

Structure of a modular multilevel system of continuing vocational education of mechanics in Poland

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Prefacio

La educación, preparación, perfeccionamiento y actualización de los ingenieros está estrechamente relacionada con múltiples factores entre los que cabe destacar: las características y condiciones del desarrollo científico y tecnológico de país; la estructura y nivel del sistema económico nacional, el grado de participación en la economía y especialmente el mercado internacional, la flexibilidad del sistema educativo básico, las formas y orientaciones del sistema de educación superior, etc. En suma: el lugar y el lapso definen el marco que guía la forma en que se prepara un ingeniero.

Polonia, posee un sistema educativo con muchas de las condiciones propias de Europa, entre ellas solo 11 universidades entre 100 instituciones de educación superior. El resto son universidades tecnológicas, escuelas de ingeniería, academias de agronomía, de economistas e instituciones de formación de maestros. El sistema de educación superior ha debido adaptarse a las cambiantes etapas que el país vivió durante este siglo. Al derrumbarse el sistema socialista de Europa Oriental y desde 1990 se introducen cambios profundos que apropian la organización a las nuevas condiciones que el mundo entero enfrenta especialmente por la globalización de la economía.

La propuesta del Prof. H Bednarczyk presenta una estructura que rompe con nuestras concepciones tradicionales de niveles; nos habla

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de Educación Vocacional como medio de canalización de formación para la población de 25 a 64 años en diversas propuestas de estructuras abiertas y flexibles, que crean oportunidades de preparar los recursos humanos necesarios de acuerdo a las orientaciones internacionales más actualizadas.

Los módulos adquieren nuevas dimensiones en su proyección a la preparación de recursos humanos para el área de la Mecánica que en Polonia está adaptando rápidamente la formación a las cambiantes condiciones que ese país enfrenta. La propuesta debe servirnos de ejemplo para estudiar y meditar sobre la urgente adecuación que nuestro sistema educativo necesita para enfrentar los retos que presenta el cambio de nuestro país por los nuevos compromisos asumidos y las nuevas formas de la economía mundial.

Ingenierías

Abstract

A concept of a modular multilevel system of continuing vocational education is described on the basis of an analysis of modernisation trends concerning the educational system, in particular vocation education. Selected elements of the system and examples of implementation are also presented.

CONTINUING VOCATIONAL EDUCATION

The conception of general continuing vocational education has been presented in well-known reports "Learn to Be", "Learning without Limits" and the idea of the learning society" in the "White Paper" of the European Union and J. Delors" report "Education - there is hidden treasure in it". Now and all the more in the increase in the developed societies will have to

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cope with new challenges. Quick changes of the work contents concerning each occupation and each working stand cause the increase in the work intellectualisation. Moreover, the employment structure has been changed.

The efforts undertaken in our country to modernise education, reform it, adjust to integration with the European Union are necessary. According to the OECD report 13% of the population in Poland at the age of 25-64 years had higher education, whereas respectively in the OECD countries 22 %, USA 32%, Canada 47%, and in Turkey 8% Portugal and Czech Republic 11%. In 1994 only 15% of the same population of Poles took part in different kinds of courses, whereas in the USA 44%, Canada 37%, and the Netherlands 36%.

It is necessary to create an open and flexible system of continuing vocational education, in which school and extra school education, formal and informal one will make its integral part. Cooperation with the economy will enable to utilise new functions of employment in the process of continuing education. Graduates of all educational levels should have wide-profile base preparation and at the same time the skill of competent performance of important occupational tasks, mobile adjustment to working conditions and own development.

Creation of the system of vocational continuing education requires first of all integration of subjects and research we propose the following definition of a module: a separate, curricular didactic unit made of one or more modular units, which objectives and educational contents separated according to criteria and thematically integrated from different disciplines of knowledge are formulated in a univocal and measurable way and state intellectual and motor

skills and attitudes”, Formed, assessed and controlled skills enable to carry out occupational activities or tasks in a defined, logical order in a competent way according to the approved standard at working stands.



A MODULAR MODEL

On the basis theoretical studies, an analysis of experiences, constructing modular curricula and their evaluation below we present basic assumptions of the modular model of vocational education and development.

- Modular education integrates conceptions of demonstrative, curricular, individual, problem, structural, algorithmic, many-sided and multimedial teaching.
- Modular education is strictly connected with achieving vocational competencies, what means that during the final test the student must be able to demonstrate work executed according to standards.
- Education is carried out on the bases of gradual gathering of knowledge, forming skills and attitudes. Going to the next level (next stage) takes place after crediting each student with the previous module (modular unit).

- Module is a basic didactic unit, which integrates thematically related and essential educational contents from a range of scientific disciplines (subjects). As a result of teaching-learning and acquisition of the module's contents, the student achieves concrete, measurable, approved and recognised skills.
- Modular curricula integrate the whole multilevel system of continuing vocational education thanks to a flexible choice of the way and pace of education and recognition of previously formed skills.
- Multilevel system of continuing education may be executed in plenty of variants at schools and beyond it, from basic, through secondary to higher level of education or only at a particular educational level.
- In the teaching-learning process, learning, choice of the way, pace and educational methods are stressed. The teacher's function is changed from a teaching person into an advisor and consultant in the course of choosing active methods and educational aids.
- This model can be executed according to the current normative-legal system or with its small modifications.
- Modular education's objectives will be achieved with a radical change of the educational technology, thanks to teaching-learning individualisation, a bigger share of self-education with the use of active methods and multimedial didactic means, among other educational packages.

