DOI: https://doi.org/10.26565/2074-8922-2025-84-33
УДК (UDC): 378.147

N. P. RUBAN[1], PhD (Pedagogy), Associate Professor,
Associate Professor of the Department of Pedagogy, Methods and Management of Education
e-mail: ruban_73@ukr.net ORCID ID: https://orcid.org/0000-0001-8337-2739
YU. YU. CHERNENKO[1], PhD (Economy), Associate Professor,
Associate Professor Department of Local Lore and Tourism Work, Social Sciences and Humanities
e-mail: ychernenko@karazin.ua ORCID ID: https://orcid.org/0000-0002-8403-1853
[1]*V. N. Karazin Kharkiv National University,*
4, Svobody Square Kharkiv, 61022, Ukraine

CRITERIA AND INDICATORS FOR EVALUATING THE EFFECTIVENESS OF CREATIVE TEACHING METHODS FOR TECHNICAL SPECIALTY STUDENTS

Abstract: The present day demands continuous development of new objects of technology and engineering, and creative self-realization from future engineers. Creative teaching methods in technical disciplines are capable of ensuring this. The quality of forming creative-level knowledge in technical disciplines among future specialists will increase if the methodological system is based on modeling the development of technical disciplines, and the content of teaching technical disciplines is presented in two parts – basic and creative, where the latter should be created by students independently during the learning process using methods and tools for managing students' creative educational and cognitive activity. The necessity of introducing specially organized pedagogical influence within the educational process requires the development of a system of criteria and indicators for identifying the quantitative and qualitative level of the pedagogical phenomenon's formation.

The article proposes the developed content, criteria, and indicators for evaluating the effectiveness of the teaching methodology for students in technical disciplines, which allow future engineers to assess the level of formation of professional knowledge and skills, creativity, and professionally important qualities. The assessment of the formation of professional knowledge is carried out in accordance with the acquaintance-orienting, conceptual-analytical, and productive-synthetic (creative) levels. Creativity is proposed to be evaluated using four factors of divergent thinking: fluency, flexibility, originality, and elaboration. As indicators of the formation of professionally important qualities of future engineers, it is proposed to assess the formation of interest and activity in professional activity, risk-taking in future professional activity, and the level of professional independence through questionnaires. All proposed criteria and indicators are thoroughly substantiated, and a methodology for evaluating each indicator is proposed.

KEY WORDS: *creative learning, criteria and indicators, methodology, level of professionalism, technical disciplines, creative activity.*

In cites: Ruban N. P., Chernenko YU. YU. (2025). Criteria and indicators for evaluating the effectiveness of creative teaching methods for technical specialty students. *Problems of Engineering Pedagogic Education*, (84), 382-391. https://doi.org/10.26565/2074-8922-2025-84-33

Introduction

The generally accepted understanding of the main component of technical education as the student's assimilation of the past experience in the form of a large number of technical objects rather than as the creative process of their creation today comes into conflict with the existing public need for development of new technical objects and the student's need for creative self-fulfillment [6]. Creative teaching methodologies used with technical disciplines can ensure purposeful and consistent transfer of the methodology of creative activity and creative experience (knowledge, ability, skills, educational and professional-creative problem-solving techniques) to future specialists under specially organized conditions.

Modern creative teaching methodologies (methodologies that ensure achievements of creative, productive-synthetic, level of knowledge acquisition) used at institutions of higher education (hereinafter referred to as IHE) for teaching technical disciplines need to adequately simulate the development of the relevant technical area [1]. It is important that training should not be limited to mastering of the existing objects, rules and definitions. It is necessary that learning should be a process of "knowledge mining" [3,7].

Therefore, the purpose of this research is to determine the criteria and indicators for creative teaching methodology in higher education as part of future engineers' innovative activity.

Method

Some authors [8,9] assume that the knowledge cultivation quality in technical disciplines taught to future specialists at the productive-synthetic level will increase provided that:

- the methodological system relies on simulation of technical discipline development;
- the content of technical discipline teaching can be presented into two parts: basic and creative, where the latter needs to be created by students independently during their learning using the methods and resources for students' creative educational and cognitive activity management.

