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THE ROLE OF INTELLECTUAL SYSTEMS IN AUTOMATED ASSESSMENT AND ASSESSMENT OF STUDENTS' KNOWLEDGE AND SKILLS IN THE SUBJECT OF «ARTIFIC INTELLIGENCE AND NEURAL NETWORK TECHNOLOGIES»

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Abstract: This study covers the theoretical and practical aspects of using intelligent systems in the process of assessing students' knowledge and skills in the subject "Artificial Intelligence and Neural Network Technologies". The study analyzed the impact of an automated assessment system based on artificial intelligence on educational effectiveness, and conducted statistical comparisons between the experimental and control groups. The results show that the assessment process organized on the basis of an intelligent system serves to increase the level of student mastery, ensure the objectivity and transparency of assessment, and optimize teacher activities.

Keywords: artificial intelligence, intelligent system, automated assessment, educational technologies, neural network technologies, student knowledge and skills, adaptive learning, digital learning.

Introduction

Nowadays, digital transformation is developing at a rapid pace worldwide. In this process, the concept of artificial intelligence stands out as one of the most important technological achievements that has penetrated almost all areas of human life. Initially formed as a result of research in the fields of science and philosophy aimed at modeling human intelligence, the possibilities of forming and using

knowledge, the concept of AI has been widely applied in technological, practical and social spheres, while retaining its fundamental essence.

Artificial intelligence is a set of tools for thinking, learning, producing, and solving problems that are similar to human intelligence. AI is reflected in many areas of computer science, philosophy, neuroscience, psychology, linguistics, informatics, education, medicine, transportation, and more. In modern, modern education, health care, economics, and management systems, artificial intelligence plays an important role in optimizing the use of technology for humans and finding solutions to modern problems.

Literature Review

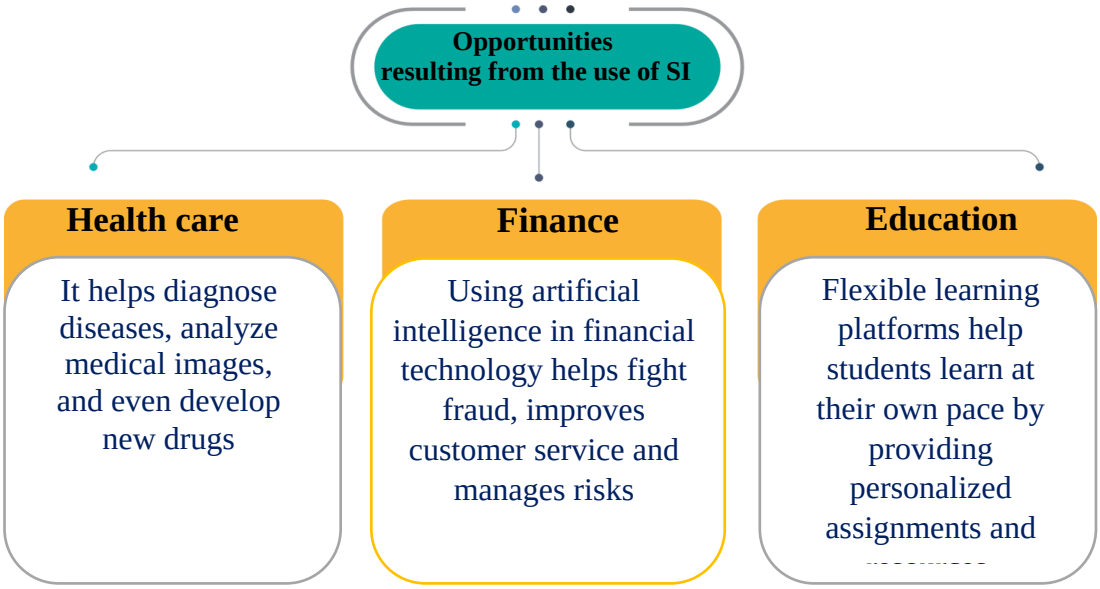
The stages of development and achievements of artificial intelligence were analyzed as follows: Until the 1950s - the first ideas and concepts of artificial intelligence had not yet been formed.[1] During this period, scientific research based on mathematics, logic, and computer technology began. Programs such as Alan Turing's "Turing test" helped create the basic theory of artificial intelligence. In the 1950s-1960s:[2] there were great achievements in the field of artificial intelligence. In 1956,[1.2] the term "artificial intelligence" was introduced at the Dartmouth conference. During this period, the creation of the first theoretical developments of artificial intelligence began. In the 1970s-1980s: expert systems and rule-based systems were created and began to be used in many applications. During this period, interest in the application of artificial intelligence in real life increased.[3]

