



Pedagogical Conditions For Training Future Environmental Engineers In A Mixed Educational Environment

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ABSTRACT

This work reflects on the pedagogical conditions of training future engineers in a mixed educational environment.

Keywords:

mixed education, digital technologies, Internet network, conditions, student, information technologies.

It is very important to create certain pedagogical conditions for effective teaching in mixed education. Because in a mixed environment, students learn in face-to-face and distance learning formats, and the combination of both methods requires thorough pedagogical preparation. The main conditions for the training of environmental engineers in mixed education are considered below.

1. Provision of digital technological infrastructure and resources

A stable Internet network — High-speed and reliable Internet access is required for students and teachers, because continuity and stability are necessary when the learning process is carried out in a distance format.

Interactive platforms — Interactive learning platforms such as Moodle, Google Classroom, and Microsoft Teams are key tools for easy delivery and monitoring of learning materials in blended learning.

Access to digital resources—Online access to digital textbooks, research articles, and other educational materials can help improve the effectiveness of blended learning. Through this, students will have the opportunity to learn independently and use the necessary resources.

Technical Support - A technical support team is needed to quickly solve technical problems during the training process. This is especially important for technology-based learning styles. These conditions increase the effectiveness of the process of imparting knowledge in mixed education and help to effectively use the opportunities of the digital infrastructure in the training of environmental engineers.

2. Introduction of interactive and practical teaching methods

The introduction of interactive and practical teaching methods in the mixed education system plays an important role in organizing an effective learning process. These methods allow students to actively participate, deeply master the learning material, and develop practical skills.

Interactive teaching methods can include:

Debate and Debate - This method develops students' critical thinking and articulate thinking skills. In this process, students develop new ideas by debating with each other.

Finding solutions as a team - Working in a team strengthens the interaction between students and teaches them to solve design and creative problems together. This process forms students' decision-making skills in problem situations.

Practical teaching methods allow students to apply theoretical knowledge to real-life situations:

Laboratory training — students are given the opportunity to test their knowledge in practice through laboratory training in the technical direction. This is an opportunity for them to strengthen their professional skills and get acquainted with new technologies.

Case-study (situation analysis) — Through the analysis of a specific situation, students learn how to make decisions in real-life situations. This method helps to develop practical solutions, especially in engineering.

By introducing such methods, the integration of modern technologies and digital resources into the educational process expands the knowledge and skills of students and adapts them to the requirements of the labor market.

3. Integrate face-to-face and online training

The integration of face-to-face and online training is important in increasing the effectiveness of the educational process. This model expands educational opportunities for students and allows them to effectively manage their time and create a flexible schedule.

Advantages of an integrated model

Flexibility: In face-to-face classes, students will have the opportunity to study complex topics in detail by interacting directly with the teacher. At the same time, online training gives them the opportunity to spend time on repetition and deep learning.

Revision of delivered material: Online lessons and study materials can be recorded, providing opportunities for students to review challenging topics and study independently.

Increase student engagement: The combination of online and face-to-face formats increases the opportunity for each student to receive individual guidance and recommendations from the instructor, ensuring that they are actively engaged in the learning process.

Simplification of monitoring and evaluation: Through online platforms, it is possible to continuously monitor and evaluate the level of students' knowledge. This helps teachers to regularly check students' knowledge and provide them with the support they need at the right time.

By combining face-to-face and online learning, students can continuously monitor their learning and offer personalized learning strategies.

4. Conditions for the formation of ecological competences. Special attention should be paid to the development of skills important in environmental engineering:

The conditions aimed at the formation of ecological competences serve to seriously train students in the field of environmental engineering. In this direction, it is recommended to create the following basic conditions during the educational process:

Emphasis on practical training: To develop environmental engineering skills, students need to be exposed to real-world problems. Through this, students gain practical experience in the process of solving environmental issues.

Conducting laboratory and field studies: To study ecological analyzes and monitoring processes, it is necessary to work in laboratories, conduct field studies and provide modern equipment that allows to measure ecological parameters.

Project-based learning: Students should work on projects that focus on solving environmental problems to strengthen their knowledge and develop practical skills. This skill helps develop the analysis, synthesis, and creative approach essential for environmental engineers.

Application of information and communication technologies: Using technologies in environmental monitoring and environmental analysis, in particular, by applying geographic information systems (GIS), simulation programs, and cloud technologies, students develop skills in solving engineering problems with technologies.

Environmental responsibility and ethics: By teaching students the social and ethical responsibilities of environmental engineering, it is important to guide them not only in technical knowledge, but also in developing a sense of responsibility towards the environment and society.

These conditions play an important role in the formation of not only technical skills in environmental engineering, but also competences aimed at environmental

responsibility, creative approach and sustainable development.

5. Encouraging students' independent study

In mixed education, it is important that students have the opportunity to study theoretical materials independently. For this:

- Preparation of video materials, electronic training manuals and tests for online classes.
- Encouraging students to demonstrate their knowledge through portfolios and creative works.
- Guide to using MOOC courses for independent work.

The main result: Students' self-development skills are formed.

6. Establish regular communication between the teacher and the student

It is important to establish communication and information exchange for the successful organization of the educational process in mixed education:

- Implementation of the feedback system - pedagogues regularly assess students' knowledge and make recommendations.
- Organization of interactive communication between pedagogues and students through online forums and webinars.
- Establishing a mentoring system, in which each student develops individually with the support of a pedagogue.

The main result: regular communication between the teacher and the student makes the educational process effective.

7. Adjustment of the assessment and monitoring system

In a blended learning environment, the assessment system should also be adapted to face-to-face and distance formats:

- Continuous monitoring through online tests and quizzes.
- Assessment of student knowledge based on portfolio and project work.
- Evaluating students' activities in environmental projects and determining individual development directions.

Main result: The transparent assessment system encourages students to be more active in the learning process.

In short, the combination of technological, methodological and pedagogical conditions is

important for the training of environmental engineers in a mixed educational environment. Students get hands-on experience in traditional laboratory classes while learning using digital tools. By combining digital and face-to-face formats, environmental engineers become professionals who can meet the demands of sustainable development and environmental security.

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