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Competency-Based Approach to Education Programme Development: the Case of Technology and Engineering Teacher Qualification (Technology of Light Industry)

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The article is devoted to development of competency-based education programme to train technology and engineering teachers with regard to prospects of light industry development. The developed model includes general and professional competences. The general competences comprise instrumental, interpersonal, systemic, informational, communicative, and legal ones. Professional competences include professional, pedagogical and special competences: engineering and production technology.

Key words: competency, technology and engineering teacher, vocational education, light industry, industry forecast.

Problem statement. Development of competency-based education programmes in the frame of Bologna process is one of the challenges for the contemporary higher education in Ukraine. Competency-based approach allows reaching general understanding of qualification requirements and learning outcomes for a particular professional activity, as well as ensuring consistency, comparability and transparency of European education programmes. To obtain a license for educational activity, a project group of an educational institution should develop a number of documents, with a curriculum being a key one. The curriculum development should include some stages. First of all, it is necessary to make a list of competencies and learning outcomes the graduates are to acquire and show as a result of education. The second stage implies determining the subjects (internships) that should form the curriculum with regards to the developed list of competencies.

Specialty 015.17 "Professional education. Technology of light industry" in Kirovohrad State Pedagogical University is being under way for being licensed. The faculty staff has the task to develop a model of a graduate's competency taking into account the prospects of the industry development and employers' requirements. Thus, to determine a set of competencies required for a Bachelor of vocational education and training (B.V.E.T.) is a topical task of pedagogical design.

Analysis of modern research and publications. Competency-based approach to engineering education standard development is in focus of Ukrainian and Russian educators. The article [1] determines competences for Master's programmes in standardization, metrology and certification as cultural and professional. The cultural competences involve personal and professional development, communicative competences, the competence of thought process and information culture, and systems thinking.

Participants of TUNING project [2, p. 8] identified 30 general competencies of higher education graduates, which were classified in 3 categories: instrumental, interpersonal and system. In addition to the general competencies, there are special ones that are unique for each professional area. In particular, the Bachelor should

"know the basis and history of the basic subject, implement the methods and technologies typical for the professional area", and be able to understand and implement the methods of scientific analysis and theory [2, p. 9-10].

We acknowledge undeniable theoretical and practical values of the publications mentioned above, and consider them a theoretical foundation in meeting our challenge. However, there is a difference between two notions "competency" and "competence". In this paper we use the following definitions [3]: Competency is a set of skills and abilities that ensure effective professional behavior (or rights to take decisions). Competence is an integrated personal quality resulted from development of a number of competencies (professional integrity).

According to [4], the basic competencies of educators and scientists are: professional, informational, communicative, and legislative. Communicative competency is apparently distinguished due to the specific features of pedagogical activity. However, the competency list of TUNING project regards informational and communicative competencies as constituents of the instrumental one.

The paper [5] presents a competence model of a vocational training teacher (specialty- Hospitality management) based on the analysis of competencies of Bachelor in hospitality management and teacher of vocational education. The model incorporates general and professional competencies. The latter, in its turn, are divided into pedagogical and specialty-oriented. We consider such competence model to be the optimal one for the specialties combining pedagogical and engineering activities.

Thus, the review of publications proved that the issue on competence model development (for B.V.E.T. in light industry) has not been fully studied yet and needs theoretical development.

The aim of the article is to justify the use of learning outcomes as a list of competencies of B.V.E.T. (specialty 015.17 "Professional education. Technology of light industry").

The qualification of teaching engineer refers to the sphere of "education", though it implies skills and knowledge of engineering activity. Bachelors of vocational education should be able to perform the following activities: technological, technical, training, predictive, research, project, management etc. in vocational colleges and at light industry enterprises.

A B.V.E.T. (specialty 015.1) can take the following positions: at a vocational school – teacher of professional training, training technologist, master of vocational training, senior master; at an enterprise – production supervisor, technology technician, laboratory technician, design technician, safety engineer, and clothing manufacturer.

The education programme of specialty 015.17 is intended for training specialists both for vocational schools (teaching activity) and enterprises of light industry (design, management, production, technological and research activities).

A competence model of vocational teacher (hospitality management) [5] was taken as a base for developing the competence model of vocational teacher (specialty "light industry") so far as it relates to general competencies and teacher's professional competencies. To identify the specialized professional competencies related to light industry we take into account the forecast of changes in content of education of clothing industry specialists [6]. In particular, the basic scenario of clothing industry development predicts preproduction automation and automation of separate production areas as well as development of online custom tailoring. It requires developed informational skills, using professional software, internet surfing for new important job-related data and its processing. Thus, it is not enough for a prospective teaching engineer to have only basic computer skills as described in [2]. The content of informational competency is enlarged for the Bachelors to be able to

apply informational technologies in light industry, in particular, CAD system. The competence model for a teaching engineer is shown in Tab. 1 and includes a list of competencies (Column 1) and learning outcomes (Column 2).