The need to introduce a specially organized pedagogical influence within the academic process requires development of a system of criteria and indicators to determine the quantitative and qualitative level of the pedagogical phenomenon.

The higher school didactics has the corresponding criteria developed and their system proposed [12].

The qualitative indicators include:

- integrity of reflection in the educational content of the tasks to teach, educate and develop the student's personality;
- structural compliance of the content taught with the accepted psychological-pedagogical concept of knowledge and skill acquisition;
- reflection in the content taught of the modern level of science, technology and production development;
- optimal correlation between the empirical and the theoretical, the specific and the abstract.

Combined with the qualitative indicators, it is desirable to use quantitative indicators, for example:

- the informative capacity of the educational material, which is determined through the correlation between the content elements provided by the curriculum and the content elements imparted to students per time unit;
- the level of acquisition of the educational material, which is determined by the correlation between the educational material volume acquired by a student per time unit and the material amount delivered to students over the same period of time. The learning material acquisition unit is a conditional quantity for which one can take knowledge of formulae, rules, etc.

However, the criteria and indicators for assessing the effectiveness of creative training methodologies in technical disciplines remain undefined, which is associated with the need to improve the quality of professional knowledge and skills, and the need to increase the level of students' creativity. Moreover, the elements of the proposed methodological system should influence cultivation of professionally important qualities in future engineers. Thus, the criteria to assess the effectiveness of the methodology used in training of future engineers in technical disciplines can be divided into three groups (Table 1) [8,9]:

- the criterion to determine the level of professional knowledge and skills acquired;
- the criterion to determine creativity;
- the criterion to determine the influence of the methodological system on cultivation of professionally important qualities in future engineers.

Table 1.

System of criteria and indicators in experimental research

Indicator No.	Name of Indicator
Criterion to determine the level of professional knowledge and skills acquired	
1	Indicator of professional knowledge acquired at AO level K_3^{AO}
2	Indicator of professional knowledge acquired at PA level K_3^{PA}
3	Indicator of professional knowledge acquired at PC level K_3^{PC}
4	Indicator of professional skills acquired K_s
5	Relative training time t'
Criterion to determine creativity	
6	Problem-solving efficiency indicator K_{PS}
7	Thinking flexibility indicator K_F
8	Thinking originality indicator K_O
9	Thinking fullness indicator K_E
Criterion to determine the influence of the methodological system on cultivation of professionally important qualities in future engineers	
10	Level of influence of methodological system elements on cultivation of interest for and activity in professional occupation
11	Level of influence of methodological system elements on cultivation of risk in the future professional activities
12	Level of influence of methodological system elements on cultivation of professional independence

Results and Discussion

The first and the second groups of criteria allow us to quantitatively evaluate the creating teaching methodology applied in technical disciplines taught to IHE students. These groups contain objective indicators of the level of mastery of professional knowledge, skills and creativity.

Let us determine the content of the indicators within the first criterion – the level of professional knowledge and skills. New standards of higher education by specialities [13] define the content of the educational elements through different levels of knowledge acquisition (acquaintance-orientation (AO), concept-analytical (CA), and productive-synthesis (PS), and the indicators of the professional knowledge acquired have to correspond to these levels. Therefore, the first indicator of the first criterion will be that of the professional knowledge at the AO level K_3^{AO}. It requires the student to have a rough idea about the notions of the main production processes, to be able to recreate the definitions, laws, etc., be able to resolve typical problems by substitution of numerical data and to recreate and explain the significant characteristics of the object under study [15].

By the methodology proposed by V.P. Bespalko, the K_3^{AO} indicator refers to the reproductive level, and it should be determined with:

- identification of objects among the similar ones, resolution of problems following the example provided,
- algorithmic activity from memory, resolution of standard problems.

Therefore, for the topics requiring the students to obtain the AO level knowledge, reproductive level tests are proposed, which contain questions for identification, differentiation and classification (Ibid).

The indicator of the AO level professional knowledge K_3^{AO} is calculated by the formula:

$$K_3^{AO} = \frac{i}{n}, \qquad (1)$$

where:

i is the number of tests correctly done;

n is the total number of tests.

