

SYSTEMATIZED PEDAGOGICAL STRATEGIES FOR DEVELOPING COMPREHENSIVE DATABASE COMPETENCIES IN STUDENTS

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Abstract: This article investigates systematic methodologies designed to enhance student proficiency in database management systems. The research is underpinned by a comprehensive literature review of existing academic works within the field. Consequently, the 'Database Systems' curriculum was designated as the primary research focal point. The study was executed within an instructional framework, supported by empirical data gathered via structured surveys conducted by the Department of Information Technology faculty. Employing an integrative analytical approach, the research utilized systematic criteria and data visualization techniques to ensure the rigor and clarity of the findings. The results suggest that such systematic interventions significantly bolster the academic performance of engineering students in data-centric disciplines.

Keywords: databases, data analysis, information systems, pedagogical approaches, educational platform.

Introduction

Today, the rapid development of digital technologies is significantly increasing the importance of databases in the processes of data collection, storage, processing, and transmission. The effective functioning of modern information systems, e-learning platforms, management systems, and analytical systems directly depends on the well-developed knowledge and skills related to database technologies. Therefore, the development of students' competencies in databases in higher education institutions is emerging as one of the urgent pedagogical issues.

Practice shows that database-related knowledge is often taught in a fragmented manner, that is, within separate topics, while the logical interconnection between these topics is not sufficiently ensured. As a result, the stability of students' knowledge and the effectiveness of its practical application tend to decrease. This situation necessitates the introduction of modern pedagogical approaches aimed at forming knowledge as an integrated system alongside traditional approaches in the educational process.

Literature Review And Methodology

It is well known that specific methods and technologies are applied in teaching each academic discipline. In particular, the use of modern technologies in teaching information technology-related subjects is considered highly appropriate [1]. The organization of students' independent learning activities in different subjects continues to remain a significant issue. In reconsidering solutions to this problem, recommendations are being developed from a scientific and pedagogical perspective [2]. Moreover, in school education, integrated STEAM methods should be implemented not only with a subject-oriented approach but also in a topic-oriented manner [3]. Numerous scientific studies are being

conducted on teaching general professional subjects at technical universities. In addition, electronic learning, blended learning, artificial intelligence, and mobile technologies are being widely introduced into the teaching process through modern educational technologies [4]. Educational objectives in engineering education at Tashkent State Technical University have been achieved through the integration of heutagogy and Industry 4.0 technologies [5]. Context-based teaching methods are also developing in order to ensure that students effectively apply the knowledge acquired in their subjects and achieve better practical outcomes [6].

At a time when data flows are rapidly increasing, the application of modern information technologies has made data processing more efficient and manageable. In all technical universities, training competitive specialists capable of simplifying data processing has become an urgent issue. To address this need, the Database course has been included in the bachelor's degree curricula of information technology programs [7]. Currently, the credit-module system has been implemented in all higher education institutions of the Republic of Uzbekistan. In addition, the HEMIS educational platform has been recommended by the government as a unified system. Various factors are being studied in order to teach database subjects in accordance with modern requirements, while innovative approaches are continuously being improved and implemented [8]. Furthermore, there are views suggesting that, in order to encourage students' acquired knowledge, traditional testing systems should be minimized and greater emphasis should be placed on listening to and evaluating students' actual understanding [9].

Under current conditions, universities should be oriented not only toward solving problems in national markets but also toward addressing challenges in global markets. For this purpose, it is necessary to identify strategies for developing economically growing sectors, business clusters, and institutional cooperation [10]. Students participate in such real-world environments and partially support their own budgets by solving practical problems. After graduating from higher education institutions, they become capable of performing more complex professional tasks and adapting to teamwork and collaborative activities.

The application of artificial intelligence technologies in data analysis and problem solving is becoming a traditional and increasingly important direction [11]. In particular, processes aimed at integrating artificial intelligence technologies into higher education curricula are being actively organized. The main objective of this integration is to optimize students' knowledge acquisition and transform large-scale data flows into meaningful and high-quality information. For example, ensuring that numerous published resources correspond to readers' perspectives and needs is considered a highly challenging task. The application of such modern technologies in educational programs facilitates the process of solving major educational problems, even through the use of virtual environments.

Results And Discussion

Based on the above-mentioned scientific studies, it can be observed that different approaches exist for teaching various academic disciplines. In order to conduct research in the field of Data Science, the Database course is taught within technical education programs. Various modern approaches are applied in teaching this subject, including pedagogical methods, teaching technologies, and other innovative practices.

The Database course is mainly planned to be taught in the second year of study. Therefore, the scope and sequence of related subjects are of great importance. In other words, students are required to acquire the necessary competencies before studying the course. This,

in turn, leads to the implementation of an integrative approach. The application of the integrative approach within the discipline is considered essential for every learner attempting to engage in data analysis processes.

In order to promote the use of the integrative approach, a survey was conducted among the professors and instructors of the Department of Information Technologies at University of Information Technology and Management. This survey was organized because the Database course is taught across all educational programs related to information technologies.

Table 1. Integrative Approach in Teaching the Database Course

<i>No</i>	<i>Course Titles</i>
1	Programming
2	Information Systems
3	Artificial Intelligence and Data Analysis
4	E-learning Platforms

The preliminary form of the survey is presented in Table 2, and the significance levels of subject integration were evaluated using a scale from 1 to 5.

Table 2. Application of the Integrative Approach in Teaching the Database Course

Course Title	1	2	3	4	5
Programming					
Information Systems					
Artificial Intelligence and Data Analysis					
E-learning Platforms					

A total of 15 professors and instructors participated in the survey developed based on Table 2. The results of the survey are presented in Table 3.

Table 3. Survey Results on the Use of the Integrative Approach

Course Title	1	2	3	4	5
Programming					15
Information Systems			1	3	11
Artificial Intelligence and Data Analysis		7	3	4	1
E-learning Platforms			3	2	10

According to the survey results, the application of the integrative approach in teaching the Database course produced generally positive outcomes. The highest and lowest indicators were recorded in the subjects “Programming” and “Artificial Intelligence and Data Analysis,” respectively. It can be understood that the Database course is inherently connected with programming disciplines and plays an essential role in solving object-oriented problems.

The negative opinions related to the subjects “Artificial Intelligence and Data Analysis” were mainly explained by the fact that students often complete assignments using various artificial intelligence technologies. This situation has become one of the major factors contributing to the decline in students’ actual knowledge levels and independent learning skills. In order to provide a clearer understanding of the results presented in Table 3, Figure 1 was introduced.

Diagram of the Structural Indicators of the Integrative Approach

In the application of the integrative approach, educational and regulatory documents serve as a basis for professors and instructors to develop strategic actions aimed at increasing the coherence and interconnection of course topics.

Conclusion

Thus, professors and instructors teaching the Database course can increase students' interest and achieve the expected educational outcomes through the application of integrative approaches. This is particularly important for students who are beginning to engage in data analysis, as effective mastery of the Database course is closely connected with understanding subject knowledge through practical and real-life perspectives, as well as transforming conceptual ideas into realistic outcomes.

The study of the Database course requires the acquisition of knowledge from the above-mentioned related disciplines, which plays a significant role in enabling students to analyze and solve problem-based tasks effectively.

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