

Forming Occupational Safety Culture on the Basis of Development of Students' Risk-Focused Intellection

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ABSTRACT

Bologna process puts in a high claim for the modern European education in terms of competency building approach. The control is conducted by the agencies which monitor learning activity level in higher education institutions. This paper presents the aspects of higher education within the conduction of competency building approach projects in Europe and Russia. We propose the technology which evaluates students' professional competence qualimetricly. The technology represents the evaluation algorithm at all levels of student training.

KEYWORDS

forming risk-focused attitude of students, occupational safety culture, model of pedagogical process, structural and dynamical model.

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Introduction

This research is aimed to seek and analyze the means and opportunities of the contemporary educational process, pedagogical technologies with the purpose to form occupational safety culture via development of risk-focused attitude in students. The rationale of this paper is caused by a number of factors described hereafter.

In Russia, there are over 45 thousand of hazardous production facilities (HPF) of various profiles. Hazardous production facilities in compliance with the Federal Law dated July 21, 1997 No. 116-FZ (Federal Law No. 116-FZ) are enterprises or their workshops, sites, areas and other production infrastructure specified in Annex 1 to the said Federal Law. In a broad sense, a hazardous production facility is a production facility, during the maintenance of which emergencies or incidents (pre-emergency situations) may occur with serious consequences for operating companies and for life and health safety of staff, local inhabitants in the emergency zone and the environment. The level of wear and tear of some hazardous production facilities is over 90% and is still growing.

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According to the statistics of the latest 5 years, at least a thousand rather large emergency situations of technogenic nature occur annually in the country caused by human factor (Podosenova, & Tskhadaya, 2013). Taking into account the current situation, under the contemporary conditions the issue of ensuring safety (ecological, road/transport, energy, production) remains a crucial governmental task, an integral part of the national security fixed in the Constitution of the Russian Federation, federal laws (Federal Law No. 116-FZ, Federal Law No. 256-FZ), Strategy of the National Security of the Russian Federation till 2020 (Decree of the President of the RF No. 537) Doctrine of Energy Security of the Russian Federation (approved by the Order of the President of the Russian Federation No. Pr-3167 of October 29, 2012), and other regulations. As a normative regulation to solve the above task on improvement of the level of operational safety of hazardous production facilities the Government of the Russian Federation in 2011 approved 'Concept for Improvement of the State Policy in Industrial Safety Including the Need to Stimulate Innovative Activity of Enterprises till 2020'. The main focus in that document is made on the contemporary approach to ensure safe maintenance of HPF using so-called risk-focused approach.

The system analysis of the existing and prognosticated risks and other advantages of the risk-focused approach a priori allow identifying problem areas of industrial safety processes in HPF which are missed by the current safety requirements due to their a posteriori nature, which will therefore allow improving the general level of safety of technological processes and production sites and decreasing the risk of emergency occurrence during their maintenance. For full-scale implementation of the new approach approved by the RF Government, specialists with new type of thinking – risk-focused – are required.

In compliance with the Order of the Ministry of Education and Science of the RF No. 723 dated December 14, 2009 (valid till September 1, 2016, furthermore, the Order of the Ministry of Education and Science of the RF, identical to the extent studied herein, will be valid, dated March 21, 2016 No. 246 'On Approval of the Federal State Educational Standard of Higher Education under Training Area 20.03.01 Technosphere

Safety'), a graduate, among other competencies, should possess general cultural competency OK-7 providing for knowing culture of safety and risk-focused intellection attitude which considers environmental safety and preservation the most important priorities in life and activity.

Back in 1920s, the famous English philosopher A.N. Whitehead noted that development of new principles of studying greatly falls behind the societal development and that the main task of education system is to teach a man to think in a systematic way and to form the way of thinking allowing analyzing problems in any sphere of life. Creating thinking attitude capable to reveal new elements and come to unidentified generalizations in a continuously changing situation was considered the main purpose of the contemporary pedagogics by A.V. Brushlinskiy (Brushlinskiy, 1996). Most strictly the concept of the education system for the 21st century was worded by A. Urbanski (Urbanski, 1994), vice-president of American association of teachers: 'On the basis of teaching, teaching the way of thinking will prevail'.

