BG Pulse Journal USA
ISSN:1947-2536 http://www.bgpulseusa.com/index.php/bg
BG PULSE JOURNAL

DEVELOPING DATABASE KNOWLEDGE THROUGH LMS PLATFORMS

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https://doi.org/10.5281/zenodo.20208733

ABSTRACT

This study analyzes the role of distance and blended learning formats in teaching the "Database" discipline within the higher education system. The functional capabilities of Learning Management System (LMS) platforms in developing student competencies are examined, including the impact of interactive SQL trainers, automated assessment systems, and multimedia resources. Furthermore, the process of testing SQL-related code – which forms the foundation of the database discipline – through the W3Schools.com web platform is described.

Keywords: LMS platforms, database management systems (DBMS), SQL teaching methodology, distance learning, virtual laboratories, blended learning, Moodle, interactive learning, digital competency, automated assessment.

Introduction

In the context of the modern digital economy, data is the new oil. Yet just as extracting oil requires specialized equipment, working with data demands specific knowledge and skills. At the heart of this knowledge lies database technology.

Nevertheless, teaching this subject continues to rely predominantly on traditional methods: textbooks, lectures, laboratory sessions, and so forth. Students read theory but frequently fail to understand where and how to apply it in practice. Knowledge exists, yet it remains "untested" – disconnected from practical application and difficult to transfer to real-world contexts.

It is precisely this gap that Learning Management System (LMS) platforms are attracting attention as a new opportunity to bridge. Systems such as Moodle, Canvas, and Google Classroom serve not merely as repositories for learning materials, but as powerful pedagogical environments that enable instructors to monitor student progress, assign interactive tasks, and support individualized development pathways.

A review of international experience reveals that leading universities have already migrated their database courses to LMS platforms, achieving measurable improvements in educational outcomes. Interactive SQL assignments, automated grading systems, and project-based learning are all being implemented through LMS infrastructure. In Uzbekistan, however, this field remains in its early stages of development, with numerous opportunities yet to be explored.

Databases – considered the cornerstone of modern information technologies – represent collections of logically interrelated information pertaining to a specific domain. These systems are widely employed today across critical sectors including banking, education, healthcare, and commerce. The stable and efficient operation of a database is directly facilitated by a Database Management System (DBMS), a software suite that enables users to create, store, modify, and manage data. Systems organized on the basis of the relational model are particularly dominant in this regard.

A study by Nigora K., Zulfiya Kh., and Sulaymon H. provides a systematic analysis of the significance of an integrative approach in teaching specialized disciplines and its role in enhancing educational effectiveness. The authors view integration as a means of strengthening interdisciplinary connections and ensuring the unity of theory and practice. Unlike traditional teaching methods, this approach addresses the problem of "knowledge fragmentation" among students, fostering holistic systemic thinking, independent reasoning, and professional competencies. The article identifies the key factors for successful implementation of this model as the mutual alignment of curricula, strengthening of pedagogical collaboration, and the effective use of digital technologies such as virtual laboratories and multimedia tools.

In today's information-driven society, the ability to work with databases has become an essential requirement not only for programmers but for all IT professionals. However, the "Database Management Systems" (DBMS) course proves difficult for students to master due to its highly abstract conceptual content.

Traditional teaching methods frequently result in a disconnect between theory and practice. LMS platforms – including Moodle, Canvas, Blackboard, and HEMIS – address this challenge by providing a unified learning environment. The relevance of this research is determined by the need to enhance students' independent learning activity and optimize instructor workload in the context of educational digitalization. The HEMIS educational platform deserves particular mention in this regard.

Methods

This study employed systematic analysis and empirical observation methods. The experimental work was carried out in two stages with the participation of 60 second-year undergraduate students majoring in Software Engineering:

LMS Content Development: The platform was populated not only with PDF materials but also with SCORM packages;

Blended Learning Model: The Flipped Classroom methodology was applied. Students independently studied theoretical content through the LMS and attended classes solely for the purpose of solving problem-based case studies;

Virtual Laboratory Implementation: Resources utilized through LMS platforms were tested and validated via the W3Schools.com web platform;

Monitoring: Student activity on the platform (log analysis), task completion speed, and the number of submission attempts were subjected to statistical analysis using Microsoft Excel.

