Оқушылардың пән бойынша білімі сапалы да, терең болуы үшін оларда жақсы меңгерілген өзара тығыз байланысты негізгі ұғымдар жүйесі қалыптысуы керек. Мақалада физикалық білімнің және физикалық ұғымдар жүйесінің құрылымдық элементтері көрсетілген. Сондай-ақ, мектеп оқушыларына физикалық ұғымдарды қалыптастыру әдістемесі берілген. Физикалық ұғымдарды қалыптастырудың белгі-шарттары, көрсеткіштері және деңгейлері көрсетілген.

Түйін сөздер: ғылыми білім, ғылыми ұғым, физикалық ұғымдарды қалыптастыру, әдістеме, ұғымдарды қалыптастыру деңгейі.

Проблемы формирования фундаментальных научных понятий

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Аннотация

Система понятий – это основа знаний, все данные сосредоточены вокруг них. Без овладения понятиями невозможно и сознательное усвоение законов и теорий, так как они выражают связь между понятиями. Высокое качество знаний учащихся зависит от степени сформированности у них системы понятий. Усвоение учащимися научных понятий, умение применять их на практике, в жизни происходит только при целенаправленном обучении.

Для того чтобы знания учащихся по предмету были как качественными, так и глубокими, у них должна сформироваться хорошо усвоенная система тесно связанных между собой основных понятий. В статье представлены структурные элементы физического знания и системы физических понятий. Также дана методика формирования физических понятий у школьников. Рассмотрены критерии, показатели и уровни формирования физических понятий.

Ключевые слова: научное знание, научное понятие, формирование физических понятий, методика, уровень сформированности понятий

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EDUCATIONAL OPTIONS OF SCIENCE AND RESEARCH IN DEVELOPING THE CREATIVITY OF AN ENGINEERING STUDENT

Abstract

The goal of this essay is to assess the potential of scientific research in both national and international professional education in the creation of a future engineer's creativity.

Methods of research: theoretical examination of foreign and local literature, dialogues, questionnaire analysis, personal experience, undergraduate assessment and self-assessment, generalisation and systematisation of data collected

Research outcomes: the article gives a theoretical analysis and analysis of research results, which allows: to give a formulation and disclose the substance of the idea of "scientific search," to define it as a significant side of the future engineer; to identify processes, models, principles, rules, and kinds of scientific research; to create a methodology for the application of research research as a way of developing a future engineer's creativity;

educational requirements and conditions enabling efficient science studies; validate the process of developing a future engineer's inventiveness; to identify the hazards of scientific research in the process of developing a future engineer's creativity; to discover the strategy for obtaining inspiration for academic experiments; to determine the possibilities of objective evaluation of scientific research outcomes; to regard the advanced engineer as a self-taught personality.

Conclusions and recommendations: It has been established that scientific research has the potential to influence a future engineer's creativity and that it is crucial for a student of engineering to be motivated and reflective. We see the potential for researching how a student who is self-learning develops their creative abilities in the areas of: encouragement for academic and research activities; validation of creative activity; as well as further scientific study of national and international interaction in engineering education in this context.

Key words: contemplation; scientific research; engineering creativity; creative engineer; engineering education.

Introduction. The primary goal of a technical university in the present era of the creation of a unified global educational environment is the high-quality preparation of future experts who can independently propose hypotheses, conduct research, plan, invent, and discover – in other words, who can arrange and actively engage in an independent scientific quest.

Specialists with systemically structured, reflexive, self-organizing, and creative principles are needed for a new kind of economic innovation that enables them to excel in engineering. The ability to recognize and overcome professional growth obstacles and to discover positive solutions to professional crises depends in large part on creativity, which is a critical component of professional development for future engineers.

The intrinsic impact of a future engineer exhibited in the capacity to innovative, non-standard cognition, together with awareness, the evolution of his/her knowledge, is referred to as an engineer's creativity. Creativity is what guarantees a rapid integration to vocational growth and self-awareness.

According to our findings, scientific surveys allow for the development of creativity in the courses of the academic process in the field of technical education. Creativity is formed by immersing a student at an engineering university in research and innovative interaction, which really is subject to change in the context of increasing the educational program's share through creative technologies, competitions, and project activities, and which enables students to intensify their knowledge and apply it in real life.

