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## FORMATION THE PROFESSIONAL AND PERSONAL COMPETENCIES OF AGRICULTURAL ENGINEERING STUDENTS VIA EXPERIENCE OF NATURE SCIENCES STUDY

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## ФОРМУВАННЯ ПРОФЕСІЙНО-ОСОБИСТІСНИХ КОМПЕТЕНЦІЙ МАЙБУТНІХ ФАХІВЦІВ АГРАРНО- ІНЖЕНЕРНОГО НАПРЯМУ НА ПРИКЛАДІ ВИВЧЕННЯ ДИСЦИПЛІН ПРИРОДНИЧО-НАУКОВОЇ ПІДГОТОВКИ

### *Abstract*

**Introduction.** The paper deals with the problems of organization of educational process at higher educational institution based on the use of the case study method in a course of studying engineering disciplines. Leading to readiness for making autonomous decisions the case teaching method increases learning motivation, encourages creative thinking helps in expanding professional knowledge, gaining qualification skills, reinforcing work-related skills, and prepares student for future professional activity.

**Methods.** The theoretical analysis of recent scientific and methodical publications, as well as empirical data, obtained from practical experience of academics of the Tractors, Automobiles and Power Tools department of Engineering faculty at the State Agrarian and Engineering University in Podilya were used.

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**Results.** The present paper validates the effectiveness of the case teaching method in Hydraulics and Water-Supply Agriculture Engineering course.

**Discussion.** The organization of educational process with the use of case method in a course of studying mathematical and physical sciences allows extending the amount of information given to students, and therefore helps engineer graduates to gain some important skills for their professional activity in industry.

**Keywords:** production activities, hydraulics, experience, engineering solutions, method competence, practical skills, natural sciences training, engineering specialists.

#### **Анотація**

**Вступ.** Розглядається організація навчального процесу у вищому навчальному закладі, побудованому на методах конкретних виробничих ситуацій при вивченні технічних дисциплін природничо-наукової підготовки з метою прищеплення кожному студенту бажання навчатися, розвивати творче мислення для придбання професійно-особистісних компетенцій, певного досвіду та практичних навичок, що дасть можливість майбутнім фахівцям аграрно-інженерного напрямку приймати оригінальні технічні рішення в умовах майбутньої виробничій діяльності.

**Методи.** Використано публікації наукових і науково-методичних видань, методи педагогічних досліджень та методичні матеріали і практичний досвід кафедри тракторів, автомобілів та енергетичних засобів інженерно-технічного факультету Подільського державного аграрно-технічного університету.

**Результати.** У статті обгрунтована важливість використання методу конкретних виробничих ситуацій при вивченні технічних дисциплін природничо-наукової підготовки, зокрема, дисципліни «Гідравліка та сільськогосподарське водопостачання».

**Перспективи.** Для покращення організації навчального процесу, набуття практичних навичок, наближених до умов виробництва, формування професійно-особистісних компетенцій у майбутнього фахівця аграрно-інженерного напрямку, доцільно використовувати метод конкретних виробничих ситуацій, що є основним стержнем вивчення навчальних дисциплін циклу математичної та природничо-наукової підготовки для забезпечення можливості самостійного пошуку вирішення поставлених інженерних завдань, розширення фахових знань, прийняття оригінальних інженерно-технічних рішень в умовах майбутньої виробничої діяльності.

**Ключові слова:** виробнича діяльність, водопостачання, гідравліка, досвід, інженерно-технічні рішення, метод, компетенції, практичні навички, природничо-наукова підготовка, технічні дисципліни, фахівці.

#### **Аннотация**

**Вступ.** Рассматривается организация учебного процесса в высшем учебном заведении, построенном на методах конкретных производственных ситуаций при изучении технических дисциплин с целью привить каждому студенту желание учиться, развивать творческое мышление для приобретения профессионально-личностных компетенций, определенного опыта и практических навыков. Это даст возможность будущему специалисту аграрно-инженерного направления принимать оригинальные технические решения в условиях будущей производственной деятельности.

