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Training of Industrial Sphere Managers in a Specially Organized Education Environment

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ABSTRACT

The professional activity of industrial sphere managers has an integrated character and includes managerial, economic and production activity. Due to this the structure of readiness of industrial sphere managers for professional activity is composed of three components: subject, reflexive and technological ones. The objective of this paper consists in providing grounds for the choice of means of forming the readiness for professional activity. As such means, the professionally oriented education environment is viewed, i.e. the total variety of pedagogical conditions and means of learning that reinforce the formation of readiness. The results of the experiment demonstrate the growth of parameters in the readiness component structure.

KEYWORDS
Industrial sphere manager, readiness for professional activity, educational environment, professional environment, integrated training course

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Introduction

In today's conditions, the competitiveness of an organization is determined not so much by the availability of advanced technologies rather than its intellectual capital. It is the intellectual capital that proves to be the main driving force in creation of innovation products. Efficient competition in industry is only possible as a result of close integration of science and education with production. H. Etzkowitz (2007) believes that the modern higher education institutions are the main generators of innovations and so their activity should focus at the intersection of interests of an educational institution with two principal influence groups – business and the state.

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This leads to creation of educational and industrial groups which unite their assets (both material and intangible) according to the participation system in order to implement investment and other projects. The world experience demonstrates such groups founded around universities increase their innovation character greatly (Bergman & Feser, 1999). However, the traditionally formed approaches to production management do not further its upgrade. The existing integration of systems "economy-education-production" that successfully ensures training of personnel for the industrial sphere in the part of engineering and work specialists virtually ignores the managerial personnel. The present day production has a compelling need of industrial sphere managers. An industrial sphere manager is a specialist who not only possesses knowledge in economics and management but also is capable of solving the problems of designing, engineering, functioning and practical application of the innovation equipment and technologies in a certain branch of industrial production.

The analysis of psychological and pedagogical literature shows that the problem of training managers in various profiles has received enough attention in the world of science during the latest decade. Foreign business and managerial periodicals as well as the Internet resources were valuable sources for our analysis. We have studied the materials of such magazines as the Academy of Management Journal, the Management International Review, the Management Learning, international annual bulletins in management and business education etc. Quite a large number of studies deals with the problem of forming the readiness of managers for various activities: for business communication (Dembrovskaya, 2012, Khusainova & Melchenkova, 2007); for managerial activity (Morusov, 2012); for establishing the business relations (Solomykin, 2006); for analytical activity (Borisova, 2012). Some problems of training of managers are considered in the works of D. Bok (2009), O. Zuber-Skerritt (1994), H. Rosovsky (1990), S.D. Charlier (2014) and others (Blimling, 2008; Blumberg & Pringle, 1982; Michalos, 2014; Davies, Fidker & Gorbis, 2011; Gamble & Jelly, 2014, Koźmiński & Spillane, 1971; Sutic & Jurcevic, 2012). However, there is a lack of works which would reflect the specific character of professional activity of industrial sphere managers and highlight the means of training of these specialists.

Industrial sphere managers make managerial decisions the results of which influence the development of production. Meanwhile, the educational process of a higher education institution that is oriented to training a multipurpose manager without taking into account the specific character of activity and focus of the industrial sphere does not further readiness of graduates for solving the innovation managerial tasks. Thus, there arises an objective controversy between the integrative character of professional activity of industrial sphere managers and underdevelopment of means of forming the readiness for professional activity during the learning process at higher education institutions.

It is the aspiration to find ways of solving the above controversies that has brought about the problem of our research. In the theoretical sense, this is the problem of preparing the industrial sphere managers for professional activity in line with the development of the modern production. In the practical part – it is the problem of identifying the means furthering the formation of industrial sphere managers' readiness for professional activity.

This has allowed determining the objective of the research: to give theoretical grounds for the structure of readiness for professional activity proceeding from the specific character of the professional activity of industrial sphere managers, to develop and evaluate by experiment the means of forming the readiness for the professional

activity of industrial sphere managers during the higher education institution learning process.

The results of our study provide a more profound insight into the specific character and particularities of the professional activity of industrial sphere managers and they contribute to the development of means of formation of their readiness for professional activity in the innovation production conditions. The practical importance of the research consists in its results being focused at improving the professional training of industrial sphere managers.