The need to form risk-focused intellection in graduates urged us to begin the research in that area and, in particular, to develop the methodological basics of



occupational safety culture based on risk-focused attitude of students in a polytechnic higher school.

In various professional communities, the following typical contexts dominate in using 'risk' notion:

- for economists, risk is an opportunity of an economically unfavorable event, uncertainty of decision-making: 'dangers always are and risk is where a solution is' (Luhmann, 1991),

- for sociologists, risk is a synonym of dangers and threats for an individual or a society, model of perception and assessment of dangers by the mass consciousness in so-called 'risk society' (Beck, 1986),

- for historians, risk is an antonym of historical dependency (Luhmann, 1991),

- politicians call risks solely unwanted events and results in future (Luhmann, 1991),

- for engineers, risk is a measure of hazard of beyond design basis emergency losses (RD 03-418-01 'Metodicheskie ukazaniya po provedeniyu analiza riska opasnykh proizvodstvennykh ob"ektov' [RD 03-418-01 'Methodological Guidelines on Risk Analysis of Hazardous Production Facilities'], 2001, July 10; Kates, & Kaspersen, 1983).

Inside professional communities, there are some discrepancies in interpretation of 'risk' notion, for instance, in technical staff:

- in industrial safety (RD 03-418-01 'Methodological Guidelines on Risk Analysis of Hazardous Production Facilities), emergency risk is a measure of hazard characterizing the probability of emergency at a hazardous production facility and the severity of its effects;

- in technical regulation (Federal Law No. 184-FZ), risk is the probability of damage to life or health of individuals or entities, state or municipal property, environment, life or health of animals and plants with due regard to severity of that damage;

- in technical regulation of fire safety requirements (Federal Law No. 123-FZ), fire risk is the probability of fire hazard of the facility protected and its consequences for people and material property; virtually, probability here means statistical assessment of probability – frequency (Resolution of the Government of the RF No. 272 of March 31, 2009 'On Procedure of Settlements to Assess Fire Risk') (Grazhdankin, 2012).

Currently, 'risk-focused intellection/attitude' is mentioned rather seldom; it may be explained by non-formed theoretical basis of the risk-focused approach. GOST R ISO 9001-2015 (identical to ISO 9001:2015 'Quality Management Systems – Requirements', IDT) interprets this notion in the risk management context: 'risk-focused intellection allows an organization to identify the factors which may cause deviation from the scheduled results of the processes and system of quality management of the organization and use preventing control to minimize negative results and maximize the emerging opportunities'.

Based on the adopted documents and research by Russian scholars, we opine that risk-focused attitude is an individual's ability to identify any situation from the risk standpoint, to identify, analyze and assess a risk, readiness to affect a risk to ensure a positive outcome including occupational safety.

Culture formation process in occupational safety continues through the whole life of a human (Belov, & Devisilov, 2005). In this research, targeted pedagogical process to change the personality is focused, including formation of risk-focused intellection/attitude of students.

In the course of education a student should obtain view of the required components ensuring the basics, organizational steps and structure for development, implementation, monitoring, review and continuous improvement of occupational safety risk management in his/her profession.

Formation is understood by us as a comprehensive pedagogical feasible process of a professional's evolution comprising development, raising, education, socialization.

Therefore, occupational safety culture formation based on risk management thinking of learners is a targeted process aimed at the acquisition of knowledge related to risks, acquisition of skills and expertise to affect risks and readiness to prevent safety risks, assume responsibility and liabilities, derive benefit from risks.

The selected definition is rather valuable as it enabled to identify deep specifics of the methodology and conditions of occupational safety culture of learners.

Targeting, as we opine, is the most important component pre-determining the fact of the existence of the system. Targeting has two organically interrelated elements: global societal target (state social mandate – according to V.P. Bepalko) and indirect social mandate being an exact target of the operation of the pedagogical system. The target of society, state and social mandate is the need for specialists capable to take part in control of comprehensive technical systems and solve production-related tasks with due regard to the need for preservation of the natural environment, interests and concerns of the society.

