

**ACADEMIC ASSISTANT SYSTEM: PREDICTIVE ANALYTICS TOWARDS
GUIDING COLLEGE STUDENTS CAREER-ALIGNED SPECIALIZATIONS**

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ACADEMIC ASSISTANT SYSTEM: PREDICTIVE ANALYTICS TOWARDS GUIDING COLLEGE STUDENTS CAREER-ALIGNED SPECIALIZATION

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INTRODUCTION

In higher education, numerous students face academic difficulties stemming from the absence of tailored support systems, inadequate career advice, and poor utilization of data for guiding academic interventions. These deficiencies obstruct not just academic success but also the students' capacity to make knowledgeable choices regarding their future professions. With educational institutions working to enhance inclusive and quality education, there is an increasing demand for intelligent systems that offer real-time insights and tailored support.

The research suggests creating a Smart Academic Assistant System that utilizes predictive analytics to track student performance, detect academic shortcomings, and propose tailored learning options. In addition to academic assistance, the system provides career-oriented suggestions informed by student strengths, performance trends, and aptitude patterns. By advocating for early intervention and matching academic achievement with future career aspirations, the

system seeks to establish a more adaptive, student-focused, and future-oriented educational atmosphere.

Incorporating such a system into schools is anticipated to boost student performance, lower dropout rates, and improve the quality of academic advising. Furthermore, the initiative investigates the possibilities of scalable, data-informed tools in aiding lifelong learning and career advancement for various student groups through the application of machine learning and predictive modeling.

Statement of the Problem

The lack of personalized academic support and career guidance in higher education continues to affect student performance and long-term success. Despite the availability of Learning Management Systems and institutional data, many students still face academic uncertainty, poor engagement, and misaligned career decisions. This study aims to provide a solution to the following problems:

1. How can students receive timely support when they are struggling academically?
2. How can academic data be used to guide students toward a suitable career path?
3. How can educators efficiently monitor student progress and adjust teaching strategies?
4. How can institutions reduce dropout rates by addressing learning gaps early?
5. How can students make informed educational choices based on real data?.
6. How can student performance predictions be trusted and accurate?

Theoretical Framework

The theoretical framework (shown in Figure 1) describes how the academic assistance system interacts with its end users, namely students, administrators, and educators. The system is designed to leverage predictive analytics and

recommendation engines to enhance student performance, provide career guidance, and offer timely interventions.

Input Academic Data (Grades, Attendance, Activities): The Access Module is the portal to the Academic Assistant System, controlling user authentication as well as authorization. It performs login and logout operations and enforces role-based access controls for maintaining system security. Students are granted access to enter their academic information and look up recommendations, teachers are given access rights to track classes and view analytics, and administrators are granted system-wide control privileges. This module keeps a record of all activities by users and synchronizes with the Centralized Database for access pattern analysis and security auditing.

Academic Performance Module: This is the central module that captures, processes, and presents all academic measures such as grades, attendance records, and quiz marks. It converts raw academic data into visualized progress reports that enable students to monitor their performance and teachers to see classroom trends. The module is used as the source of data for the Predictive Analytics Module, providing it with structured academic data. Its dashboard environment shows trends in past performance and current position, allowing students and teachers to make informed decisions regarding learning approaches.

Predictive Analytics Module: Building upon the processed data from the Academic Performance Module, this component analyzes trends and patterns to predict future academic outcomes. It identifies students at risk of underperformance and highlights potential areas for improvement.

Recommendation Engine: Using insights from the Predictive Analytics Module, this engine generates personalized learning recommendations. It suggests interventions, study materials, and learning resources tailored to each student's academic needs.

Career Guidance Module: This component aligns student performance with potential career paths. It provides recommendations for academic specializations and career directions, helping students make informed choices about their future based on their strengths and achievements.

Access Module: The Access Module manages user authentication and role-based access. It ensures that students, educators, and administrators have appropriate permissions and access only to the information relevant to their roles.

Reporting and Alert System: This module delivers timely alerts to educators regarding at-risk students. It also generates summary data and visual dashboards for both educators and administrators, allowing them to make informed decisions based on real-time academic data.

Centralized Database: This module serves as the core data repository of the system. It stores all academic records, prediction results, recommendations, and user data, allowing consistent and reliable access to information across the entire platform.

Monitor Student Performance (Administrator): This output represents the administrator's ability to oversee student academic progress.

Oversee System Performance (Administrator): This output indicates the administrator's function in monitoring the overall efficiency and effectiveness of the system.

Generate Institutional Reports (Administrator): This output signifies the administrator's capability to generate comprehensive reports for institutional planning and assessment.

Monitor Student Performance (Educators): This output represents the educators' ability to track individual or group student performance.

Receive Alerts (Educators): This output indicates that educators receive notifications, especially concerning at-risk students, from the reporting and alert system.

