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Active Teaching Methods in Professional Content-based English Language Learning as an Important Component of CDIO Concepts
(profile/specialization 12.03.01 "Instrument Engineering")

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The article describes the possible quality provision of engineering training in profile (specialization) 12.03.01 "Instrument Engineering" via developing creative environment. Examples of applying active teaching methods in compliance with CDIO Initiatives are discussed.

Key words: CDIO, active learning methods, professional training, co – management of cognitive activity, competence.

Introducing multi-level education system, integrating unified education space, implementing CDIO concepts (initiatives) into National Research Tomsk Polytechnic University specified the relevant organization of practice-oriented-based teaching process. The instructors are not knowledge "translators", but are "selectors" of the optimal teaching strategy by applying modern education technologies and "thinkers" of creative education process environment. In this case, activities are characterized as partnership and co-management of subject-subject relationship between student and instructor.

It should be noted that active student cognitive activity is the psycho-pedagogic principle of practice-oriented based teaching approach, whereas the student applies attained skills, abilities, experience and knowledge during the process activities, which, in its turn, furthers the development of creative thinking skills.

Besides, modern education orientation in competence shaping as a result of organized didatic and psychological conditions promotes and develops possible intelligent cognitive and active life philosophy and professional attitude, which, in its turn, identifies the individuality of the subject. In most cases, the student is engaged in a dialogue with the instructor, executing creative, research and problem-solving tasks, oriented on the cognitive process development. Another aspect is the pair-group activities in task performance in accordance with this or that discipline. Above-mentioned aspects are effective if they are based on Standard 8- international CDIO Initiative: "Active teaching methods" [1].

We shall consider in detail the active teaching methods within the framework of the discipline "Professional Content-based English Language" in module "Intro in Engineering" (Bachelor degree program: profile / specialization – 12.03.01 "Instrument Engineering"), executed in the 5th semester:

- teaching domain: shaping professional foreign language communication competence, i.e. oral and written communication skills, as well as a good command of engineering terminology;
- mentoring domain: effective individual and/or team performance, demonstrating professional skills and abilities and personal development;
- development domain: training students for future professional (engineering) activities, involving professional English language, assimilation and transfer of new knowledge, new experience acquisition and self-education.

Above-mentioned goals could be achieved only in the case of applying active teaching methods within the framework of a discipline [2].

One tutorial method, demonstrating high student activity level, is seminar-conference where students deliver different reports with further instructor-conference participant discussion. Within the sphere of studied discipline the students prepare reports describing leading engineers and scientists and their contribution in the development of instrument engineering. In this case, one specific requirement is that the students should use only authentic materials, while another important aspect is the grading system for students. Total grade is the average sum of the instructor and student grades as well as self-assessment. According to the authors, the estimated grade is rather objective. In addition, the student enhances his/her responsibility for the performance results provided that the assessment of this activity includes the assessment of other groupmate performance.

The second tutorial type – seminar-discussion. The classes are conducted as (scholar) debates. The primary focus is on the fact that a student executes material research and actively participates in the debate (discussion). It is important that diversified information source embraces different approaches to the problem-solving, while the debate (discussion) is conducted by means of student-instructor interaction. For example, within the framework of the module "Intro to Engineering" the students conduct a discussion (debate) devoted to the topic "Future-oriented engineering spheres in today's world".

Another tutorial type – seminar-extended colloguy (dialogue), which is conducted in the process of mastery challenging materials. In this case, the initiator is the instructor. The instructor elaborates the colloguy – plan in advance. During the dialogue the students express their opinion through relevant planned ready-to reports. This teaching technique focuses on the problem issues in the study and acquisition of the discipline, develops comprehension and listening skills, as well as skills in preparing concise and short presentations. The students are able to follow the relevance of a groupmate presentation to the seminar-plan, and then further review it. Within the framework of the module "Intro to Engineering" the above-described method could be implemented into the subject-topic "Development and successful commercialization of a new device".

Tutorials based on such a technique as problem-solving seminar via discussion includes a combination of "brain-storming" and "creative discussion", individual and teamwork not only at the initial preparatory stage but also throughout the discussion itself. Students are free to express their critical comments and questions. The principle of the problem-solving seminar is to produce a problem situation which could be elaborated in advance (7-10 days beforehand). A plan indicating the further results is outlined, which, in its turn, introduces the research concept and tasks. The students independently navigate for necessary information concerning the subject-topic, examine different versions and proposals in its problem-solving. In the above-mentioned module the students create an ideal portrait of an instrument-engineer with an extended description of competencies.

