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INNOVATIVE, INTERACTIVE AND LANGUAGE DETERMINANTS OF INTERNATIONAL INTEGRATION OF RUSSIAN HIGHER MINING EDUCATION

Russian industry embarking on an innovative development path reflects world trends of international cooperation among higher education institutions dealing with engineering staff training and integration of higher technical education. Russia's joining the Bologna Process requires that higher schools prepare graduates, on the one hand, for an immediate start of professional activity at enterprises and, on the other, to ensure their mobility on the global labor market.

At the same time, Russian higher education institutions should be capable of training engineers from foreign countries, attaining the international level of skills training. The training of mining engineers in Russian technical universities cannot stand apart from the international integration of the educational process.

The generality of technological, production and administrative processes of the mining industry in different countries makes the international integration of the higher education of mining engineers in Russia especially topical. However, the low standing of Russian technical universities in the world ratings, the limited acknowledgment of Russian diplomas abroad, insufficient study motivation of students and poor foreign language skills all serve to constrain the process of international integration of Russian higher mining education.

The response to the challenges placed by globalization of the higher education system and the compelling need for the international expansion of Russian higher schools should become innovative, interactive and language determinants of this process. They represent the conditions that determine the prospects for integration of mining engineers' higher training in the international economic community. The given determinants should be implemented at the level of specific higher education establishments by using innovative pedagogical technologies, such as binary lectures, role-plays, brainstorming, case study, and project training in the educational process.

Keywords: educational integration, mining engineers' education, innovation, interactive, language determinants.

The prospects of Russian industry development have been determined as a transition to the postindustrial development stage of public production [7]. It is characterized by a high share of deep raw material processing, mass intellectual product generation on the one hand, and by "knowledge-driven economy" development and transformation of engineering universities into innovation-driven development flagships on the other hand [14, 17, 19, 20]. The scientific community has been actively discussing Russia's advantages, required for innovation-driven development: these are the comparatively high urbanization level, the USSR's considerable scientific and industrial heritage, including the developed sector of raw materials, and the relatively modern educational system for engineering staff [4, 5, 9, 13, 18].

The tendency towards the integration of industrial entities and higher engineering education institutions has been intensifying lately along with the globalization of national educational complexes and the development of international university cooperation. All of this has become part of the production and educational globalization process. Formation of the global educational system is fully reflected in the Bologna Agreements.

The following objectives can be set when translating the imperatives that the Bologna Process places upon Russian higher education in respect of mining engineers [1, 8, 15, 16]:

1. Not to extend the higher education period while cutting government expenditure for students and preserving the specialist education quality. This is of special significance for the

higher mining education, its quality determined by the competitiveness of the national raw material sector on the one hand and by occupational safety on the other.

2. To ensure the qualification level of graduates, allowing for their immediate engagement in the manufacturing process and control of complex processes applied at the modern mining enterprise.

3. To integrate the Russian mining engineer educational system into the international labor market with a view to reproducing modern specialists in the oil-gas, coal, mining, ferrous and nonferrous, energy, oil-chemistry and coal-chemistry industries.

4. To provide for the mobility of graduates with a view to advanced training and possible employment in any country, including in the European Union, through a system of educational grants for students from other countries.

5. To ensure compatibility and comparability of the national systems of higher engineering education and establish uniform educational standards.

Besides the above mentioned objectives, the Bologna Agreements established distinct requirements for contemporary higher education in the globalization environment, entailing the following changes. First of all, work has begun on introducing the European Credit Transfer System (ECTS). Second, university graduates will soon have to obtain a European diploma supplement, containing details about all the student's academic activities together with a letter rating of the student's knowledge, ranging from A (excellent) to F (unsatisfactory). Third, we are now observing the first steps in pursuing the policy of international openness of higher education institutions that should result in the growth of student and teacher mobility. And finally, there is the introduction of a point rating system for the evaluation of students' knowledge and self-educational activities.

However, the principal requirements placed on contemporary higher education are dictated by the international community of primary producers, where barriers on the means of international circulation of products and investments are relaxed and where international migration of specialists accelerates with every year.

Many graduates of modern engineering universities leave for on-the-job training to Germany, France, Great Britain, or China and find themselves in a cross-cultural and educational multi-platform community with coexisting modern and traditional knowledge transfer techniques, various educational rules and regulations, corporate culture and social responsibility standards.