Advanced research focuses on teaching, fosters imagination, and makes innovative solutions into reality. As a result, it has the potential to be successful in addressing society's social demands. To perform an innovative scientific research, it is required to have internal drive and talents, which N.V. Bodrovskaya refers to as research potential.

According to N.V. Bodrovskaya, the motivational component of academic research prospective signifies:

• an emphasis on originality, opposition to ambiguity;

• "the willingness of comprehension," cognitive enthusiasm, "just so the spirit of God wakes up in each individual," according to V.A. Sukhomlinsky.

Consciousness, identity, and versatility are examples of behavioural components with study potential [1, p.127].

Theoretically analysis allows us to discuss the relationship between the level of execution of the opportunities of academic research for future engineers and experience, identity, interpersonal perceptions, uniqueness, and subconscious. Learners that exhibit the aforementioned traits efficiently undertake scientific research and produce excellent outcomes. As a result, adequate educational circumstances must be given the opportunity to boost consciousness, foster a creative environment, and enhance the effectiveness of analysis in the scientific research process.

Main body. A controversial issue of educational study is "scientific search as a technique of moulding the inventiveness of an engineering student." On the one hand, there is creativity, which is defined by unpredictability and the disintegration of methodology standards; on the other hand , experimental knowledge does not represent a disorganized activity, but a deliberate movement towards the objective, towards the completion of the prescribed tasks.

In pedagogical approaches, scientific search is indicated as: a teaching strategy (Y.I. Lerner, N.M. Skatkin); a component of creative thinking (A.P. Tryapitsyna); a process of creating an inventive outlook to action (N. Gromova); an interaction (S.A. Koval); a method of innovative developmental activities, a method of forming a value system (N. Gromova); an interaction (S.A. (A.V. Kiryakova).

The search, according to V.S. Rotenberg and V.V. Arshavsky, is indicated by non-satiation and transition from one sort of activity to another.

In psychology, scientific search is widely regarded as a method of realising the skills and capabilities of the things around oneself, as well as the capabilities of oneself and society as a whole. N.P. Chupakhin regards scientific research as a cultural phenomenon, and scientific research culture as a vital component of the cultural world - a sphere produced by humanity just on basic principle of the world today, comprised of biological and chemical industries.

In other terms, the idea of scientific inquiry highlights the importance of the study topic by exposing issues with global vision, worldview, and the purpose of human life from a philosophical perspective.

In our research, we use the following working concept: Scientific search is a method of information retrieval that defines the outcome of scientific knowledge and fixes innovation in accordance with the direction of study.

In our research, scientific search is a tool for developing a specialist's creative thinking. According to philosophy, a technique is an activity that is connected to the objective that it is intended to assist attain.

Future engineers are expected to do scientific research as a way to actualize their potential to develop research methodologies while carrying out professional duties.

The fundamentals of scientific inquiry, the order of steps, and the logic of research make up a collection of methodological qualities that are provided in a certain order and are referred to as methodological literacy.

The major scientific research paradigms may be distinguished by a theoretical study of local and international experience:

According to Bayer, Nelson, Feton, and Joyce, the solution to a problem is linear (problem description, analysis, search); systemic and structural (guideline review, determination strategy, guess, final choice); and inductive approach (according to Massmalas).

Let's focus on Ch. Pearce's inductive approach model of scientific inquiry, which is divided into two parts:

Retraining is the process of confirming the theories put out by abduction, which is the progress, innovation, and generation of theories, hypotheses, and guesses [2].

Ch. Pearce asserts that scientific inquiry is a creative process that calls for the use of intuition and creativity in addition to logic. As a result, there is no one, universal procedure for scientific research, and deductive research approach is only a method for evaluating ideas [1].

Studying the phenomena and the possibilities for using scientific research to foster creativity are very important since it has a big impact on the rise in the amount of lexical diversity, which fosters creativity in pupils. In order to shift from a stereotyped programming training to a reflecting innovative learning process that may lead to a new class of creative engineers, search forms of student participation must be developed. And the urgency of this requirement only increases.

Demand aspect, which contains an assessment of the nature and content of general educational programmes, and social communication, that is, the system of interpersonal relationship that creates a creative climate in the educational environment, were required to be taken into

consideration in the study by A.A. Derkach and E.A. Sigida on the development of creativity.