The second indicator belonging to the first effectiveness criterion in the creative teaching methodology used to train future engineers in technical disciplines is the level of professional knowledge at the AO level K_3^{AO}. This requires that the student should have a clear idea and understanding of the object under study, be able to identify, explain, analyze and transfer the previously acquired knowledge to apply it in standard situations [8].

According to V.P. Bespalko methodology [9], the indicator belongs to the productive level. Therefore, when covering the topics that require the CA level knowledge, students are given productive level tests that contain questions (without prompts).

The indicator of the CA level professional knowledge is calculated by the formula:

$$K_3^{AO} = \frac{j}{m}, \qquad (2)$$

where:

j is the number of tests correctly done;

m is the total number of tests.

The third indicator within the first criterion of the creative training method effectiveness in technical disciplines for future engineers is the PS level professional knowledge acquired. The professional knowledge the student has acquired at the PS level implies carrying out synthesis, generating new ideas and applying the previously leant knowledge to non-typical, non-standard situations [5]. According to V.P. Bespalko methodology [9], the indicator of PS level professional knowledge acquired belongs to the creative level. In this case, when covering the topics that require the PS level knowledge, students are given creative tasks to find a technical solution in solving a problem. This indicator is calculated by the formula:

$$K_3^{PS} = \frac{a}{p}, \qquad (3)$$

where:

a is the number of steps correctly made when completing a creative task;

p is the total number of steps in the creative task.

The fourth indicator, which belongs to the first criterion is the level of professional skills mastered K_s. The standard of higher education in the speciality 015 “Professional Education” for the first, bachelor’s, level of higher education requires proficiency in the students’ professional skills K_s at three levels [11]:

- with reference to material information media containing relevant information;
- using on constant mental control without reference to material media;
- automatic use, at the skill level.

Therefore, to check the level of professional skills mastery, depending on the requirements of the standard, various topics in technical disciplines require students to perform a number of k tasks (Ibid.). The indicator value depends on the number of correctly completed b tasks:

$$K_s = \frac{b}{k}, \qquad (4)$$

where:

b is the number of tasks correctly completed;

k is the total number of tasks.

Thus, the quantitative value of indicators K^{AO}, K^{CA}, K^{PS} and K_s are determined primarily by the number of errors made by the student. V.P. Bespalko [9] proposes the following scale of values:

- low level ($0 < K < 0.7$);
- medium level ($0.7 \le K < 0.8$);
- sufficient level ($0.8 \le K < 0.9$);
- high level ($0.9 \le K \le 1$).

An important indicator for the level of professional knowledge and skills acquired is the time the student spends on solving the problem [11]. Therefore, the fifth indicator in determining the level of professional knowledge and skills acquired is determined by the relative academic time spent t', which is calculated by the formula:

$$t' = \frac{t_{st}}{t_{in}}, \qquad (5)$$

where:

t_{st} is the time the student spends to solve the task;

t_{in} is the time the instructor spends to solve the task.

To determine the relative time spent using the scale, we use V.P. Bespalko's scale where the relative academic time spent t' is the value that is inverse to the coefficient of activity learning [1]:

low level ($t^* \geq 4$);

medium level ($3 \leq t^* < 4$);

sufficient level ($2 \leq t^* < 3$);

high level ($t^* < 2$).

Determining the composition of indicators belonging to the second criterion of creativity. According to scientists [13,14], the term "creativity" is interpreted as the ability of a special kind, i.e. the ability to generate novel ideas, to deviate, when thinking, from traditional schemes, and to quickly resolve problem situations. Creativity manifests in the mental qualities that contribute to creative expression. The most well-known psychodiagnostics tool for assessing creative thinking characteristics is the divergent creative thinking test by F. Williams [14]. Its aim is to diagnose a combination of verbal left-hemispheric indicators and right-hemisphere visual-perceptual indicators [14]. The data are assessed using four factors of divergent thinking: speed, flexibility, originality and elaboration, obtained through factor analysis, in the studies of intelligence by J.P. Guilford (the Structure of Intellect (SOI) [2,4,10]. Under the SOI, these factors are classified as divergent image transformations. We will adapt these factors to assess students' creativity in the subject area of the technical discipline. The first creative factor, the speed of thinking (solving as much as possible) [2,4,14], means generating a large number of solutions. It is determined by the number of problem-solving options offered by the student. The more options the student offers, the higher their performance is. Therefore, the first creativity indicator that corresponds to the subject area of the technical discipline is the indicator of performance in problem solving K_P, which is calculated by the following formula:

$$K_P = \frac{n_{st}}{n_{sp}}, \qquad (6)$$

where:

n_{st} is the number of problem-solving options the offered by the student;

n_{sp} is the number of problem-solving options the offered by the specialist instructor.