The professional expertise of industrial sphere managers as specialists in managing the production systems is the integration of three competences: the production one, the managerial and economic ones. The production competence of industrial sphere manager is the ability to perform production activity formed in the process of learning. The managerial competence of industrial sphere managers is viewed by us as the ability to perform organization and managerial activity formed in the process of learning. As for the economic competence of the industrial sphere managers, this is the capacity for the information and analytical activity formed in the process of learning (Firsova, 2013; Innovations in education, 2014). The formation of the entire required total of the professional competences is only possible in a specially organized education environment.

The notion of education environment is an important characteristics of the educational process yet it is treated by different authors differently.

S.M. Vishnyakova (1999) deems the education environment to be the total of specially organized conditions, processes and social interactions influencing the personality in teaching and upbringing ways. A.P. Liferov (1997) believes the education environment to be the "area of certain interaction of educational systems and their individual elements… This is the total of all kinds of education institutions as well as the management bodies relevant for them in cooperation with leisure, sports and recreation, cultural, scientific and production and other institutions oriented to the needs of education". V.A. Yasvin (2001) determines the education environment as a system of effects and conditions of formation of a personality according to the set pattern as well as opportunities for the development thereof contained in social and spatial and objective surrounding and including three components: spatial and architectural, social, and psychodidactic ones. Within this study, by the education environment of higher education institutions we are going to mean the professionally oriented environment as a total of conditions and means ensuring the students mastering the way of life, thinking and professional behavior of industrial sphere managers.

Materials and Methods

In our case, pedagogical efforts should further the satisfaction of potential employers' requirements for the quality of training of industrial sphere managers. This brings about the necessity of integration of the education and professional environments i.e. the professional environment should be "inbuilt" into the education environment in such a way as to ensure efficient interaction between the main participants of the pedagogical process: teachers – students – employers.

In order to find out the required professional and personal qualities for industrial sphere manager, in 2012 we conducted a questioning survey of heads of the leading industrial enterprises of Samara region (the sampling made 100 top managers); of graduates of the branch who are employed as managers in the industrial sphere (50 people); of students who study in the Management profile (100 people); and of

economic subject teachers of the branch (20 people). The respondents were asked to determine the competences essential for industrial sphere managers. We identified these competences with the professional activities and functions of industrial sphere managers, which has enabled us to elaborate the structure of their readiness for professional activity.

For studying the content of formation of industrial sphere managers' readiness for professional activity, we used the content analysis method on the text of work programs of the curriculum courses based on functional duties that correspond to the content of the professional activity of industrial sphere managers. The following word meanings were selected: for the production function – "engineering", "design", "resources provision"; for the managerial function – "decision making" and "organization"; for the economic function – "analysis" and "forecasting". In the content analysis, we counted the occurrence of measurement units in the text. When performing the content analysis, we assumed that every course had reserves for forming the readiness for the professional activity of industrial sphere managers. However, the content analysis has shown that the content of courses included into the curriculum needs essential supplements. Although the word meanings are not an exact reflection of names of the industrial sphere manager competences, the content analysis has demonstrated there is a basis for forming the readiness of industrial sphere managers for the professional activity in the sphere of economy and management yet there is virtually no such basis concerning the training in the production sphere. However, the formation of the technological component is impossible without the formed subject and reflexive ones.

The integrated course "Foundations of production systems management" developed by the authors becomes the main element of the professionally oriented education environment. The tasks of the course is to form a responsible attitude to the profession, an idea about the professional values and opportunities and the professional competences of industrial sphere managers. With regard to this, the professional competences comprise both the basic ones stipulated in the educational standard and the additional ones revealed as a result of questioning of the employers. In the learning process, the course performs the following functions: the coordinating one (streamlining the information up to the content of readiness components); the forming one (it develops the abilities for the professional activity); the system building one (it makes up a scientific knowledge system); the intellectual one (developing the interest in knowledge and enthusiasm for the process of gaining the professional abilities by solving the practical tasks); the control and correction function (this ensures monitoring the learning activity results and subsequent adjustment of the former); the illustrative one (it allows working with the modern software means and practice-oriented learning methods).