The Russian higher education institutions are now at the initial stage of integration into the global educational community. At the same time, the low standing of Russian universities in the international rankings is a serious setback to such integration. Thus, for example, not one Russian university appeared in the top 200 world universities in the Times Higher Education-QS World University Rankings 2012–2013, the first positions being taken by the universities of the USA and Great Britain. This list included universities, for example, from China, Singapore, Australia, Belgium, South Korea and elsewhere [10].

Another problem for the integration of Russian engineering education is the limited recognition of domestic university diplomas when seeking employment abroad. Russian graduates have to confirm the level or their knowledge and skills through a system of additional tests. At the same time, the qualification of higher education specialists, including mining engineers, has been gradually declining in Russia. One of the reasons for this is the low learning motivation and insufficient preparedness of applicants for studying at higher education institutions. In fact, the Russian higher mining education will have to overcome the divergence of interests of higher education institutions as the sellers of educational services, enterprises as the educational customers and the government as the owner of institutes and

universities, and pass through several levels of globalization of the educational sphere. The following package of integration processes is currently underway at Russian engineering universities:

1. At the academic level of a given university, a wider introduction of international practical engineering experience into the educational process has been implemented in the course of the project-based and case studies, and interactive communication of teachers and students.

2. There has been more extensive adaptation of curricula and educational programs to the requirements of specific enterprises acting as educational customers and target education of engineering staff has been developed. The entry of international-level manufacturers into the Russian markets imposes world-class requirements on the universities as regards the quality of engineering staff education, pushes universities to cooperate with scientific organizations, initiates the elaboration of original courses, and gives impetus for development of intracompany on-site training.

3. At the regional level, conditions for the development of interuniversity cooperation, scientific and research collaboration have been formed. At the same time, improvement of competition in the Russian and international markets of educational services raises the question of enhancing the competitiveness of engineering universities. Its primary factors are the innovative educational activity and ability of universities to participate in the development of the national innovative system.

4. At the national level, the system of Russian universities is now being adapted to international requirements regulating the quality of engineering staff education, to the competence level of graduates, and to technical and academic support of the educational process. To date, the integration processes at the national level have involved higher school legislation and laid the foundation for development of a number of strategic and policy documents. Here, the Education Development Federal Targeted Programme for 2011-2015 should be mentioned, which is aimed at "…ensuring the accessibility of high-quality education complying with the requirements of the innovation-driven socially-oriented development of the Russian Federation" [12]. Without doubt, the leading role is this process is played by the engineering universities, which should preserve and increase the scientific and production potential of the Russian economy. The discussion of problems facing the higher education system for engineering staff in Russia is aimed at generating a proposal to the Government of the Russian Federation and Ministry of Science and Education of the Russian Federation regarding modernization of the engineering education system which is much-needed for staffing support of the import substitution and rehabilitation of the industry on a new technological base.

5. At the international level, globalization of the educational system is a kind of response to integration processes in the world economy, formation of a common information space, and international labor migration. For the Russian engineering universities, educational globalization provides an opportunity to act within the framework of a space and knowledge paradigm of social and economic development. This means that higher engineering education, owing to its applied nature, is becoming an important factor in production and generates a guaranteed income for its owner irrespective of the country where the engineer is employed.

Thus, the Russian engineering universities that train mining industry personnel have now encountered two fundamentally new international integration challenges.

On the one hand, globalization of the educational sphere as a response to economic globalization makes mining education unitary by imposing similar educational requirements on engineering staff in different countries. This process is facilitated by the application of similar processes and technologies, industrial control and management techniques at the mining enterprises

in Russia, countries of Eastern and Western Europe, North and South America, Africa, Australia, China, etc. This gives new impetus to universities in various countries to integrate their scientific and educational activities and implement new projects aimed at improving the quality of higher mining education.

On the other hand, integration of the Russian engineering universities that train mining engineers into the global educational system is hindered by problems that decrease their competitiveness in the global educational market. These problems relate to the long-term isolation of Soviet and Russian higher education from worldwide standards, degradation of the academic science during the period of reforms, marginalization of pedagogic work and the loss of its social status, and the non-innovative nature of the Russian economy. As a result, many engineering universities are busy simply surviving on the educational market by providing non-core educational services (economic, managerial, judicial) and have no staff, financial, material or technical resources for transformation into flagships for promoting the development of the innovation-driven process in the industry.

Along with this, the teaching of mining engineers in Russia is characterized by insufficient implementation of the intrauniversity capabilities for integration into the global educational space: familiarization with the latest technological innovations in the industry, language proficiency, and the practice of international student exchange with leading mining education centers in the USA, France, Germany, and China.