**Методы.** Использованы публикации научных и научно-методических изданий, методы педагогических исследований и методические материалы, практический опыт кафедры тракторов, автомобилей и энергетических средств инженерно-технического факультета Подольского государственного аграрно-технического университета.

**Результаты.** В статье обоснована важность использования метода конкретных производственных ситуаций при изучении технических дисциплин естественнонаучной подготовки, в частности дисциплины «Гидравлика и сельскохозяйственное водоснабжение».

**Перспективы.** Для улучшения организации учебного процесса, приобретения практических навыков, приближенных к условиям производства, формирования профессионально-личностных компетенций у будущего специалиста аграрно-инженерного направления, целесообразно использовать метод конкретных производственных ситуаций. Он является основным стержнем изучения учебных дисциплин цикла математической и естественно-научной подготовки для

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*обеспечения возможности самостоятельного поиска для решения поставленных инженерных задач, расширения профессиональных знаний, принятия оригинальных инженерно-технических решений в условиях будущей производственной деятельности.*

**Ключевые слова:** *производственная деятельность, водоснабжение, гидравлика, опыт, инженерно-технические решения, метод, компетенции, практические навыки, естественно-научная подготовка, технические дисциплины, специалисты.*

**Introduction.** The case teaching method is attracting increasing interest in terms of the need for new approaches to educational process organization that may encourage creative thinking, motivate students to acquire knowledge and skills in order to gain some practical experience, as well as to improve students' academic performance. Moreover, to relate to real-world professional problems the agrarian engineering graduate must have formed professional and personal competence. This paper focuses on the hands-on teaching as a key method of highly-qualified personnel training. We believe the case teaching method, leading to readiness for making autonomous decisions, helps in expanding professional knowledge, gaining qualification skills, reinforcing work-related skills, and preparing students for future professional activity.

**Analysis of recent research and publications.** The case method relates to active, problem-based, and heuristic teaching methods. The term's "case" origin goes from English, and means 'situation, instance'. According to this method, the student in a process of studying has to solve some work-related situations, which is particularly important since any life situation cannot be solved with the help of template, unambiguous standard approaches.

A key problem with much of the literature on this method is that there is a lack of related to real world learning activities in modern degree courses schemes and programs of disciplines, which is of special importance for mathematical and physical sciences. However, much work on the problem of usage of individual close-to-practice learning activities in special courses teaching has been carried out. L. Avramchuk evaluated the effectiveness of problem-based learning as a tool of agrarian student's efficient cognitive activity training; I. Bendera investigated the organization of agrarian engineering students' independent research activity; N. Brukhanova grounded the theory and methodology of engineering educators' professional training; V. Duhanets highlighted the theory and methodology of on-job training of agrarian engineering students; I. Kankovskyi developed the system of professional training of transport services students; M. Kozyar introduced some innovative teaching methods in graphic courses for engineering students; V. Lugovyi outlined the problem of implementation of the European competence concept in higher education within Ukrainian educational system; V. Mozgovyi studied the formation of engineering educators teaching competence; G. Podpryatova introduced the system of agricultural engineering students' training; V. Swystun investigated the theory and methodology of management activity training of agrarian students [1-10].

In the literature the case method has been identified as a tool of improvement of the teaching effectiveness both in laboratory classroom and within students' independent research activity. Moreover, the method helps engineer graduates to gain some important skills for their professional activity in industry.

**Purpose.** The present paper aims to validate the effectiveness of the case teaching method in mathematical and physical courses, such as Hydraulics and Water-Supply Agriculture Engineering course. This teaching method is one of the most feasible ways to optimize the educational process, intensify the acquisition of students' knowledge and progressive experience, as well as to gain important professional skills, and as a result to improve the quality of higher education. The object of our study is the case method in Hydraulics and Water-Supply Agriculture Engineering course teaching for students enrolled in the specialty Energetic and Electrical Engineering in Agricultural Industry. The target of the

research is the professional training of electric power engineering students.

