INNOVATIVE TECHNOLOGIES OF DEVELOPMENT OF ENGINEERING AND PEDAGOGICAL EDUCATION

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Abstract

The article deals with the issues of evolutionary transformations of engineering and pedagogical education (EPE). Attention is focused on the fact that it is a kind of general education system and provides training teachers for pre-professional, professional (vocational and technical) and professional pre-higher education.

The authors distinguish five periods of evolvement and development of engineering and pedagogical education: emergence, evolvement, initial, mature and prospective development.

Management modernization tools are innovative management technologies such as outsourcing, benchmarking, coaching, marketing and monitoring technologies. The paper reveals the essence of the aforementioned innovative technologies.

Outsourcing is considered as a management technology in the article. It is noted that IT outsourcing addresses the issues of the information system development, implementation and support. Benchmarking reveals its true form as a continuous systematic search and implementation of best practices aimed to lead organization to more advanced forms. A benchmarking cycle is provided. A consulting and training method like coaching is considered. Special attention has been given to marketing and monitoring technologies in the paper. The qualimetric factor model is represented as a tool to determine the level of an individual creative development used in professional (vocational) institutions and institutions of engineering and pedagogical education.

Keywords:
engineering and pedagogical education
professional (vocational and technical) education
innovative management technologies
outsourcing
benchmarking
coaching
marketing and monitoring technologies
development

1 Introduction

Engineering and pedagogical education (EPE) is currently regarded as a form of education that provides special training and professional growth of teachers of vocational and general technical disciplines for institutions that ensure pre-professional, professional (vocational and technical) and professional pre-higher education.

EPO emerged as an independent field in the 1960s in the wake of the rapid development of vocational and technical education (VTE) at the time and it has its peculiar features. It is primarily a combination of pedagogical, manufacturing, engineering and technical activities affording development of a qualitatively new profiling. The interpenetration occurs between professional and engineering education and professional and pedagogical education stipulating emergence of integrated knowledge for training an integrated qualitatively new specialist. The emergence of interrelation between education and a particular industry consequently generates a new industrial and pedagogical type of educational process stemming from the establishment of a

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robust relationship between engineering and pedagogical education and the VTE system. This fact reveals the dual function of EPE. On the one hand, it ensures the quality of workforce training, and, on the other hand, it should constantly adapt to the changeable demands of the skilled labor market. In other words, engineering and pedagogical education feeds on itself by strengthening the connection with vocational and technical education and it has a dual nature.

2 Chapter

The development of engineering and pedagogical education contains several periods. The first one described above was classified as "emergence" by us and stretched during 60-70 years of the last century. The second one classified as "evolvement" was during 70-80 years and characterized by preparation of teachers of special disciplines and job training instructors for the system of vocational and technical education. The third period is "initial development" which lasted from the mid 1980's up to and including 1997. EPE focused on training a comprehensive specialist for vocational and higher education (higher education institutions (HEIs) of I-II accreditation levels) at this time. Such a specialist could simultaneously perform the functions of a teacher of special disciplines and job training instructor and he had acquired the qualification of a teaching engineer. During these years a two-tier system was formed for training engineering and pedagogical personnel: industrial and pedagogical technical colleges produced job training instructors, and higher educational institutions produced teaching engineers. The fourth period classified by us as "mature development" had started since 1998, as the teaching engineers training was differentiated into four levels: junior specialist, bachelor, specialist and master. Therefore, a four-tier education was introduced. The intensive development of new professions and integrated specializations/specialties had led to the establishment of new engineering and pedagogical faculties in a range of HEIs under the context of the new needs of the labor market and accession of Ukraine to the Bologna process [2; 6]. The fifth period of "prospective development" has continued for engineering and pedagogical education since 2017. The new Law of Ukraine “On Education” (2017) and the regulations direct the development of EPE towards differentiation of particular engineering and engineering-pedagogical specializations/specialties. Possible changes are envisaged in the education and qualification description of the graduates implying introduction of a double education and qualification level “engineer; teaching engineer” intended to expand employment opportunities for graduates. Moreover, the acquisition of dual specialties is associated with the development of the adapting ability in volatile market situations, that is urgent and absolutely essential from the standpoint of contemporary challenges.

All of the aforementioned changes are possible only through the modernization of management actions meant to shift its character from authoritarian to more flexible democratic. It can be accomplished by activation of adaptive processes through decentralization.

Control decentralization requires mutual interest from the public (employers, parents, philanthropists, sponsors, etc.) and officials, pupils/students. For this purpose, it is necessary to have a modernized regulatory and legal framework for functioning of engineering and pedagogical institutions and establishments, as well as advanced market conditions. Let's reveal the essence of some innovative management technologies *(outsourcing, benchmarking, coaching, marketing and monitoring technologies).*

Outsourcing is a management technology involving a company to transfer its tasks or processes to other performers under the subcontracting conditions. It is an agreement whereby the work is performed by employees from an outside firm usually being an expert in this type of work. Outsourcing is often used to reduce costs [http://uk.wikipedia.org/wiki/Аутсорсинг] [1].

Put simply, it is outside resourcing to meet inside needs. The core principle of outsourcing is to keep what you can do better and transfer to an outsourcer what he can do better.

The main source of cost savings by the agency of outsourcing is to improve business performance as a whole and to create an opportunity for releasing the relevant organizational, financial and human resources in order to develop new areas, or place greater focus on existing ones that require increased attention.