According to scientists [8], the performance indicator scale for solving problems K_P is as follows:

low level ($0 < K_P \leq 0.3$);

medium level ($0.3 < K_P \leq 0.5$);

sufficient level ($0.5 < K_P \leq 0.7$);

high level ($0.7 < K_P \leq 1$).

The second creativity factor in divergent thinking is flexibility, which means application of different approaches and the ability to switch from one category to another (Ibid.). A student with flexible thinking will not inertly follow one path or stick to one category. They will change everything, their thinking being flexible and agile. For example, possible shifts between categories, according to F. Williams, are the following: live, mechanical or subject matter; symbols, generic or genre. For the subject matter area of the technical discipline, the student's thinking flexibility indicator K_F can be a change in such categories as, for example, the apparatus operation principle, transfer to improvement of other operating parts of the apparatus, execution of operating parts that were stationary, movable and vice versa, execution of the operating pars of the apparatus asymmetrical. Each change in the category is assigned one point. The range of possible points is from 1 to n_{sp}-*1* depending on how many times the decision category changes (excluding the first decision).

According to scientists (Ibid.), the scale of flexibility of thinking is as follows:

low level ($0 < K_F \leq \frac{(n_{sp}-1)\cdot 30}{100}$);

medium level ($\frac{(n_{sp}-1)\cdot 30}{100} < K_F \leq \frac{(n_{sp}-1)\cdot 50}{100}$);

sufficient level ($\frac{(n_{sp}-1)\cdot 50}{100} < K_F \leq \frac{(n_{sp}-1)\cdot 70}{100}$);

high level ($\frac{(n_{sp}-1)\cdot 70}{100} < K_F \leq n_{sp} - 1$).

The third creativity factor in divergent thinking is originality, which means having nonconventional ideas and deviating from the obvious, the conventional. A more creative idea is one that concerns the inner, closed part rather than the outer visible part (Ibid.). To do this, you need to synthesize, combine the parts of the object under study. For the subject matter area of the technical discipline, the originality indicator in the student's thinking can be an idea that concerns both the apparatus as a whole and its individual elements, or the processes that happen as a result of this idea application.

If the problem-solving idea relates only to the apparatus, the student receives 1 point, if it relates only to the internal operating parts of the apparatus – 2 points, and if it rates to the apparatus as a whole, its individual elements, and the processes occurring as a result of this idea application – 3 points. The maximum possible score for originality of thinking is equal to the sum of points for all the problem-solving options (n_{sp}*3).

According to scientists, the scale of originality of thinking K_O is as follows:

low level ($0 < K_O \le \frac{(n_{sp}\cdot 3)\cdot 30}{100}$);

medium level ($\frac{(n_{sp}\cdot 3)\cdot 30}{100} < K_O \le \frac{(n_{sp}\cdot 3)\cdot 50}{100}$);

sufficient level ($\frac{(n_{sp}\cdot 3)\cdot 50}{100} < K_O \le \frac{(n_{sp}\cdot 3)\cdot 70}{100}$);

high level ($\frac{(n_{sp}\cdot 3)\cdot 70}{100} < K_O \le n_{sp.*}3$).

The fourth creativity factor in divergent thinking is elaboration, which consists in expanding and adding something to the main idea to render it deeper. In terms of the subject matter area of the technical discipline, the indicator of elaboration K_E is responsible for the volume of the student's thinking, which refers to the main idea of solving problems and obtaining technical solutions [Ibid]. If the student has an idea, but fails to elaborate on it or supplement it with important details, they receive 0 points for the volume of thinking. If the idea is expanded outside (supplemented with elements relating to the main operating parts of the technical system, without which it will be inoperable), it gets the student 1 point. If it is supplemented inside the main idea (supplemented with elements that are auxiliary, but important for the operation of the system as a whole) it gets the student 2 points. When supplemented both internally and externally (supplemented with elements that are subsystems and supersystems for the technical system), it is 3 points. The scale of the indicator of volume of thinking K_E is the scale used to assess the indicator of originality of thinking K_O:

