INTELLEKTUAL SIMULYATSIYA TIZIMLARI ORQALI TALABALARNING SARALASH ALGORITMLARI BO'YICHA KOMPETENSIYALARINI RIVOJLANTIRISH METODOLOGIYASI

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Annotatsiya: Tadqiqot natijalari taqdim etilgan bo'lib, u sorting algoritmlari bilan bog'liq kompetensiyalarni shakllantirish metodikasini ishlab chiqish va uning samaradorligini baholashga qaratilgan. Tadqiqot davomida talabalarning algoritmik bilim va ko'nikmalarini rivojlantirish uchun intellektual simulyatsion tizimdan foydalangan holda interaktiv va moslashuvchan o'quv muhiti yaratildi. O'quv natijalariga ko'ra, simulyatsion tizim orqali o'qitish an'anaviy usulga nisbatan samaraliroq ekanligi namoyon bo'ldi.

Kalit so'zlar: Intellektual simulyatsiya, sorting algoritmlari, kompetensiya, ta'lim texnologiyalari, moslashuvchan ta'lim, algoritm, individual.

МЕТОДОЛОГИЯ РАЗВИТИЯ КОМПЕТЕНЦИЙ СТУДЕНТОВ В АЛГОРИТМАХ СОРТИРОВКИ С ПОМОЩЬЮ СИСТЕМ ИНТЕЛЛЕКТУАЛЬНОГО МОДЕЛИРОВАНИЯ

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Аннотация: Представлены результаты исследования, направленного на разработку методики формирования компетенций, связанных с алгоритмами сортировки у студентов с использованием интеллектуальных симуляционных систем, а также на оценку её эффективности. В ходе исследования была создана интерактивная и адаптивная обучающая среда с применением интеллектуальной симуляционной системы для развития

алгоритмических знаний и навыков студентов. Согласно результатам обучения, было продемонстрировано, что обучение с использованием симуляционной системы более эффективно по сравнению с традиционным методом.

Ключевые слова: Интеллектуальная симуляция, алгоритмы сортировки, компетенция, образовательные технологии, адаптивное обучение, алгоритм, индивидуальный.

METHODOLOGY FOR DEVELOPING STUDENT COMPETENCIES IN SORTING ALGORITHMS THROUGH INTELLECTUAL SIMULATION SYSTEMS

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Abstract: The results of research aimed at developing a methodology for forming competencies related to sorting algorithms in students using intelligent simulation systems and evaluating its effectiveness are presented. The study created an interactive and adaptive learning environment using an intelligent simulation system to develop students' algorithmic knowledge and skills. According to the learning outcomes, it was demonstrated that teaching through the simulation system is more effective compared to the traditional method.

Keywords: Intellectual simulation, sorting algorithms, competence, educational technologies, adaptive learning, algorithm, individual.

INTRODUCTION

Effective teaching of programming and algorithms in the field of information technology is a pressing issue. Sorting algorithms are one of the fundamental topics in programming and play a crucial role in developing students' algorithmic thinking and problem-solving skills. Intelligent simulation systems are widely used as an effective tool to make the educational process interactive and

visual. This approach examines a teaching methodology that utilizes simulation systems to deepen students' knowledge of sorting algorithms and develop their algorithmic competencies.

Information is available on the effectiveness of computer-based learning in secondary and higher education. The process of learning the algorithm in an interactive way using a computer includes research on enhancing student learning. [6]

Detailed information is provided on how interactive learning affects students' learning processes, and methods for enhancing students' learning motivation are described [1].

METHOD

This study involved 100 students in the educational process and divided them into two groups. The first group studied sorting algorithms based on traditional teaching methods, while the second group studied sorting algorithms using an intelligent simulation system.

The construction of the simulation system.

- Visualization: Each sorting algorithm is visualized step-by-step. This helps students better understand the mechanism of the algorithm's operation.

- Interactive exercises: Students were able to control each algorithm, review its steps, observe the results, and apply them in practice.

- Adaptability: The simulation system has the ability to provide tasks that are adapted to the student's level of knowledge, which serves to individualize the learning process.

This study aims to compare adaptive learning strategies using algorithms. This topic includes an analysis of the impact of adaptive learning on student learning [5].