The content of the course is formed according to the kinds of professional activity of industrial sphere managers and is composed of three sections. Each section is aimed at forming the relevant activity in students – managerial, economic and production one.

When the section "Foundations of production systems management" is studied, the abilities for enhancing the organization and managerial activity are formed. The results of surveying the heads of the city's and region's leading enterprises helped find out the following additional competences for this activity:

- an ability to manage the production systems;
- an ability to act decisively and bear responsibility for decision making;
- an ability to coordinate the work of technical and production personnel;

- an ability to control oneself;

- an ability to make up a team.

When the section "Design and engineering activity" is studied, the abilities for the production design and engineering activity are formed that are based on studying the software means for designing and engineering the new products, the technological situations, ways of reorganizing the production and so on. In this case, the additional competences are as follows:

- a capacity for the design and engineering activity;

- an ability to participate in goal setting of the project;

- an ability to master and use the modern methods of production organization and management;

- an ability to participate in development of existing productions upgrade projects and in creation of new ones;

- an ability to perform organization and planning calculations for creating new ones and reorganizing the existing process production areas.

When the section "Forecasting the development of production complexes" is studied, the abilities are formed that allow performing the economic information and analytic activity at high a quality level:

- an ability to analyze the professional situation;

- an ability to analyze the financial reports and make justified investment, loan and financial decisions;

- an ability to forecast;

- an ability to evaluate the result of activity;

- an ability to analyze the market and specific risks and to use the results for managerial decision making.

The positive side of the integrated course consists first of all in the following aspects:

1) the opportunity of joint interaction of both pedagogical technology and didactic means;

2) the opportunity of changing and adapting to any system of forming the readiness for professional activity;

3) the content-related element of the integrated course will be based on the specific character and particularities of the professional activity;

4) the opportunity to teach students with the knowledge already obtained and to be obtained borne in mind, i.e. with basic general cultural and professional competences, proceeding from the requirements of the society and the time.

Moreover, an essential distinction of the integrated study course from a similarly taught standard subject will also be the diversity of abilities gained, as there are several related subjects studied.

Another element of the professional and education environment of higher education institutions is organization of managerial and production practices in definite jobs at the city's leading enterprises with the subsequent employment of graduates. Thus the professional environment turns out to be integrated into the education environment.

The objective of pilot and experimental work was to create methodical support and test it out. The research was conducted on the basis of the branch of the federal

state budget-funded institution of higher education "Samara state technical university" in Syzran in 2012-2015. The general sampling for the survey was made up of the third year students of the faculty of engineering and economics studying in full-time, part-time and extramural form of studies in the Management profile (bachelor's degree), the total being 100 people. Optimum conditions for achieving the objective of the experiment were created, which implied adjustment of the learning process without having to breach the requirements of the federal state educational standard and interdisciplinary consistency.

The experiment included three stages. At the first stage, the elements of the system for forming the readiness for the professional activity in industrial sphere managers were developed and the indices of formation of the components thereof were determined. Stage two saw the ascertaining experiment aimed at studying the formation of indices of the components of readiness for the professional activity of industrial sphere managers. At the third stage, the content of the integrated academic subject "Foundations of production systems management" was implemented and the results of the ascertaining and the forming experiments were compared. Efficiency of the experiment was determined by comparing the results of the two years longitudinal study.

For studying the formation extent of the reflexive, subject and technological components of readiness for the professional activity of industrial sphere managers, a complex of methods was used: interviewing, questionnaire survey, self-assessment and expert judges' assessment.

The ascertaining experiment was aimed at revealing the formation extent of the reflexive, subject and technological components of readiness for the professional activity of industrial sphere managers. A five points system was used for assessing the answers, where score 5 corresponded to the highest formation level of the component index and score 1 – to the lowest. The percentage of sampling was determined as the ratio of the average score to the maximum possible one.

During the ascertaining experiment, the indices of the reflexive, subject and technological components of readiness were measured. It has been found out that for the most respondents taking part in the experiment a low level of development thereof is characteristic. This can be explained by the controversy between the wish to study the industrial sphere manager's profession and the lack of set to the industrial sphere managers' professional activity as well as by the students lacking the knowledge about the specific character of the professional activity. This result of the ascertaining experiment has confirmed the necessity to introduce the integrated course "Foundations of production systems management" into the process of preparation for the professional activity of industrial sphere managers which will promote the development of the required professional competences.

