Development of Personnel Specialized Training in the Field for High-tech Production Quality

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The article deals with some problems of personnel training for high-tech productions in relation to the implementation of the federal state standards. It justifies the need to vary the training in the frame of one specialty to take into account regional and professional peculiarities of personnel training in the field of quality.

Key words: *high production, quality education, training profile.*

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The information society is characterized by constant economy increasing on account of breakthrough high technology implementation. It makes new requirements for the professional education system and the process of personnel training.

The increase of national economy competitiveness under conditions of globalization and Russian entrance into the WTO depends directly on how successful we are in creating intellectual products, advanced scientific and engineering developments and their business implementation. It is impossible to do without qualified personnel. There is a need both in high technology personnel and in specialists in quality management field. These are the specialists who are capable of adaptation in a changing world, who are ready to self-study and self-improve, who can take a non-standard decision and promote a product to the world market.

It is generally known that the training level of a particular graduate rarely meets the demand of particular enterprises. Thus, there is a need to complete the education, to have tutors and even to retrain a fresh graduate [1].

This problem is the most obvious in the high-tech field because this field is being developed the most rapidly. For example, training of specialists in nanotechnology becomes difficult because of its interdisciplinary character and rapid information change. It needs making programs of "anticipating" training focused on particular tasks of enterprises [2].

Taking into account high rates of economic growth with increasing technology and equipment complexity, it is critical to develop such educational programs that allow training students whose knowledge and competence can meet the demands of enterprises. It can shorten the post educational adaptation period of a graduate.

Thus, it is necessary to include innovative content, to develop technologies and methods that challenge students' activity. Along all this, it is also important to do the following:

- to strengthen interdisciplinary components both inside the discipline and in specialty modules of educational programs (EP), to consolidate the contents of mathematic, natural, professional and special subjects;
- to ensure individual student training and diversification of educational direction by means of module variety of the specialty part of EP.

Application of the third-generation Federal State Educational Standard (FSES)

is an important step in this direction. It gives much more freedom to universities ensuring the opportunity to have some curricula for one specialty to comply with particular customers' demand.

In comparison with the second-generation State Educational Standard (SES) the FSES is more structured and brief. The requirements to education results are termed as competences; there is no excessive specification in some subjects, variable elements of all subject blocks give more freedom for high schools to develop educational programs.

The basic peculiarities of FSES requirements are:

- Changes in labour input measurement of student's educational load and program acquisition,
- Possibility to organize a module studying process ,
- Education results are termed as competences, which have a wider notion than knowledge and skills.

Along with these basic changes it is necessary to note:

- There are requirements for the application of active and interactive forms and methods in education process,
- There are possibilities of constant development of education programs (item 8.1 has the requirement to reconsider the programs annually, to monitor and to review them).

Application of these requirements together with employers will allow matching the education level of graduates with the level of the employers' demands. This joint work should be implemented by joint education program development, creating of a "competence model" of a graduate taking into account professional standards, educational programs reviewing by specialists of enterprises, joint evaluation of education results(for example, in the frame of State Accreditation Committee) and participating of employers in education programs analyzing at least as a feedback on graduates.

The comparative data on education standards in specialty "Quality Management" in Table 1 testify the extension of possibilities of high schools to develop targeted education programs.

It is necessary to note that a very important factor influencing the education quality is the quality and topicality of the stated standards, requirements and targets (Fig. 1).

From this point of view, the passed edition of FSES has some drawbacks:

- The notion "module" is not clearly defined (for example, what is the difference between the completed subject section and the subject module). It can cause some difficulties while developing a module scheme of education programs;
- It seems that the definitions of kinds of activity and competences were done in a hurry, which makes the qualification "Master" an equivalent to the qualification "Specialist". In this case the bachelor is assumed (though not declared) to be half-taught specialist. The circumstances mentioned above can lead to education quality loss.

The implementation of the FSES in the Pilot education programs has the previous set of specialties. As a result, some specialties are too generalized. For example, a set of specialties for educational direction 22140 "Quality Management" includes the following:

1. Quality management in industrial-technologic systems
2. Quality management in socio-economic systems
3. Quality management in domestic and service sphere
4. Quality management in ecologic systems
5. Quality management in information systems
6. Quality management in logistics
7. Quality management in construction.