Apart from the competencies mentioned in Tab. 1, some scientists also identify the following competencies: axiological, socio-economic, life- and health protective, polytechnic, managerial, etc. We do not distinguish them as the basic ones in the

Table 1. Basic competence constituents of teaching engineer (specialty – light industry)

Competency	Learning outcomes
	General competencies
Instrumental (cognitive, methodological, and technological)	– ability to analyze, synthesize, organize and plan; – basic knowledge in humanities and social science, fundamental and natural science, and economy; – fundamentals of professional knowledge; – problem-solving and decision-making.
Interpersonal	– ability to criticize and self-reflect; – ability to work in a team including interdisciplinary and international ones; – skills of interpersonal relations; – ability to perceive cultural diversity; – commitment to humanistic, democratic and ethic values.
System	– ability to apply theory to practice; – research skills; – learning ability; – ability to rapidly adapt to new conditions or environment; – ability to generate new ideas (creativity); – leadership; – understanding culture and traditions of other countries; – ability to work and learn independently; – project development and management; – self-starter quality and entrepreneurial skill; – focus on quality; – need for achievement.
Information	– effective information search and structuring, data adaptation to training or production process conditions; – skills to use information resources, and software packages; – skills to use automated workplace of the teacher, designer, or production manager; – skills to conduct distance educational and project activities; – skills to apply computer and multimedia technology, as well as digital educational resources in educational and production process; – maintenance of engineering and design documentation and documentation relevant to education process on an electronic data carrier; – skills to apply CAD system in light industry product design.
Communicative	– ability to ensure effective relations and feedback from students of different ages and their parents; – ability to develop communicative strategies, methods and techniques to ensure effective interaction between team members; – ability to persuade and defend its own position; – official language skills, elocution, professional etiquette, skills of public presentation of work results; – native language written and oral communication; – second language skills.
Legal	– skills to apply legislative and regulatory documents related to professional activity.
	Professional competencies
Pedagogical	– effective solving of typical professional pedagogical problems; – application of educational technologies, techniques of pedagogical diagnostics, and correctional psychology; – constant improvement and implementation of new pedagogical and education ideas into educational process; – implementation of reflective practice.
	Special professional competencies
Engineering	– general technical and technological knowledge, engineering graphics; – efficient application of special knowledge and skills to complete educational, design, technical and creative professional tasks; – ability to develop technical and design documentation for products of light industry taking into account the development prospects of the industry; – good knowledge of basic technology and history of a costume; – understanding and ability to implement methods of scientific analysis, predict technology of light industry.
Production technology	– good knowledge of methods of professional activity and their adequate choice; – ability to choose and use modern equipment in accordance with their characteristics and production aims; – ability to choose and treat modern tissues and materials taking into account available range, characteristics and market development prospects; – ability to plan the production technology in light industry; – ability to implement design methods and production technologies in light industry using modern equipment and technologies, to ensure quality control, meet health and fire- and electric safety requirements; – ability to identify and improve technical and economic indexes of products, to improve economic efficiency, and to promote the products on the market.

paper; however, some of their elements are incorporated in the competencies described above.

Conclusion. The research resulted in a new competence model of a teaching engineer in the sphere of light industry technology. The model is distinguished from other similar models by introducing such new parameters as prospects of innovative development of light industry. The model takes into account the review of publications related to competence-based approach, and meets the Ukraine education regulations and standards. It includes general and professional competencies. The general ones embrace instrumental, interpersonal, system, information, communicative, and legislative. Professional competencies are subdivided into pedagogical and those related to professional activity: engineering and production and technological. Further research will be focused on the competency development model for a teaching engineer in light industry.

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UDC 378

Analysis of the Curriculum Subjects Correlation

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The methodological foundation for the analysis of courses dependencies within the university curriculum has been studied. To build an effective curriculum, a model of disciplines correlation analysis based on Spearman's rank correlation using students' assessment as input information was proposed.

Key words: curriculum, discipline, correlation, model, analysis, prerequisites, co-requisites.

Introduction

One of the main goals of University control automation is to develop a curriculum. It provides initial data for dean's offices.

While implementing the new federal state educational standards of higher education (FSES HE) in the education system, it is necessary to take into account the relations between studied subjects to develop new curricula. These relations are reflected in the terms of "prerequisites" and "post-requisites".

Prerequisites are subjects that are required to be studied beforehand.

Post-requisites (co-requisites) are the subjects that should be studied after a particular subject.

In most cases, prerequisites and post-requisites are chosen by a faculty member without taking into consideration the interrelations between these disciplines. Thus, the curriculum can only partially reflect the relations between the subjects, which leads to inconsistent assessment and auditors' claims in the framework of education quality management system.

1. Approaches to curriculum development with regard to logical coordination and consistency of subjects

Let us consider some approaches to effective development of curriculum in higher education institutions with regard to logical coordination between subjects.

The aim of curriculum enhancement is to choose the most essential content for a particular professional activity and distribute it throughout the academic terms in an optimal manner.

It should be noted that curricula can be presented as directed graphs, tables, or matrix, which conditions the variety of approaches to curriculum design [1, pp. 16-28].

Works [2, pp. 90-97, 3, pp. 111-116, 4, pp. 134-143, 5, pp. 179-185] offer algorithms of curriculum design with regard to interrelations between studied subjects and developed competencies. While developing curricula, the value of a subject, faculty qualification, and sequence of subjects are taken into consideration. However, it is a user who determines the dependency between the subjects. Thus, the issue of adequacy of such relations remains open.

Mathematical models offered in [6, pp. 66-71] are based on automation of curriculum development by using a semantic net to arrange the sequence of the subjects. In this case, relation-associations reflect the subject dependency, which reveals all non-realized dependencies in the curriculum.

Studying the issues of material

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