

Development of Additional Education to Increase the Level of Competence of Specialists in the Field of Technosphere Safety

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Abstract. The article describes the system of modern professional education. Today includes practical training, the use of modern technologies, the use of communication technologies and the use of the experience of practicing specialists with extensive experience in these areas. The information provided indicates the possibility of a qualitative increase in the level of competence of technosphere safety specialists in higher educational institutions. Cloud resource resources can effectively advance in the implementation of state policy in the field of a competency-based approach to training specialists in the field of technosphere security.

1. Introduction

Risks of problems in the field of technosphere safety (TS) despite the well-known statistics of a decrease in injuries are still relevant. They can be solved, including on the basis of increasing the competence of specialists in the field of TS.

It is known about the influence of the level of competence of specialists on the solution of technological problems in various sectors of the economy.

Currently, technology and industrial production continue to gain momentum in their development. In this regard, for servicing equipment and performing technological tasks, employees are required who are sufficiently qualified and competent to carry out this activity. According to [1], competencies become fundamental in the management of knowledge and skills of workers in many applied areas.

The term "competency" was first introduced in 1959 by R. H White [2]. Later in 1973, the concept of "competency" became popular. This was the article [3], where the author touched on the topic of competence of specialists in achieving professional success. Currently, there are many different definitions of the term "competency". Miranda and etc. [4] in his work distinguishes the following:

- Competence is the ability of the subject to effectively and efficiently act in a particular situation; it cannot be directly measured, but measured by the results of the implementation;
- Competence is an observable or measurable part of competency, such as a skill, part of knowledge or attitude.

Therefore, one of the fundamental elements of competence is the knowledge of the employee of his profession and the ability to apply them in practice. The author [5] also confirms that one of the elements of professional competence is knowledge and skills. Currently, the term professional competence is understood as a set of employee characteristics that determine the effectiveness of his work in various professional situations.

Along with this, M. V. Bernavskaya states [6] that competency management at all staff levels is an urgent task for human resource management. According to the results of studies [7], the relationship between professional competencies and the quality of human activities is established.

In the field of technosphere safety, the competence of specialists is also one of the important and relevant elements. This statement is confirmed in a number of works [8, 9, 10]. One of the priority tasks in the field of technosphere safety is to reduce the level of injuries and professional risks of workers. This is confirmed by the authors of [11], who argue that improving working conditions and improving the competence of specialists will improve the state of labor protection at the enterprise, reduce the level of injuries at work and the number of occupational morbidity of personnel. They also note that the higher the level of harmful working conditions in the workplace, the higher should be the competence of the employee.

Thus, increasing the competence of specialists in the field of technosphere safety is an urgent issue for research. According to the above, one of the main elements of professional competence is knowledge and skills. Consequently, the importance of proper education and training of specialists is a priority for increasing their level of competence. In the framework of this work, an increase in the level of (professional) competence of specialists in the field of technosphere safety through the development of additional education is considered.

2. Methods research

Today, among specialists in the field of TS, the number of specialists with specialized higher professional education is limited. Therefore, the vast majority of specialists need to bring their competence in accordance with the requirements of a professional standard. This is possible through the use of additional educational technologies [12].

Over the years, the FSBEI HE Omsk State Technical University has gained extensive experience in the field of additional professional education (professional retraining) of specialists in the field of TS. Institute for Life Safety Omsk State Technical University (ILS OmSTU) has trained hundreds of specialists in additional professional programs.

Since 2005, the IBRD has been conducting research in the field of the development of additional professional education (APE) in the field of TS. The influence of both internal factors and external circumstances on the development of APE was investigated. So, changes in legislation in the field of education in the Russian Federation have led to changes in the system of APE.

The introduction in 2014 of professional standards [13], which require the necessary set of professional competencies for specialists, has changed the approach to candidates for vacant positions on the part of personnel services. The professional competencies of employees should also be confirmed by the presence of specialized education.

These circumstances have changed the market in the field of additional professional education to increase competence, confirm or acquire additional professional competencies from specialists in the field of TS. Employment problems of pre-retirement age workers in other types of labor activity today can also be solved by means of APE [14]. There is an increase in demand for professional retraining programs in various areas of TS (Figure 1).

Today, for the further development of services in the field of APE in technosphere safety (APE TS), an analysis is necessary: quality problems of the services provided; pricing (in the context of "price - quality"); problems of optimal consumer choice of educational services in the field of APE (customer) of an educational institution; problems of the optimal choice by the consumer of educational services in the field of APE (customer) of training programs as the goals of acquiring and increasing the competence of specialists in the field of TS; the level of customer satisfaction in the established approaches to training in various programs; modern educational tools for searching promising, competitive ways and means of APE for specialists in the field of TS.

