

Arrangements for Practical Training Through the Example of Ufa State Petroleum Technological University

Lyaysan Zulfarovna Zainagalina

Department of Oil and Gas Field Machines and Equipment
Ufa State Petroleum Technological University,
Branch of the University in the City of Oktyabrsky
Oktyabrsky, Russia
E-mail: zlz11@mail.ru

Flyura Zinnatovna Bulyukova

Oil & Gas Field Machinery and Equipment
Ufa State Petroleum Technological University
Ufa, Russia
E-mail: flura2003@mail.ru

Abstract — the paper is devoted to the description of arrangements for practical training of students majoring in Program Track 21.03.01 Oil and Gas Engineering in Ufa State Petroleum Technological University, Oktyabrsky branch. The paper includes information on objectives, tasks and procedure of the practical training, a list of primary professional skills mastered by the students, including the primary skills and experiences in scientific research in accordance with the Federal State Educational Standard of Higher Education, Generation 3+. Arrangement of the practical training includes visiting leading enterprises of the oil-and-gas industry, training in specialized departments and training at a specialized Scientific Industrial Training Testing Ground SOLUNI. Experience is shared from arrangements for the practical training at the departments of *Machinery and Equipment of Oil and Gas Fields* and *Oilfield Machinery and Equipment*. Experience is shared from the work of USPTU branch in Oktyabrskoye, where students completed their practical training within the framework of academic mobility programs in Samara State Technical University, Almet'yevsk State Oil Institute, Tyumen State Oil and Gas University. Recommendations are given aimed at improving efficiency of the educational process aimed at primary professional skills and experience.

Keywords — *practical training, specialized department, professional competences, academic mobility.*

I. INTRODUCTION

Practical training of students is an integral part of education for Bachelor's degree according to the Federal State Educational Standard of Higher Education (FSES HE), Generation 3+.

The purpose of the practical training is to consolidate theoretical knowledge and provide practical familiarity with the main processes and equipment: in drilling for oil and gas; production of oil and gas, gathering, treatment and transportation of well production; installation, repair and maintenance of oil equipment; provision of students with practical skills and competences in the field of their future professional activity.

Tasks of practical training:

- studying organizational structure of an industrial facility (or that of an organization with production facilities), its technological capabilities, manufactured or repaired products, processes in the production cycles, operation of the enterprise;
- studying the current management system;
- familiarizing oneself with the content of main works and research conducted at the facility or in the organization where the practical training is taking place;
- mastering approaches, methods and techniques of identification, observation, measurement and control over production, industrial and other processes in accordance with the student's Program Track [1].

The time frame of the practical training is defined by FSES HE in accordance with program tracks, curricula and academic calendar. Referring students to specific practical training facilities is formalized in a form of a university-wide directive. Practical training supervisors are appointed from the numbers of faculty of a graduate chair upon the recommendation of the Head of the Department. On completing the practical training, a student draws a report and takes a graded test.

II. PROBLEM STATEMENT

The completion of the practical training shall facilitate mastering general engineering and special subjects' studies during the later years of the university course.

Practical training in obtaining primary professional knowledge and experience, including primary experience in scientific research are among the main subjects for students following the Program Tracks 15.03.02 Process Machinery and Equipment and 21.03.01 Oil and Gas Engineering. The application of innovative educational approaches is necessary in teaching this subject, in order to form deep knowledge, as during their future professional activities graduates will resolve the issues relevant for the whole oil industry, namely:

- 1 – maintaining a technically sound state of all the oil-field equipment (OFE);
- 2 – identifying causes of wear and failure of parts, assemblies and units;

3 – increasing reliability, service life of OFE, reducing repair and maintenance costs [2].

In order to solve these tasks, a close relation is required between the theory and the practice, as it happens in advanced industrial sectors. The practical training shall be arranged in such a way, that the future graduate is not a passive observer, as it is insufficient for consolidation of knowledge obtained in the university, but rather an active participant of the educational process, involved with interactive educational technologies [3, 15].

The practical training consists of several stages. A Preparatory Stage includes familiarizing students with the goals and objectives of their practical training, describing report preparation, informing the students on time frame of the training, safety briefing.

The Main Stage is gathering information for production of professional skills and experience. It includes familiarization of the students with the history, general activities, modern state, economic indicators and industrial objectives of the oil-and-gas enterprises, studies of HSE issues in the oil and gas production industry, analysis and generalization of the obtained information in the report.

The Final stage is defense of the report and taking a graded test.