Results

The HEMIS learning management system was adopted as the LMS platform. **Figure 1** illustrates the collection of resources compiled for the "Database" discipline. The primary modules consist of folders dedicated to practical sessions, lecture sessions, and relevant instructional videos. Within each folder, content encompassing the curricula and syllabi of the database discipline has been organized accordingly.

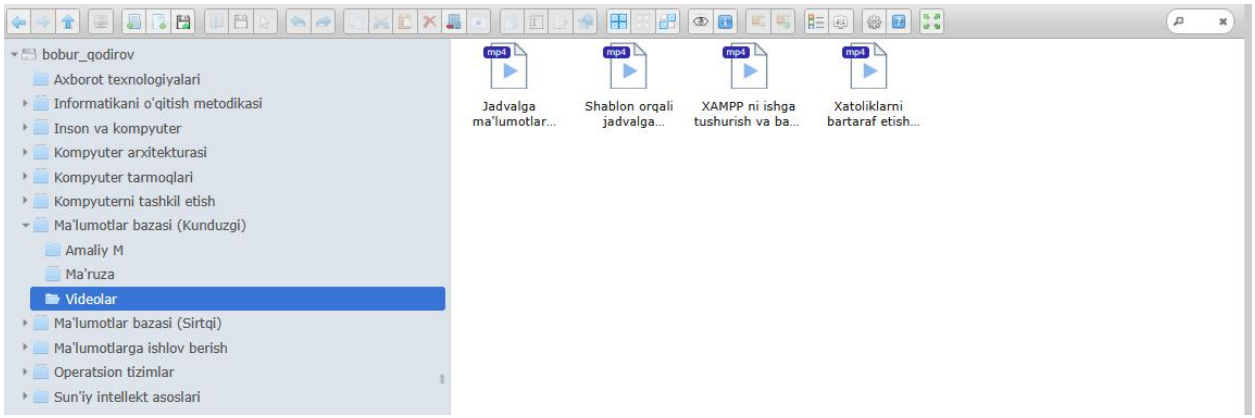


Figure 1. Collection of Resources for the "Database" Discipline

Figure 2. Working interface of the W3Schools.com web platform for testing SQL queries in a real environment

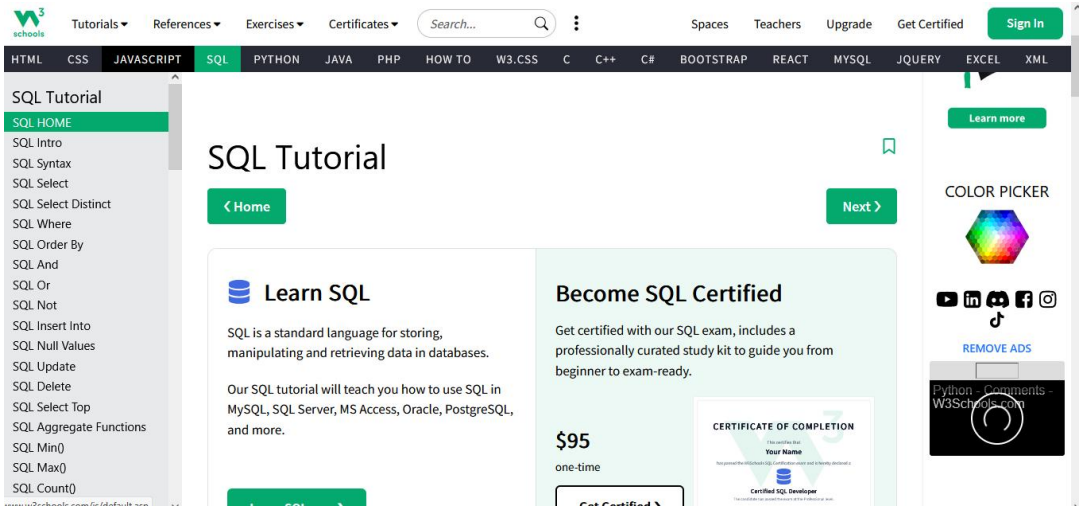


Figure 2. Virtual Laboratory for Conducting Database Practical Sessions

The following positive dynamics were observed as a result of the experiment:

Academic Achievement Coefficient

In the group utilizing the LMS platform (Experimental Group), the quality of final project work on "Database Design" improved by 24%. Notably, performance indicators related to SQL query optimization were significantly higher compared to the traditional instruction group.

Table 1. Statistical Indicators Table

Learning Activity Type	Traditional Method (Score)	LMS (Score)	Growth (%)
Drawing ER-diagrams	62	84	+22%
Complex SQL (Subqueries, Joins)	45	78	+33%
Normalization (1NF–BCNF)	55	72	+17%
Independent learning activity	30%	85%	+55%

Based on Table 1, it is evident that the resources uploaded to the HEMIS educational platform prove beneficial for studying complex topics in database management.

Psychological Aspect

Survey results indicated that 82% of students reported a sense of confidence in making mistakes without fear, as the automated verification system on the W3Schools.com web platform afforded them unlimited attempts. Figure 3 presents the code editor interface designed for initial SQL code testing.

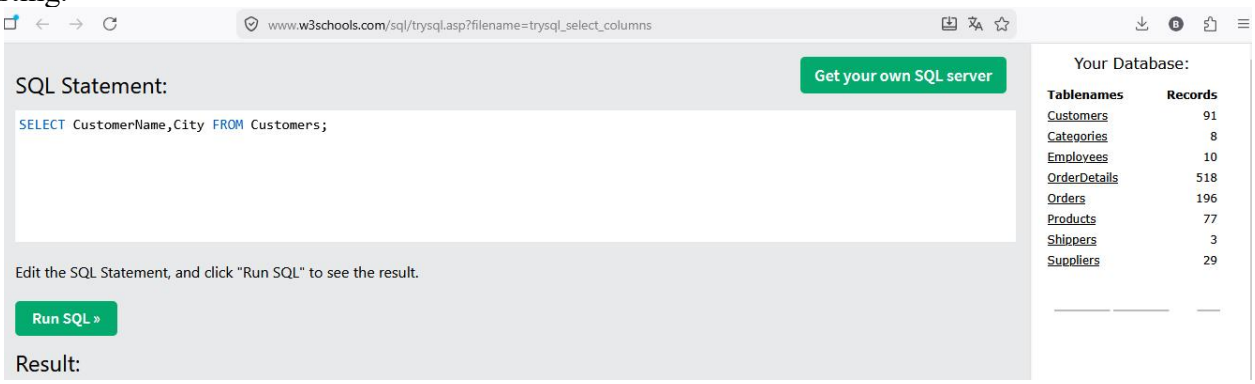


Figure 3. SQL Code Testing Environment

Discussion

The findings of this study confirm that elements of gamification and instant feedback play a decisive role in teaching through an integrated approach combining LMS platforms and virtual laboratories that support practical session delivery.

Role of the Instructor: The instructor's role evolved from that of an information transmitter to that of a mentor and guide;

Virtual Laboratories: Configuring and setting up servers for database operations is a time-consuming process. Cloud-based laboratories embedded within the LMS effectively eliminated this challenge.

Limitations and Constraints: In the course of the study, it became apparent that certain students may exhibit an increased tendency toward academic dishonesty (plagiarism). To mitigate this risk, it is necessary to implement question randomization and integrate anti-plagiarism systems within the LMS.

Conclusion

LMS platforms represent not merely an auxiliary tool in teaching the "Database" discipline, but a strategic resource that guarantees educational quality. They enable students to chart individualized learning trajectories. Looking ahead, it would be advisable to integrate Machine Learning algorithms into these systems in order to develop adaptive learning models in which the level of difficulty adjusts dynamically in accordance with each student's degree of mastery.

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