Seminar-role game objective is the commercialization of a new device and drawing investors into its production. The student-group is divided into six sub-groups: industrialists, bankers (economists), elective administrators, design engineers, ecologists and consumers. The goal of the design engineers is to provoke the interest of potential investors in a new device or its technological concept and providing not only its specifications, but

also its resource efficiency. The device name with a brief description can be proposed by the instructor or invented by the students. The goal of the bankers and elective administrators – select the device that would guarantee maximum profit. The ecologists should verify the proposed device environmental safety. The consumers can be either students or instructors from other groups.

Active teaching methods could include watching English videos. For example, the students have a list of questions which he/she should answer during and / or after watching the video. The students review a set of questions, then exchange questions between each other, checking the correct answers and adding necessary information.

Oral test involves debates devoted to such topic as "Who generates the development of a society – an engineer or a scientist?" [3].

It should be noted that the students compile a glossary, i.e. they write down 5-10 words in each class throughout the semester. The written test involves writing an essay based on a topic associated with the student's future profession and including as many glossary words as possible.

The students highly praised the application of above-mentioned active methods in the teaching process. The questionnaire survey showed that the students actively and thoroughly prepared their study assignments. According to the student-respondents, such active methods as debates, discussion, seminar-confetences have two advantages: (1) monitoring one's communicative skills and (2) depth-in understanding of specific topics associated with the student's future profession.

Thus, the following methods applied in teaching the discipline "Professional Content-based English Language" embrace such skills and abilities as:

- activation of thinking and behavior;
- motivation -promotion in learning, teaching process management and personal engineering activities;
- administrative response to teaching process;
- understanding technological processes, engineering problem – solving and their promotion;
- experience exchange (personal and professional);
- motivated interest in studying engineering;
- material acquisition and consolidation (in Russian);
- development of individual, intellectual and behavioral skills and abilities under non-standard conditions;
- english proficiency for graduates;
- implementation of CDIO standards;
- enhancement of engineering education.

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Papplication of International CDIO Standard and Innovative Approach in the Methodology of Scientific Creativity

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Innovative methods of scientific work combined with the international CDIO initiative criteria are a new approach to engineering education. The article presents the assessment tools and evaluation techniques which can be applied during various master's thesis project stages, with main focus being paid to "production" in parts «testing» and «validation». The present article is the continuation of the work done previously.

Keywords: innovation in higher engineering education, methodology of scientific research on the particular algorithm.

Engineering education of the previous period consisted in the development of the following chain: «learning – engineering knowledge development – skill acquisition - practice». The essence and spirit of the CDIO International Program are focused on development of features of engineering education relevant to the contemporary state of society, science, and technology. Thereby, academic process implies the following elements: «learning – practice – engineering knowledge development – practice – skill acquisition – practice – outcome correlation – practical application of the whole knowledge volume». Further education under the slogan «lifelong education» forms an individual «learning trajectory».

Competence approach to higher engineering education sets the task of tool development for future master's competence formation and corresponding innovative methodical supplement for their realization. CDIO program sets a through goal: «Graduates are to be ready for complex engineering activity: Conceive, Design, Implement, and Operate engineering products, processes, and systems of the contemporary environment based on team work of specialists» [3, p.5].

CDIO standards are focused on «eliminating the contradictions between theory and practice in engineering education» through «enhancement of practice-oriented learning process as well as introduction of problem and project learning techniques» [3, c.2]. The given contradictions include a gap between theory and practice, irrelevence of educational practice to the level of contemporary scientific theory development also predetermined by such an unprecedented achievement as IT-technologies. According to the researcher's statement, cofounder of Concept Labs CA, chief engineer of BT Labs P. Cochrane: «Imagine this school with children that can read and write, but with teachers who cannot, and you have a metaphor of the information age in which we live» [4, 5]. It is referred to school, but this feature is also relevant to the stage of higher education.

At Tyumen State Oil and Gas University a propaedeutic course of «Methodology of scientific work» was introduced for masters of major «Electrical Power and Electrical Engineering». Its key task is preparation for master's dissertation. It is performed by means of innovative developments in the sphere of scientific creativity methodology

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