International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 02 | Feb - 2026 SJIF Rating: 8.659 ISSN: 2582-3930

# "Student Performance Prediction System"

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## ABSTRACT

Academic performance evaluation plays a crucial role in shaping students' future learning outcomes. Traditional assessment methods often rely on periodic examinations, which may fail to identify learning difficulties early on. This delay can result in academic failure, reduced confidence, and ineffective teaching methods.

This paper presents a Student Performance Prediction System designed to analyze student data and predict academic performance at an early stage. The proposed system consists of multiple interactive modules, including user authentication, student personal information management, educational data collection, subject-wise question and answer analysis, and performance prediction visualization.

By applying data-driven analysis techniques, the system predicts student performance in both graphical and descriptive formats. It highlights weak areas where students require additional support and helps teachers identify learners who need additional guidance. The main objective of this system is to support students and teachers through early prediction, reduce academic failure, save evaluation time, and improve overall learning outcomes of students. The proposed model is highly useful for schools and colleges because it makes the evaluation process smarter, faster, and more accurate..

## INTRODUCTION

Education systems today generate a large amount of student-related data, including academic records, attendance, assessments and behavioral patterns. However, much of these data remain underutilized in traditional evaluation processes. Teachers often rely on final examination results to judge student performance, which limits opportunities for early intervention.

Early identification of learning gaps is essential for improving academic success. Predicting student performance in advance allows educators to design personalized teaching strategies and provide timely academic support to students. With the advancement of data analytics and machine learning techniques, it is now possible to efficiently analyze educational data and generate meaningful predictions.

The Student Performance Prediction System proposed in this study aims to provide a structured and intelligent solution for monitoring and predicting student academic performance. The system is divided into five major modules: User Login, Student Personal Information, Educational Information, Question and Answer Analysis, and Performance Prediction. Each module contributes to a comprehensive evaluation of student learning behaviors.

The system not only predicts performance but also presents the results in an understandable graphical and textual format. This helps both teachers and students to clearly understand their strengths, weaknesses, and areas for improvement. The proposed approach supports decision-making in academic planning and enhances the overall teaching and learning process.

## LITERATURE REVIEW

Several studies have explored the applications of data mining and predictive analytics in education. Early research focused on using student grades and attendance records to predict the final outcomes. These studies demonstrated that academic performance can be estimated using historical data; however, they often lack real-time adaptability.

Recent studies have emphasized the importance of continuous assessment and formative evaluation. Researchers have highlighted that subject-wise performance analysis provides better insights than overall grade prediction. However, many existing systems focus only on prediction accuracy and ignore usability and interpretability for teachers and students alike.

Some learning analytics platforms provide dashboards for performance monitoring, but they often require technical expertise and lack personalized feedback. Additionally, many systems do not integrate question-level analysis, which is critical for identifying conceptual weaknesses in the test.

The reviewed literature indicates a gap in developing an integrated system that combines personal data, educational records, subject-wise question analysis, and early performance prediction on a single platform. This study addresses these limitations by proposing a user-friendly and role-supportive system designed specifically for educational institutions.

## SYSTEM MODULES

### User Login Panel

The User Login Page provides secure authentication for students and teachers. Each user is required to log in using valid credentials to access the system. This ensures data privacy and role-based access control. Authentication helps maintain the integrity of student records and prevents unauthorized access.

### Student Information Panel

The Student Information Page allows students to enter personal details, such as name, standard/class, enrollment ID, age, and contact information. These data form the basic identity profile of the student and are stored securely in the system database. Accurate personal information helps maintain structured student records.

### Educational Information Panel

This page collects academic-related details, including previous exam scores, attendance percentage, subject selection, and internal assessment marks. Educational data play a vital role in understanding students' learning backgrounds and academic consistency. The system uses this information as an input for performance analysis and prediction.

### Question And Answer Analysis Panel

The Q&A page focuses on subject-wise assessment. Students attempt questions related to their subjects, and the system evaluates their answers. Teachers can analyze performance at the question level to identify conceptual gaps in students' understanding. This module supports continuous assessment and helps students improve their understanding before the final examinations.

### Performance Prediction Page

The Performance Prediction Page presents the predicted results using graphical representations, such as bar graphs and line charts, along with descriptive feedback. The system indicates whether a student is performing well, is at risk, or

needs additional academic support. Teachers can easily identify students requiring extra guidance, and students receive clear feedback on areas of improvement.

## DESIGN CONSIDERATIONS

### Usability

The system is designed with a simple and intuitive interface so that students and teachers can use it without any technical knowledge. Clear navigation and structured forms improve the user experience and encourage regular use.

### Scalability

The system architecture supports expansion to handle a large number of students and subjects in the future. New academic parameters and prediction models can be added without affecting the system performance.

### Security

Student data security is a priority. Secure login mechanisms, encrypted data storage, and role-based access control were implemented to protect sensitive inform.

## DEVELOPMENT METHODOLOGY

### Requirements Gathering

Functional and non-functional requirements were collected by analyzing the academic evaluation challenges faced by teachers and students. Early prediction, ease of use, and accurate analyses were identified as key requirements.

### Technology Stack Selection

The system follows a web-based architecture using front-end technologies for user interaction, back-end services for data processing, and a centralized database for storage.

### Module Development and Integration

Each module was developed independently to ensure its modularity. Integration testing ensured smooth communication between the modules and an accurate data flow.

### Deployment

The system was deployed in a controlled environment and tested for performance and reliability before final implementation of the system.