The target of the research issue and the pedagogical system to be constructed is formation of occupational safety culture based on risk-focused intellection of learners and respectively arranged processes of the pedagogical system aimed to achieve it.

The objects of the research were educational and training environment of PNRPU, namely, professional education, re-training, in-service education, off-class activities.

The subject of the research was the process to form occupational safety culture based on risk-focused intellection.

The research was divided into three stages.

The first stage (2008-2010) – study and analysis of philosophical, psychological and pedagogical, methodological literature on the research topic; identification of theoretical and methodological basics of the research; reasoning of content, structure, criteria and parameters of the formedness of occupational safety culture based on risk-focused intellection of learners in continuous education system in occupational safety in a polytechnic higher school.

The second stage (2011-2013) – development of the methodology and identification of pedagogical conditions contributing to occupational safety culture formation and development of risk-focused intellection; checking efficiency of the technology and conditions identified during formation experiment.



The third stage (since 2014) – analysis, processing, generalizing and systemizing the results of tests/experiments; formulation of basic theoretical conclusions and methodological recommendations on the research topic.

Methodology

For our pedagogical research we applied modeling method as it ensures a fuller view of the analyzed object and events/processes occurring in it under some restrictions in conducting field experiments and other studies. With due regard to the need for systematic and interdisciplinary nature of the activity to form OS culture in a polytechnic university, we developed structural and dynamical model to form OS culture. During its development, the following structural elements were identified: target, content-related, technological; diagnostic and analytical and finalizing units.

The target unit comprises the rationale of prognosticated result of education and training, being a comprehensive characteristic of the knowledge gained, skills learnt, expertise obtained, priorities created.

The content-related unit represents the expected results of OS culture formation as respective knowledge, skills, expertise and targets acquired contributing to general culture (GC) and professional (PC) competencies, that's why this model to form OS culture may be easily integrated into any competency model of a graduate within the main curriculum or be used for development of academic programs for related disciplines.

The technological unit reveals the opportunities (resources) of the educational space of the higher school to activate OS culture formation in two ways – via academic process and via off-class work (in class-free time). That unit comprises four stages: 1) motivation/targeting to call students' attention to human safety issue in the contemporary world, to show its urgency and need for discussion; 2) formation stage – to create the knowledge on that issue for fullest perception and understanding; 3) activities stage – R&D, seminars, public events, contests, etc. with the objective to develop and/or adjust the life priorities/values, own view of this issue, exchange of opinions and, most important, development of stable views transforming into skills of consciously 'safe behavior'; 4) controlling stage – a system of diagnostic procedures (consultations, examinations, passing examinations, tests, etc.) required to assess knowledge/skills/expertise.

The diagnostic and analytical unit suggests diagnostics of OS culture formedness by the criteria, level and parameters set, after which the results obtained are analyzed, and, if required, the measures to correct the respective stages of the technological unit are offered.

Risk-focused intellection efficiency in learners was assessed by the following criteria:

- knowledge (theoretical training in sociology, ecology, law, OS, etc., understanding of the current state and prospects of OS culture development in political, public and scientific life of the country/region/university);
- skills (search, study, use of the information required, qualified choice and correct application of means to ensure OS to maintain own, public, ecological and state safety on sufficient level);
- expertise (search, study, use of the required information, software to analyze and calculate risks, qualified choice and correct application of means to ensure OS to maintain own, public, ecological and state safety on sufficient level);

- values (priority of general human and civil values; human life and health state, public and ecological safety; health-saving and green technologies; tolerance and intercultural relations).

In compliance with the specified criteria, the research identified three levels of formedness of risk-focused intellection of students: initial (high school graduate level), middle (required to do production activities) and higher (for researchers and management).

The finalizing unit summarizes the work done and may serve as the data source for annual 'Report on self-analysis of university's results' including the dynamics of individual and general levels of students' OS culture and assessment of efficiency of that model.

