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APPLICATION OF AN ADDITIONAL RENEWABLE ENERGY IT-COURSE

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In the digital age, technology has become an essential part of daily life, leading to rapid growth and a high demand for the information technology (IT) industry serving as a professional sphere. Pursuing additional IT-courses presents an appealing opportunity for those interested in studying technology and its applications across various industries. Furthermore, government-backed digitalization of education highlights the necessity to shape the content and methods of implementing modern educational programs to keep pace with the evolving educational landscape. Therefore, this article highlights the practical implementation of the educational trajectory of minors in IT in the

Kazakhstan education system, with an emphasis on Renewable energy sources (RES) and the relevant standards of the European education system. The main purpose of the article is to present the results of a study on the creation and development of secondary programs in the field of sustainable development, conducted at two regional universities – Karaganda Technical University and the International University of Information Technology. In addition, the article presents the results of a survey of undergraduate IT students from two regional universities of Kazakhstan, assessing the impact of renewable energy and IT on their choice of secondary disciplines from the point of view of consumer behavior.

Key words: *digital technologies, educational program, renewable energy sources, informational technology, renewable energy, sustainable development.*

ЖАҢАРТЫЛАТЫН ЭНЕРГИЯ КӨЗДЕРІ БОЙЫНША АҚПАРАТТЫҚ ТЕХНОЛОГИЯЛАР САЛАСЫНДА ҚОСЫМША КУРСТЫ ҚОЛДАНУ

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Қазіргі цифрлық дәуірде технология біздің күнделікті өміріміздің ажырамас бөлігіне айналды, бұл ақпараттық технологиялар (АТ) саласының кәсіби сала ретінде қарқынды дамуына және жоғары сұранысына әкелді. Қосымша АТ курстарынан өту сонымен қатар технологияларды және олардың әртүрлі салаларда қолданылуын егжей-тегжейлі зерттегісі келетіндер үшін тартымды мүмкіндік болуы мүмкін. Бұдан басқа, мемлекет қолдайтын білім беруді цифрландыру стратегиясы қосымша кәсіптік білім беру бағдарламаларының мазмұнын және оларды іске асыру әдістерін қалыптастыру қажеттілігін көрсете отырып, қазіргі заманғы білім беру кеңістігін дамытуға сұраныс туғызады. Демек, бұл мақала жаңартылатын энергия көздеріне (ЖЭК) және еуропалық білім беру жүйесінің тиісті стандарттарына баса назар аудара отырып, қазақстандық білім беру жүйесіне ат-да кәмелетке толмағандардың білім беру траекториясын іс жүзінде енгізуді қамтиды. Мақаланың басты мақсаты екі өңірлік жоғары оқу орындарында – Қарағанды техникалық университетінде және Халықаралық ақпараттық технологиялар университетінде өткізілген орнықты даму саласындағы кіші бағдарламаларды құруға және дамытуға арналған зерттеу нәтижелерін ұсыну болып табылады. Сонымен қатар, мақала Қазақстанның екі өңірлік университеттерінің АТ саласындағы бакалавриат студенттерінің ЖЭК және АТ-ның тұтынушылық мінез-құлық тұрғысынан олардың қосымшаі пәндерді таңдауына әсерін бағалайтын сауалнаманың нәтижелерін ұсынады.

Түйінді сөздер: *Цифрлық технологиялар, білім беру бағдарламасы, жаңартылатын энергия көздері, ақпараттық технологиялар, жаңартылатын энергетика, тұрақты даму.*

ПРИМЕНЕНИЕ ДОПОЛНИТЕЛЬНОГО КУРСА В ОБЛАСТИ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ ПО ВОЗОБНОВЛЯЕМЫМ ИСТОЧНИКАМ ЭНЕРГИИ