The development of innovative awareness and creative engagement during scientific inquiry are two of the ways through which creativity is formed. The preponderance of focus towards research activities is what distinguishes creative consciousness as being unconventional.

The following instructional conditions can be identified via theoretical and practical investigation as ensuring creative engagement over the course of scientific research:

• Introducing aspiring engineers to scientific inquiry (formation of motivation for scientific research, enrichment of the experience of research activities, variability of methods for enhancing scientific research).

• Planning scientific research in a creative-reflective setting that takes into consideration the future engineer's interests (by fostering a psychologically safe environment and establishing a map of the student's scientific interests).

• Application of findings from scientific research (creation of a card index of experimental activities, formation of a portfolio of scientific achievements, creation of a research media library).

Let's list the roles that scientific research activities play:

• Organizing scientific studies in a creative-reflective atmosphere that takes into account the preferences of the aspiring engineer (by promoting a psychologically secure setting and creating a map of the student's scientific preferences).

• Making use of discoveries from science investigation (creation of a card index of experimental activities, formation of a portfolio of scientific achievements, creation of a research media library).

Here is a list of the functions performed by scientific research activities:

Scientific research in a creative-reflective setting that takes into account the future engineer's interests (building a comfortable psychological environment and establishing a map of the student's scientific interests).

• Making use of findings from scientific research (creation of a card index of experimental activities, formation of a portfolio of scientific achievements, creation of a research media library).

Let's list the roles that scientific research activities play:

• Transformative – new ways of interpreting the data, theoretical modelling.

• Technological – understanding the methods used in technological design and engineering tasks.

• Program-targeted – the application of scientific research through the defining of objectives, making forecasts, planning, and organising.

• Control and regulation – governs scientific research approach, including decision-making, controlling, and correcting.

• Research is concerned with analysing the procedural and dynamic elements of the environment.

• Creative – focuses on the creation of fresh concepts and determines all facets of the future engineer's creative growth via analysis and systematisation of the knowledge acquired.

Future engineers' professional development results in their ability to look beyond the constant stream of daily practise and perceive professional activity as a whole. This enables pupils to consciously build a self-development programme.

In our study, we raised the subject of tracking the potential of scientific research, identifying the benefits and drawbacks of research activities in developing a future engineer's creativity.

The research interprets opportunity as a collection of methods to attain the aim.

The choice of educational options of scientific study targeted at creating the creativity of the future engineer was established by an examination of theoretical research and our personal experience:

• self-presentation;

• diversity, flexibility of training organisational structure;

• socialisation of students in the process of collaborating in the scientific online community;

• potential of giving an informational and interaction approach;

• possibility of strengthening the learning process.

Methods / Methodology. The activity approach, comprehensive review of the outcomes of individual dialogues, portfolio analysis, surveys, the experience of the writers of the article, self-assessment, observations, and systematisation of the data acquired form the work's methodological foundation.

A theoretical study of foreign and local psychological and educational works was necessary as part of the research approach.

The diagnostic tools were chosen after an investigation of the theoretical model of a modern engineer and self-learning student's activity.

The major empirical research was conducted during the first, second, third, and fourth years of study at West Kazakhstan Agrarian Technical University, as well as among students of the International Educational Holding "GAUDEAMYS." The study included 160 bachelors and 120 applicants. To ensure that the sample was representative, the experimental findings were delayedly verified.

Results. In our research, we found that exposing students to scientific research experience helped to develop their inventiveness as future engineers.

The positive and negative consequences of creative research were studied. The work targeted at students' self-development, self-realization, and the growth of their creativity. The problems that the future engineer would experience in the process of implementing the specified scientific research methods were underlined throughout the approval procedure.

The requirements for assessing the outcomes of scientific engineering search were corrected at the final step of the improvement of existing knowledge, consequence of the innovation and originality of the solution of the most complex and urgent problems; development of an idea in an applied aspect and its implementation in practise; determining the risks of introducing scientific research.

According to our research, the following risks of future engineer scientific research activities have been identified:

• lack of integrity of the scientific research structure;

• incorrect selection of the research object, complexity or ambiguity of the method of scientific research;

• discrepancy of the application of science studies with the declared pedagogical goals;

• the desire to conduct scientific research that is limited to a single resource and does not seek or create new ones;

• the utopian nature of research;

• the possibility of negative consequences as a result of the future engineer's implementation of the fruits of scientific research;

and • an absence of ethical preparatory work of qualitative research for the necessary changes.