Proceeding from the results of the ascertaining experiment, the tasks for the forming experiment were determined: to design and introduce the new content into the system of professional training of industrial sphere managers; to select methods and forms of learning that further the formation of readiness for the professional activity of industrial sphere managers; to select techniques for monitoring the results of the experimental work.

The forming experiment was aimed at developing and testing out the system of forming the readiness for the professional activity of industrial sphere managers. The objective of the forming experiment is inclusion of students into the process of mastering the special content proceeding from the integrated, team, learner-centered and competence-based approaches.

The learner-centered approach allows taking into account and involving each student when selecting the methods of learning. Individual situations have yielded a positive result, which is represented by the growth of ability values in the materials of the forming experiment. The team approach has allowed developing the abilities essential for team work. Based on the activity and competence approaches, competences the importance of which is confirmed by the potential employers are developed in the readiness structure.

L.V. Lvov (2009) insists that the "professional expertise" is an integrative property of a specialist (the capacity and readiness for carrying out the professional activity) that consists of the system of the displayed competences. Thus, readiness for the professional activity of industrial sphere managers will be an integrative property of personality conditioned by the specific character and particularities of this activity and represented by the total of competences expressed by abilities.

The objective of professional activity is associated with the object and subject of the activity. According to E.A. Klimov's classification of occupations (Klimov, 2012), the activity of industrial sphere managers covers the following subjects: "man – sign system", "man – equipment", "man – man". Respectively, the objects of this activity will be the sign system (figures, formulas, texts, graphs and drawings, diagrams etc.), equipment (technical mechanisms and structures), and man (personnel).

The subject of the industrial sphere managers' professional activity is the strategy using which they directly perform their work. The "man – sign system" sphere corresponds to the financial strategy consisting in certain actions of using the own and borrowed external financial resources in the organizations for achieving the target performances up to forecasts. The risk factor and taking into account the forecasts are of special importance for working out the financial strategy. Therefore, a financial strategy should be developed with the risk of mala fide purchasers, trends and possible events, inflation staggering, financial crisis forecasts, change at financial markets and in currency rate borne in mind.

The strategy of managing the personnel and processes corresponds to the object of the "man – man" sphere. Its essence consists in making up the efficient teams capable of implementing strategic tasks of enterprises in line with its resource opportunities.

The production strategy corresponds to the object of technological nature in the "man – equipment" sphere. This is a program of certain actions in creating and selling the products of enterprises that is targeted at the consumer. The strategic tasks to be solved in the production sphere encompass the following directions: concentration of the production capacities; development of the production organization; the use of production and technical personnel; the development of production infrastructure; controlling the quality of works and products; organization of contractual relations with contractors and suppliers and other commercial production partners; managing the production process.

Each activity sphere has got its matching component in the structure of industrial sphere manager readiness for the professional activity: the reflexive one corresponds to economic activity, the subject one – to managerial, and the production one – to technological.

Results and Discussion

A comparative analysis of the results obtained has demonstrated that the formation extent of indices of the components of industrial sphere managers' readiness for the professional activity has an increasing trend in the forming experiment versus the ascertaining one, which confirms the performance of the developed and tested out

system of forming the readiness for the professional activity of industrial sphere managers. In all indices, a positive dynamics can be seen (Table 1). It should be pointed out that the independent students' assessment of readiness indices and that by experts are almost equal.

Table 1. Results of Pilot and Experimental Work of Forming the Readiness for Professional Activity

Components of readiness	Ascertaining experiment		Forming experiment		Increment of component values	
	Self-assessment	Experts assessment	Self-assessment	Experts assess-ment	Self-assess-ment	Experts assess-ment
Technolo-gical	45,3	43,0	83,7	82,7	38,4	46,6
Subject	41,2	38,8	76,9	77,7	35,7	38,9
Reflexive	74,8	74,9	82,1	80,3	7,3	5,4

So, the values of reflexive readiness component indices has gone up by 5,4%, which is due to the content of the "Foundations of production systems management" course that includes a large resource of information and practical tasks, a business game and introduction practical training that work for the development of abilities to analyze and forecast in the industrial sphere supplementing the basis for forming the reflexive component abilities available in other courses. Case studies containing situations to be analyzed for economic performances of the industrial sphere have played an important part in forming the reflexive readiness component indices.

