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Prospects of using a practice oriented approach in teaching smart technologies: systematic review

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Abstract. The article is devoted to the prospects of teaching using a practice-oriented approach to the study of smart technologies in the preparation of future computer science teachers. Currently, the trend of production development, changes in society, technical and technological progress require new results from the higher education system. Therefore, the issue of professionally trained, competent specialists ready to find solutions to the problems they will face in the future is considered one of the most pressing tasks facing universities. The relevance of the research lies in the analysis of the results of scientific empirical research conducted using a practice-oriented method of training future specialists in universities. The practice-oriented method of training provides stages of interaction with all subjects of the educational process, joint solution of educational tasks, and modeling of situations. A distinctive feature of this method from others is not only the practical development of tasks, but also their correlation with real life and focus on solving problems. During the study and generalization of scientific literature, the results of research aimed at studying such fields of knowledge as computer science, design and teaching programming technologies using a practice-oriented approach were obtained. The PRISMA method was applied to scientific research that was received by filtering information from the database. Based on the collected data, an analysis of the information and the methods used was carried out, as well as the methods and techniques that were used in accordance with the subject of the study were analyzed. The study showed that the use of a practice-oriented approach makes it possible to get better results in the training of future specialists.

Keywords: practice-oriented approach, higher education institution, SMART technologies, Computer science.

Introduction

When teaching and implementing an educational program, teachers should use several methods and technologies and even in some cases require a change in teaching approaches. It is explained by the fact that some traditional approaches do not correspond to the subject in which they are conducted, to the students who participate. Correctly chosen methods will undoubtedly give positive results, so the methods that will be chosen depending on the characteristics and needs of each course will also be different. Depending on the course material being studied, the choice of effective teaching methods and its practical application give positive results. Today's students use more visual aids than previous generations. This is due to the fact that accessibility and the development of technologies in the modern field of education not only cover the theoretical form, but also give students the opportunity to try practical tasks themselves. Thus, teachers can experimentally use relevant educational resources.

Teaching "Smart technologies" to future computer science teachers has its own specifics. Smart technologies act as an object of learning, as well as a tool of subject and pedagogical activity. Whereas to learn smart technologies gives future specialists the possibility not only to explore one subject, but also to participate in various competitions and projects in the upcoming work, to understand the content of computer science courses, to apply new technologies in the professional activities of educational institutions. Recently, the inclusion of the word "smart" in technology has become a trend, and also attracts people. this is due to the fact that if you add the word "smart" rather than a simple type, this word will leave associations of devices with their compact, responsive, convenient and other properties. Therefore, a future teacher should be a specialist who is able not only to have knowledge in the field of computer science, but also to solve maximum tasks. The application of a practice-oriented teaching in the training of specialists in higher education institutions creates conditions for solving, understanding and applying problems that they may face in the future [1].

The practice-oriented teaching method consists in the formation of practical skills in students and the assimilation of the curriculum by performing specific practical tasks and exercises [2]. A number of prerequisites for a practice-oriented teaching method can be put forward. They are: interaction with the subjects of the learning stages, data exchange with each other, mutual solution of tasks, modeling situations, active participation in the academic environment and cooperation in solving problems. A distinctive feature of this method from others is not only the practical development of tasks, but also their correlation with real life and orientation to solving certain tasks. That is, to coach future employees in such a technique that they can figure out to questions that will arise in the future [12].

Methodology

To determine the prospects of a practice-oriented approach to teaching at universities, the results of an empirical study were considered, in which a practice-oriented approach to teaching subjects was applied. Based on research papers, publications have been obtained over the past ten years, that is, from 2013 to 2023. The main data was viewed from the Scopus,