low level ($0 < K_E \le \frac{(n_{sp}\cdot 3)\cdot 30}{100}$);

medium level ($\frac{(n_{sp}\cdot 3)\cdot 30}{100} < K_E \le \frac{(n_{sp}\cdot 3)\cdot 50}{100}$);

sufficient level ($\frac{(n_{sp}\cdot 3)\cdot 50}{100} < K_E \le \frac{(n_{sp}\cdot 3)\cdot 70}{100}$);

high level ($\frac{(n_{sp}\cdot 3)\cdot 70}{100} < K_E \le n_{sp.*}3$).

Quantitative assessment of students at the levels of the first (mastery of professional knowledge and professional skills) and the second (creativity) criteria to measure the methodological system effectiveness in teaching higher education students in technical disciplines uses the four-point scale [3]: low (2), medium (3), sufficient (4), high (5).

The third group of indicators methodology effectiveness trained in technical disciplines, which belongs to the criterion of the methodological system impact on professionally important qualities of future engineers, is subjective. These indicators were determined by students responding to questionnaires.

The criterion of the methodological system impact on cultivation of professionally important qualities in future engineers includes the following indicators:

- the level of impact of the methodological system elements on cultivation of interest and involvement in the professional activity;
- the level of impact of the methodological system elements on cultivation of risk-taking in the future professional activity;
- the level of impact of the methodological system elements on cultivation of professional independence.

Qualitative assessment of students at the levels of the third criterion (methodological system impact on cultivation of professionally important qualities in future engineers) to measure the methodological system effectiveness uses the numerical four-point scale, too (Dimitrova-Burlayenko, 2018): low (2), medium (3), sufficient (4), high (5). This scale is implemented in the questionnaire to determine the level of impact of the methodological system on cultivation of professionally important qualities in future engineers, which is provided in Table 2 below.

Table 2.

Questionnaire for assessment by students of the level of impact from creative training methodological system elements on development of professionally important qualities of future engineers

Assess the impact from the methodological system on development of professionally important qualities of future engineers by ticking off the appropriate answer:	
1. How would you assess the level of your interest and activity in the process of solving problems you are set? ❑ The content, methods, tools and forms of training are presented so that the problems could be solved actively and with interest ❑ The problems set were solved quite actively and with interest. The content, methods, tools and forms of training facilitated their solution ❑ The problems set were solved mainly actively and with interest. The content, methods, tools and forms of training facilitated their solution, but some steps required certain effort. ❑ The problems set were not solved actively or with interest. The content, methods, tools and forms of training did not help in their solution **2. Was it interesting to come up with new problem-solving ideas and test them?** ❑ The methodology enables active generation of new problem-solving ideas and their testing ❑ The methodology enables quite active generation of new problem-solving ideas and their testing ❑ The methodology mainly enables generation of new problem -solving ideas, but without the opportunity to test them ❑ The methodology fails to enable generation of new problem-solving ideas	**3. How would you assess the level of impact from the methodological system on development of professional independence?** ❑ The training technology enables independent resolution of problems set ❑ The training technology mainly enables independent resolution of problems set ❑ The training technology enables independent resolution of problems set to some extent, but partially requires the instructor's consultation ❑ Independent work on resolution of problems set is complicated; constant consultations from the instructor are required

Conclusions

The low quality of future engineers' training by the traditional training methods is conditioned by insufficient impact from the traditional content, methods, tools, forms and technologies of training on development of professional knowledge, skills, creativity and professionally important qualities of future engineers.

The study substantiates and defines the criteria and indicators for assessing the training methods effectiveness for future engineers taking into account the level of professional knowledge, skills, creativity and impact on development of professionally important qualities of future engineers.

The criteria and indicators defined for the methods of creative training of future engineers enabled conformation of the hypothesis about its effectiveness. The most significant increase in the medium values were the indicators that most impact the development of a creative specialist: the indicator of the PS level of professional knowledge acquired, the indicator of problem-solving performance originality of thinking, risk-taking in the future professional activity, as well as professional independence.