For an example of quantitative assessments of the development indicators of APE TS, we use the experience of ILS OmSTU for 13 years (2005-2018).

1. The indicator "number of listeners". In a market economy, the number of students attending is often an indicator of the development of APE TS. To this end, the ILS OmSTU expanded the territorial boundaries of the provision of its services through training using distance educational technologies. G. Mozheva notes [15] that with their help it is possible not only to increase the competitiveness of APE, but also to create conditions for constructing individual educational trajectories. So in the first 5 years, the number of regions of students increased from 1 to 12, and over the next 8 years it reached 80 regions of Russia and more, including regions of the near abroad [16].

This allows us to maintain the conditional stability of this indicator, despite the logic of its decline (due to changes in legislation in the field of APE) (Figure 2).

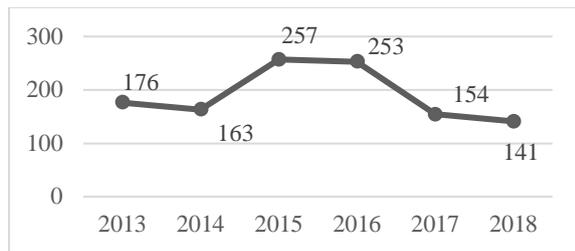


Figure 1. Dynamics of changes in the number of students in the main area of APE TS.

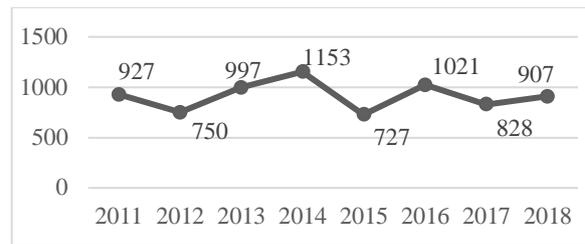


Figure 2. Dynamics of changes in the number of students for APE TS.

Such results of the ILS OmSTU were obtained due to timely professional response to changes in the "market conditions" in this segment of educational services. So, for example, under the Technosphere Security program. Labor safety over the past 5 years, the number of students increased by 5.5 times, the period from 2005 to 2015. According to the professional retraining program, the number of students increased from 120 to 700 people per year, but now their decline is observed.

The indicator "number of programs." ILS OmSTU for the period until 2015, a constant increase in the number of students by type of educational program: short-term continuing education programs (up to 72 hours); continuing education programs (from 72 to 200 hours); Professional retraining programs (over 256 hours).

However, during the analyzed period, the structure of demand for the APE TS programs changed. Termination since 2015 the issuance by state educational institutions of state-standard documents on professional retraining, placed them in unequal financial conditions with private training centers with a simplified tax system. Since 2016, the number of organizations studying is fixed by a gradual decrease in the number of students in continuing education programs. The introduction of professional standards [17], within the framework of which the need for specialized education arose, has led to an increase in demand for professional retraining programs in the areas of TS: labor safety (labor protection), fire safety, emergency protection, environmental safety, and demand is currently growing on industrial safety.

In general, our studies have shown that in non-state private educational institutions (90% of all studied organizations) training is of poor quality, at a low cost of courses in comparison with state educational institutions.

The task of developing the APE TS can be solved using mechanisms to increase student satisfaction with training. The search for such mechanisms is based on: the needs and capabilities of students (usually on the job) [18]; resource capabilities of training organizations (based on modern information technologies, etc.) [19]; the application of practice-oriented training in narrow-profile competencies [20].

So, using the example of OmSTU today, the ILS OmSTU can provide its students with more than 50 professional retraining programs and more than 50 continuing education programs. The change in demand for some professional retraining programs in the main areas is shown in Figure 3.

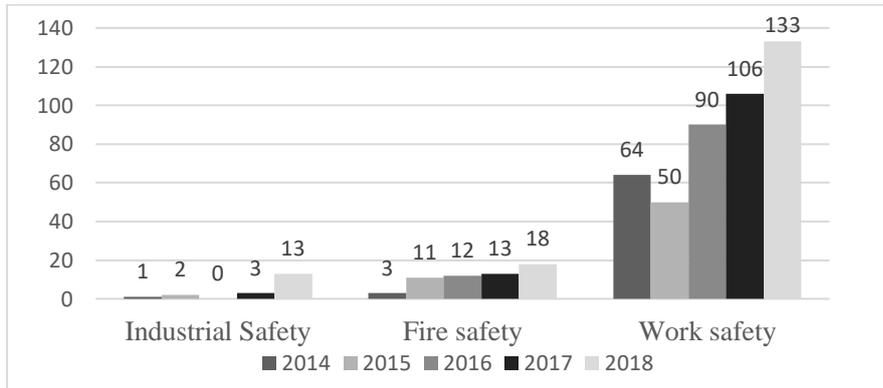


Figure 3. The dynamics of changes in demand for selected professional retraining programs.