WoS and Google Scholar databases. In the order of keywords, the phrases "practice oriented approach" or "practice based learning" were used to find relevant publications. At that time, publications issued in connection with the application of the generalizing practice-oriented method were received from all three databases. The largest number of publications found, as shown in the figure 1, was in the Web of Science database. But since all the publications found do not correspond to the topic of our research, filters were created for articles on special restrictions and criteria. At this stage, only the Scopus and WoS databases were used. Repeated searches were made with the limits specified in the table 1. The reason for this is the study was reviewed according to the necessary area and according to the own standard of the educational systems in Kazakhstan. In Kazakhstan, future specialists can study at universities, colleges, institutes, etc. Enrollment in higher education institutions in Kazakhstan is possible only at the age of 17 (in some cases 16), graduates with secondary education, i.e. graduates of grades 11 (12) or special educational institutions (colleges). And college is considered an environment of secondary vocational or special education. At this time, future specialists study special courses and subjects to become professionals in their field. Therefore, during the literary review, experimental studies conducted in higher educational institutions were obtained. The PRISMA method was used to select articles. Figure 2 shows the process of selecting articles based on the PRISMA proposal. The Excel program was used for the selection of articles. With the help of Excel, efforts were undertaken to eliminate duplicate articles, designate special signs and distinctive features, records, etc. Articles that did not correspond to each stage were excluded. Out of 209 articles, the results of 8 articles were tabulated.

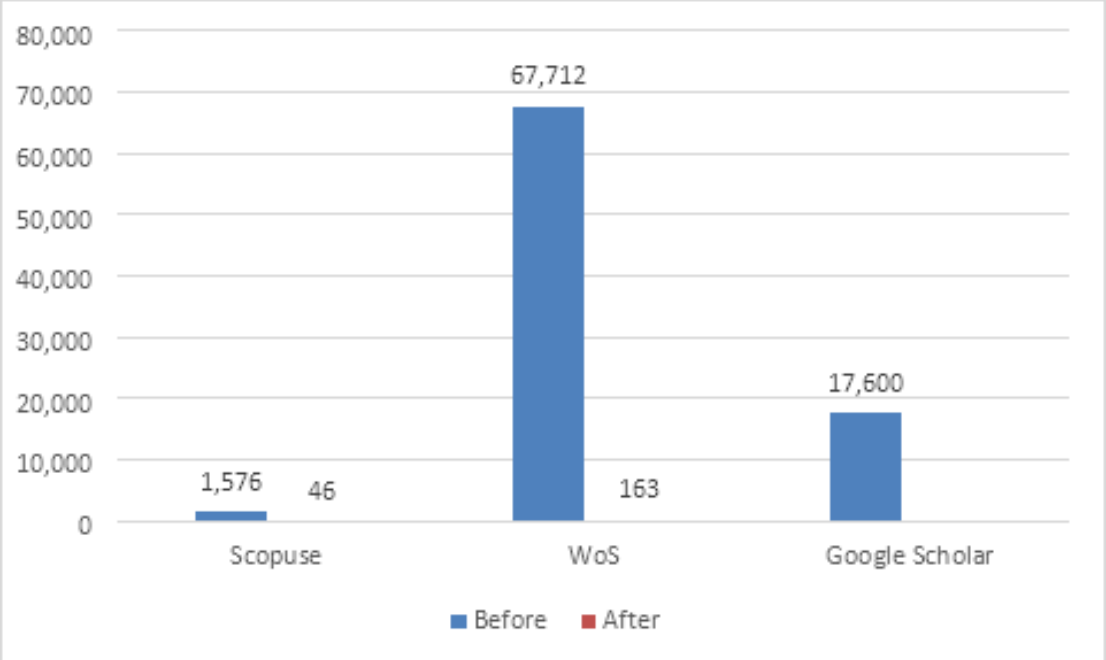


Figure 1. Results of Scopus, WoS and Google Scholar databases

Table 1

Marks taken into account when choosing articles

Selection of the necessary articles according to the criterion	Marks
University students	+
College students	-
School students	-
Medical students	-
Foreign language learners	-
Research conducted as part of the course	+
Practices in the organization	-
Subjects studied by students in the field of ICT, programming	+
Engineering students	+