The efficiency and effectiveness of the

proposed methodology for creative training of students will significantly increase the innovation component in the future engineers's competence in comparison with the traditional methodologies.

The conducted pedagogical study confirmed the correctness of the hypothesis that the developed methodology for creative training of students at institutions of higher education ensures better results of knowledge acquisition by future engineers at the productive-synthetic level.

Prospective research can seek to experimentally verify the methodological system of creative training of future engineers in technical disciplines by the substantiated and defined criteria and indicators under the conditions of distance education.

Conflict of interest

The authors declare that there are no conflicts of interest in the publication of this manuscript. In addition, the authors fully complied with ethical standards, including plagiarism, data falsification, and double publication.

References

1. Bezhenar, A. A., Yankivska, H. A. (2017). The development and use of creativity as a method of forming of a competent person in secondary and vocational education. National education : electronic scientific professional edition, 1(31), 62-67. https://www.narodnaosvita.kiev.ua/?page_id=4415 (in Ukrainian).
2. Buzan, T., Buzan, B. (2010). The mind map book: Unlock your creativity, boost your memory, change your life. https://www.amazon.com/Mind-Map-Book-Unlock-Creativity/dp/1406647160
3. Dimitrova-Burlayenko, S. D. (2018). Methods of forming the creative competence of the future engineers. Středoevropský Věstnĺk pro Vědu a Výzkum, 5 (49), 14–18. (in Ukrainian).
4. Goff, K., Torrance, E. P. (2002). Abbreviated Torrance Test for Adults Manual. Bensenville, IL: Scholastic Testing Service. https://www.scirp.org/(S(351jmbntvnsjtlaadkozje))/reference/referencespapers?referenceid=2923543
5. Golovenkin, V. P. (2019). Pedagogy of higher education: textbook. 2nd ed., revised and supplemented. Kyiv: Igor Sikorsky Kyiv Polytechnic Institute. https://ela.kpi.ua/server/api/core/bitstreams/dca98cbd-487b-43eb-86ef-d5c4634bf16c/content (in Ukrainian).
6. Future of jobs report 2023. https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf
7. Kaufman, J. C., Glăveanu, V. P. (2019). A Review of Creativity Theories. In The Cambridge Handbook of Creativity, pp. 27–43. https://doi.org/https://doi.org/10.1017/9781316979839
8. Kovalenko, Denys, Ruban, Nataliia, Shumskyi, Oleksandr, Bilotserkivska, Yuliia, Shemyhon, Natalya, Korolova, Nataliia. (2024). Forming future engineering teachers' creativity using the model of presenting learning content of technical disciplines. Towards a Hybrid, Flexible and Socially Engaged Higher Education. Proceedings of the 26th International Conference on Interactive Collaborative Learning (ICL2023), 3, 293-304. https://doi.org/https://doi.org/10.1007/978-3-031-53022-7_30 (in Ukrainian).
9. Lazariev, M. I., Ruban, N. P. (2009). Laws of evolution of technical systems as a philosophical basis of methods of creative teaching of students of technical disciplines. Problems of Engineering Pedagogic Education, 22–23, 262–270. https://surl.li/hddjur (in Ukrainian).
10. Lemons, G. (2011). Diverse Perspectives of Creativity Testing: Controversial Issues When Used for Inclusion Into Gifted Programs. Journal for the Education of the Gifted, 34(5), 742–772. https://doi.org/doi:10.1177/0162353211417221
11. On approval of the standard of higher education in the speciality 015 "Professional education" (by specializations) for the first (bachelor's level of higher education): Order of the Ministry of Education and Science dated 21.11.2019 No. 1460. (2019). https://mon.gov.ua/static-objects/mon/sites/1/vishcha-osvita/zatverdzeni%20standarty/2021/07/28/015-Profosvita-bakalavr.pdf (in Ukrainian).
12. Strazhnikova, I. V. (2016). Didactic systems in higher education: teaching-methodical manual, Ivano-Frankivsk. https://surl.li/xtdlgj (in Ukrainian).