1990s-2000s: The development of the Internet and the ability to analyze big data helped AI technologies move to a new level. Technologies such as machine learning and natural language processing (NLP) began to be widely used. 2010s to present: The development of deep learning and neural networks brought AI to new achievements.[4] It was widely used in areas such as automatic translation, facial recognition, voice recognition, and car control. Analysis shows that in the context

of the globalization of education, the fields of medicine, economics, and education have achieved positive achievements in the use of AI (see Picture 1).

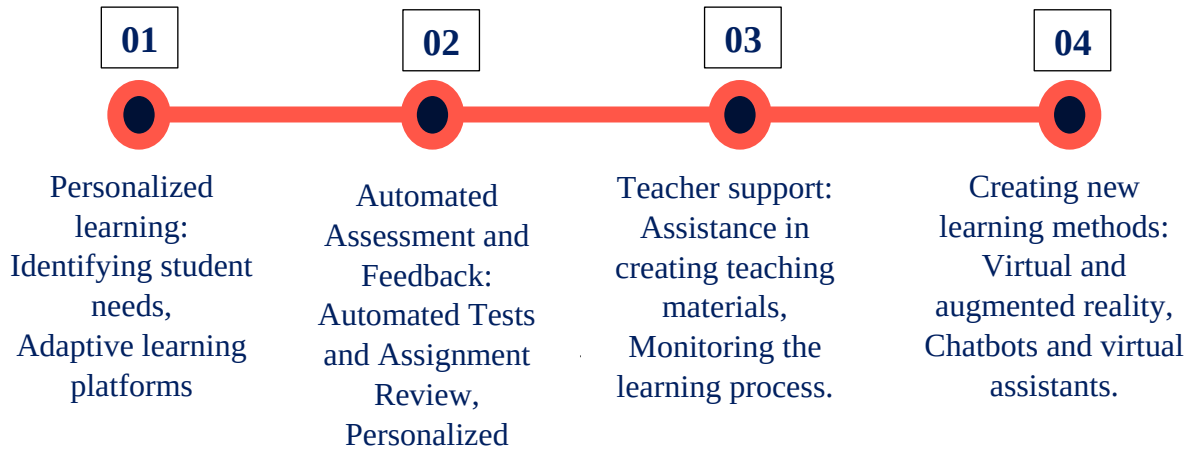
Artificial intelligence (AI) is a field of science and technology aimed at creating machines capable of imitating human intelligence.

Examples of artificial intelligence technologies that are widely used today include smart web search engines (YouTubeSearch), recommendation systems (YouTube, Amazon and Netflix), natural language understanding (Google Assistant, Siri and Alexa), self-driving cars (Waymo), etc.



Picture 1 (Possibilities resulting from the use of artificial intelligence)

In modern education, artificial intelligence tools, in particular learning and teaching through an intelligent system, create great opportunities for improving educational efficiency when assessing students' knowledge and skills in the subject "Artificial Intelligence and Neural Network Technologies" (see Picture 2).