We generally regarded the level of development of the future engineer's intellectual abilities (this enabled students to promptly and accurately learn and develop the technical, financial, and social changes in society) as well as the degree of initiative and readiness to work in modern conditions when planning the integration of the future engineer in the stages of enacting scientific research.

We created an unique database of scientific interests that guides students' scientific research on a personal level.

From the first year of study, each student develops a portfolio of scientific accomplishments that shows the outcome of the application of his or her qualifications, the demonstration of talents, and the creative notion of engineering experience in overcoming challenges and unanticipated scenarios. This combines increased preparation with major market engagement.

During the elective course "Theory and Practice of Scientific Research," during questions and interviews, it was found that students choose an engineering speciality for the following reasons: (Fig. 1)

• 37.4% of grants are for technical specialisations;

• prestige of engineering – 52.6%;

• personal motivation – 46.3%;

• family business – 7.9%;

• other – 4.3%.

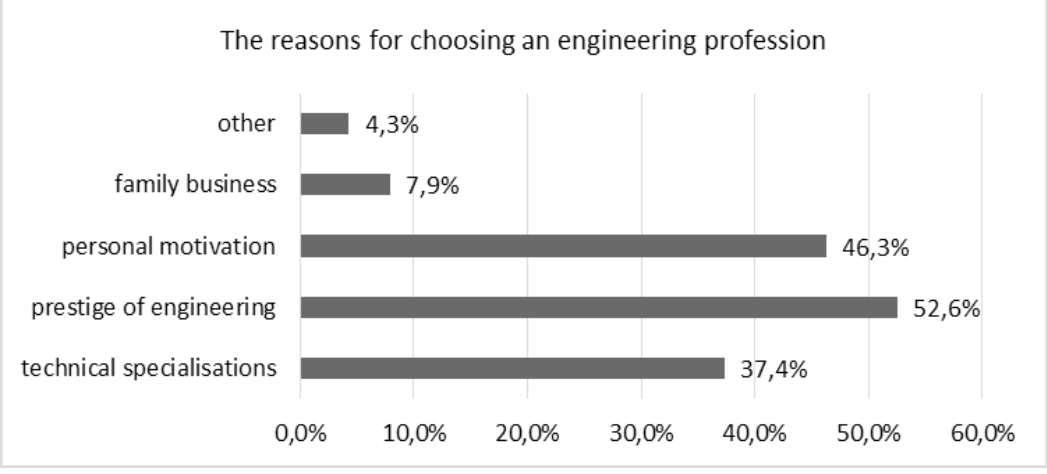

Fig. 1 **Diagram showing the reasons for choosing an engineering profession**

In response to the question, "Should a prospective student be creative?" 84% of the 120 responders said yes.

Observing third-year bachelors' attitudes about the profession in practise, during talks, revealed that future engineers had trouble carrying out autonomous scientific inquiry without a programme of further training for its execution. The participation of future engineers in the digital research community allowed for the sharing of expertise and helped to more effective scientific research and task accomplishment.

According to the findings of a study of first-year engineering students, 5.3% stated a willingness to pursue a master's degree. The execution of the programme for the development of future engineer creativity lead to a rise in this indicator to 46.7%.

According to the poll, a number of reasons were discovered in response to the question "What obstacles do you have that prevent you from obtaining a master's degree, with the goal of further ongoing science investigation in the learning process?"

- financial difficulties – 46.8%;
- complexity of the training program – 14.7%;
- waste of time – 12.3%;
- low number of budget places – 43.8%.