A modular system of continuing vocational education was elaborated on the basis of jobs from the mechanical branch.

Mechanics are an occupational group of specialists in the field of mechanical engineering. The following occupational groups are the subject of our analyses and interest.

- Mechanic of machinery and appliances (graduates of two- and three-year basic vocational schools)
- Technicians - mechanics (graduates of five-year secondary vocational schools)
- Mechanical engineers (graduates of three-year studies and masters engineers graduates of five-year studies at higher schools)

A multilevel system of mechanics' education and development takes into account relations between the vocational educational system and the economy, showing in what jobs (at what work stands) the graduates could be employed.

More and more often graduates are employed in enterprises, in which quality assurance systems exist. Employers look for employees with a wide base preparation and master skills or performing the offered work. Certificates and diplomas do not contain such information.

Failures of graduates and the necessity of re-qualification already at the beginning significantly points to the necessity of implementing qualification standards and education quality assurance systems and continuous modernisation of educational contents.

A modular division of general vocational contents of mechanics' education (table 1) was elaborated on the basis of many years' analyses of the contents of mechanics work and work evaluation.

Table 1. Modular division of general vocational contents of education at all the levels of mechanics vocational education

No.	Subject (subject blocks)	Number of modules					
		Number for all levels	Basic vocational School	Technical school on the base of Basic Vocational School	Primary School	Higher school on the base of Technical School	Polish Secondary School
1	Graphics GF 1-19	56	16	14	30	26	56
2	Electrotechnics and electronics EE 1-8	73	28	29	56	16	72
3	Machine bulding BM 1-30	104	36	30	65	39	63
4	Technical mechanics MH 1-33	148	15	76	90	57	147
5	Automation and robotics AR 1-12	76	29	30	50	17	68
6	Measuring technique TP 1-5	36	18	16	34	1	35
7	Materials technology MT 1-6	24	10	13	23	1	23
8	Mechanical technology TM 1-7	156	36	28	58	19	59
9	Computer tecnology TK 1-7	24	6	10	15	8	19
10	Thermodynamics and hydrodynamics TD 1-8	46	10	20	28	15	43
11	Economics EK 1-8	37	17	18	35	2	37
12	Working enviroment of mechanies SP 1-19	34	17	16	33	2	34
13	Technical maintenance ET 1-5	20	7	9	14	7	20
	Σ Subjects blocks 157	Σ 834	245	309	531	210	676

Integration of educational contents, recognition and approval of knowledge and skills obtained at previous educational stages may cause a significant improvement in educational effectiveness.

OUR EXPERIENCES

According to our investigations, about 60% to 95% students of mechanical departments is recruited from technical secondary vocational schools. Partly it proves that the decision about choosing the occupation was made too early and improperly.

It means that a graduate of technical school should be credited with not 676 modules, as a graduate of Polish comprehensive secondary schools, but only with 210 modules.

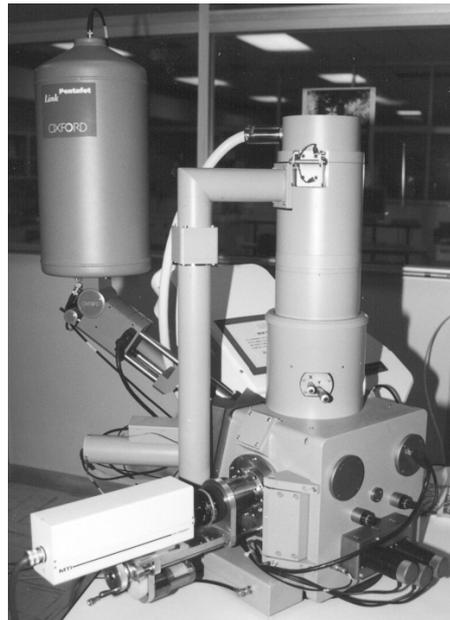
Experiences of Institute for Tecrotechnology, executed huge pedagogical experiments with participation of schools and universities from Poland, England, Germany, the Netherlands and France within the framework of international programmes confirm the appropriate direction of new searches.



Constructing the system of continuing vocational education is strictly connected with

and conditioned by the implementation of the education quality assurance system based on vocational qualification standards.

On the basis of standards it will be possible to obtain the approval of obtained qualifications and skills. The structure and the contents of diplomas and certificates should also be changed or complemented by a document, "passport" containing descriptions of qualifications and a list of obtained and assessed skills, what we propose together with Prof. St. M. Kwiatkowski.



Experience concerning the implementation of MES modules of International Labour Organisation, an experiment of the technical secondary school, the PHARE IMPROVE Programme, as well as activities of the Institute for Tecrotechnology concerning the modular system of mechanics education are just the beginnings of creating a new system of continuing vocational education in our country.