## TESTING AND VALIDATION

### Unit Testing

Individual components, such as login, data entry forms, and prediction modules, were tested independently.

**Integration Testing**

Data exchange between the front-end, back-end, and database was validated to ensure consistency.

**User Acceptance Testing**

Teachers and students tested the system to evaluate its usability and the clarity of its predictions.

**Performance Testing**

System performance was evaluated under multiple user conditions to ensure stability

**FIGURE**

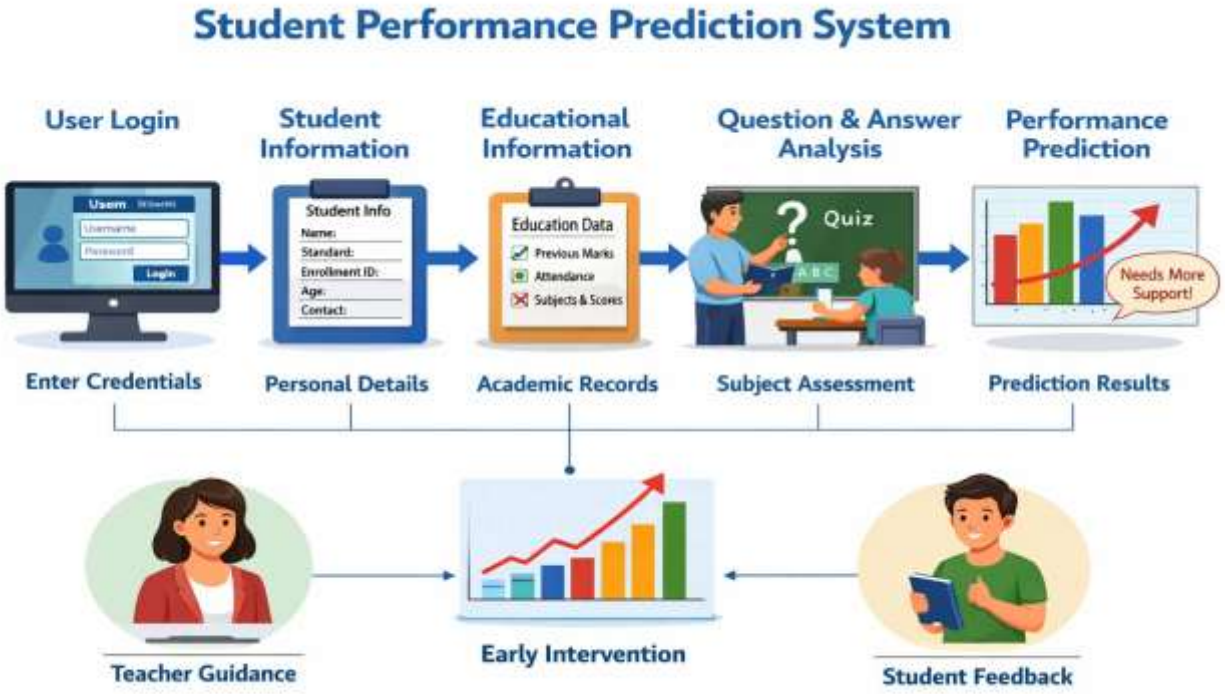


**Fig. System Architecture**

**CONCLUSION**

The Student Performance Prediction System presented in this study demonstrates the effective use of educational data analytics for early academic evaluation. By integrating students' personal information, historical academic records, attendance data, and subject-wise question analysis, the system provides a comprehensive view of students' learning behavior. Unlike traditional evaluation methods that rely heavily on final examination results, the proposed system enables continuous monitoring and early identification of learning difficulties in students.

The modular design of the system ensures structured data collection and meaningful analysis at multiple levels. The inclusion of question-and-answer analysis allows educators to detect conceptual weaknesses rather than relying solely on aggregate scores. Predictive visualization in graphical and descriptive formats further improves interpretability, making performance insights accessible to both students and teachers alike. This supports informed academic

decision-making and promotes personalized learning interventions.

Early prediction of student performance plays a vital role in reducing academic failure and improving student confidence. Teachers can proactively guide at-risk students, while students gain awareness of their strengths and areas that require improvement. The system also reduces manual evaluation efforts, thereby saving time and ensuring consistency in the assessment process.

Overall, the proposed Student Performance Prediction System offers a scalable, secure, and user-friendly solution for modern educational institutions. Its adoption can enhance teaching effectiveness, support data-driven academic planning, and contribute to improved learning outcomes for students. The system has strong potential for real-world implementation in schools and colleges seeking intelligent and efficient evaluation mechanisms

## ACKNOWLEDGEMENTS

The successful completion of this research would not have been possible without the guidance and support of several individuals and institutions. I sincerely express my gratitude to my faculty mentors for their continuous encouragement, valuable suggestions and academic insights throughout the development of this project. Their expertise played a crucial role in shaping the direction and quality of this study.

I am also thankful to my institution for providing the necessary resources, academic environment and learning opportunities that supported the completion of this work. The availability of technical facilities and institutional support significantly contributed to the smooth execution of the system design, development, and testing.

Special thanks are extended to my peers and classmates, who provided constructive feedback during the system validation and user testing phases. Their observations helped improve the system usability and clarity of performance predictions. Collaborative discussions and peer reviews enhanced the overall quality of this study.

Finally, I acknowledge all educators and researchers whose work in the field of educational data analytics has inspired this study. Their contributions laid the foundation for exploring intelligent solutions for academic performance prediction and motivated the development of this system.

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