The fact that most Russian universities training mining engineers are still not able to address adequately the above challenges hinders their transformation into national innovation centers, lowers their positions in the international university rankings, and complicates the formation of teaching staff to satisfy international requirements.

Therefore, conditions should be created to facilitate the integration of Russian engineering universities into the international environment of higher mining education. These governing conditions – determinants of the integration process – relate not just to the external environment (joining the Bologna Agreements, international student exchange and education of foreign students). The starting point should be the introduction of international requirements for the higher educational process proper. We believe the determinants for integration of Russian universities into the international mining education system that relate to the educational process proper are the innovative, interactive forms of its organization and the development of linguistic competence up to a level enabling Russian graduates to be equally competitive on the global labor market.

The innovative determinant includes a continuous creative search of university teachers, familiarization with advanced processes and technologies, and diffusion of the new knowledge within the teacher community. In fact, we are talking about creating a sound innovation teaching unit in the mining education system. An important part in this process should be given to the innovative technologies of teaching proper, in particular, the switch to new forms of lecture material presentation – problem-based and binary.

At the contemporary stage of mining science, development the traditional lecture is less effective in communicating new information as compared to scientific publications, the sharing of experience on introducing new processes and technologies within the professional mining community, patenting of inventions and diffusion of innovations within industries. Therefore, the traditional form of lectures – monotonous presentation of information by the teacher – should be replaced with lectures engaging students in collective collaboration with the teacher and each other, in discussions of problems and prospects of introducing innovations into mining operations.

For instance, during a problem-based lecture the teacher and students are involved in an

active scientific and educational process, provided the lecture is conducted in the form of a live dialog. The subject of such dialog may be the discussion of an effect resulting from the introduction of innovations, replacement of obsolete equipment, or the use of new progressive forms of industrial management.

Thus, for students of the major discipline 21.05.04 "Mining engineering" of the "Open-pit mining" specialism, the issues selected for problem-based lecture discussion can be the objectives of improving the environmental friendliness of mining operations and cleaning of polluted water bodies [11, 21], increasing equipment capacity, and enhancing product quality.

The teacher raises issues for discussion involving the entire audience by putting questions to the attendees and finding answers together with them. While answering, the students develop their engineering thinking, display responsibility and defend their point of view. The principal organizing role in conducting a problem-based dialog lecture lies with the teacher as it is his/her ability to hold a discussion and pursue interaction with the students that has a decisive impact on their active study of the innovation-driven process in the industry.

Another example of teaching technology implementing problem-based and dialog-oriented principles is a binary lecture. This is essentially the work of two teachers who simultaneously conduct a lecture in the same subject and interact one with another and with the audience on the basis of problem-organized material. During the dialog between the teachers and students, objectives are set and a problem situation is analyzed, hypotheses are made, proved or rejected, contradictions are solved, and solutions are found.

To prepare mining engineers for open-pit mining operations, it is important that the practitioners – the employees of surface coal mines, processing plants, and power engineers – are involved in the educational activity. It is these practitioners who can get the message about the horizons of innovation-driven activity in the mining industry, challenges and prospects of introducing innovations at certain enterprises across to students and share their views. However, practicing mining engineers usually have no teaching or lecturing experience and are therefore reluctant to participate in the university educational process.

This is precisely why binary lectures conducted by a university teacher jointly with an engineer or a manager from a mining enterprise satisfy to the maximum extent the conditions governing the inclusion of the educational process into the innovative process. The binary lecture process as part of mining engineer training implies the following:

– selection of a relevant subject, disclosing both traditional and innovative issues of mining technology or different points of view;

– selection of two teachers who are compatible both in terms of thinking style and means of interacting;

– elaboration of the lecture scenario (thesis plan, content blocks, time distribution, etc.).

Of course, the lecture as a form of teaching plays an important part in the university education of mining engineers. At the same time, we should note the significant importance of practical studies, which are often conducted in a traditional manner – solving calculation problems and providing answers to questions.

Therefore, the interactive determinant of the integration process in the university education of mining engineers includes the implementation of specific teaching techniques aimed at enhancing the students' acquisition of professional competences and promoting their interest in innovations. Such methods include organizational-activity games, brainstorming, and case studies.

A specific feature of an organizational-activity game is that it is aimed mainly at obtaining a certain final result in discussing a problem. This result can be the development of a new equipment introduction project, elaboration

of new mining operational plans, the introduction of a new bonus system for employees of an enterprise, implementation of occupational safety improvement measures, and so on.