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В современной цифровой эпохе технологии стали неотъемлемой частью нашей повседневной жизни, что привело к быстрому развитию и высокому спросу на область информационных технологий (ИТ) в качестве профессиональной сферы. Прохождение дополнительных курсов в области ИТ также может представлять привлекательную возможность для тех, кто желает более подробно изучить технологии и их применение в различных отраслях промышленности. Кроме того, стратегия цифровизации образования, поддерживаемая государством, создает спрос на развитие современного образовательного пространства, указывая необходимость формирования содержания дополнительных профессиональных образовательных программ и их методов реализации. Следовательно, данная статья освещает практическое внедрение в казахстанскую систему образования образовательной траектории майноров в ИТ, с акцентом на возобновляемые источники энергии (ВИЭ) и соответствующие стандарты европейской системы образования. Главной целью статьи является представление результатов исследования, посвященного созданию и развитию второстепенных программ в области устойчивого развития, проведенного в двух региональных вузах – Карагандинском техническом университете и Международном университете информационных технологий. Кроме того, статья представляет результаты опроса студентов бакалавриата в сфере ИТ двух региональных университетов Казахстана, оценивающего влияние ВИЭ и ИТ на их выбор второстепенных дисциплин с точки зрения потребительского поведения.

Ключевые слова: *цифровые технологии, образовательная программа, возобновляемые источники энергии, информационные технологии, возобновляемая энергетика, устойчивое развитие.*

Introduction. Currently, there is no effective system for training specialists capable of developing, implementing and operating renewable energy sources. It should be noted that the educational sphere related to RES is a multifaceted and interdisciplinary field of knowledge, which requires a combination of different disciplines and finds application in various industries. As a result, it is crucial to create an educational system that will help professionals to cover the various aspects of renewable energy and its widespread application. This has become an important component of sustainable development and is crucial to optimize the efficiency of renewable energy in modern industries and society [1, p.1017].

The lack of systematic training in renewable energy creates significant challenges for the development and efficient utilization of these energy sources. The renewable energy sector is multifaceted and requires in-depth

knowledge and skills in various fields and is widely used in different industries. According to a study by Lucas, Pennington, and Cabeza (2018), there is a significant barrier to the expected growth of the renewable energy market and this is due to the lack of highly skilled personnel. This study analyzes global data on renewable energy education and training and highlights the challenges faced in improving, promoting and making education and training in this field more accessible [2, p. 452].

Modern higher education seeks to form competent specialists with a harmonious combination of professional and personal qualities, capable of self-development and self-realization in future professional activity. To achieve this goal, the educational process should be student-centered and take into account the individual needs and capabilities of the user. This approach allows students to independently choose components of educational programs and form their individual educational trajectory [3, p.9528].

The additional course is designed to provide interested students with the opportunity to learn about and experiment with advanced renewable energy and sustainability technologies in these areas of science and technology. In addition, this educational course will allow information technology students to learn the principles, characteristics, and operation of various renewable energy sources and energy conversion systems. In addition, this course is designed to interest non-energy students (students of other majors) to expand their knowledge in the field of sustainability and green energy so that they can expand their skills as well as career opportunities [4, p. 755].

The relevance of this study is justified by the growing use of information and communication technologies in modern society, which has led to the need to improve the general skills of citizens, including information literacy. In recent years, there has been a noticeable increase in the number of people using information technologies in everyday life, which is associated with the significant impact of the digital revolution on all spheres of human activity. In this context, information literacy becomes a key competence necessary for successful adaptation to modern conditions [5, p. 255].

Today, RES are the most important sources of electric power, ensuring rational use of natural resources, environmental safety and energy efficiency. Scientifically justified development of renewable energy is impossible without improvement of design technologies. [6, p.570]. To ensure the long-term sustainability and efficiency of RES, it is necessary to actively develop and implement modern computer technologies in the design, construction and operation of such energy facilities. This includes the application of computer modeling, big data analysis and artificial intelligence methods.

One of the key advantages of using modern computer technology is the ability to accurately predict energy production, optimize the operation of renewable energy sources and monitor the condition of equipment. Computational methods can be used to optimize the placement and configuration of solar panels and wind turbines, taking into account local climatic conditions and energy needs.

Artificial intelligence-based control systems, which can automatically adapt to changing conditions and optimize the operation of renewable energy sources, make a major contribution in this area. Such systems help to reduce maintenance costs and increase the efficiency of energy production.