RESULTS

During the experiments, students underwent preliminary and final tests. The results showed that a high level of knowledge and skills was formed for the group

trained on the basis of simulation. Based on the preliminary test results, the knowledge level of the two groups was similar, while the final test results showed that the results of the simulation group were 20% higher than those of the group trained using the traditional method.

Traditional learning:

    • Comparison between initial and final scores: ttt-statistic value: -27.17, ppp-value: 5.99e-10. This indicates that $p < 0.05$, indicating that the final scores are significantly different from the initial ones.

Simulation-based learning:

    • Comparison between initial and final scores: ttt-statistic value: -58.14, ppp-value: 6.64e-13. This also confirms that $p < 0.05$, meaning that students trained using simulation showed significant improvement in the final test.

Comparison of final scores (traditional and simulation):

    Comparison result: ttt-statistic value: -21.79, ppp-value: 2.19e-14. This also indicates that $p < 0.05$, confirming that simulation-based learning is significantly more effective than the traditional method.

Table 1.1

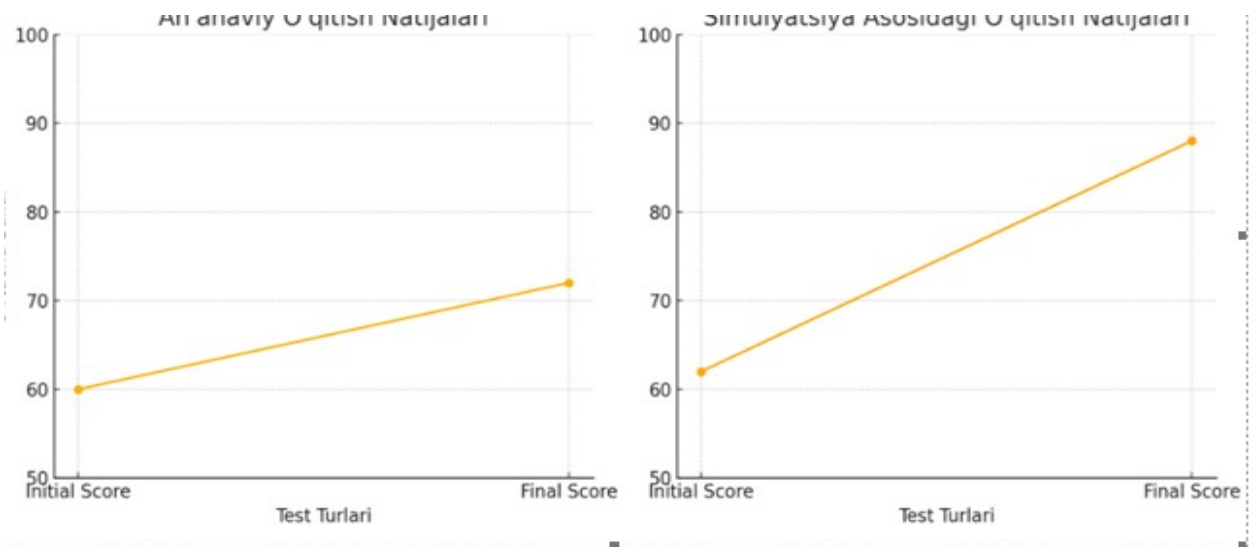| Compare	T-statistics	P-value	Significance
Traditional learning: Preliminary and final scores	**27.17**	**5.99e-10**	**Significant**
Simulation training: Preliminary and final scores	**58.14**	**6.64e-13**	**Significant**
Comparison of final scores (Traditional vs. Simulation)	**21.79**	**2.19e-14**	**Significant**

Figure 1.1. Diagram of the obtained result.

The diagrams above show the results of traditional learning and simulation-based learning.

- In traditional learning, there was a slight improvement between the initial and final test results, the final score averaged 72.

- Simulation-based learning showed significant improvement, with an initial score of 62 on average and an average of 88 on the final test.

This research includes the scientific foundations of teaching algorithmic knowledge through adaptive technologies. The effectiveness of flexible learning systems for students has been analyzed [2].

CONCLUSION

Research results show that learning using intelligent simulation systems is more effective than traditional learning methods in the study of sorting algorithms. Using the simulation system, students gained a deeper understanding of algorithms and consolidated their knowledge in practice. This methodology helps to optimize the learning process and increase students' motivation by taking into account their individual abilities.

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