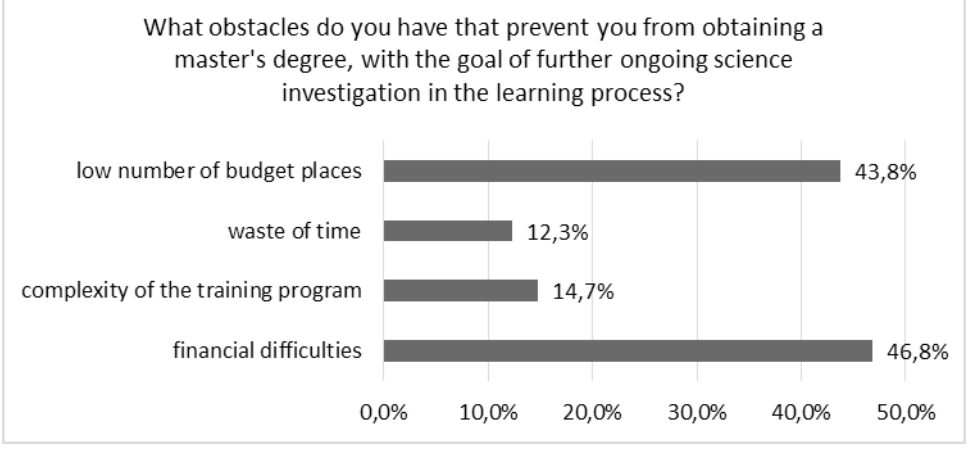

Fig. 2 **Diagram of limiting factors in the implementation of scientific research associated with admission to the magistracy**

Students obtained the capacity to determine the degree of their creative and professional talents through scientific investigation. Future engineers' independent research activities allowed independence and creativity, as well as the possibility to master methods and strategies for efficient creative and professional engagement.

Bachelors responded to the question "What function does academic research play in the life of a future engineer?" by stating that it is the key indication of a person's research and creative activity, the bounds of his/her responsibilities, and a guideline for personal growth [2, p. 9].

As a reason for refusing scientific research, the respondents noted:

fear of failure – 26.3%;

laziness – 12.3%

lack of information regarding the methodology of scientific research – 23,4%;

plagiarism of scientific ideas – 48.9%.

The survey results indicate the importance of developing and executing additional programmes that bridge knowledge gaps in the theory and practise of performing the empirical research for a future engineer and minimize concerns in this context. Nearly half of the participants refuse to take part in science investigation and to submit their research strategic ideas as a result of their negative experience with the deprivation of copyright to their invention, as a result of the widespread practise of scientific youth project organisers plagiarising scientific ideas and appropriating their ideas for the purpose of subsequent funding. This is a major issue that necessitates a reassessment of the norms and safeguards for arranging grant-funded research programmes and recruiting young researchers.

This is a major issue that necessitates a reassessment of the criteria and assurances for conducting grant-funded research programmes and encouraging young professionals to participate.

Discussion. The results of self-diagnostics show that whereas most bachelors were labelled as passive-negative (14.1%) and formally-performing (44.3%) in the first year, by the end of the fourth year they were controlled by productive (11.3%) and creative (67.7%) research types. By the end of the year, 71% of respondents had identified the causes of their difficulty in their activities.

Future engineers came to judgments about their level of professional preparation through individual interactions with professors and after reviewing their portfolio of scientific accomplishments. In other words, they developed suggestions, defended their image-projects, and forecasted the success of their creative endeavours.

An engineer of the present day is capable, adaptable, communicative, creative, and able to independently conduct scientific research, introduce innovations, and produce results of the highest calibre.

The following competencies are developed by the use of scientific research:

• autonomous research work; initiative and creativity; teamwork; proficiency with scientific literature; proficiency with critical evaluation and reflection; administrative ability—planning tasks, allocating time, and anticipating outcomes.

But for 37.7% of bachelor's degree holders, achievement in substantiating the selection of efficient methods, techniques, and means of scientific research as well as consciousness of creative activity in advance of scientific and creative activity demonstrated itself pragmatically, and it was found to be insufficiently stable for 15.9% of bachelor's degree holders.

Conclusion. According to the study's findings, there was insufficient information to handle rising difficulties. Emotional desires frequently obstructed the intellect.

At the empirical stage, future engineers used the following teaching approaches: teaching students to work in small groups, with the goal of organising joint performance of the learners under the leadership of a tutor; design technology methods (personal and group activities of trainees for the selection, distribution, and systematisation of content based on the topic under study); case-study, which allows for the analysis of real problem situations that occurred in the classroom. The

major diagnostic procedures were situational analysis, creative techniques and methods (“cross-sense”, “mind maps”, “original usage”, “collective intelligence”).

The principal diagnostic procedures were problem-solving and creative methods (such as cross-sense, mind mapping, original usage, group notebooks, coup, relevance tree analysis, and cause-and-effect diagrams), among others.