Thus, the use of modern computer technologies in the field of renewable energy sources not only contributes to the reduction of negative environmental impact, but also makes this industry more competitive and cost-effective. Implementation of scientifically based RES development using innovative design and management methods is an integral part of the sustainable energy development strategy.

Effective use of information and communication technologies allows to significantly reduce the probability of errors at the design stage, reduce the time of preparation of design documentation, and ensure synchronous interaction between designers, builders and operating organizations. As a result, it contributes to the competitiveness of the project under development [7, p.266].

Therefore, it is important for modern students mastering the program of study at the Faculty of Computer Science to master key aspects in the field of renewable energy sources (RES). This will allow them to acquire additional competencies and become more qualified specialists ready to work effectively in the modern market environment in our country and abroad. This also emphasizes the importance of global aspects in education and training, not limited to the national context.

The establishment of a course on renewable energy at the Faculty of Computer Science of national universities will help students to obtain higher qualifications after graduation.

Studies have shown that the use of digital resources and computer technology in teaching improves student-teacher interaction, can improve the quality of education and promote greater student engagement, ICTs can increase students' awareness and interest in RE, which in turn can lead to an increase in the number of professionals in the field and ultimately to accelerated development and application of RE in various sectors of the economy. However, it is still unclear how these technologies are utilized by different faculty members. Comprehensive research is needed to assess the overall impact of digital technologies on different pedagogical practices [4, p. 756; 7, p.267].

The purpose of this paper is to describe the results of a pilot work on the implementation of a supplementary course program for students of the Computer Science Faculty of two regional universities, such as Karaganda Technical University and International University of Information Technologies.

The objectives of this study are the following:

- To present the results of the experimental work aimed at evaluating the possibility of implementing an additional educational course program in the field of renewable energy sources (RES) for students of national universities specializing in information technology.
- To describe students' attitudes towards the proposed additional course, to analyze and evaluate students' interest and readiness to participate in this training program.
- To formulate conclusions and recommendations regarding further prospects and feasibility of introducing such an additional course in the educational process, taking into account its importance and relevance for the professional training of students specializing in information technology.

Methods and Materials. Visualized simulations are an integral part of higher education in many disciplines. They form a way for educators to demonstrate any topic. In addition, advances in visualization technology have made it possible to create visual aids to demonstrate effectively new concepts of how certain products work. Teachers use presentation, simulation, and animation to make their lectures more expressive and demonstrative to reach students

tending to remember learning material with visual elements better. An additional course based on information and communication technology (ICT) aims to use multimedia materials and visualized simulations to better understand and explore the operation and application of renewable energy sources (RES). The inclusion of such elements in the course helps students and trainees to witness in real time how different renewable energy technologies work and explore their functionalities. Furthermore, it contains video tutorials that explain the theory and basic principles of RES such as solar panels, wind turbines, geothermal plants, etc. as well as visualized simulations that show how different RES systems work, such as solar panels, wind turbines or biogas plants.

