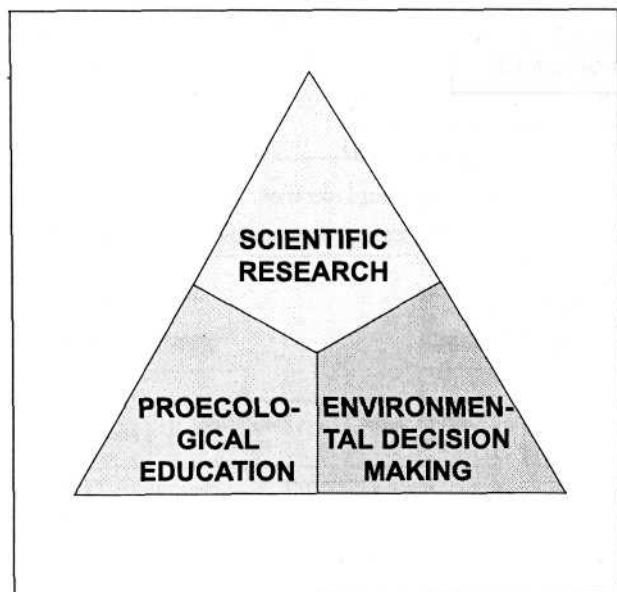


Fig. 1. A model of mutual interactions between the different fields of human activities having a direct influence upon quality of the environment [1].

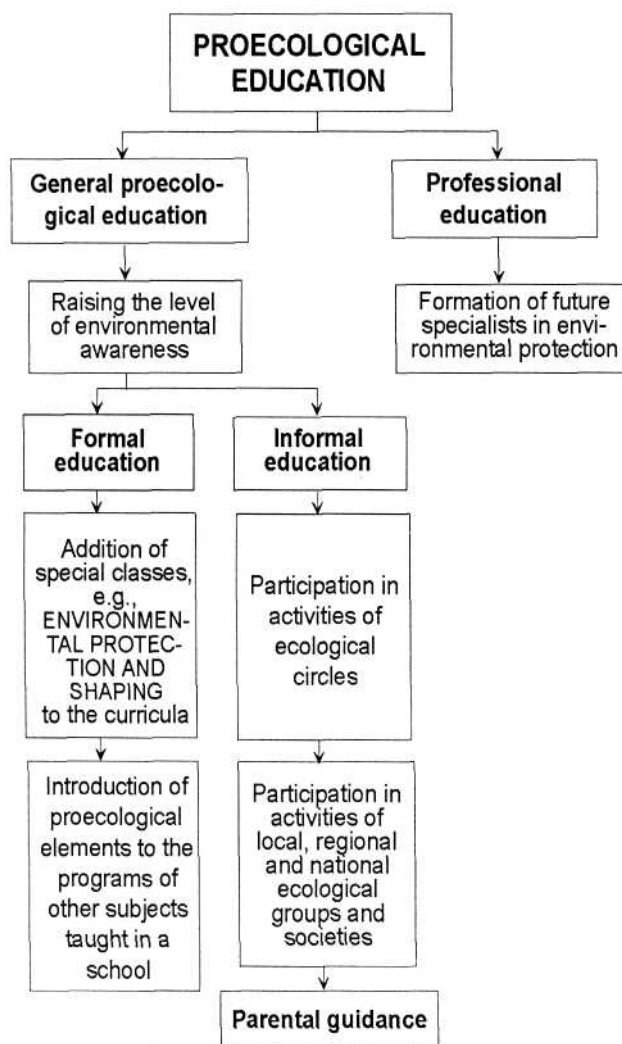


Fig. 2. A scheme of proecological education at different levels.

- training future specialists in particular, environment-related branches of science and technology.

International co-operation in the field should not be forgotten. Examples of such co-operation can be found among the following programs:

- *TEMPUS, SOCRATES*
- *TESSA* (Teaching and Education in Strategically Significant Areas) as well as actions initiated by organizations like: CBB (Coalition for a Clean Baltic) or *GREEN* (Global Rivers Environmental Education Network). We are aware, anyway, that the state of the Polish environment remains poor and, in some areas, nearly catastrophic.

In literature, one can find information on the new attitude towards the education of chemists, taking into account interdisciplinary environmental knowledge [2-8]. There are examples of new educational schemes introduced at a number of chemical faculties of German universities [5], and at the Swiss Federal Institute of Technology at Zurich (ETHZ) [6,7].

Environmental Education at Chemical Faculties of Polish Universities

It is necessary to state that at the majority of chemistry departments of Polish universities and technical universities, one can get specialized education in the field of environmental protection. This is being accomplished within such specializations as:

- environmental chemistry,
- environmental protection,
- environmental engineering.