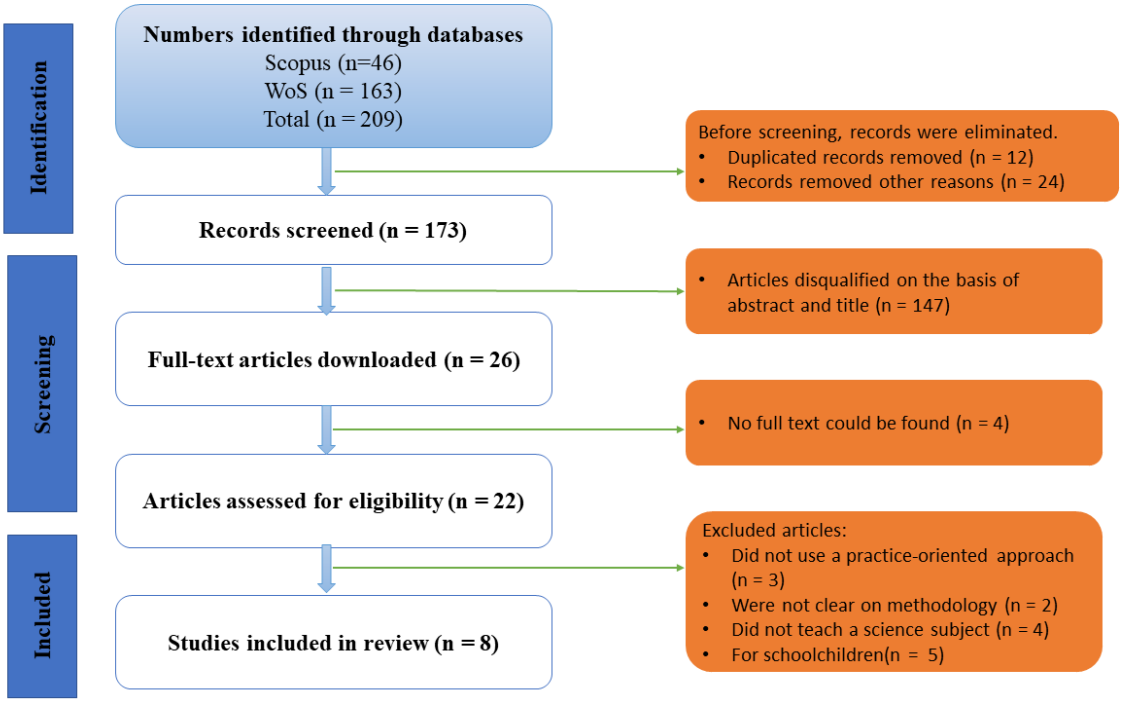
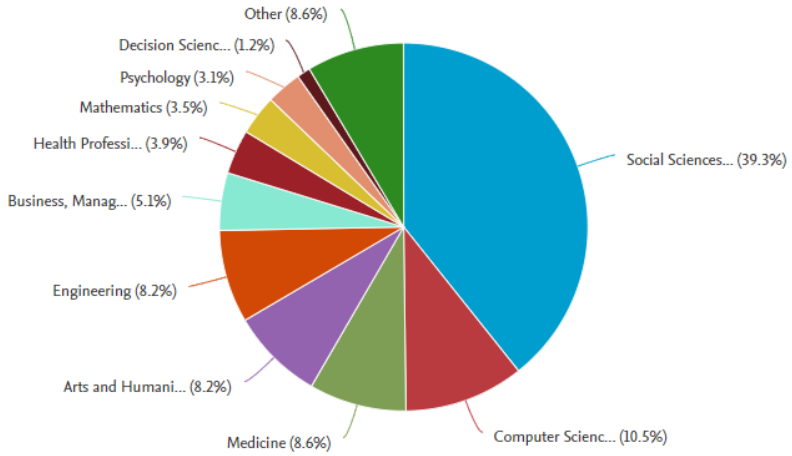


Figure 2. PRISMA flowchart with guidelines

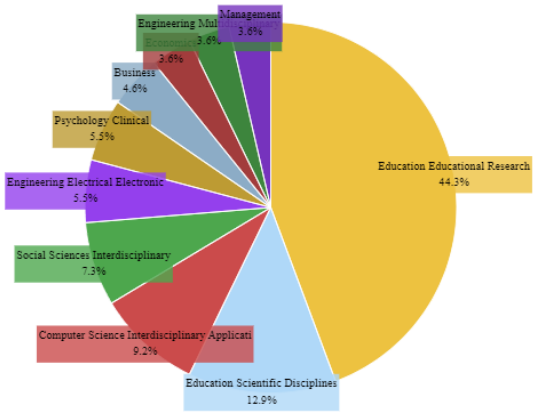
Discussion

Although the number of articles originally released using the practice-oriented method is much larger, it can be seen in Figure 1 that the number of articles released during the creation of the filter by setting a limit is small. Figure 3 shows that the practice-oriented method was applied in different directions. While most of the papers published using the practice-oriented method in the Scopus database were in the Social Science direction, the second most common

was the Computer Science direction. Accordingly, the Education, Educational Research direction in the Web of Science database switched to the top spot for posting content about the use of the practice-oriented technique. In both databases (Scopus – 10.5%, Web of Science – 9.2%), it is clear that the studies written in the direction of Computer Science are equal.