It was discovered that encouraging students to do scientific study, providing methods to gather resources around students’ ideas, and accepting both tiny adjustments and novel concepts on a big scale can successfully actualize the creative potential of the future engineer.

It also has to be reconsidered if courses targeted at fostering future engineers’ creativity and the practise of scientific inquiry should be added to the variable portion of educational curricula.

A contemporary engineer is a conscience learner, in large part because he or she has the freedom to freely create learning objectives, choose the method of instruction, educational materials, and experiences, as well as to request new technologies and individualised instructional formats. In other words, a contemporary student develops a distinctive cognitive style as he conducts a quantitative investigations for the knowledge he needs. This means that a student may intentionally organise, generalise, and understand the knowledge they have learned if they have the chance to observe on the facts they have learned, emphasise the material that interests them, evaluate it, and offer clarifying, complete queries.

This is assisted by modern students’ ingenuity, as well as their willingness to evaluate, solve, and do numerous troublesome assignments with a collaborator in the scientific research study.

References

[1] Bugakova, E.V. Organization of creative interaction in professional self-determination of students / E.V.Bugakova, D.V. Miroshnikova // KANT. – 2019. – No. 2 (31). – Pp. 28-32.

[2] Bultseva M.A., Lebedeva N.M. Intercultural contacts and creativity: analysis of foreign approaches // Modern foreign psychology. - 2018 - Vol. 4. - Pp. 15-21.

[3] Rozhik, A.Y. Creative component of engineering thinking: theoretical and experimental research / A.Y. Rozhik // Bulletin of SUSU. Series “Education. Pedagogical Sciences”. – 2018. – Vol. 10. – No. 2. – Pp. 89-108. DOI: 10.14529 / ped180212

[4] Tranquillo, J. “The T-Shaped Engineer.”Journal of Engineering Education Transformations 2017. – T.30. – №4. – Pp.12–24.

[5] Dunne, C. Can Intercultural Experiences Foster Creativity? The Relevance, Theory and Evidence. Journal of Intercultural Studies, –2017– T.38–№–2 –Pp.189-212

[6] Wheadon J., and N.Duval-Couetil. “Elements of Entrepreneurially Minded Learning: KEEN White Paper.”The Journal of Engineering Entrepreneurship 2017. –T. 7.–Pp.17–25.

[7] Marquis, A Present Absence: Undergraduate Course Outlines and the Development of Student Creativity Across Disciplines. Teaching in Higher Education, (2017). – Vol 22. – №2, – Pp.222-238, doi: 10.1080/13562517.2016.1237495.

[8] Steghöfer J. “Teaching Agile: Addressing the Conflict Between Project Delivery and Application of Agile Methods.” In Proceedings of the 38th International Conference on Software Engineering Companion 2016. – Pp.303–312.

[9] Mariana Leandro Cruz, Gillian N. Saunders-Smits & Pim Groen European Journal of Engineering Education, Volume 45, 2020 - Issue 5 Published Online:25 Sep 2019

[10] Rotenberg, V.S. The way of a thought. How ideas immerge. –Publishing solutions, 2018. – 48 p.

[11] Rae D., and D. E.Melton. “Developing an Entrepreneurial Mindset in US Engineering Education: an International View of the KEEN Project.”The Journal of Engineering Entrepreneurship, 2017.

[12] Rozhik A.Y. Creative Component of Engineering Thinking: Theoretical and Experimental Study. Bulletin of the South Ural State University. Ser. Education. Educational Sciences. –2018. – Vol.10 – № 2 – Pp.89–108. DOI: 10.14529/ped180212

[13] Cheville R. A. "Hidden constraints in the design of liberal studies in engineering", Eng. Studies – 2015. – Vol.7 – C.147-149, http://dx.doi.org/10.1080/19378629.2015.1062487

[14] Ryndak V.G., Saifutdinova G.S., Kozyar M.V. Didactic means of overcoming difficulties in the development process of students' motivation for creative activity // Vestnik of Samara State Technical University Psychological and Pedagogical Sciences. –2022. –Vol. 19. – N. 2. – P. 169-180. doi: 10.17673/vsgtu-pps.2022.2.11

Болашақ инженердің шығармашылығын қалыптастырудағы ғылыми ізденіс педагогикалық мүмкіндіктері

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Аңдатпа

Мақаланың мақсаты: болашақ инженердің шығармашылығын қалыптастыруда отандық және шетелдік кәсіптік білім берудегі ғылыми ізденістің әлеуетті педагогикалық мүмкіндіктерін анықтау.