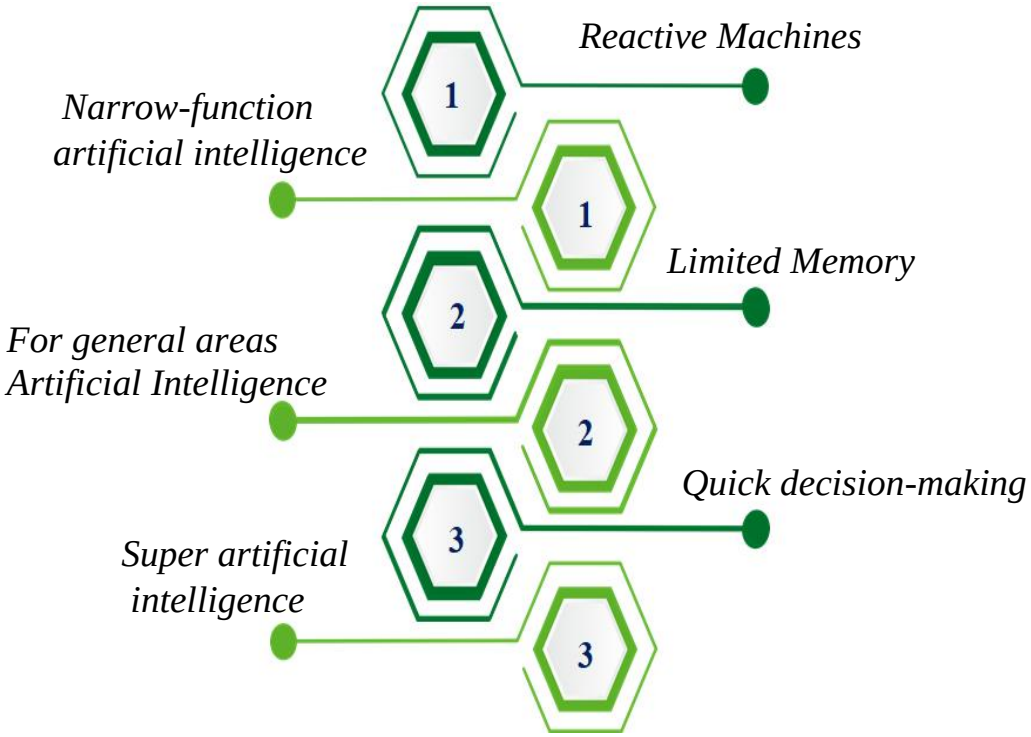
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Picture.2 (Artificial intelligence's potential to improve educational efficiency)

Research Methods

Artificial intelligence has great potential to improve educational effectiveness, but it cannot replace teachers, but rather provides them with support and additional tools. The most effective results can be achieved by combining artificial intelligence with the experience and professionalism of teachers (see Picture 3).

The possibilities of artificial intelligence in every field



Picture.3 (Function-based types of artificial intelligence)

Students' competencies in using artificial intelligence:

1. Knowledge of the concept and technologies of artificial intelligence: AI fundamentals, algorithms, technologies, fundamentals of data science.

2. Skills in using artificial intelligence tools: using AI tools, programming fundamentals, data analysis, working with APIs.

3. Ethical and social responsibility: ethics of artificial intelligence, protection against attacks, vulnerability detection, copyright and intellectual property.

4. Problem solving and creative thinking: identifying and formulating problems, designing solutions, interpreting and evaluating results, creativity and innovative approaches.[15]

The above competencies may vary slightly across educational levels and disciplines. For example, while programming skills are very important for computer science students, the skills to use SI tools and interpret results are more important for students in other fields.

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Results

Today, the process of teaching the subject "Artificial Intelligence and Neural Network Technologies" is developing not only based on traditional methods, but also on the capabilities of new pedagogical technologies and intellectual systems. This implies a radical renewal of approaches to the educational process, the advantages of individual and flexible teaching. With the help of artificial intelligence technologies, educational subjects will reshape their participation in the educational process, control their learning activities and have the opportunity to develop independently.[10.11.12.13]

Especially in the process of studying the subject "Artificial Intelligence and Neural Network Technologies", the use of a wide range of intellectual system tools plays a major role in deepening students' knowledge and skills, motivating them, and assessing their achievements.