Results

Currently, there is an opinion that 'teaching safety is the main priority to prevent accidents, emergencies and incidents by fuller accounting for human factor' (Mossoulina, 2002). For instance, there are provisions on education which are reflected in the following federal laws: 'On Protection of Environment' dated January 10, 2002 No. 7-FZ (as amended on July 13, 2015), 'On Civil Defense' dated February 12, 1998 No. 28-FZ (as amended on June 29, 2015), 'On Protection of People and Territories from Emergency Situations' dated December 21, 1994 No. 68-FZ (as amended on May 2, 2015), 'Labor Code of the Russian Federation' dated December 30, 2001 No. 197-FZ (as amended on July 13, 2015), 'On Industrial Safety of Hazardous Production Facilities' dated July 21, 1997 No. 116-FZ (as amended on July 13, 2015) and so on.

However, to ensure safety of a separate workplace/enterprise/region it is not sufficient to simply observe the provisions of regulations – training is focused on that; risk-focused type of attitude is required as well as general human and civil values being a result of raising.

In PNRPU, the work to form OS culture is two-way in general – via the academic process and via off-class work (during class-free time), however the contemporary situation is bringing new requirements, old methodologies are inefficient, links between a higher school's divisions participating in formation of OS culture are getting lost or becoming formal, inconsistency of actions causes time and financial loss and does not ensure the desired result (Dolinina, & Kushnaryova, 2015).

At the beginning of studying at the first year a few parameters characterizing the values established by students were studied. According to the studies in PNRPU (Tsarapina et al., 2010), for own self-identification and self-affirmation, alcohol, drugs, violence and gambling are accepted in students' communities. Many people feel it hard to reply whether there is anything more important for them than material well-being and what the true human values are (57% of respondents). A sad consequence of the above is destructive phenomena in the students' community and a decrease in the quality of training specialists, bachelors and masters – highly qualified, capable for creative development, having high moral values and good health (Rabinovich et al., 2013). Meantime, OS culture has not yet become a required personally valuable characteristic of graduates despite the course 'Occupational safety', OS section in diploma projects, off-class work with students.



To implement the task set, we developed a workbook 'Formation of occupational safety culture of students' (methodological guidelines for an academic group tutor).

While making the workbook, we accounted for the needs: students' familiarity with the basic provisions of the Strategy of national security of the Russian Federation (Decree of the President of the RF No. 537); personal tutor's example of safe and healthy way of life; creating favorable psychological microclimate in students group; advising students of the impact of motor activities on human health and safety; advising of safety provision of an educational institution, personal and public safety in case of terrorist acts, fire, earthquake; advising of opportunities to keep and improve health, disease and vicious habits prevention, first aid measures; calling third party professionals/specialized institutions for consulting/seminars on 'Prophylactics and fighting AIDS', 'Drug and alcohol addiction', 'Radical groups and fighting them', etc.

The efficient formation of OS culture in junior students is possible subject to overall support by tutor, including organizational and methodological support of training with continuous control of the performance via tests, questionnaires, contests and seminars.

According to the sociological research data (Lozhkina et al., 2011), junior students, in turn, are paying attention to insufficiency of the prophylactic measures. Many of them note that health problems occur quite often (13.5%), meantime, health post operation is partly satisfactory for students, they are interested in growing number of services provided (39.1%), change of open hours (27.9%), and improvement in service quality (24.8%).

The work to form OS culture is important for students, while the most significant being: improvement of students' rest; establishment of psychotherapeutic rehabilitation or consulting center and improvement of information work among students to fight drug, alcohol and tobacco addiction; need to teach special disciplines, for instance, Valeology, Social Ecology, to form ideas of healthy way of life, ensuring personal, public and environmental safety in the contemporary world.

With due regard to the above, we think it more feasible to form OS culture of students from the standpoint of targeted learning and tutoring to ensure high quality of training for professional activities and conscious participation in life of the society and the country as a safe type of person. That affirmation complies with the contemporary direction of the national policy represented in Decree of the President of the RF 'On Strategy of the National Security of the Russian Federation till 2020'(Decree of the President of the RF No. 537).