Therefore, the primary characteristics of such games are maximum approximation to actual industrial management problems, the conventional nature of roles, a shared objective for the whole group, and decision-making teamwork.

Another equally important interactive method in university engineering personnel teaching is brainstorming. It enables the generation of a significant number of solutions for a professional problem and their critical review within a short period of time. After a detailed review by the participants of their own ideas, they are to find the best one for the given situation.

The range of problems that future specialists in open-pit mining operations can solve through brainstorming include the response to emergency situations, increasing labor productivity, the selection of new domestic and foreign equipment, improvement of product quality, and so on.

It is customary in scientific literature to highlight the following brainstorming mechanism: formulation of the problem to be brought up for discussion; selection of the brainstorming leader; selection of two secretaries to record the proposed ideas; the brainstorming session; review of the results and selection of the final problem solution. The brainstorming session should be conducted in three stages: introductory briefing (5 to 10 min), working session (10 to 20 min), final stage – selection and discussion of the final option (10 to 15 min).

The case study technique, i.e. the study of practical situations that have predominantly occurred in real life, is based on the discussion by a group of students of the problems actually encountered by mining enterprises and finding solutions. It is desirable that these problems are formulated with the involvement of practicing mining engineers, in order to convey the message to students on the importance of taking weighted and reasoned engineering decisions and on the corresponding responsibility.

Each problem situation (case) should contain the following: a detailed description of the source of the problem and comments related thereto as well as the role of certain managers and engineering staff. In the context of mining enterprises, problem situations may pertain to staff relations, adaptation of employees to new duties and positions, measures to introduce innovations, install new software, and on problems arising in the course of equipment operation, and during mining activities [3].

The primary advantages of the case study technique as part of the university education of mining engineers are as follows:

1. The ability to "immerse" students in an actual complicated situation, which is typical of future professional activities.

2. Improvement of teaching efficiency through a more intensive digestion of educational materials as a consequence of indicative visualization of the problem.

3. Emotional involvement of students in the teaching process and increased motivation to study the subject due to its obvious practical usefulness.

4. Enhanced formation of practical skills and professional competences in the course of case-study teaching.

Along with the above said, the most important factor of the international integration of Russian mining education is the mobility of students and teachers of engineering universities. This increases the significance of the language determinant of the integration process, which is a package of skills enabling an engineer to solve the personal and professional tasks of communicating in a foreign language. Implementation of the language determinant enables a student to "absorb" innovative technologies, obtain data on advanced equipment and its application prospects, and procure information on improving the mining machinery and manufacturing processes. A significant

component of the linguistic determinant is the lexical and grammatical knowledge necessary for obtaining information from foreign-language sources [2].

The international transfer of new technologies, universal employment of the equipment produced by world's leading manufacturers, entry of the Russian engineering universities into the global market [22] cumulatively resulted in the need for preparing the mining engineers with profound foreign language proficiency. However, despite the undeniable importance of knowing a foreign language, the Russian universities engaged in teaching mining engineers reduce the number of academic classes for studying foreign languages.

In this case, the problem of implementing the interactive determinant arises (application of game-based, brainstorm, and case-study techniques) during practical training on foreign-language subjects. Due to the reduction of the number of classroom hours, this process is shifting towards self-educational and non-classroom activities of students, where the project-based techniques are one of the forms.

The project-based educational technique involves non-classroom activities of students who acquire production information in the foreign language on the professional topics set by the teacher and then analyze this information. The result of the project-based activities is the elaboration of projects for the development of a mining enterprise and its site and presentation of these projects. On the one hand, the importance of preparing such projects in a foreign language is conditioned by the need to use the scientific and production potential accumulated in the mining engineering development abroad. On the other hand, it is precisely the "project" thinking that enables university graduates to successfully find employment and climb the career ladder at international industrial companies.

Thus, the objectives that the Bologna Process sets for the Russian higher education institutions involved in teaching mining engineers are inseparably associated with the integration of the domestic higher engineering education system into the international system. Successive solution of the said objectives is constrained by such problems as the degradation of academic science during the period of reforms, long-term isolation from worldwide standards, and the underfunding of universities. Therefore, an important driver in the international integration of the mining engineer education is the international requirements – innovative, interactive and language determinants. Their implementation requires the development of educational techniques at university level and a focus on language competences as well as involvement of practicing mining engineers in the educational process.

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