Adjust Teaching Strategies (Educators): This represents the educators' action based on the insights and alerts received from the system, allowing them to modify their teaching methods to better support students.

Career Path Suggestions (Student): This represents the output from the Career Guidance Module, providing students with recommendations for potential career paths.

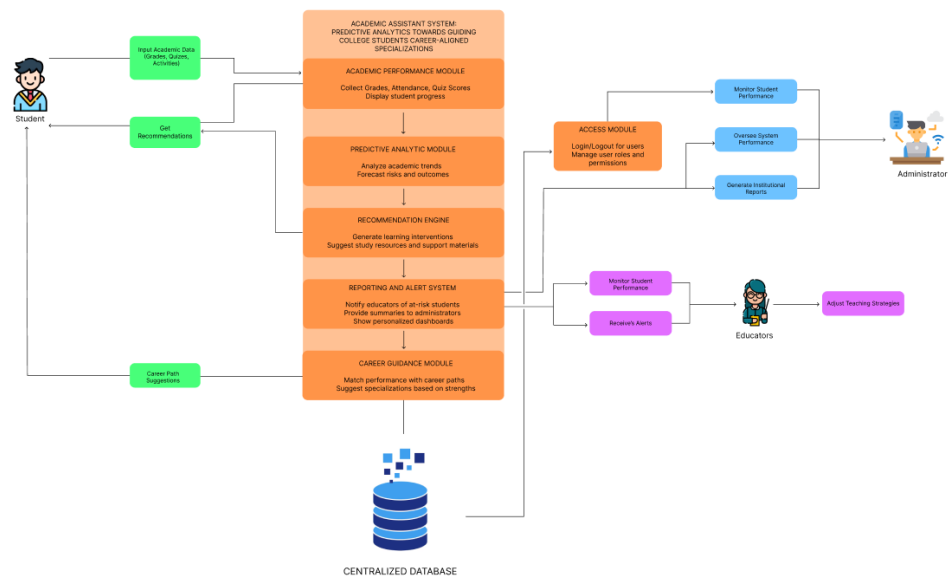


Figure 1: Academic Assistance System User Interactions

Objectives of the Study

To develop a Smart Academic Assistant System that utilizes predictive analytics to enhance student academic performance and provide personalized career guidance.

1. Develop a Smart Academic Assistant System that utilizes predictive analytics to assess student performance based on academic data such as grades, quizzes, activities, and attendance records.

2. Create a user-friendly platform for both students and educators that features academic progress tracking, performance alerts, and personalized learning path recommendations linked to career-aligned fields of study.
3. Implement machine learning models to identify at-risk students, forecast academic outcomes, and suggest subject-specific interventions for academic improvement.
4. Integrate the system with Learning Management Systems (LMS) and institutional databases for seamless real-time data retrieval, analysis, and performance reporting.
5. Evaluate the system's effectiveness based on accuracy of academic predictions, user engagement levels, and the relevance of career recommendations.
6. Analyze the impact of the Smart Academic Assistant System on reducing student failure and dropout rates, improving learning outcomes, and enhancing career decision-making in higher education institutions.
7. Utilize programming languages such as Python for machine learning and data analysis, Java or C# for backend development, and JavaScript (with frameworks like React or Angular) for the frontend user interface.

Significance of the Study

The current study is significant in addressing the growing need for personalized academic support and career guidance in higher education institutions. The development of the Smart Academic Assistant System aims to enhance student performance, promote inclusive education, and improve academic outcomes through data-driven insights and predictive analytics.

For Students: A lot of students feel lost when it comes to figuring out what they're good at or where they're headed academically. This system gives them

personalized insights, learning support, and even career suggestions based on their actual performance not just guesses. It's like having a virtual academic coach that helps them stay on track and make smarter decisions.

For Educators: Teachers have a tough time keeping up with every student, especially in big classes. This system helps by pointing out who's struggling and why, so instructors can step in early and offer help where it's needed most. Plus, it gives a clearer view of how the whole class is doing, helping them tweak their teaching strategies.

For Academic Institutions: Colleges and universities want students to succeed, but they don't always have the tools to catch issues early. This system helps improve retention rates, academic outcomes, and student satisfaction all while using data they already have. It also gives schools a more modern, tech-driven way to support both academics and career development.

For Career Counselors and Advisers: It's hard to give personalized career advice when you don't have a full picture of a student's academic strengths or interests. This system makes that easier by suggesting specializations or career paths based on actual performance trends, giving counselors better information to work with.