It may be taken for granted that there is a special role, within the bulk of proecological activities, reserved for chemists. They can and ought to do their share due to the fact that chemical technologies of production of a wide spectrum of chemical products constitute the main anthropogenic sources of emission of respective pollutants. Therefore, both in education and in scientific research, the significance of environmental chemistry cannot be overestimated. This new scientific discipline, being a part of chemistry, embraces numerous problems bordering both pure and applied science. One can say that the structure of environmental chemistry may be represented by a mosaic, shown in Figure 3 [9].

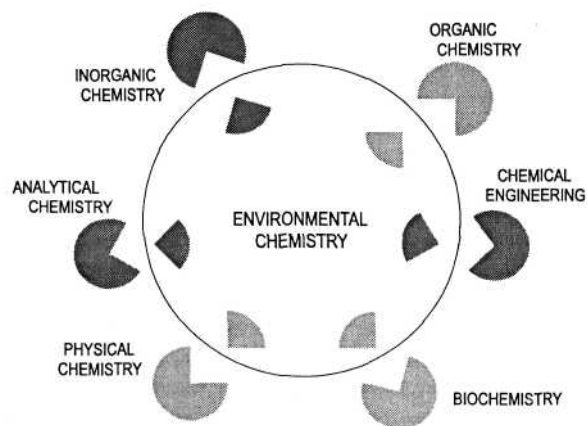


Fig. 3. Mosaic-like structure of environmental chemistry [9].

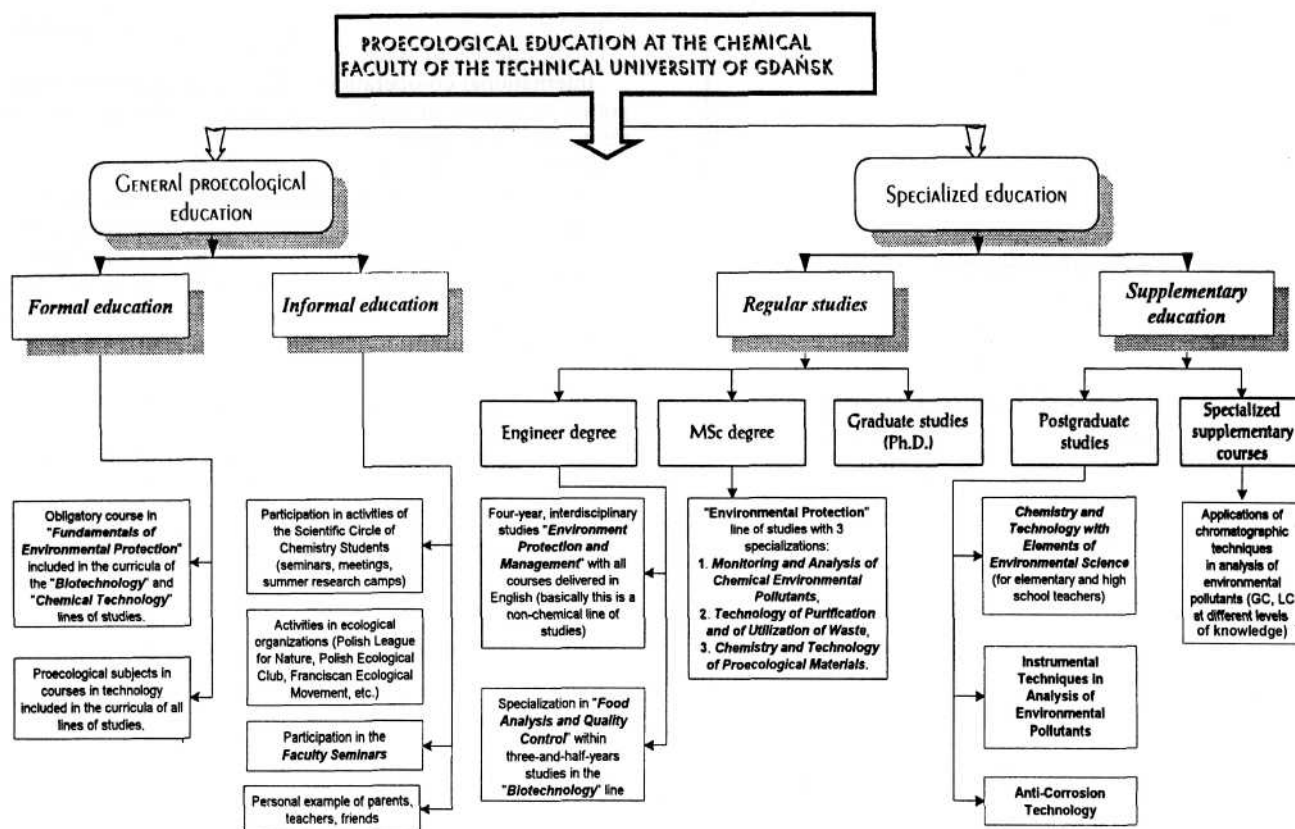


Fig. 4. The scheme of proecological education organized at the Chemical Faculty of the Technical University of Gdansk (TUG).