The subject component indices also demonstrated a positive growth of abilities (38,9%), which is brought about by introducing the relevant sections into the integrated course and active learning methods with students getting involved in team managerial decision making. Higher values of subject component abilities confirms the efficiency of trainings aimed at the development of students' abilities to make up a team and manage it, to make decisions for achieving the common goals of the enterprise and to consciously perceive themselves as subjects of interaction with others.

The technological component indices gave an increment of 46,6%, which is due to the use of simulation learning methods and production practice forming the abilities to apply engineering tactics. We have found out that business games (STRAPLAN, SIPROM, ORGPRO) simulating the professional activity of industrial sphere managers have to be used as well as the modern production software for engineering and design of production processes. Moreover, the students were granted an opportunity to apply their abilities in production practice when allocating the resources in the Lean production system.

Using the correlation analysis, a close relation between the technological and subject components, technological and reflexive components, and between the subject and reflexive ones, which confirms the integrated character of readiness as a personality property. According to the forming experiment results, it is the technological component that has become the prevailing index as it has got the greatest quantity of significant relations (in the data of the ascertaining experiment, it was the reflexive component that dominated).

Thus, the results obtained confirm that the development of abilities for professional activity owing to the use of the integrated course as an element of education environment of higher education institution causes the students to actively

get involved into the learning process and helps the formation of the components of readiness for the professional activity of industrial sphere managers.

The research into the problem of higher educational institution preparation of industrial sphere managers for the professional activity conducted by us contributes to a certain extent to the development of professional education in conditions of its upgrading and the employers' sophisticated requirements for the graduates. Alongside with that, we realize that not all the tasks set have been solved thoroughly. Such aspects as methodical support of the educational process, retraining of higher education institution teachers who form readiness of industrial sphere managers for the professional activity remained beyond the scope of our study.

Conclusion

The particularity of innovation economy consists in the necessity to solve the overtaking and advancing tasks in production. According to surveys of enterprise employees, a valuable intellectual resource of production enterprises are managers of industrial sphere – it is on their expertise that the implementation of strategic plans of the enterprises depends. The analysis of job descriptions of industrial sphere managers, educational standards and qualification characteristics has allowed revealing the specific character of the professional activity which is expressed by integration of professional activities conditioned, in its turn, by the "economy-production-education" integration, with production activity being the leading one. The analysis of pedagogical, psychological, and methodical literature has confirmed the necessity of introducing some change into the industrial sphere manager training process thus proving the necessity being conditioned by potential employers' requirements and by the development of industrial sphere.

The theoretic search has discovered the principal controversy between the need of practice-oriented profile of the professional activity of industrial sphere managers and underdevelopment of the pedagogical means ensuring the formation of their readiness for the professional activity, with its specific character and particularities borne in mind. The lack of practical skills of solving the professional tasks has confirmed the necessity of looking for the means of forming of industrial sphere managers' readiness for professional activity.

At the diagnostic and design stage of our research during the ascertaining experiment, the insufficient formation extent of the components of readiness for professional activity was found, which has confirmed the validity of the approaches selected and the necessity of bringing change into the industrial sphere managers training system. The forming experiment taking place on the basis of the branch of the federal state budget-funded institution of higher education "Samara State Technical University" in Syzran has confirmed our hypothesis: an integrated course does promote the formation of readiness for the professional activity of industrial sphere managers.

Proceeding from the analysis of the empirical materials obtained during our study and their theoretical thorough understanding, we can come to the following conclusions:

1. The professional training of industrial sphere managers has to rely on an integrated approach taking into account the specific character and particularities of the professional activity.

2. Readiness for the professional activity of industrial sphere managers is formed in a certain education environment the main element of which is the integrated course "Foundations of production systems management".

3. The results of implementation of the system of forming the readiness of industrial sphere managers for the professional activity are expressed by the quantitative increase of indices in the readiness components structure with the technological component prevailing, which is a prerequisite of successful professional adaptation to the innovation conditions of the modern production.

Disclosure statement

No potential conflict of interest was reported by the authors.

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