Зерттеу әдістері: шетелдік және отандық әдебиеттерді теориялық талдау, әңгімелер, сауалнамаларды талдау, жеке тәжірибе, бакалаврларды бағалау және өзін-өзі бағалау, алынған деректерді жалпылау және жүйелеу.

Зерттеу нәтижелері: мақалада зерттеу нәтижелерін теориялық талдау және талдау ұсынылған, ол: «ғылыми іздеу» ұғымының мазмұнын тұжырымдауға және ашуға, оны болашақ инженер қызметінің маңызды жағы ретінде анықтауға; ғылыми іздеудің механизмдерін, модельдерін, принциптері мен ережелері мен түрлерін анықтауға; болашақ инженердің шығармашылығын қалыптастыру құралы ретінде ғылыми іздеуді жүзеге асыру алгоритмін жасауға мүмкіндік береді; тиімді ғылыми ізденісті қамтамасыз ететін педагогикалық алғышарттар мен жағдайлар; болашақ инженердің шығармашылығын қалыптастыру процесін негіздеу; болашақ инженердің шығармашылығын қалыптастыру процесінде ғылыми ізденіс тәуекелдерін анықтау; ғылыми ізденіске мотивация алу стратегиясын анықтау; ғылыми ізденіс нәтижелерін объективті бағалау мүмкіндіктерін анықтау; заманауи инженерді өзін-өзі оқытушы ретінде қарастыру.

Қорытындылар мен ұсыныстар: болашақ инженердің шығармашылығын қалыптастыру құралы ретінде ғылыми ізденістің мүмкіндіктері анықталды, оның инженерлік білім берудегі мотивациялық - рефлексиялық ұстанымының маңыздылығы негізделген. Болашақ инженердің шығармашылығын қалыптастыруды зерттеу перспективасын біз өзін-өзі оқытатын студенттің ғылыми-зерттеу білім беру іс-әрекетін ынталандырудан; жасампаз қызметтің негіздемесінен; осы тұрғыда инженерлік білім берудің отандық және шетелдік тәжірибесін одан әрі ғылыми талдаудан көреміз.

Кілтті сөздер: шығармашылық; құру; инженерлік білім; инженер; рефлексия; ғылыми ізденіс; инженерлік шығармашылық; шығармашылық инженер.

Педагогические возможности научного поиска в формировании креативности будущего инженера

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Аннотация

Цель статьи: определение потенциальных педагогических возможностей научного поиска в отечественном и зарубежном профессиональном образовании в формировании креативности будущего инженера.

Методы исследования: теоретический анализ зарубежной и отечественной литературы, беседы, анализ анкет, личный опыт, оценка и самооценка бакалавров, обобщение и систематизация полученных данных.

Результаты исследования: в статье представлен теоретический анализ и анализ результатов исследования, который позволяет: дать формулировку и раскрыть содержание понятия «научный поиск», определить его как значимую сторону деятельности будущего инженера; выявить механизмы, модели, принципы и правила и виды научного поиска; разработать алгоритм осуществления научного поиска как средства формирования креативности будущего инженера; педагогические предпосылки и условия, обеспечивающие эффективный научный поиск; обосновать процесс формирования креативности будущего инженера; выявить риски научного поиска в процессе формирования креативности будущего инженера; определить стратегию приобретения мотивации к научному поиску; выявить возможности объективного оценивания результатов научного поиска; рассматривать современного инженера как самообучающегося.

Выводы и рекомендации: определены возможности научного поиска как средства формирования креативности будущего инженера, обоснована значимость его мотивационно- рефлексивной позиции в инженерном образовании. Перспективу исследования формирования креативности будущего инженера мы видим в мотивации к научно-исследовательской образовательной деятельности самообучающегося студента; обосновании созидательной деятельности; дальнейшего научного анализа отечественного и зарубежного опыта инженерного образования в данном контексте.

Ключевые слова: креативность; творчество; инженерное образование; инженер, рефлексия; научный поиск; инженерное творчество; креативный инженер.

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