The scheme of proecological education organized at the Chemical Faculty of the Technical University of Gdansk (TUG) is presented in Figure 4 [10].

It is worth noting that at the Chemical Faculty, Technical University of Gdansk, since 1994, there have been interdisciplinary engineering studies in environment protection and management with all the lectures and tutorials being delivered exclusively in English. This form of educating future specialists in the field of environmental protection and management is unique in Poland. This is our input towards integration with the European Union structures, which it seems will become a reality soon.

Figure 5 shows a general concept of educating future specialists in the field of environmental protection at the Chemical Faculty, Technical University of Gdansk.

The Chemical Faculty is currently the largest at TUG with respect to the number of students taught (above 2000). The graduates (150 with M.Sc. degree or engineer's diplomas in 1997/98 academic year) can find an employer rather easily. Their competitiveness on the labor market may, perhaps, be connected to the interdisciplinary approach of their education.

It is necessary to prepare and introduce new, suitable educational auxiliary materials to facilitate the inclusion of proecological elements into the curricula. This aspect is currently the main line of activity. First textbooks and lecture notes connecting environmental science with specific subjects and lectures have already been printed.

More detailed information on the curricula at the chemical faculty of TUG may be obtained by contacting the author directly.

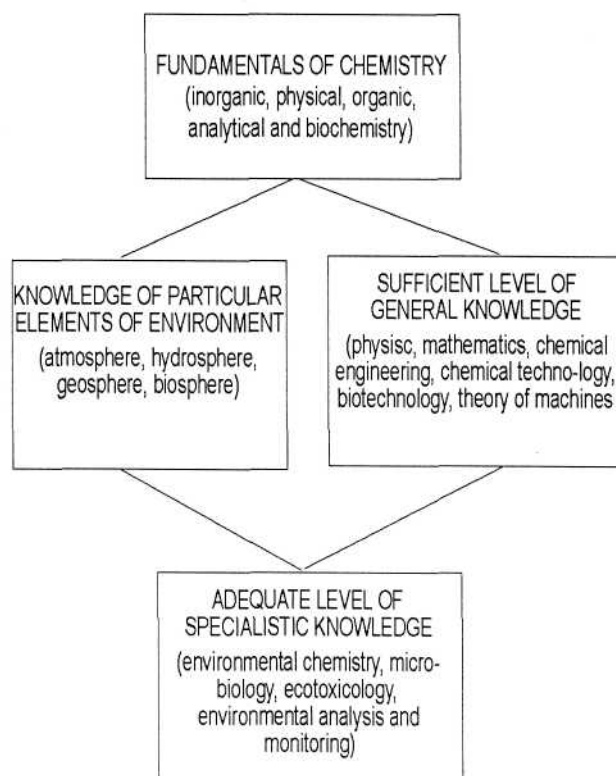


Fig. 5. General concept of educating future specialists in the field of environmental protection at the Chemical Faculty, Technical University of Gdansk.

References

1. A. KALINOWSKI, „Ekologia jako dziedzina nauk biologicznych. Obrona terminu przed zawłaszczeniem czy też nadużywanie?” (*Ecology as a Branch of Biological Sciences. A Defence of the Term Against the Larceny or Its Abuse?*) In: Wybrane zagadnienia z ekologii i ochrony środowiska (*Selected Problems in Ecology and Environmental Protection*) (Ed.: D. Kalinowska), Uniwersytet Warszawski, Warszawa, **1992**, pp. 35-45.
2. J. NAMIENNIK, T. GORECKI, A. KOTODZIEJCZYK, Proecological education at the Faculty of Chemistry of the Technical University of Gdansk. Proceedings of the 2nd East-West Congress on Engineering Education, 20-24.10.1993, Lodz, pp. 33-36.
3. J. NAMIENNIK, Proecological education at the Faculty of Chemistry of the Technical University of Gdansk. Proc. Seminar on Modernisation of Education in Environment Protection under TEMPUS scheme. Gdansk-Nadole, 27-30.04. **1994**. p. 31-42.
4. J. NAMIENNIK, *Chemia-Ekologia-Dydaktyka*, **1**, (1-2), 37, **1996**.
5. D. LENOR, R.G. MAY, *Environ. Sci. Pollut. Res.*, **4**, 235, **1997**.
6. U. MULLER-HEROLD, *Interdisciplinary Sci. Rev.*, **21**, 305, **1996**.
7. B. WEHRLI, R.P. SCHWARZENBACH, *Chimia*, **51**, 865, **1997**.
8. J. NAMIENNIK, *Chemia-Ekologia-Dydaktyka*, **3**, (1-2), 39, **1998**.
9. W. CHRZANOWSKI, *Pollut. Environ.*, **1**, 39, **1991**.
10. J. NAMIENNIK, Strategies of environmental protection. Production technology and quality of the environment. Proc. V Int. Symp. "Chemistry Forum", 19-21.04. **1999**, Warsaw, p. 36-40.