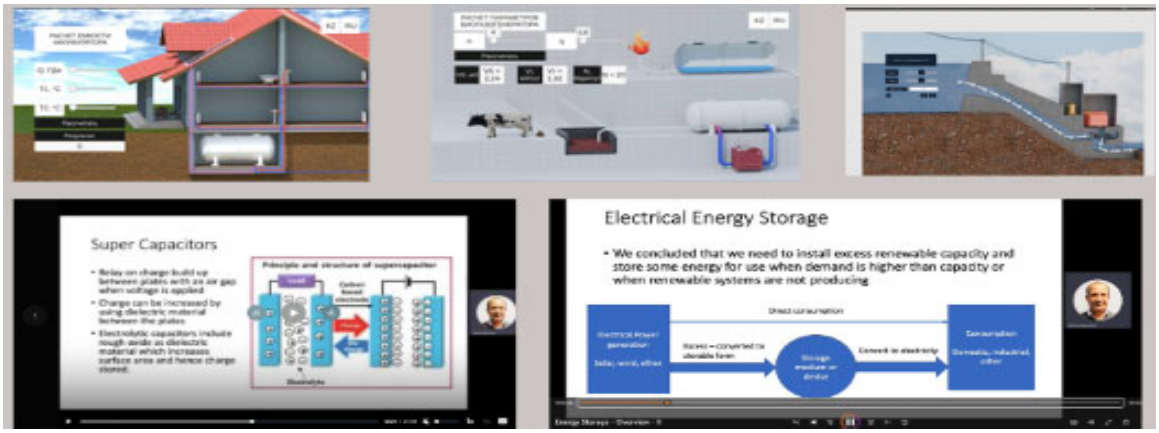

Figure 1 – User interface with video lessons and with visualized simulations

In the framework of this study, a survey using a questionnaire was conducted with the participation of undergraduate students specializing in information technology at various universities in Kazakhstan. The online application Google Forms was used to organize the survey and collect data, which provided convenience and accessibility for the participants.

A total of 120 students enrolled in information technology related programs participated in the pilot study. They were instrumental in providing valuable information and insights into the subject of the study.

To better analyze and assess students' attitudes and opinions towards renewable energy development in Kazakhstan, specially designed questions were included in the questionnaire. Particular attention was paid to assessing their interest in the new renewable energy information technology course, as well as the expected impact of this course on the development of their professional skills and preparedness in the rapidly changing field of renewable energy.

The participation of different students representing two major universities maximized the completeness and representativeness of the data, which increased the reliability and significance of the results of this study.

Results and Discussion. In the initial phase of the experimental study, it was necessary to analyze the interest of students studying at the Faculty of Computer Science in issues related to the provision of additional educational courses in the field of renewable energy. This procedure is aimed at assessing the potential relevance and relevance of such courses among the student audience.

The implementation of this analysis involves determining the degree of interest of students in acquiring knowledge and skills in the field of renewable energy. Such an analysis may include surveys, questionnaires and opinion research of the student community in order to identify their needs and interest in these educational initiatives. This information can serve as an important component of making a decision on the further development of the program of additional courses on renewable energy at the Faculty of Informatics.

An initial survey of students revealed a significant level of interest in a prospective renewable energy supplemental education course (see Figure 2). Among the respondents, 69 people (57.5 % of the total number) were in favor of the course, 39 participants (32.5 % of the sample) found it difficult to give a definite answer, and 12 respondents (10 %) expressed a negative attitude towards the course.

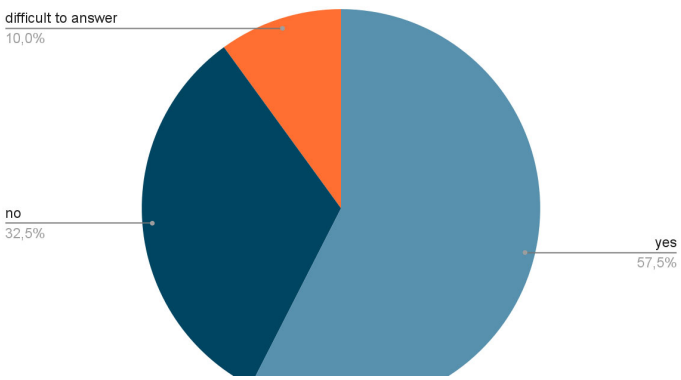

Figure 2 – Students' interest in the proposed course

During the study, it was noted that 50.6% of the interviewed respondents classified themselves as female and 49.4% as male.

As for the opinion on the development of renewable energy sources in Kazakhstan, among 101 surveyed students, 73% expressed a positive opinion, 27% have a neutral position, and only one person expressed a negative point of view (Figure 3).