**Methodology.** The methodological basis of the paper is scientific and applied researches on the case method, provided during its' implementation into engineering educators teaching practice as one of innovative teaching technologies. Consequently we used the theoretical analysis of recent scientific and methodical publications, as well as empirical data, obtained from practical experience of academics of the Tractors, Automobiles and Power Tools department of Engineering faculty at the State Agrarian and Engineering University in Podilya.

**Results.** Agrarian engineering students training process is based on creation of respective conditions to differentiate the learning content, providing manifold and flexible opportunities for individual educational programs development, ensuring the foundations of engineering literacy, technical thinking, sense of orientation, and design capabilities in order to ensure the continuity between high and professional education together with more efficient university training process [11, p. 85-99].

The whole educational process is aimed at the engineering students' professional and personal competencies formation, becoming the basis of the educational content design. Competence formation provides creation professionally significant qualities of the engineer. Fundamentals of special subjects are based on two concepts: the concept of the unity of all that exists and the concept of the singleness of nature's laws.

All phenomena and physical processes, covered by the discipline Hydraulics and Water-Supply Agriculture Engineering, exist in cause-and-effect unity. In this course studying, students often find it difficult to track and identify the main connections during the analysis of complex technical processes due to a number of additional interdependencies. Therefore, educator must, above all, highlight the main processes, thus create certain simplified phenomena scheme, its' abstraction [12, p. 222-227]. Hydraulics and Water-Supply Agriculture Engineering is one of the basic professional disciplines in the degree course scheme. It is based on the study of the water supply operation, agricultural machinery, hydropower, and land reclamation, road and bridge construction and so on. In addition, hydraulics is of great importance for food and energy programs, environmental protection, water use, water supply and sewage systems modeling, and hydraulic machines design. It is impossible to carry on studying professional disciplines without learning the ropes of the Hydraulics and Water-Supply Agriculture Engineering course. Hydraulic principles explain utilities system diagrams (water supply, sewerage and heating), operational capabilities of individual intakes (wells), information on reclamation land work etc. After all, all the agricultural machinery, vitally important for agriculture, has pumps and hydraulic drives.

Use of modern forms and methods in studying of this course allows students to grasp hydraulics principles, mechanics and constructive structure of hydraulic machines, widely used in various spheres of production, as well as in household use. The educational standard identifies the key competencies, according to which educator introduces students to professional activities. Correspondingly, engineer's mindset formation goes on in the process of special courses studying. This approach allows the single purpose that is training of highly qualified graduate to be achieved. In general, engineering studies are based on scientific approaches to broaden students' horizons and deepen their knowledge. Our research has shown that nowadays engineering disciplines teaching is challenged by the deep need for innovative approaches that would generate a higher return from education.

The empirical research provided by the staff of the Tractors, Automobiles and Power Tools department has demonstrated that the use of case method related to real-world working conditions is one of the most promising pedagogical techniques in engineering education. Pedagogical justification of case method is based on the need to prepare students for professional activities, requesting skills of application of the scientific-based approach to engineering technologies study.

Case-based pedagogical approaches in educational process provide more opportunities for in-class communication and open the door to proficient educational materials. Hence, it helps to achieve mastery in the Hydraulics and Water-Supply Agriculture Engineering course teaching, improving methods of teaching, class management, and educational efficiency. As a result, it promotes a positive influence on the course of study and has a positive impact on learning. In this regard it is worth paying attention to the need for a case method as one of the key forms of engineering students training.

Experimental work on identifying the effective forms of specialized engineering disciplines teaching conducted at the Engineering faculty has demonstrated that the case method applied in educational process enhances the quality of training of students enrolled in the specialty Energetic and Electrical Engineering in Agricultural Industry.