Ukraine unlike developed market economy countries starts only to master this technology of management. Outsourcing is carried out abroad in the following areas as staff relations, computer hardware and IT technologies usage, printing, labor protection, legal services, accounting, sales and many other directions.

IT outsourcing deal with issues related to the development, implementation and maintenance of information systems. It could be at the enterprise infrastructure level:

- maintenance of hardware or software;
- support for the functioning of selected areas of the system, such as programming, hosting, testing, etc.

We have not seen examples of outsourcing in engineering and pedagogical education of Ukraine.

Benchmarking is a continuous systematic search and implementation of best practices that will lead the company to a better shape. It is an effective tool for positioning the firm against other firms of comparable size and/or sphere of action [uk.wikipedia.org/wiki/Бенчмаркінг].

There are the following types of benchmarking:

1) Internal benchmarking boils down to analyzing and comparing the performance of different business units within entities.

2) Competitor-oriented benchmarking is focused on the comparative analysis of goods (performance, services), productivity and other measures between competing entities. It is considered that the best analogue for comparison is the "market leader". Identification of the factors determining a gap of the firm with a leader makes it possible to develop guidelines for reducing the gap.

3) Functional benchmarking whereby the individual processes, functions, methods and technologies are analyzed in comparison to other non-competing entities. Companies using similar methods, techniques or technologies and not being competitors readily exchange mutual primary information and seek to implement joint projects aimed at improving one or another comparable operation.

4) *Process* benchmarking – studying and comparing process characteristics; general benchmarking – comparing the specific function of several entities from different activity sectors;

5) *Strategic* benchmarking – studying successful strategies of partner companies;

6) *Global* benchmarking – exploring the culture and national characteristics of an entity activity [uk.wikipedia.org/wiki/Бенчмаркінг].

Benchmarking is considered in management as a special procedure for introducing best technologies, standards and methods of work into an educational institution. However, it is not a simple copying of other person's ideas, but an effective method of improving the activity of the educational institution based on the creative attitude to the leader experience. “Benchmarking” is an unknown word for most Ukrainian executives, and it is not perceived as a management method but as a simple competitor analysis or marketing study.

What exactly could an EPE get using benchmarking? Firstly, benchmarking enables EPE to “see itself through others’ eyes” – to analyze objectively its weaknesses and strengths. Secondly, a targeted study of EPE leaders will allow to determine strategic benchmarks in order to be ahead of the times.

Thirdly, benchmarking allows you to draw on new ideas both in the organization of the learning process and in the marketing of educational services. Fourthly, benchmarking is an alternative to traditional strategic planning opening up the opportunity to move to planning based on an analysis of competitors' metrics.

The biggest advantage of this process is that the organization learns to change without major disruption of its structure. Given the lack of a single standard for its implementation, well-known world benchmarking models require further adaptation for engineering and pedagogical education in Ukraine.

Coaching (education, training) – a method of consulting and training; classic consulting and training differs in that the coach does not give advice and rigid recommendations, but seeks solutions together with the client. From psychological counseling coaching differs orientation of the motivation. Working with a coach involves achieving a certain goal, new, positively formulated results in life and work.

The coach does not teach his client how to do some things. It creates the conditions for the student to understand what he/she needs to do, to identify ways in which he/she can achieve the goal, to choose the most appropriate course of action and to outline the main stages of achieving the goal.

Coaching in the system of engineering and pedagogical education is, first and foremost, an instrument of personal growth, which is ready to establish itself in the society and plan its life in the light of successful professional activity through professional self-improvement. Coaching technologies in the process of training of high-level specialists in system of engineering and pedagogical educational institutions and software will allow to expand the limits of classical vocational training through the system of knowledge, skills, forming professional and social motives of future specialists, will trigger them to create and successfully implement their life plan respond to social and industrial changes.

To make informed decisions in terms of market relations in the management of engineering and pedagogical education *marketing and monitoring researches* are useful. Marketing technologies are closely related to Internet technologies. Recently, vocational schools that build partnerships with engineering and pedagogical educational institutions use *websites and web pages* to promote the institution, revealing its strengths, a list of professions, conditions of study and living in a hostel, partnerships with employers and so on. *The promotion of marketing activities in the virtual space of the Internet* is a worldwide trend, which is clearly observed in Ukraine.

Innovative technology in monitoring research is a kind of toolkit, which not only plays a generalizing role, but including the criteria characterizing the desired result, acquires the properties of a qualimetric standard. The data is populated in an Excel spreadsheet to automate the calculation of results. The following is an

example of a qualimetric model for measuring the level of creative personality growth used in the educational work with students of institutions and structures of engineering and pedagogical education

Thus, market transformation influences the management of vocational education and engineering education in the areas of decentralization, as well as the gradual introduction of innovative, inherent in market economy, management technologies: outsourcing, benchmarking, coaching, marketing and monitoring technologies.

In general, the modernization of the system of management development of engineering and pedagogical education will be directed to the further development of its institutions, the relevant structural departments of higher educational institutions, including the extension of the head along, increasing their personal responsibility for the quality of teaching staff for VTE system, pre-professional and pre-higher education.

Thus, the use of innovative management technologies contributes to the further perspective development of engineering and pedagogical education.

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