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EDUCATION IN STATISTICS AT THE HIGHER INSTITUTE OF CHEMICAL TECHNOLOGY - SOFIA

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1. Organisation of the education in statistics at the Higher Institute of Chemical Technology - Sofia

The Higher Institute of Chemical Technology-Sofia (HICT-Sofia) is concerned with undergraduate and postgraduate education in chemical technologies, metallurgy, material sciences and automation. The teaching of statistical methods for engineers began more than 20 years ago and HICT-Sofia is widely recognised as a pioneer in disseminating the statistical way of thinking among the engineers of Bulgaria.

Education in statistics at the HICT-Sofia has several levels depending on the specialisation chosen by the students. All students (except those specialising in automation) obtain some basic knowledge in probability theory from the courses of mathematics in the first two years of study. Then they have some deeper insight in applied statistics, following the course of "Theory of experimental research and optimisation".

The main objective of this course is to give the students an introduction to model building, regression analysis, design of experiments, hypothesis testing and optimisation methods deep enough to make possible their application in solving technological problems. Our experience showed that the course is extremely useful for students in chemical engineering, metallurgy and material sciences but it requires more hardware and software support now.

Students in automation obtain more advanced knowledge in statistical methods and their application. They follow several courses with statistical content like "Statistics for engineers", "Theory of experimental research", "Identification methods", "Quality control" and some others where partially statistical methods are applied.

Some of these courses are supported by problem oriented software developed by the academic staff of the Department of Automation.

A considerable part of diploma thesis and postgraduate research is often connected with application of statistical methods for solving technological problems.

To satisfy the need of teaching statistics for postgraduate students and industrial practitioners a special curriculum for statistical education was included in the programme of the School for Postgraduate Education in Cybernetics at the Department of Automation. For more than 15 years it has trained a large number of postgraduate students and practitioners from all branches of industry in applied statistics and quality control. In the last few years the crisis in industrial production led to nearly closing this way of teaching.

The education in the regular courses and the postgraduate education was supported by a variety of special textbooks and manuals in statistics and design of experiments written by the departmental staff. A Catalogue of Optimal Experimental Designs was also developed and published. It is still widely used in the experimental practice and for education (Vuchkov *et al.*, 1978).

2. Prospects in the education in statistics in HICT

The low quality of industrial production in Bulgaria is one of the main restraints to the process of transition to a market economy. A substantial contribution to solving this problem can be achieved by the wide application of statistical methods for quality improvement such as industrial design of experiments and optimisation methods. In a short time substantial numbers of students and industrial practitioners have to be trained to a competent level in this area. This leads to the need for highly qualified university teachers who are familiar with the successes of the leading European countries.

The development of education in this area has been held back in the last few years by the need for sophisticated computer techniques, software and teaching materials.

One of the possible ways of improving the education in statistics is European cooperation within TEMPUS. In the last two years the staff of the Department of Automation has been involved in two TEMPUS projects. The cooperation will promote professional contact, the transfer of expertise, sophisticated hardware and software and also technology transfer between United Kingdom, Italy, Germany and Bulgaria. The major aim is to reconstruct university education in the subject area in Bulgaria to bring it into line with European standards by transferring educational expertise and know-how from EC countries to Bulgaria.

It concerns the organisation of educational units and the management and conduct of undergraduate and postgraduate education. Taking into account that the university system of Bulgaria is changing now in

accordance with the transition to a market economy it is a recognition of an urgent existing need in Bulgaria. Academic staff retrained in the EC countries immediately apply their knowledge to develop teaching materials for wide distribution in the country. They will also teach large groups of undergraduate and postgraduate students and industrial practitioners. This will have a long term multiplier effect on education and on industrial applications and will contribute to the economic restructuring of the country.

The TEMPUS project connected mainly with statistical education has a title "Education in industrial design of experiments and optimisation of production in Bulgaria" (Torsney *et al.*, 1992). Its main objective is to develop in the HICT-Sofia an educational centre for teaching undergraduate and postgraduate students and practitioners from all branches of industry. The following outputs are to be achieved:

- Improving the level of undergraduate and postgraduate education in the area of application of statistical computing, experimental design and optimisation methods in solving industrial problems and promoting the transition to a market economy.
- Creation of new up-to-date facilities for education and production of teaching materials with a long lasting multiplier effect.
- Provision of retrained university teachers who in turn will promote the retraining and education of other teachers, of postgraduate students and of industrial practitioners.
- By improving the educational level in statistics in technological universities in Bulgaria to increase the speed of social and economic changes.
- Bringing the level of education in Bulgaria nearer to that of the EC countries and continuing the cooperation between the universities in EC and Bulgaria.

Some of the JEP activities in Bulgaria are the following:

- Two industrial courses on "Strategies in Computerised Education" and "Application of Industrial Design of Experiments and Optimisation Techniques for Improving the Quality of Production".
- The update of three existing training courses in "Methods for Experimental Research and Optimisation" for undergraduate students in HICT-Sofia. Retrained Bulgarian Staff will take an active part in developing new teaching materials, in updating the curricula, in exchanging information and in introducing a European dimension. A Catalogue of Optimal Composite Sequential Designs is developed as teaching material.

– A laboratory provided with 10 personal computers connected in network is developed and will be intensively used in educational activities. Computers and software are compatible with those presently existing in UK centres to maximise technology and know-how transfer.
– An integrated Postgraduate Training Unit is developed. It consists of a seminar room and office facilities equipped with a computer, with desk-top publishing and graphics software and also copying and printing facilities to enable efficient preparation of educational manuscripts and slides.

The establishment of the Laboratory and the Postgraduate Training Unit will enable the expertise and curricula of EC countries to be transferred to Bulgaria in a short time. It will result in developing the Higher Institute of Chemical Technology -Sofia into a national centre for the education and distribution of expertise in "Design of Experiments", "Statistical Quality Control" and "Optimisation of Industrial Production" in Bulgaria.

Bibliography

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