The use of case method in teaching of the Hydraulics and Water-Supply Agriculture Engineering course is grounded on the unity of systematic approach to training, principles of scientificity, problemativeness, modularity and others. Theoretical and practical importance of the method is that it is seen as complex and has targeted, meaningful and effective components, alongside with principles, forms, methods, and ways to design training content, i.e. tasks and exercises, instructional materials, academic achievement testing materials etc.

Practice of using cases in engineering disciplines teaching involves applying of special didactic tools to develop students' skills of individual work and continuous learning with due regard to common didactic principles and approaches (systemic, person-centered, differentiated, and others).

The proposed case-based technology of the Hydraulics and Water-Supply Agriculture Engineering course teaching has demonstrated its significant impact on the education effectiveness. As has been noted, it enhances students' learning motivation, their engagement in the course, as well as the desire to be highly praised for work-related activities. As a result, implementation of case studies in the course significantly increases student' attendance and independent research activity, hence, improve their academic results.

The introduction of the case method in the educational process as one of interactive teaching methods helps strengthening cooperation between teacher and student that facilitates academic performance rating. Studying the discipline using case method makes its positive impact on the quality of students' research papers and projects. Engineering students get a sense of confidence, feeling professional readiness for workplace professional activity.

The results of the study on the use of case method in the Hydraulics and Water-Supply Agriculture Engineering teaching at the Engineering faculty allows us to devise the following recommendations for organization of teaching process:

- create conditions for training of the competent specialist able to meet competition in the labor market;
- base the engineering disciplines study on principles of innovative educational technologies in order to improve the quality of classroom cooperation through solving of different types of complex real-world problems;
- coordinate training approaches and the courses content, the curriculum of the discipline; availability of educational, material and technical base, as well as potential place of employment.

Within this framework the case method becomes the specific practical approach to educational process organization, joining educational discussion that increases students learning motivation, practical laboratory control and self-control. It involves the formulation of some problem based on actual events and the search for the ways of these problems solving. As an interactive teaching method, it is well-received in university environment due to its capability to proactivity and self-sufficiency in the process of professional skills acquisition.

The experience of academic staff in agricultural engineers training at the State Agrarian

and Engineering University in Podilya has demonstrated that there is a tendency to applying of structured teaching materials and educational multimedia systems in university educational environment. Returning to the question posed at the beginning of this paper, it is now possible to state that the study of the case method in the Hydraulics and Water-Supply Agriculture Engineering course teaching is the problem of special interest.

Generally speaking, the case teaching method facilitates the development of both teachers and students creative potential. It is provided by the broad democratization and modernization of educational process, formation of progressive style of thinking, ethics and career motivation of engineer graduates. This approach involves case instructions either during the task formulation, or in a course of some production-related problems solving. Either way, the process of in-service training model development becomes an effective form of students' professional skills mastering [13].

The case method in engineering courses for agriculture engineering students isn't just some methodological novelty, but the method directly connected to modern educational tendencies. It aims not so much to the development of specific knowledge or skills, but to the development of general intellectual and communicative potential of students studying, e.g. the Hydraulics and Water-Supply Agriculture Engineering course.

Thus, the introduction of the case method into the agriculture engineers training process has demonstrated that it proves its efficiency as one of the effective methods of interactive learning provided by the state educational standard.

**Discussion.** 1. The organization of educational process with the use of case method in a course of studying mathematical and physical sciences allows extending the amount of information given to students, and therefore increasing their learning motivation and the readiness to future professional activity.

2. The case method can be used within different types of educational activity in order to develop theoretical and practical skills, to become a tool of consolidation and control of knowledge.

3. The use of case method in the Hydraulics and Water-Supply Agriculture Engineering course teaching requires engineering educators' method competence on the latest educational technologies.

4. The main purpose of the studying of mathematical and physical sciences with the use of case method in the first place is to promote self-learning during the training period. This allows coordinating student's educational trajectory with the general requirements of employers.

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