a. Scopus



b. Web of Science

Figure 3. Published documents on the branch of knowledge in Scopus and Web of Science

Table 2

Systematic review of the course content based on the PRISMA criteria

Author & year	Program type	Sample size	Control group	Checklist item	Type of evaluation
Aguilar -Gonzalez, A., Lozoya, C. et al., 2017, [3].	bachelor	16	+	Experimental and control projects. Using projects to solve real practical problems	Students' feedback

L. H. Gonzalez-Guerra and, [4].	bachelor	758	-	No control group. 21 groups in 4 different courses during two semesters	Subject assessment
Goldberg Mary R., Pearlman Jonathan L., 2013, [5].	Masters and PhD	7	-	No control group. Students had multiple disciplines in background	Pre - and post -assessment, Mid - point interviews
Chandrasekaran, S., Stojcevski, A., et al., 2013, [6].	bachelor	Not given	-	No control group. 1st year and senior year undergraduate engineering students.	Subject assessment
Varsha T. Lokare, Prakash M. Jadhav, Snehal S. Patil, 2018, [7].	bachelor	75	-	No control group. Students were variety of engineering departments.	Pre - and post -assessment
Block, B. M., Haus, B., Anton Stenken, Torge von Geyso, 2020, [8].	bachelor	13	-	No control group. Resalts not given	Subject assessment
A. Bosović, A. Merzić and M. Musić, 2021[9].	bachelor	25	-	No control group. Only program students analysis	Subject assessment
Liu, Z., Alimbekov, A., et al., 2023 [10]	bachelor	112	-	Experimental and control projects.	Pre - and post -assessment
Pettersen, I. B., Åmo, B. W, 2018 [11]	bachelor	99	-	No control group. Students were variety of engineering department.	Pre - and post -assessment

In table 3 of the above literature, a quantitative and qualitative analysis was conducted in 6 research papers. In addition, [3], [9] the researchers stated in their work that the quantitative assessment is small and it was difficult to do. All the sources discussed above indicate that studies conducted using the practice-oriented method have received positive results. During the selection of literature, experimental works were obtained on the use of a practical method in teaching programming languages, design, Smart Grid, VR training.

Results

Aguilar-Gonzalez and co-authors used in their project work specific projects for students performing the functional duties of clients. Such interdisciplinary projects allowed students to create specific tasks in the form of practice and assimilate knowledge. Another important aspect was the feedback from students. Students showed interest in learning by performing practical tasks during the development and execution of practical tasks. Students performing practical tasks with a group, providing work through the development of the project actively involves

them during the educational journey and increases motivation for a deeper study of theoretical material. This is evidenced by the work of Goldberg Mary R. and co-authors. In addition, it was the only research work that included undergraduates and doctoral students (Table 3). Faced with practical tasks that need to be completed in practical classes, students begin to grasp the significance of the theoretical concepts, transmitted knowledge and understand how to apply theory in practice [13].

One of the most important features of practice-oriented learning in teaching Smart technologies is the interdisciplinarity of knowledge gained in the learning process. This happens because in the technological process of learning smart technologies, there is interaction with IoT, artificial intelligence, Arduino, Databases and etc.

A practice-oriented approach to learning means the formation of professional skills of students through active participation in practical activities. During the process of instruction, problem methods, analysis of specific situations, project training, project development in a team, work on solving tasks for solving specific tasks can be used. Thus, the method aimed at performing practical tasks forms a structural picture of the acquired knowledge and skills.