13. Tekmen-Araci, Y. A., Kuys, B. (2016). Product performance vs. product creativity in engineering education. AAEE Conference 2016, Coffs Harbour, Australia. https://aaee.net.au/wp-content/uploads/2018/10/AAEE2016-Tekmen-Araci_Kuys-Product_performance_vs_creativity.pdf
14. Williams, F. (1980). Creativity assessment packet. East Aurora, N.Y. : D.O.K. Publishers, Inc. https://www.scirp.org/reference/referencespapers?referenceid=2965014
15. Zvarych, I., Kalaur, S. M., Prymachenko, N. M., Romashchenko, I. V., Romanyshyna, O. I. (2019). Gamification As A Tool For Stimulating The Educational Activity Of Students Of Higher Educational Institutions Of Ukraine And The United States. European Journal of Educational Research, 8(3), 875–891. https://doi.org/10.12973/eu-jer.8.3.875 (in Ukrainian).

The article was received by the editors 15.04.2025
The article is recommended for printing 16.05.2025

Н. П. РУБАН[1], канд. пед. наук, доцент,
доцент кафедри педагогіки, методики та менеджменту освіти
e-mail: ruban_73@ukr.net ORCID ID: https://orcid.org/0000-0001-8337-2739
Ю. Ю. ЧЕРНЕНКО[1], канд. екон. наук, доцент,
доцент кафедри краєзнавчо-туристичної роботи, соціальних і гуманітарних наук
e-mail: ychernenko@karazin.ua ORCID ID: https://orcid.org/0000-0002-8403-1853
Харківський національний університет імені В.Н. Каразіна,
майдан Свободи, 4, м. Харків, 61022, Україна

КРИТЕРІЇ ТА ПОКАЗНИКИ ОЦІНКИ ЕФЕКТИВНОСТІ МЕТОДИКИ КРЕАТИВНОГО НАВЧАННЯ СТУДЕНТІВ ТЕХНІЧНИХ СПЕЦІАЛЬНОСТЕЙ

Сьогодення вимагає від майбутніх інженерів безперервної розробки нових об’єктів техніки і технологій, творчої самореалізації. Це здатні забезпечити методики креативного навчання технічних дисциплін. Якість формування в майбутніх фахівців знань творчого рівня з технічних дисциплін підвищиться, якщо методичну систему ґрунтувати на моделюванні розвитку технічних дисциплін, а зміст навчання технічних дисциплін представити у вигляді двох частин – базової та креативної, де остання повинна створюватися студентами самостійно у процесі навчання за допомогою методів і засобів управління творчою навчально-пізнавальною діяльністю студентів. Необхідність упровадження спеціально організованого педагогічного впливу в межах навчального процесу потребує розробки системи критеріїв і показників для виявлення кількісного та якісного рівня сформованості педагогічного явища .

У статті запропоновано зміст, критерії та показники оцінки ефективності методики навчання студентів за технічними дисциплінами, що дозволяють у майбутніх інженерів здійснити оцінювання рівня сформованості професійних знань та умінь, креативності, професійно-важливих якостей. Оцінювання сформованості професійних знань здійснюється відповідно до ознайомлювально-орієнтовного, понятійно-аналітичного та продуктивно-синтетичного (творчого) рівнів. Креативність пропонується оцінювати за допомогою чотирьох факторів дивергентного мислення: швидкість, гнучкість, оригінальність та розробленість. Показники сформованості професійно-важливих якостей майбутніх інженерів пропонується оцінити через анкетування формування інтересу та активності професійної діяльності, ризикованості в майбутній професійній діяльності та рівень професійної самостійності. Всі запропоновані критерії та показники детально обґрунтовано й запропоновано методику оцінювання кожного показника.

КЛЮЧОВІ СЛОВА: *креативне навчання, критерії і показники, методика, рівень професійності, технічні дисципліни, творча діяльність.*

Конфлікт інтересів

Автори заявляють, що конфлікту інтересів щодо публікації цього рукопису немає. Крім того, автори повністю дотримувалися етичних норм, включаючи плагіат, фальсифікацію даних та подвійну публікацію.