Training of graduates, specialty "Quality Management in Industrial-technologic Systems" for enterprises of the special economic zone "Zelenograd" can serve as an example. The professional

Table1. Comparative Characteristics of Educational Standards for Specialist, Bachelor and Master Degree in "Quality Management" Specialization

Second-generation SES	SES "657000" Order N686 in 02.03.2000	Third-generation FSES	FSES "221400" Order N 704 in 8.12.2009	FSES "221400"
qualification	specialist	qualification	bachelor	master
Special subject + General professional subject (high school components and electives), hours	2340	Profile component including variable components in all blocks	3888	3276
Percentage of theoretical course	50	Percentage of theoretical course	50-33	71-84
General professional subjects(GPS)(high school components and electives), hours	566	Only a profile block, hours	2052	1404
Percentage of GPS	10	Percentage of a profile block	48	78

activity sphere of the graduates can cover telecommunication, bioengineering, micro and nanoelectronics, etc. To meet all specific requirements, to take into account all peculiarities in one variant of educational program (EP) is impossible, because the degree of a graduate's competence in a particular industrial-technologic system is determined by peculiarities of the system, specific character of its faults and imbalance as well as measuring systems etc. As a result the period of graduate's adaptation is prolonged.

The development of some EP variants in the frame of one profile can be a solution of the problem. These programs should take into consideration regional production peculiarities and be based on a module principle with a wide range of modules focused on particular production sector. It will ensure the possibility for targeted personnel training in the field of quality.

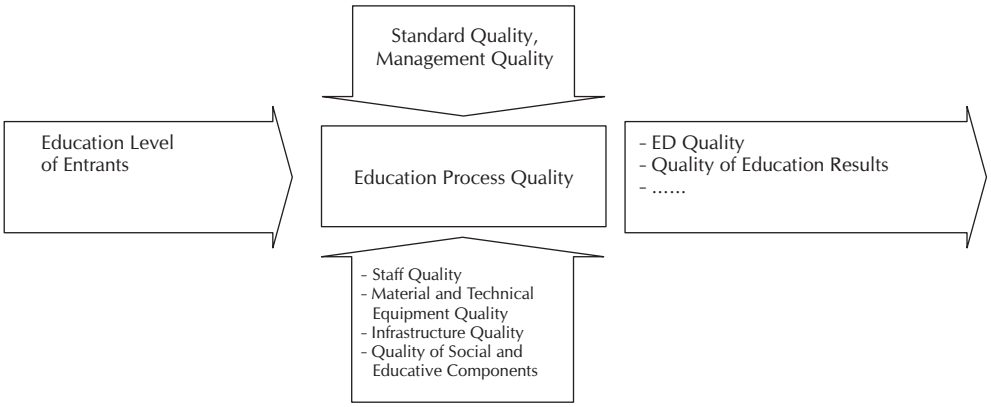
It is important for any specialist in the field of quality to master the following modules (without any reference to a specific economy sector):

- Connected with the development and implementation of quality management system (QMS) based on the All-Union State Standard (GOST) in Russia (ISO 9001:2008) and its further approval by authoritative international certification systems;
- Connected with mastering of special methods and means of control, management and quality provision including such subjects as " General Quality Management", "Statistical Methods in Quality Management", "Metrology", "System Reliability", "Quality Qualimetry", and "Measuring and Control Methods and Means";
- Connected with law and regulatory knowledge. This module consists of the subjects concerning European and Russian legislations. These are the subjects "Technical Market Regulation", "Quality System Certification", "Consumer Protection", "International Certification Sphere";
- Focused on mastering of information technology and computer process simulation (according to standards IDEF3), function simulation (IDEF0), data base simulation (IDEF×), data base management, net management, object oriented programming etc.

Together with these modules it is also necessary to include such modules as:

- Specialized (industry-specific) modules reflecting peculiarities of requirements to quality for example in telecommunication (TL-9000),

Figure 1. Basic Aspects of Education Quality



medicine and pharmacology (GMP), food processing industry, microelectronics (SEMI and ASTM), electrical engineering, automobile production (QS-9000/ISO 16949). These modules should provide the application of general approaches, requirements, and management methods to particular industry activities of enterprises.

- Specialization of basic courses (in the examples, issues and aspects) both in specialty subjects and in mathematical and natural blocks. Thus, to have good knowledge in nanotechnology it is necessary to study such sections of physics and chemistry as "Fundamentals of nanotechnology", "Certification and metrology of nanoscale objects ", "Measuring methods of nanoscale structures", "Defects of structures";
- Particular features of QMS, an enterprise or an employer can also influence the choice of special subjects. For example, courses devoted to integrated management systems, standards of computer-integrated productions, applied protocols of product information support (PIS/CALS), mastering of specialized application programs can be included in an individual training program of a particular graduate. Though it means an active collaboration of a high school and employers.

Laboratory and experimental facilities of high schools are the most important component of providing high quality education for a high-tech production section taking into account its characteristic features like searching and interdisciplinary character of the scientific and technology area. These facilities are made for creating a good combination of practical and theoretical skills, as well as for a well-functioning system of curricular practical trainings in modern enterprises that should be based on an active and constant interaction of a high school and enterprises.

The development of specialty training and extension of its possibilities will help to overcome the contradiction between high potential of high schools and low education quality and to balance the education level and labour market demand. As a result it would increase the educational system efficiency.

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