3. The indicator "listener satisfaction." This indicator is subjective, since the criteria for evaluating it are different, both among students and among training organizations. Our research allows us to formulate the main criteria for evaluating this indicator for the development of APE TS. In our opinion, they are based on the resource capabilities of training organizations, including exclusive ones.

1. Personnel capabilities.

For example, at the ILS OmSTU more than 40 teachers (of which 38 are full-time), 30% of whom have worked in professional fields for more than 20 years, 20 teachers have the titles of associate professors, professors, academic degrees of candidates and doctors of science, graduate students, young scientists and practicing specialists in specialized fields, 12 employees have the status of current experts in different areas of TS.

2. Resource material, technical and methodological capabilities.

For example, in OmSTU for training under the programs of APE TS, it is used: modern material and technical base; means of visual agitation (stands, mock-ups, simulators, devices, etc.); more than 100 relevant print publications and electronic educational and methodological complexes, examiners with relevant copyright certificates.

3. Opportunities for the implementation of various forms of training, knowledge testing, individual approach.

Training and testing of knowledge on TS is carried out using:

- computer technologies (testing, virtual simulators, modeling of design solutions in 3D);
- reference information systems and specialized programs;
- various distance technologies and forms (webinars, press conferences, online courses, etc.)
- mobile and video content;
- interactive forms of training (imitation trainings, debate seminars, discussions, "brainstorming", didactic and business games, information and communication forms, etc.) [20]
- practice-oriented training (problem lectures, thematic seminars, full-time and part-time sessions, thematic "master classes", organization of thematic round tables, internships for students, etc.) [20];
- various forms of knowledge testing (full-time forms - by the commission, examiner, testing formats, solving situational problems, demonstrating acquired skills in simulation situations, etc.);
- specially designed individual programs;
- best practices in the field of TS (both Russian and foreign) and the results of scientific research in these areas.

4. Feedback from listeners. A quantitative assessment of this indicator should be based on professional reviews of students who completed training under the vocational health care programs.]

3. Results

According to the results of the study, the following areas can be identified for the development of additional education to increase the competence of specialists in the field of TS:

1. The introduction of new, promising and original training programs taking into account the interests of customers both in obtaining additional competencies and in raising (improving) the existing level of competence of specialists in the field of TS [18].

2. An increase in the share of practice-oriented training (the use of interactive forms, business games, training in the management mode of production simulation situations to assess and develop the skill of making true independent professional decisions, responding to a situation, etc.). In our opinion, the priority is to obtain new knowledge, to exchange experience in solving complex professional problems, to receive answers to accumulated professional questions, etc.) [20].

3. To increase the level of satisfaction with the training of customers "knowledge" is a continuous reform of the learning process. So, it seems to us promising to introduce short-term programs of APE TS based on narrowly professional competencies (training only for what the student needs) in the training system.

4. Development of mass online courses (development of a system of regular short-term courses using distance technologies).

5. The increase in varied forms of training to meet the needs and capabilities of the customer, taking into account the resource support of the institution of APE TS.

6. Development of APE TS programs in accordance with international standards, including the issue of the Diploma Supplement (European Diploma Supplement in English). At the same time, it seems to us promising for a number of industries that training in vocational education programs is aimed at obtaining European competencies of specialists in the field of TS.

7. Development of online educational platforms for APE (like an online store: logged in - selected - paid - studied - received (printed) a document) for students with different levels of professional interests. Ideally, with the simultaneous development of a student identification system on an online platform.

8. Attracting practitioners with a competency profile for APE TS to develop educational and methodical training kits, implement practice-oriented training and teaching.

4. Conclusions

1. To implement the state policy to preserve the life and health of workers, it is necessary to pay attention to the influence of the level of competence of specialists in the field of TS on the state of working conditions.