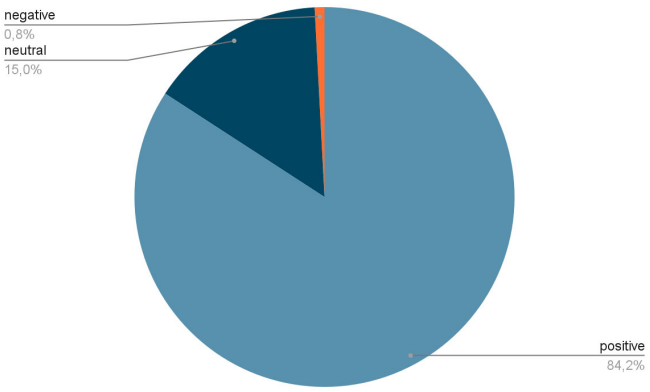

Figure 3 – Attitude of IT students to RES

In line with student preferences, an additional IT course on renewable energy has been developed for Computer Science students. The main objective of the course is to train professionals with the necessary knowledge and expertise to meet the diverse needs of emerging industries in the renewable energy sector, thereby enhancing their competitiveness and sustainability. The educational program aims to prepare professionals specialized in renewable energy with specific knowledge in the application and integration of clean energy technologies related to green energy, contributing to the efficient use and production of clean energy. Ultimately, this educational program is designed to mitigate negative environmental impacts by promoting the wise use of renewable energy and training experts capable of finding the most appropriate and environmentally friendly energy solutions for each unique scenario.

This course is structured as a modular system consisting of two key modules:

- Renewable Energy: This module will provide students with a fundamental understanding of the different types of renewable energy sources, their operating principles and environmental impact. This module will provide students with the basic level of competencies required to understand and evaluate the practical applicability of renewable energy sources.
- Application of New Technologies in Renewable Energy Development: In this module, students will explore advanced technologies and innovations in the field of renewable energy. This includes analyzing modern methods of harvesting, storing and utilizing renewable energy, as well as exploring control and monitoring technologies for renewable energy systems. This module will provide students with practical skills to implement and optimize renewable energy solutions.
- Thus, this course provides students with a comprehensive training in renewable energy, from theoretical foundations to the use of modern technologies, providing them with a wide range of knowledge and skills in this important field.
- The first module includes an analysis of the following topics:
- The main types of renewable energy sources (RES): In this part of the module, students study different types of renewable energy sources, analyzing their advantages and disadvantages. They look at different types of renewable energy sources and conduct research to assess their potential.
- The share of non-conventional energy in the energy sector of Kazakhstan and the world: In this part, students study the importance and potential of renewable energy in the modern energy sector. They analyze global and regional trends in renewable energy sources.
- Physical Basis of Solar Energy Conversion Processes: Students study the physical basis of the processes involved in solar energy conversion. They examine different types of solar collectors and their operating principles.
- Wind Energy Plants: This part of the module focuses on wind energy. Students study the classification of wind power plants, analyze wind reserves and the possibilities of its use. They also study the different types of wind turbines and wind turbines and the principles of rotating plants.
- Energy Resources of the World's Oceans: In this unit, students study the energy resources of the world's oceans, including the technical characteristics of hydroelectric and tidal power plants. They understand how the ocean's potential can be utilized for energy.
- Sources of geothermal heat: Students learn about various sources of geothermal heat and methods of their use both in the Republic of Kazakhstan and around the world. They study the principles a techniques of geothermal energy.

This module provides students with a thorough understanding of a variety of renewable energy sources, their potential and practical applications, and develops skills in analyzing and evaluating the performance of these sources.

The second module of this course includes the following important topics:

1. Application of IT technologies in unconventional energy, world experience: In this topic, students study the world experience and best practices in the application of information technologies in the field of unconventional energy. They analyze what solutions and innovations exist in the world.

2. Solar Energy Technologies: In this part of the module, students explore the different technologies used to generate solar energy. They master the methods of collecting and storing solar energy and analyze the current developments in this field.

3. Innovative Technologies in Wind Energy: This topic focuses on innovative technologies used in wind energy. Students learn advanced techniques and developments in wind energy.

4. Use of information control technologies in hydroelectric power plants: In this part of the module, students are introduced to information control technologies used in hydroelectric power plants. They study automation and water management systems.

5. Improving the Use of Geothermal Energy: Students analyze ways to improve the use of geothermal energy and develop new technologies in this area.