1-table

Criteria for assessing students' skills in using artificial intelligence

Assessment areas	Criteria	Skills in using artificial intelligence

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I.Theoretical knowledge	SI Concepts	Understand and be able to explain the basic concepts of AI (machine learning, deep learning, neural networks, algorithms, etc.)
	Types of SI	Distinguish between different types of SI (e.g., narrow-purpose SI, general-purpose SI) and understand their applications
	Advantages and disadvantages of SI	Be able to identify the advantages and disadvantages of SI technologies, including ethical issues
	Application of SI in various fields	Be able to explain the application of SI in various fields (e.g., medicine, education, business) with examples
	Data analysis	Understand and apply methods for collecting, cleaning, and analyzing data.
	Knowledge of SI tools and platforms	Knowledge of various SI-related tools and platforms (e.g. TensorFlow, PyTorch, Google Colab)
II. Practical skills	Problem definition and formulation	The ability to identify a problem that can be solved using SI and formulate it clearly.
	Data set preparation	Ability to prepare and clean the necessary data sets for the SI model.
	Choosing and using the SI model	The ability to select an SI model that is appropriate for the problem and apply it in practice.
	Model training and evaluation	Ability to train an SI model and evaluate its effectiveness
	Interpretation of results	Ability to analyze and interpret model results
	Coding skills	Ability to create and manipulate SI models using programming languages, if necessary
	Troubleshooting	Ability to troubleshoot and resolve problems that arise in SI models
	Taking ethical considerations into account	Ability to consider ethical issues in SI projects and work responsibly

III. Evaluation methods	Theoretical tests	Tests to assess students' knowledge of SI concepts
	Practical tasks	Practical tasks to assess students' ability to use SI tools and solve problems
	Projects	Projects to assess students' ability to independently implement SI projects
	Presentations	Assessing students' ability to present their work and results
	Cooperation	Assessing teamwork and collaboration skills

Didactic principles are one of the main criteria determining the effectiveness of any technology used in education. When implementing an intellectual system in the process of teaching the subject "Artificial Intelligence and Neural Network Technologies", it is important to take these principles into account (see Table 1). [15]

- the principle of scientificity and consistency;
- the principle of conscious and active mastery;
- the principle of visuality;
- the principle of individualization and differential approach;
- the principle of control and evaluation.

These criteria can be adapted to the level of students and the content of the course. A scoring system (for example, 1-5 points or A-F points) can be implemented for each criterion. Most importantly, the assessment methods should be objective and fair.

Each of these AI programs is used at a specific level and is designed to perform tasks based on a defined goal. Below we explain the content of the activities of these programs (see Table 1).

A modern teacher of the subject "Artificial Intelligence and Neural Network Technologies" is now required not only to be a specialist with computer knowledge, but also to be an innovative, flexible and creative leader who can use digital

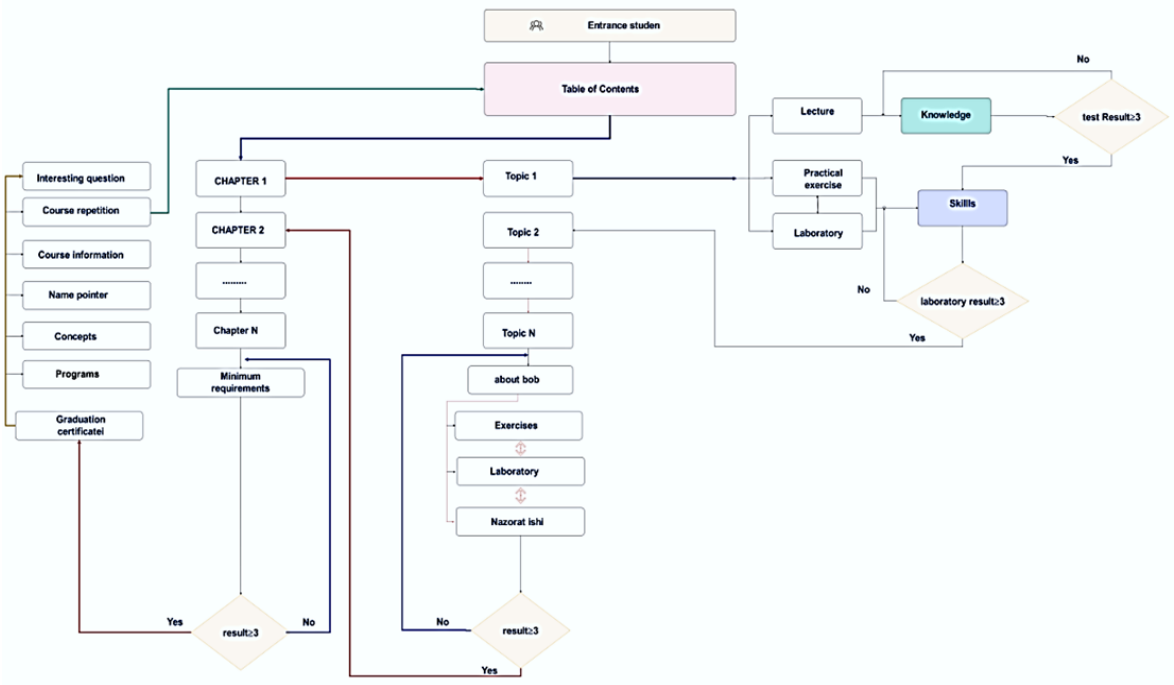
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technologies for pedagogical purposes. Therefore, preparing future specialists in "Artificial Intelligence and Neural Network Technologies" in higher pedagogical educational institutions to work with intellectual systems is one of the important directions of today's educational strategy.