It is necessary to investigate efficiency of this structure for arrangement of practical training for mastering the following competences in accordance with FSES HE 3+:

- capability to obtain new knowledge largely independently, using modern educational and information technologies
- understanding the nature and importance of information for the development of the modern society, capability to obtain and process information from various sources; preparedness to interpreting, structuring and formalizing information to make it available to others
- capability to solve standard professional tasks on the basis of information and bibliographic culture, using ICT and taking into account the basic requirements of information security
- capability to ensure processability of products and optimal nature of their manufacturing processes, a skill in controlling conformance to process discipline in manufacturing
- a capability to participate in refinement and assimilation of processes during preparation to production of a new product, check installation and adjustment quality during testing and commissioning of new specimens of produced units, assemblies and parts
- a skill in checking technical condition and remaining life of process equipment, arrangement of preventive maintenance and routine repair of process equipment and machinery
- a skill in conducting measures aimed at prevention of on-the-job injuries and occupational diseases; controlling conformance to environmental safety during the works

- a skill in modeling process facilities and processes using standard software packages and CAD tools, preparedness to conduct experiments following predefined techniques with subsequent processing and analysis of results

- a capability to participate in calculation and design of parts and assemblies of engineering structures in accordance with design specification and using standard CAD tools

- a skill in application of QA/QC methods to products and objects in the professional sphere, conduct root cause analysis and develop measures for their prevention [4, 12].

III. RESULTS AND DISCUSSION

The main stage of the practical training of USPTU students includes arrangements for the following: On-site excursions to oil-and-gas industry enterprises; training at specialized department facilities; practical exercises at testing grounds, academic mobility of students within the framework of the practical training. In accordance with the specifics of the Program Track Machinery and Equipment of Oil and Gas Fields, the practical training takes place at oil-and-gas enterprises of various subsectors: PAO ANK Bashneft, Bashneft-dobycha, Polyanskoe LPU MG OOO Gazprom transgaz Ufa, NPP Burintekh, UNPP Soluni.

Deep knowledge in structural materials, analytical mechanics, strength of materials, thermal and thermochemical treatment of metals, metal processing, repair technologies of OFE, polymer materials and practical skills of a future graduate obtained at state-of-the-art oil enterprises will allow training graduates to be capable of solving the most pressing problems of the oil industry. In order to increase the efficiency of the course, a complex approach is used in studying OFE parts and assemblies. The complex approach to studies allows familiarizing the student with all the currently known issues with a given OFE part or assembly with subsequent continuation of the studies with a similar part given for independent study with a reference paper used as a type of reporting.

Taking into account mutual interest in development of cooperation and mutually beneficial relations between institutions of higher education and specialized enterprises, there are specialized departments founded in the USPTU on the foundation of graduate departments. Creation of such specialized departments develops cooperation in training the specialists for higher and post-higher professional education, fundamental and applied research, sci-tech services based on the principles of equal rights and mutual profitability, integration of scientific-intellectual and logistical potentials, while taking into account needs and interests of the parties. There is joint scientific research (research projects and R&D projects) in the area of improving equipment and processes; joint conferences and workshops are organized; scientific technical developments undergo practical evaluation.

In Ufa State Oil Technical University, a practice has formed for extramural classes in specialized subjects, both practical and lab work-related. Undergraduates from the department of *Machinery and Equipment of Oil and Gas Fields* have their classes in the subject of *Methods and Techniques of Oil and Gas Production and Treatment* at the

facilities of OOO Bashneft-Dobycha. Master's degree students studying *Drill-through Tools* study the whole cycle of manufacture of such tools at the facilities of OOO NPP Burintekh. Direct knowledge of modern enterprise organization, technologies and diagnostics of production allow increasing the quality in mastering specialized subjects. Within the framework of the practical training, there are extramural excursions to enterprises of the industry.

One of the key factors for the successful integration of Russian higher education and science into the international educational space is academic mobility, which is on the list of mandatory parameters of the Bologna Process [5].

Academic mobility programs of students may last from one semester to one year, but they may be also oriented towards studying specific subjects or modules in a partner organization, or towards conducting research or undertaking practical training [6].

Objectives of student academic mobility:

- increasing quality of education by means of introducing modern experience of leading Russian and foreign tertiary schools into the academic process;
- increasing marketability of graduates in the Russian and global labor market;
- increasing profile and investment attractiveness of a tertiary school in the global market;
- ensuring educational trajectory of students with consideration for their features and wishes in line with the main curriculum (individualization) [7, 11].

In order to develop student academic mobility, the university needs to solve the following tasks:

- create and develop a grant system for students and instructors;
- improve organizational mechanisms and intra-university regulatory framework of the academic mobility;
- allocate funds to academic mobility and international cooperation in the university budget;
- provide high-quality training of students, instructors and university employees in foreign languages, forming a level of command sufficient for participation in international cooperation programs;
- develop an intra-university system for mobility assessment;
- create infrastructure to support adaptation;
- create social and living conditions for development of academic mentorship;
- develop a system to raise awareness of academic mobility programs [8, 13].

Stages of implementing the student academic mobility program:

1. Preliminary stage – search for partner universities.

2. Preparatory Stage – organizational activity. Compiling, approving and signing an agreement (contract) for cooperation between the educational organization and partner organizations (plan of cooperative activities, joint academic mobility program, exchange program, etc.) [9, 14].