6. Using Information Technology to Reduce Environmental Pollution: In this topic, students explore how information technology can be used to monitor and reduce environmental pollution. They review current methods and solutions for environmental protection.

This module provides students with a deep understanding of modern technologies and innovations related to renewable energy sources and develops their ability to apply information technology to solve current problems in this field.

Training on the developed program was carried out mainly with the help of active learning methods and technologies, such as case studies, trainings, critical thinking technologies, project-based learning. At the end of the course, a reflection block will be presented, allowing students to share their opinions and impressions of the course, and instructors to improve the course.

Special attention is paid to the reflection of the students as a result of the additional educational courses. This block involves open-ended questions aimed at self-assessment of the results obtained, statement of difficulties and achievements.

The obtained results of the experimental work serve as a basis for the main conclusions formulated below, which are of great importance for the further development of additional education programs for students:

Almost half of the surveyed students (57.5%) show interest in additional education as a means of forming an individual educational route. This indicates a significant need for the development and provision of new courses of additional education (see Fig. 2).

A noticeable majority of students majoring in information technology (73%) have a positive attitude to both global and national trends in the field of renewable energy (see Fig. 3).

When developing additional educational programs, it is necessary to take into account the preferences of students. Students are most interested in full-fledged long-term additional education courses that include seminars, practical classes and interactive learning formats (see Fig. 3). This confirms the importance of creating educational practical platforms that promote active learning and practical experience.

Additional RES courses can be very useful for information technology students, as these courses will help them learn about new technologies and trends in the energy field.

Information technology students can use their knowledge of programming and data analysis to develop new RE technologies. They can also help create new programs and applications that can help people use renewable energy more efficiently [8, p.1160].

Renewable energy courses can also help information technology students to better understand issues related to climate change and environmental concerns. This can help them to develop new technologies that can help reduce humanity's impact on the environment [9, p. 311].

In addition, additional courses on renewable energy can help IT students to improve their communication and collaboration skills. They will be able to work in teams with other students and professionals from different fields to develop new technologies and solutions [10, p.422].

Finally, information technology students can find new opportunities for career growth and development if they have knowledge in RES. This will help them to get a job in companies developing new energy technologies and solutions or in governmental institutions dealing with energy policy and legislation [11].

Conclusions. The study of renewable energy can provide information technology students with significant knowledge and perspectives covering various areas of research and applied knowledge. Such learning can also contribute to their deep understanding of the impact of their actions on the environment and future generation, encouraging them to develop technologies to reduce their environmental impact and ensure a more sustainable future.

The most important aspect is that information technology can be used to optimize energy production and consumption processes, which directly affects the reduction of anthropogenic impact on the environment. Information Technology students interested in renewable energy sources can develop and implement solutions that contribute to improving the efficiency of natural resources, reducing carbon footprints and minimizing environmental risks. This includes the creation of new information systems for monitoring and analyzing data from various energy facilities (solar panels, wind turbines, hydroelectric power plants), which allows to promptly respond to changes in energy consumption and ensure stable operation of these facilities.

In addition, students majoring in information technology and studying renewable energy can apply their knowledge and skills in a wide range of fields, including participating in interdisciplinary projects with other professionals and organizations. They can actively participate in research related to global climate change and develop new technologies to reduce greenhouse gas emissions and minimize pollution. In addition, they can create applications and programs designed to collect and analyze data on energy resources and their consumption, which contributes to better resource management and the development of innovative renewable energy solutions.

Thus, it can be argued, that the study of renewable energy is of significant benefit to students majoring in information technology. They gain many perspectives for participation in projects related to environmental and energy issues, as well as new opportunities for career development and personal growth.

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БОЛАШАҚ КӨРКЕМ-ПЕДАГОГИКАЛЫҚ БІЛІМ БЕРУ МҰҒАЛІМДЕРІНІҢ КӘСІБИ ҚҰЗЫРЕТТІЛІКТЕРІН ҚАЛЫПТАСТЫРУ ҮРДІСІНДЕ ДИЗАЙН ПӘНДЕРІН ИНТЕГРАЦИЯЛАУДЫҢ ТИІМДІЛІГІ

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