Based on this need, an intellectual system for assessing students' knowledge and skills in the subject "Artificial Intelligence and Neural Network Technologies" was developed. This intellectual system was developed to assess students' knowledge and skills in the subject "Artificial Intelligence and Neural Network Technologies", and is aimed at forming knowledge and skills in the effective, critical and targeted use of artificial intelligence technologies. This developed program offers solutions to the following urgent issues:

- Increasing the objectivity and transparency of assessment;
- Reducing the teacher's workload and ensuring an individual approach;
- Controlling the excessive use of tools by students in the era of generative AI;
- Accelerating digital transformation in higher education in Uzbekistan.

Picture.5 Block Diagram of the Intelligent System for Assessing Students' Knowledge and Skills



The developed intelligent system based on artificial neural networks enables the automatic assessment of students' knowledge and skills in the educational process, as well as the analysis of their learning activities using a personalized approach. The study presents the following scientific innovations and practical outcomes:

Scientific Novelty:

A new methodological approach for applying artificial neural networks in the process of assessing students' knowledge and skills has been developed.

An automatic assessment and recommendation mechanism was created within the intelligent system, taking into account the individual characteristics of the learning process.

A model for knowledge analysis, error detection, and self-correction based on artificial intelligence algorithms was proposed.

Practical Outcomes:

The research provides practical solutions for implementing artificial intelligence technologies in education.

The project results contribute to improving the quality of education, ensuring fairness and accuracy in knowledge assessment, and promoting the development of modern digital learning platforms.

During the research, when conducting the experiment, we conducted a mathematical and statistical analysis in the following order:

1. The average mastery for each group was determined using the arithmetic mean method, and their relative and average coefficients of difference were compared.

2. In order to more deeply compare the mastery results, the variability indicators were calculated in the experimental test groups and conclusions were drawn about the averages of the main sets corresponding to each

group.

3. By drawing polygons of the sampling distributions of each group, the hypothesis of the equality of the mean values of the main sets was tested based on the student's two selection criteria.

4. The relevant conclusions were drawn from the results of the mathematical and statistical method carried out in the above order.

The experimental test was conducted with students of the Applied Mathematics Department of "Namangan State University". We checked the results of the experimental test using statistical methods. The experimental test group (n1=25) and control groups (n2=25) The variation series for students are presented in the following tables.

2- tables**.**

Number of students participating in the experiment

Name of educational institution	Experimental group	Control group
Namangan State University	25	25

Experimental testing was carried out using an intellectual system for assessing students' knowledge and skills in the field of artificial intelligence and neural network technologies. In order to statistically analyze the experimental and testing work, quantitative data on mastery indicators in the experimental and control groups were obtained. In order to determine whether such data corresponded to the theoretically expected data, we conducted a preliminary statistical analysis and calculated the mean values and their errors. The student criterion (criteria) was used to test the hypotheses.

The experimental test results were conducted on a three-level evaluation system and were associated with rating points: 3 - "average"; 4 - "good"; 5 - "excellent".

3-table.