3. Main Stage – implementation of the agreement. This stage provides compiling and signing of additional agreements, e.g., on creating double degree programs. After that a process of curricula agreement starts, followed with approval of student and instructor arrival terms, legal paperwork for a trip to study in the partner university. After all the necessary documents are complete, students start their studies.

4. Final stage. After completion of the academic mobility program, a student returns to their main university, where credits, subjects and period of studies complete in another universities are transferred to [10].

In Oktyabrsky branch of the USPTU, academic mobility programs covers full-time students in Program Track 21.03.01 Oil and Gas Engineering, educational program Operation of Oil Production Facilities, and program track 15.03.02 Process Machinery and Equipment, educational program Machinery and Equipment of Oil and Gas Fields.

Within the framework of academic mobility, the students of the branch were directed to Samara State Technical University, Tyumen State Oil and Gas University, Almeteyevsk State Oil University. Surveying the students who had participated in the academic mobility programs of the Oktyabrsky branch of the USPTU showed that 96% of surveyed were content with the quality of the student academic mobility program. In the modern context of integrating Russian education into the European educational space, expansion of academic mobility largely defines improvements in efficiency and competitive performance of the Russian educational system.

The assessment tools include achievement indicators for mastering competences that provide that a student:

- can name main goals and objectives in identification of professional and environmental risks in the human-environment system that exert a negative influence onto human health and the environment;
- can list the principal diagnostic methods of oil-and-gas equipment;
- can describe the structure and stages of equipment design;
- can name modern software solutions for 3D modeling;
- can describe the principal technologies for each type of works in overhaul and routine repairs of oil-and-gas field equipment;
- determines a relation between physical-chemical and process properties of alloys from their phase diagram;
- knows grades, compositions, main mechanical and process properties of structural materials used in the oil-and-gas- industry;

- can describe modern information processing technologies, present a development procedure for developing algorithms to solve tasks;
- can describe the principal technologies for each type of works in overhaul and routine repairs of oil-and-gas field equipment;
- can list self-organization and self-training processes, their features in the context of professional self-improvement goals;
- knows maintenance and repair of process equipment;
- can be analyzed and conduct research in professional safety rules;
- is capable to compile algorithms of well overhaul activities;
- evaluates remaining life of equipment in operation;
- justifies design solutions with calculations;
- is familiar with peculiarities in applying automation methods and means;
- demonstrates operating skills for technical tools and diagnostic software solutions;
- demonstrates operating skills with Kompas 3D;
- demonstrates statistical methods of data processing;
- demonstrates methods and techniques providing environmental and industrial safety;
- explains personnel management from the point of view of social and ethical responsibility, showing tolerance to confessional and cultural differences;
- shows skills in compiling algorithms for solving tasks;
- explains a decision-making algorithm for a non-standard situation from the position of social and ethical responsibility;
- explains personnel management from the point of view of social and ethical responsibility, showing tolerance to confessional and cultural differences;
- uses reference materials to select structural materials for machinery and equipment used in oil-and-gas industry;
- determines grades of materials and production technologies for well construction and repair;
- demonstrates application of modern IT for improvement of oil and gas production processes;
- demonstrates skills in cooperation with colleagues, collective work, ethics in labor relations, conflict solving, main approaches to stress-resistant behavior;
- follows organizational procedures for all types of repair of oil-and-gas equipment;
- demonstrates skills in operation and maintenance of principal process equipment;
- demonstrates knowledge of efficiency assessment methods for manufacture processes used in production of parts and assemblies;

- shows skills in control of rational and safe professional activity.

The Practical Training Report serves as an assessment tool. It is a product of student's independent work, a brief summary and analysis of results from the practical training in written form. The report includes development of proposals and recommendations aimed at increasing efficiency of operation of the organization.

The work is graded «*excellent*» if it is complete and its author demonstrates knowledge of methods for obtaining, generalization and systematization of the material in the report at a level of 91-100%.

The work is graded «*good*» if it is complete and its author demonstrates knowledge of methods for obtaining, generalization and systematization of the material in the report at a level of 61-78%.

The work is graded «*satisfactory*» if is incomplete and/or its author demonstrates knowledge of methods for obtaining, generalization and systematization of the material in the report at a level below 61%.

The work is graded «*satisfactory*» if the author has not mastered the instructional material during the practice, does not name the principal components of oil-and-gas equipment, the report lacks structure

IV. CONCLUSION

During their defense of practical training reports, students in Program Track 21.03.01 *Oil and Gas Engineering* demonstrated high levels of results in mastering the competences provided by the Federal State Educational Standard.

The arrangement of the practical training for students in Program Track 21.03.01 *Oil and Gas Engineering* in Ufa State Technical University (USPTU and USPTU branch in Oktyabrsky includes visiting the leading enterprises of the oil-and-gas industry, training in specialized departments and at a training testing grounds SOLUNI, student academic mobility, and organically links practical and theoretical training, facilitating development of primary professional skills and experiences, including the primary skills and experiences of scientific research.

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