2. Currently, a large proportion of specialists in the field of TS need to improve their professional competence.

3. One of the effective ways to achieve this goal is the APE TS.

4. APE should be of high quality. It is necessary to use modern educational technologies and attract competent teachers. Such an approach is possible on the basis of higher education institutions accredited to train specialists with higher education in the areas of TS.

The experience of OmSTU has shown that, along with the training of specialists with higher education, the preparation of additional educational programs in the form of professional retraining of specialists who need to increase their level of competence does not represent much laboriousness. This is advisable due to the fact that professional retraining programs reflect the content, educational and methodological support of educational programs of higher education and are carried out by university teachers with the involvement of external (practicing) experienced specialists in this professional field - experts. This allows you to apply a practice-oriented approach to the implementation of programs APE in the field of TS.

6. Therefore, the additional education of specialists in the field of TS must first be developed on the basis of higher education institutions that have a license and accreditation for undergraduate, specialist, and master's programs in TS areas. This will allow us to maintain a unified approach (continuity) to the organization of training under the programs APE of specialists in the field of TS adopted in the implementation of Federal state standards of higher education.

References

- [1] Sampson D and Fytros D 2008 Competence models in technology-enhanced competence-based learning In *Handbook on information technologies for education and training* 155-177
- [2] Guerrero D and De los Ríos I 2012 Professional competences: a classification of international models *Procedia-Social and Behavioral Sciences* **46** 1290-1296
- [3] McClelland D C 1973 Testing for competence rather than for" intelligence *American psychologist* **28(1)** 1
- [4] Miranda S, Orciuoli F, Loia V and Sampson D 2017 An ontology-based model for competence management *Data & Knowledge Engineering* **107** 51-66
- [5] Martyka J 2014 Supervisors competence and safety level in coal mines *Journal of Sustainable Mining* **13(3)** 26-35
- [6] Bernavskaya M V 2014 Methodology of a system of professional competence *Pacific Science Review* **16(2)** 81-84
- [7] Ilanlou M and Zand M 2011 Professional competencies of teachers and the qualitative evaluation *Procedia-Social and Behavioral Sciences* **29** 1143-1150
- [8] Gorina L N, Danilina N E, Freze T Y and Ryabikin S A 2012 Formation of competence of the specialist in the field of technosphere (fire) safety is a condition of introduction of high-tech and innovative technologies in production *Proceedings of the Samara scientific center of the Russian Academy of Sciences* **14(4-5)** 1436-1440
- [9] Kovaleva A A, Mukhina A O and Wilch N V 2010 Competence approach as a condition for improving the quality of training in the field of technosphere safety *Proceedings of the Samara scientific center of the Russian Academy of Sciences* **12(4-3)** 760-764
- [10] Klimova E V 2015 Problems Of Professional Training Of Specialists In Labor Protection *Promotion of professional development of personality and employment of young professionals in modern conditions* 212-216
- [11] Fomin A I and Makarova E V 2009 A method for assessing the competence of personnel in the field of labor protection based on the definition of occupational risks at the coal enterprises of Kuzbass *Bulletin of Kuzbass state technical University* **6**
- [12] Serdyuk V S and Ushakov I V 2012 Training on labor protection on the basis of information technologies and means of distance education *Dynamics of systems, mechanisms and machines* **3** 339-341
- [13] Simakova E N, Gaponik N A and Sapegin O N 2015 Updating of GEF VO in the direction of "Technosphere safety" taking into account the requirements of professional standards *Life safety* **7** 59-67
- [14] Rukina N M 2009 Additional adult education as a factor of professional development of the individual *Proceedings of the Samara scientific center of the Russian Academy of Sciences* **11(4-5)** 1137-1142
- [15] Mozhaeva G V 2007 Remote technologies in additional professional education *Open and distance education* **3** 27
- [16] Serdyuk V S, Makiko E V and Dobrenko A M 2019 Problems and prospects of development of additional education on Technosphere safety *Technosphere safety* 6-11
- [17] Sevastyanov B V and Lisina E B 2016 System of continuing professional education in the field of training" Technosphere safety" In *Innovation in education* 138-140
- [18] Klimkina E I, Andreeva T A, Levchenkova O S and Kovaleva L A 2018 The role of distance learning in improving the skills of teachers of SSMU *Smolensk medical almanac* **3** 190-192
- [19] Zakharchenko T V and Ismakova L S 2011 Modern information technologies in education *Actual problems of social communication* 490-493
- [20] Romanova O A 2018 Creation of a practically-oriented educational environment for improving the quality of training of future specialists and forming their professional competence (on the example of specialty 38.02. 04 commerce (by branches) **4** 49-53