Experimental test results analysis

Groups	Number of students	Evaluation criteria		
		“5”	“4”	“3”
Experimental group	25	10	12	3
Control group	25	7	6	12

We calculate the average learning rate based on these results: Average value in the experimental and control groups:

$$X_T = \frac{1}{25}[10 * 5 + 12 * 4 + 3 * 3] = \frac{1}{25}(50 + 56 + 9) = \frac{105}{25} \approx 4{,}2$$

$$X_N = \frac{1}{25}[7 * 5 + 6 * 4 + 12 * 3] = \frac{1}{25}(35 + 24 + 36) = \frac{95}{25} \approx 3.8$$

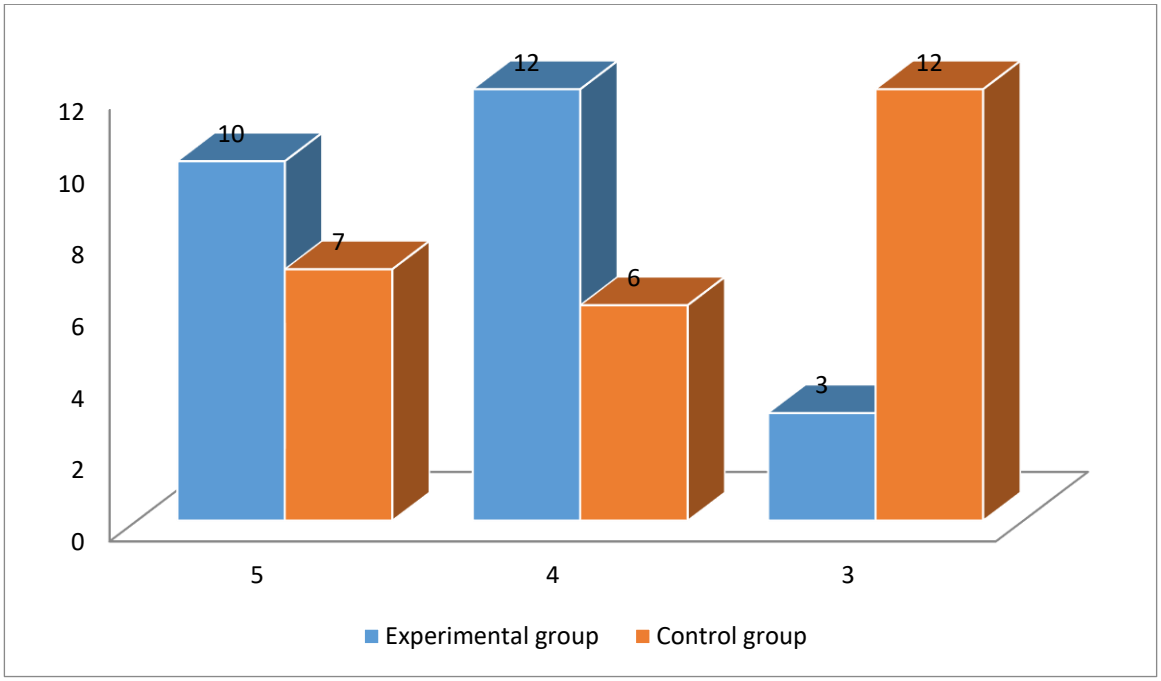
Efficiency coefficient

$$\eta = \frac{4.2}{3.8} \approx 1{,}10$$

So, according to the results of the current control, the efficiency in the experimental group is

1.10 times higher.

It was observed that the knowledge and skills of the students of the Experimental Group were significantly higher by training them on the basis of an intellectual system.



4-Picture. (Diagram of the results of the experimental and outcome groups)

As can be seen from the above, the use of new intellectual system programs created for the educational process and active learning methods in the educational process leads to the following efficiency gains:

It was found that the level of mastery of the "excellent" grade in the experimental group was 12% higher than in the control group. In addition, the number of students who received a low grade ("3") in the experimental group is much lower. Therefore, these statistical data allow us to conclude that the teaching methodology based on the intellectual system developed by us and tested in practice and active teaching methods are more effective than the current traditional teaching methodology. This indicates that the work carried out in the experimental test groups on the methodology of teaching the subject "Artificial intelligence and neural network technologies" using the intellectual system is effective.

CONCLUSION

Intelligent systems are now entering all areas of our lives and they have many advantages:

- ✓ Deep study and good mastery of the subject.

- ✓ Develop students' knowledge and skills.
- ✓ To develop independent thinking skills.
- ✓ Individualization and improvement of the effectiveness of the educational process.

In short, as a result of these advantages, students gain in-depth theoretical knowledge, master practical skills, and develop independent thinking and self-management skills. This greatly contributes to the growth of their knowledge and skills and the provision of quality education.

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