In our research we rationalized that 'Occupational safety culture of students is the result of learning and training being a comprehensive characteristic of the knowledge and skills obtained in connection with providing security and fixed skills to act in hazardous situations related to professional, natural and everyday sphere and of the system of general human and civil values as a behavioral imperative' (Dolinina, & Kushnaryova, 2015).

An integral part of OS culture is risk-focused intellection of students; to be developed within this problematics it is required to form the following kinds of competencies:

- ability to consider a hazardous event, a technological process as a system;

- knowing dependencies of mutual interaction of elements of technical (ecological or other) systems;
- ability to use the available and to find the required information to solve a problem task;
- ability to analyze and forecast the course of a hazardous situation.

System-forming factor for improvement of OS culture is formation of risk-focused intellection/attitude both at the stage of higher education and at the stage of advanced training, thus – during prolonged continuous learning.

Discussion

The system to form risk-focused intellection as an element of OS culture is based on the following theoretical basics developed by the authors: 1) multitude of elements mutually related and connected creating integrity/unity; 2) general notion build axiomatically under the conditions of: a) existence of multitude of objects; b) theory as a uniform whole inherent to all objects; c) individuality of the system due to uniqueness of combination; d) practically identified sufficiency.

Functioning of OS culture formation system based on risk-focused intellection of students suggests interconnection and interrelation of the following elements:

- methodological basis: provisions on target direction of training, philosophical, sociological, natural science works; ideas of culturological approach in pedagogics, training, axiological aspects of education, personality-oriented and personality-activity approaches in education; technologization of training and education, socialization of personality, competency approach, methodological principles of scientific and pedagogical research;
- content of educational space (natural science knowledge, intellectual and social knowledge and skills, ecosophical consciousness development, system of general human and civil values);
- competencies formed: learning, socio-political, cognitive, intercultural, communicative, creative, habitual, continuous education;
- categorical apparatus: OS culture formation based on risk-focused intellection of students, risk-focused intellection/attitude, system of general human values;
- individual levels of risk-focused intellection (I level – low, informatively neutral, emotional; II level – average selective/fragmental, emotional/willed; III level – high, systematic/value-related, emotional/rational);
- pedagogical conditions to form OS culture based on risk-focused intellection of students (developed program and workbooks, pedagogical technology, model).

For that purpose, the efficiency of the model offered was studied. In the course of the study and at the final stage the basic conditions to form OS culture via risk-focused intellection were reasoned (as exemplified by ‘Occupational Safety’ discipline):

- development of academic material based on systematic approach;
- systematic and consistent formation of systematic knowledge and skills in the structure of students’ thinking activity, in explanation of the theoretical materials and in tasks solving, for the purpose of development student’s ability to independently identify, analyze and assess the risks;



- risk control actions training via using 'preventive tools of control to minimize negative consequences and maximize the opportunities emerging'.

The technology submitted to develop risk-focused intellection under OS culture formation model has shown great efficiency of the field experimental tests. Formation of risk-focused intellection within the suggested technology was productive due to systematic approach in the academic process.

Conclusion

This model is a methodological basis of the workbook for teachers who lecture OS culture. It gives recommendations to make notes on the discipline and test tasks as well as working programs, with due regard to the content-related and technological units of structural and dynamical model to form risk-focused intellection of students as an element of OS culture.

Currently, the authors are developing 'Provisions on OS culture formation in PNRPU'. That document will govern the coordination of organizational structures and tools of academic process and off-class activities to form OS culture of students, quality of professional training and, which is quite important, inculcation of human values to students under continuous education system in the OS system of the higher school.

Further prospects and deepening of the problem concerned may be related to the study of ways and means to integrate the model developed to form risk-focused intellection of students as an element of OS culture into the educational environment of a higher school (into the academic process/work) via development of the program to improve qualification of scientists and teachers at the advanced training faculty of PNRPU, drafting federal standards to form public OS culture, development of the rational element of information content of education, improvement of tools to manage education and train students. We prognosticate positive result in improvement of normative regulation on safety, development and implementation of innovative solutions for safety-related issues, staff qualification improvement.

Disclosure statement

No potential conflict of interest was reported by the authors.

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