For Policy Makers and Education Leaders: If you're trying to improve educational outcomes on a larger scale, this system shows what's possible when you bring data and AI into the equation. It supports evidence-based decision-making, equitable learning, and better student engagement across the board

Time and Place of the Study

In May 2025, the team conducted a study on the development of the Smart Academic Assistant System. It focused on identifying the academic needs and

challenges faced by college students in higher education institutions. The research was conducted at Cavite State University, using online data collection methods such as Google Forms to gather insights from students. These insights helped shape the system's features and functionality. Development, system design, and evaluation activities were carried out using cloud-based tools and digital collaboration platforms to ensure efficient progress tracking, feedback collection, and prototype testing. The setting allowed real-time simulations of academic scenarios using actual data samples, enabling practical validation of predictive analytics and user interface effectiveness.

Scope and Limitation of the Study

Scope

The study focuses on the development, implementation, and evaluation of a Smart Academic Assistant System designed for higher education institutions, particularly colleges and universities.

Monitor Academic Performance – Track student progress using data such as grades, quizzes, assignments, and attendance from institutional databases and Learning Management Systems (LMS).

Provide Personalized Recommendations – Offer tailored learning interventions and study resources based on performance trends and identified weaknesses.

Career Path Guidance – Suggest appropriate specializations or fields of study aligned with each student's strengths, academic patterns, and interests.

Predictive Analytics and Early Intervention – Use machine learning algorithms to forecast potential academic risks, enabling proactive support for at-risk students.

LMS and Institutional Integration – Integrate with existing educational platforms and institutional databases for real-time performance monitoring and data synchronization.

User Interface Design – Include a user-friendly interface for students, educators, and administrators to easily access and interpret academic insights.

Support Tools – Provide basic dashboards and notifications for both students and faculty to support informed decisions and academic planning.

Limitations

Data Dependency – The system's predictive accuracy is heavily dependent on the completeness and accuracy of available student data. Inconsistent or missing records may reduce reliability.

Non-Academic Factors Not Included – External variables such as mental health, family issues, or socio-economic conditions—which may influence academic performance are not directly measurable or considered by the system.

Supplementary Tool – The Smart Academic Assistant System is designed to support, not replace, human academic advisors, mentors, or guidance counselors.

Technology Constraints – The system's functionality may vary based on the technological infrastructure of partner institutions, including internet access, LMS compatibility, and device limitations.

Definition of Terms

Career-Aligned Learning— An educational approach where course content and skill development are directly linked to the competencies required in specific careers or fields of study, ensuring relevance to students' future professions.

Career Path Recommendation – Personalized suggestions for fields of study or occupations generated by the system, based on a student's academic strengths, performance trends, and interests.

Data Privacy – The protection of students' sensitive academic and personal information from unauthorized access or disclosure, adhering to institutional policies and legal regulations

Early Warning System – A feature of the Smart Academic Assistant System that identifies students at risk of academic failure or dropout using predictive analytics, enabling timely intervention by educators.

Instant Data: Instant results produced from real life data that enables students/ teachers and schools to make fast and informed decisions on learning and support.

Learning Management System (LMS) - An online tool that schools utilize to facilitate and organize course materials, assignments, tests, grading, and communication for students, between students and teachers.

Machine Learning — A subset of artificial intelligence (AI) where algorithms analyze historical and real-time data to identify patterns, make predictions, and improve decision-making without explicit programming for each scenario.

Student Performance Tracking – The collection and analysis of student performance data in school via grades, attendance, participation and progress for specific subjects.

Smart Academic Assistant System – A digital platform leveraging predictive analytics and machine learning to assist students monitor their academic status, receive personalized learning recommendations, and be introduced to career options based on their data

Appendix 1. Survey Report



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“ACADEMIC ASSISTANT SYSTEM: PREDICTIVE ANALYTICS TOWARDS GUIDING COLLEGE STUDENTS CAREER-ALIGNED SPECIALIZATIONS”

SURVEY REPORT

Nature of Report

This report presents an analysis of data collected through a Google Forms survey, which aimed to assess students' academic habits, struggles, and their openness to using a smart academic assistant system. The survey gathered quantitative insights regarding students' current use of digital tools, their perceived academic challenges, and preferences for system features and feedback.

Survey Objectives

The survey was designed with the following objectives:

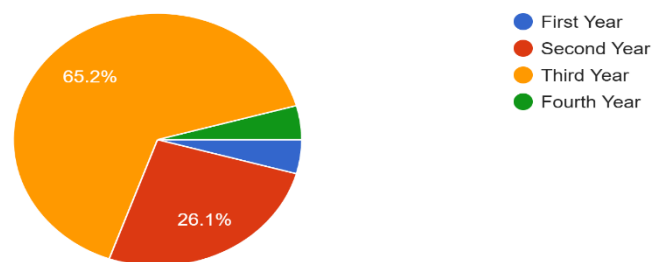
- To identify how frequently students struggle with academic materials, assignments and Activities.
- To determine current usage of digital academic tools such as LMS, planners, and apps.
- To assess interest in personalized study recommendations based on academic performance.
- To gauge student confidence in the effectiveness of a smart academic assistant.
- To understand which types of academic feedback and features students would find most useful.
- To determine student willingness to input their academic data regularly.
- To identify concerns related to privacy, prediction accuracy, and system usability.
- To find out how frequently students would like to receive feedback or insights from the system.