Список використаної літератури

1. Беженар, А. А., Янківська, Г. А. Розвиток креативності як спосіб формування компетентної

особистості в загальній середній та професійній освіті. *Народна освіта*. 2017. Вип. 1(31). С. 62-67. URL: https://www.narodnaosvita.kiev.ua/?page_id=4415
2. Buzan, T., Buzan, B. The mind map book: Unlock your creativity, boost your memory, change your life. 2010. URL: https://www.amazon.com/Mind-Map-Book-Unlock-Creativity/dp/1406647160
3. Dimitrova-Burlayenko, S. D. Methods of forming the creative competence of the future engineers. *Středoevropský VěstnÍk pro Vědu a Výzkum*, 2018. Вип. 5 (49). С. 14–18.
4. Goff, K., Torrance, E. P. Abbreviated Torrance Test for Adults Manual. Bensenville, IL: Scholastic Testing Service, 2002. URL: https://www.scirp.org/(S(351jmbntvnsjtlaadkozje))/reference/referencespapers?referenceid=2923543
5. Головенкін, В. П. Педагогіка вищої освіти: підручник. 2-ге вид., перероблене та доповнене. Київ: Київський політехнічний інститут імені Ігоря Сікорського, 2019. URL: https://ela.kpi.ua/server/api/core/bitstreams/dca98cbd-487b-43eb-86ef-d5c4634bf16c/content
6. Future of jobs report 2023. https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf
7. Kaufman, J. C., Glăveanu, V. P. A Review of Creativity Theories. In The Cambridge Handbook of Creativity, (pp. 27–43). 2019. DOI: https://doi.org/https://doi.org/10.1017/9781316979839
8. Kovalenko, Denys, Ruban, Nataliia, Shumskyi, Oleksandr, Bilotserkivska, Yuliia, Shemyhon, Natalya, Korolova, Nataliia. Forming future engineering teachers' creativity using the model of presenting learning content of technical disciplines. *Towards a Hybrid, Flexible and Socially Engaged Higher Education. Proceedings of the 26th International Conference on Interactive Collaborative Learning (ICL2023)*. 2024. Vol. 3. Pp. 293-304. DOI: https://doi.org/https://doi.org/10.1007/978-3-031-53022-7_30
9. Лазарєв, М. І., Рубан, Н. П. Закони еволюції технічних систем як філософська основа методів творчого навчання студентів технічних дисциплін. Проблеми інженерно-педагогічної освіти. 2009. № 22–23. С. 262–270. URL: https://surl.li/hddjur
10. Lemons, G. Diverse Perspectives of Creativity Testing: Controversial Issues When Used for Inclusion Into Gifted Programs. *Journal for the Education of the Gifted*. 2011. Vol. 34(5). Pp. 742–772. DOI: https://doi.org/doi:10.1177/0162353211417221
11. Про затвердження стандарту вищої освіти за спеціальністю 015 «Професійна освіта» (за спеціалізаціями) для першого (бакалаврського рівня вищої освіти): наказ Міністерства освіти і науки від 21.11.2019 № 1460. URL: https://mon.gov.ua/static-objects/mon/sites/1/vishcha-osvita/zatverdzeni%20standarty/2021/07/28/015-Profosvita-bakalavr.pdf
12. Стражнікова, І. В. (2016). Дидактичні системи у вищій освіті: навчально-методичний посібник. Івано-Франківськ, 2016. URL: https://surl.li/xtdlgj
13. Tekmen-Araci, Y. A., Kuys, B. Product performance vs. product creativity in engineering education. *AAEE Conference 2016*. Coffs Harbour, Australia, 2016. URL: https://aaee.net.au/wp-content/uploads/2018/10/AAEE2016-Tekmen-Araci_Kuys-Product_performance_vs_creativity.pdf
14. Williams, F. Creativity assessment packet. East Aurora, N.Y. : D.O.K. Publishers, Inc., 1980. URL: https://www.scirp.org/reference/referencespapers?referenceid=2965014
15. Zvarych, I., Kalaur, S. M., Prymachenko, N. M., Romashchenko, I. V., Romanyshyna, O. I. Gamification As A Tool For Stimulating The Educational Activity Of Students Of Higher Educational Institutions Of Ukraine And The United States. *European Journal of Educational Research*. 2019. Vol. 8(3). Pp. 875–891. DOI: https://doi.org/10.12973/eu-jer.8.3.875

Стаття надійшла до редакції 15.04.2025
Стаття рекомендована до друку 16.05.2025