Conclusion

This study comprehensively examined the practice-oriented method and its use in various courses. The practice-oriented approach allows students to develop specific skills and competencies necessary to work on the course. The use of a practice-oriented method in teaching smart technologies contributes to the formation of practical skills among students, as well as the development of the ability to solve specific tasks using modern technologies. This is evidenced by a review of research papers. These skills create the conditions for performing any task. The approach to learning, focused on the practical application of tasks, contributes to the development of students' systemic thinking, cooperation in groups and individual work, and the ability to work in pairs when solving various tasks. This approach also promotes the development of independence, analytical skills to identify problems, and stimulates activity and creativity.

The application of a practice-oriented approach in teaching intelligent technologies allows the future holder of a specialist diploma not only to study the theoretical aspects of this field, but also to apply the knowledge gained in practice, which makes them ready for the challenges of the modern world and innovative technologies.

Contribution of the authors

When writing the research paper, the contribution of the authors were equal. All the authors identically demonstrated their assessment to the gather, analysis of data, and summing up.

Dildabek A.K. – search of information, collection, comparison, analysis of literature, critical revision of the written text, creation of tables and diagrams, write results.

Yermaganbetova M.A. and **Zakirova A.B. –** revision of data, verification of correctness, participation in writing the results and discussion sections, approval of the final version of the article for publication.

References

1. Есен А. С., Исмакова Б. С. Деятельностно-компетентностный подход к проектированию содержания практико-ориентированного обучения //ЛН Гумилев атындағы Еуразия ұлттық университетінің хабаршысы. Педагогика. Психология. Социология сериясы. – 2023. – №. 2. – С. 68-74. DOI: https://doi org/10.32523/2616-6895-2023-142-1-68-74

2. Практико-ориентированные технологии обучения: педагогические кейсы – учебное пособие // Ж. М. Сагитова, Ж.Е. Абдыхалыкова. – Нур-Султан, 2022. -121 с.

3. Aguilar-Gonzalez A. et al. Campus kart: An automated guided vehicle to teach using a multidisciplinary approach //IEEE Revista Iberoamericana de Tecnologias del Aprendizaje. – 2017. – Т. 12. – №. 4. – С. 199-207. DOI: 10.1109/RITA.2017.2776443

4. Gonzalez-Guerra L. H., Leal-Flores A. J. Potentializing the problem-solving competence in programming courses through a practice-based learning+ tutoring strategy //2020 IEEE Global Engineering Education Conference (EDUCON). – IEEE, 2020. – С. 691-697. DOI: 10.1109/EDUCON45650.2020.9125154

5. Goldberg M. R., Pearlman J. L. Best practices for team-based assistive technology design courses // Annals of biomedical engineering. – 2013. – Т. 41. – С. 1880-1888. DOI: 10.1007/s10439-013-0798-2

6. Chandrasekaran S. et al. Project-oriented design-based learning: aligning students' views with industry needs. – 2013.

7. Lokare V. T., Jadhav P. M., Patil S. S. An integrated approach for teaching object oriented programming (c++) Course //Computer Science. – 2018. – Т. 2. – №. 3. – С. 1. DOI: 10.16920/jeet/2018/v31i3/120744

8. Block B. M. et al. Interdisciplinary engineering education in the context of digitalization and global transformation processes //Proceedings of the 48th SEFI Annual Conference. – 2020.

9. Bosović A., Merzić A., Musić M. Practice-Oriented Teaching in Smart Grids //2021 10th Mediterranean Conference on Embedded Computing (MECO). – IEEE, 2021. – С. 1-4. DOI: 10.1109/MECO52532.2021.9460300

10. Liu Z. Y. et al. Modern Tendency to Practice-Oriented Learning //MENDEL. – 2023. – Т. 29. – №. 2. – С. 155-161. DOI: https://doi.org/10.13164/mendel.2023.2.155

11. Pettersen I. B. et al. Developing engineering students' willingness and ability to perform creative tasks //Education+ Training. – 2019. – Т. 61. – №. 9. – С. 1138-1150. DOI: https://doi.org/10.1108/ET-10-2018-0219

12. Gondhalekar M. S., Bojewar S. M. Teaching Software Engineering Subjects Using a Practical Oriented Approach at the University of Mumbai //International Journal of Engineering Pedagogy (iJEP). – 2013. – Т. 3. – №. S4. – С. 27-30. DOI: https://doi.org/10.3991/ijep.v3iS4.3218

