УДК 378.147: 372.862:378.22 / 62:621.3

Educational resources for training future agricultural engineers in the system of blended learning

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Анотація. *Система змішаного навчання в сучасній освіті представляє собою ефективне поєднання традиційного присутнього навчання та використання онлайн-ресурсів для підвищення якості навчання та залучення студентів. Для підготовки майбутніх агроінженерів в контексті системи змішаного навчання необхідно використовувати різноманітні освітні ресурси, які забезпечують студентам актуальні знання та практичні навики, що відповідають сучасним вимогам промисловості. Розглянуто сучасні освітні ресурси, такі як онлайн-платформи навчання, віртуальні лабораторії, освітні додатки, доповнена та віртуальна реальність, відкриті освітні ресурси, засоби дистанційного зондування та географічні інформаційні системи, партнерство з галузевими компаніями та стажуваннями, а також онлайн-повідомлення і форуми. Використання цих освітніх ресурсів у навчанні агроінженерів в системі змішаного навчання дозволяє об'єднати навчальний процес, надати студентам доступ до актуальних матеріалів та інструментів, а також розвинути в них навики самостійної роботи та співпраці.*

Ключові слова: *навчальні ресурси, система змішаного навчання, фахівці з агроінженерії.*

Agricultural engineering is a modern branch that combines agronomy and engineering sciences to create and improve agricultural systems and technologies. The rapid development of agriculture, the growth of the world population and climate change create a need for highly qualified specialists who can solve complex tasks in the field of agricultural products and resource conservation. That is why modern educational resources in the educational process of future agricultural engineers become a key factor in their training.

One of the most important components of modern education in agricultural engineering is access to information and Internet resources. Thanks to the Internet and online platforms, students can access a large amount of up-to-date information, research, video lessons and study materials. This allows students to study at a distance, explore new technologies and effectively carry out independent work [4]. Important resources are specialized websites and platforms where you can find information about modern agricultural technologies, plant hybrids, methods of growing and processing agricultural crops.

Modern laboratory equipment and tools are extremely important for the practical training of agricultural engineers. Specialized laboratories allow students to study biological processes, the chemical composition of soil and water, as well as conduct research in the field of biotechnology and genetic engineering [2]. Thanks to modern technology, agricultural engineers can develop and test new agricultural technologies, analyze soil and plants, and improve the processes of growing agricultural crops.

Simulators and virtual learning environments occupy a special place among modern educational resources. With the help of virtual models, students can study agro-industrial processes in safe conditions, experiment with different scenarios and solve tasks related to agronomy and engineering. Such interactive educational resources allow students to gain practical experience and skills without leaving the classroom [1].

The direction of development of agricultural engineering also includes the use of modern information technologies, such as artificial intelligence, data analysis, and the Internet of Things. Production monitoring and automation systems help increase the efficiency of agricultural processes and reduce the impact of negative factors on the environment [3, 5]. Training using such technologies allows future agricultural engineers to understand how to implement and use modern solutions in the agricultural sector to increase productivity, quality and environmental safety of agricultural production.

In addition, an important aspect of modern education in agricultural engineering is an interdisciplinary approach. Future specialists need to understand the relationship between agronomic processes and engineering solutions, as well as have communication skills with colleagues from different industries. Modern educational programs emphasize an interdisciplinary approach, which allows students to develop analytical, communication and creative skills.

It is also important to consider practical experience and internships in the educational process of future agricultural engineers. Cooperation with agricultural enterprises, research institutes and agro-technological companies allows students to gain real experience and solve practical tasks in the field of agricultural engineering [6].

Integration of modern educational resources into the training process of future agricultural engineers plays a key role in providing them with relevant knowledge and skills. There are some examples of modern educational resources that can improve the educational process for future agricultural engineers: online learning platforms, virtual labs, educational apps, augmented reality (AR) and virtual reality (VR), open educational resources (OER), remote sensing and GIS Tools, industry partnerships and internships, online communities and forums.

Using online platforms such as Coursera, Udemy, or Khan Academy offers courses on agricultural engineering topics such as precision agriculture, sustainable farming practices, or operating farm equipment. Creation virtual labs where students can simulate experiments and practices in agricultural engineering. These virtual labs can help students gain hands-on experience in a controlled environment.

Educational apps focused on agricultural engineering topics, such as soil analysis tools, crop management apps, or farm equipment simulators provide students with interactive experiences and practical tools that they can use in their future careers.

Using AR and VR technologies intended to create immersive educational experiences for agricultural engineering students. For example, students can use VR simulations to explore different agricultural landscapes or operate complex farm equipment in a virtual environment. Collection OER materials such as textbooks, lecture materials, and videos that cover various agricultural engineering topics are often available for free online and can complement traditional course materials.

Integration remote sensing and geographic information systems (GIS) tools into the curriculum is necessary to teach students spatial analysis, mapping techniques, and data visualization in agricultural settings. Partner with agricultural companies and organizations to provide internships, hands-on learning, and real-world project opportunities for students allow students to gain hands-on experience and make connections in the industry. Encouraging students to participate in online communities and forums related to agricultural engineering will provide for them the environment where they can ask questions, share knowledge, and interact with professionals in the field.

By using these modern educational resources in training future agricultural engineers, educational institutions can better prepare students for the challenges and opportunities they will face in agriculture. Therefore, modern educational resources in the educational process of future agricultural engineers play a key role in training highly qualified specialists for the agricultural sector. Access to information and technology, the use of modern laboratories and virtual environments, as well as an interdisciplinary approach allow agricultural engineers to develop the skills and knowledge necessary to solve the challenges and tasks associated with sustainable and efficient agricultural production. Cooperation with practicing specialists and the use of modern technologies make the educational process in the field of agricultural engineering the most relevant and relevant to the modern requirements of the industry.

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Abstract. *The system of blended learning in modern education is an effective combination of traditional classroom learning and the use of online resources to improve the quality of learning and student engagement. To train future agricultural engineers in the context of a blended learning system, it is necessary to use a variety of educational resources that provide students with relevant knowledge and practical skills that meet modern industry requirements. Modern educational resources such as online learning platforms, virtual laboratories, educational applications, augmented and virtual reality, open educational resources, remote sensing and geographic information systems, partnerships with industry companies and internships, as well as online messages and forums are considered. The use of these educational resources in the training of agricultural engineers in the system of mixed learning allows you to unify the educational process, provide students with access to relevant materials and tools, as well as develop in them the skills of independent work and cooperation.*

Keywords: *educational resources, system of mixed learning, experts in agricultural engineering.*