13. Абрамова Н. С., Ваганова О. И., Смирнова Ж. В. Организация самостоятельной работы в условиях реализации практико-ориентированного подхода //Азимут научных исследований: педагогика и психология. – 2019. – Т. 8. – №. 1 (26). – С. 13-15. DOI: 10.26140/anip-2019-0801-0001

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Смарт технологияларды оқытуда тәжірибеге бағытталған тәсілді қолдану перспективалары: жүйелі шолу

Аңдатпа. Мақала болашақ информатика мұғалімдерін даярлауда smart технологияларды зерттеуде тәжірибеге бағытталған әдісті қолдана отырып оқыту перспективаларына арналған. Қазіргі уақытта өндірістің даму тенденциялары, қоғамдағы өзгерістер, техникалық және технологиялық прогресс жоғары білім беру жүйесінен сапалы жаңа нәтижелерді талап етеді. Сондықтан болашақта кездесетін мәселелерге бейім кәсіби дайындалған, білімді мамандар туралы мәселе университеттер алдында тұрған маңызды міндеттердің бірі болып саналады. Зерттеудің өзектілігі жоғары оқу орындарында болашақ кадрларды даярлаудың тәжірибеге бағытталған әдісін қолдана отырып жүргізілген ғылыми эмпирикалық зерттеулердің нәтижелерін талдаудан тұрады. Тәжірибеге бағытталған оқыту әдісін қолдану, білім беру процесінің барлық субъектілерімен өзара әрекеттесу кезеңдерін, оқу міндеттерін бірлесіп шешуді, жағдайларды модельдеуді қамтамасыз етеді. Бұл әдістің басқалардан айрықша ерекшелігі - тапсырмаларды практикалық түрде әзірлеу ғана емес, сонымен бірге олардың нақты өмірмен байланысы және мәселелерді шешуге бағытталуы. Ғылыми әдебиеттерді зерттеу және жүйелеу барысында келесі салаларда: информатика, бағдарламалау тілдерін оқыту, дизаин сияқты ақпараттық технологияларға негізделген бағыттар бойынша практикаға бағытталған әдістерді қолданып жүргізілген зерттеулер алынды. PRISMA әдісі дерекқордан сүзу арқылы алынған ғылыми зерттеулерге қолданылды. Алынған мәліметтер бойынша ақпараттық талдау жүргізілді, сонымен қатар зерттеу тақырыбына сәйкес қолданылатын әдістер мен тәсілдер талданды. Зерттеу нәтижелері тәжірибеге бағытталған әдісті қолдану болашақ мамандар үшін айтарлықтай жақсы нәтиже беретінін көрсетті.

Түйін сөздер: тәжірибеге бағытталған тәсіл, жоғарғы оқу орны, smart технологиялар, информатика.

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Перспективы использования практико-ориентированного подхода в обучении smart технологиям: систематический обзор

Аннотация. Статья посвящена перспективам преподавания с использованием практико-ориентированного подхода к изучению smart технологий при подготовке будущих учителей информатики. В настоящее время тенденция развития производства, изменения в обществе, технический и технологический прогресс требуют от системы высшего образования новых результатов, поэтому вопрос о профессионально подготовленных, компетентных специалистах, готовых к поиску решения проблем, с которыми они столкнутся в будущем, считается одной

из важнейших задач, стоящих перед университетами. Актуальность исследования заключается в анализе результатов научных эмпирических исследований, проведенных с использованием практико-ориентированного метода подготовки будущих специалистов в вузах. Применяя практико-ориентированный метод обучения, он обеспечивает этапы взаимодействия со всеми субъектами образовательного процесса, совместное решение учебных задач, моделирование ситуаций. Отличительной особенностью этого метода от других является не только практическая разработка задач, но и их соотнесение с реальной жизнью и направленностью на решение задач. В ходе изучения и систематизации научной литературы были получены результаты исследования, проведенных в таких областях как: информатика, преподавание языков программирования и дизайн на основе информационных технологий с использованием практико-ориентированного метода. Метод PRISMA применялся к научным исследованиям, полученным путем фильтрации из базы данных. По полученным данным был проведен информационный анализ, а также проанализированы методы и приемы, используемые в соответствии с предметом исследования. Результаты исследования показали, что использование практико-ориентированного метода дает значительно высокие результаты для будущих специалистов.

Ключевые слова: практико-ориентированный подход, высшее учебное заведение, smart технологии, информатика.

References

1. Esen A.S., Ismakova B.S. Deyatelnostno-kompetentnostnyi podhod k proektirovaniyu soderzhaniya praktiko-orientirovannogo obucheniya [Activity-competence approach for designing the content of practice-oriented learning] // L.N. Gumilev atyndagy Euraziya ulttyq universitetinin habarshysy. Pedagogika. Psihologiya. Sotsiologiya seriyasy. – 2023. №. 2. – S. 68-74. DOI: https://doi org/10.32523/2616-6895-2023-142-1-68-74 [in Kazakh]

2. Praktiko-orientirovannye tekhnologii obucheniya: pedagogicheskie kejsy [Practice-oriented learning technologies: pedagogical cases] – uchebnoe posobie [study guide]// Zh. M. Sagitova, Zh.E. Abdyhalykova. – Nur-Sultan, 2022. -121 s. [in Russian]

3. Aguilar-Gonzalez, A., Lozoya, C., Orona, L., Romo, S., & Roman-Flores, A. (2017). Campus kart: An automated guided vehicle to teach using a multidisciplinary approach. IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, 12(4), 199-207. DOI: 10.1109/RITA.2017.2776443

4. Gonzalez-Guerra, L. H., & Leal-Flores, A. J. (2020, April). Potentializing the problem-solving competence in programming courses through a practice-based learning+ tutoring strategy. In 2020 IEEE Global Engineering Education Conference (EDUCON) (pp. 691-697). IEEE. DOI: 10.1109/ EDUCON45650.2020.9125154

5. Goldberg, M. R., & Pearlman, J. L. (2013). Best practices for team-based assistive technology design courses. Annals of biomedical engineering, 41, 1880-1888. DOI: 10.1007/s10439-013-0798-2

6. Chandrasekaran, S., Stojcevski, A., Littlefair, G., & Joordens, M. (2013). Project-oriented design-based learning: aligning students' views with industry needs.

7. Lokare, V. T., Jadhav, P. M., & Patil, S. S. (2018). An integrated approach for teaching object oriented programming (c++) Course. Computer Science, 2(3), 1. DOI: 10.16920/jeet/2018/v31i3/120744

8. Block, B. M., Haus, B., Steenken, A., von Geyso, T., van der Veen, J., van Hattum-Janssen, N., ... & Ten Dam, I. (2020, November). Interdisciplinary engineering education in the context of digitalization and global transformation processes. In Proceedings of the 48th SEFI Annual Conference.

9. Bosović, A., Merzić, A., & Musić, M. (2021, June). Practice-Oriented Teaching in Smart Grids. In 2021 10th Mediterranean Conference on Embedded Computing (MECO) (pp. 1-4). IEEE. DOI: 10.1109/MECO52532.2021.9460300

10. Liu, Z., Alimbekov, A., Glushkov, S., & Ramazanova, L. (2023, December). Modern Tendency to Practice-Oriented Learning. In MENDEL (Vol. 29, No. 2, pp. 155-161). DOI: https://doi.org/10.13164/mendel.2023.2.155

11. Pettersen, I. B., Åmo, B. W., Van der Lingen, E., Håvåg Voldsund, K., & Johnstad Bragelien, J. (2019). Developing engineering students' willingness and ability to perform creative tasks. Education+ Training, 61(9), 1138-1150. DOI: https://doi.org/10.1108/ET-10-2018-0219

12. Gondhalekar, M. S., & Bojewar, S. M. (2013). Teaching Software Engineering Subjects Using a Practical Oriented Approach at the University of Mumbai. International Journal of Engineering Pedagogy (iJEP), 3(S4), 27-30. DOI: https://doi.org/10.3991/ijep.v3iS4.3218

13. Abramova N. S, Vaganova O. I, Smirnova Z. V. Organizasia samostoiatelnoi raboty v usloviah realizasii praktiko-orientirovannogo podhoda [Organization of independent work in the context of the implementation of a practice-oriented approach] // Azimuth of scientific research: Pedagogy and Psychology. - 2019. Vol. 8. No. 1(26). – P. 13-15. DOI: 10.26140/anip-2019-0801-0001

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