Respondent Demographics & Background

A total of 23 respondents completed the survey. While demographic breakdowns such as age or year level were not collected, the results reflect general student perspectives on academic support tools.

Year Level?

23 responses



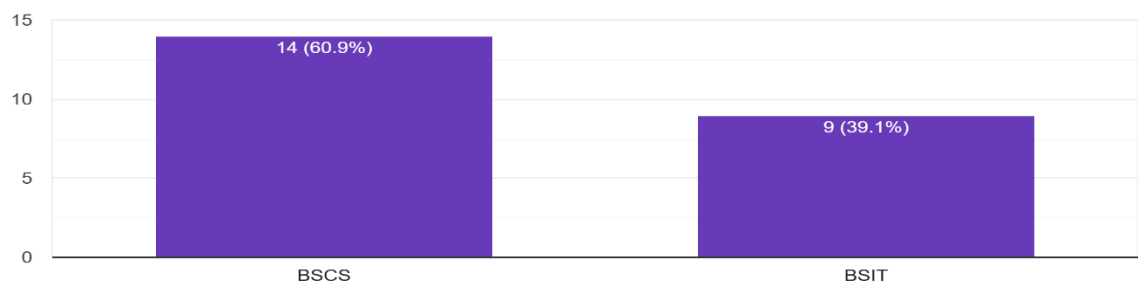
- **43.5%** (10 respondents) are in their **third year** of college. 15% of respondents fall into the 25-34 age group.
- **26.1%** (6 respondents) are **second-year** students.
- **17.4%** (4 respondents) are in their **first year**.
- **13%** (3 respondents) are in their **fourth year**.

Survey Findings & Analysis

The respondents were from two undergraduate programs: **BS Computer Science (BSCS)** and **BS Information Technology (BSIT)**.

Course? (Acronym is fine)

23 responses



- **60.9% (14 respondents)** were enrolled in **BSCS**
- **39.1% (9 respondents)** were enrolled in **BSIT**

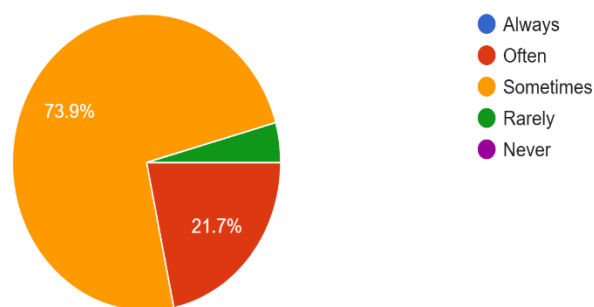
Survey Findings & Analysis

The survey explored various aspects of digital and traditional gaming, yielding the following key findings:

1. Academic Challenges & Digital Tool Usage:

How often do you struggle with understanding course materials or keeping up with assignments?

23 responses

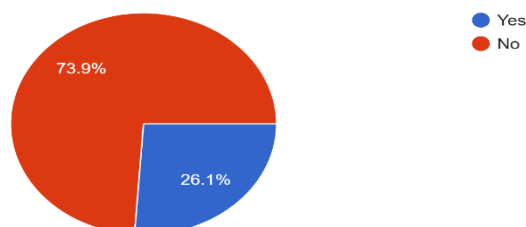


- 73.9% of respondents reported that they “**sometimes**” struggle to understand materials or keep up with assignments.
- 21.7% selected “**often.**”
- No respondents selected “always” or “never,” indicating that some level of struggle is common among all students surveyed.

2. Use of Digital Study Tools:

Do you currently use any digital tools (e.g., LMS, study apps, academic planners) to assist with your studies?

23 responses



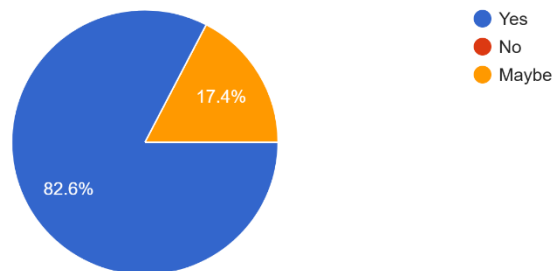
- Only **26.1%** of respondents currently use digital tools such as LMS or academic planners.
- **73.9%** do not use any such tools, suggesting a gap that a smart academic assistant could fill.

System Usefulness & Interest:

3. Interest in Personalized Study Recommendations:

Would you find it helpful to receive personalized study recommendations based on your academic performance?

23 responses

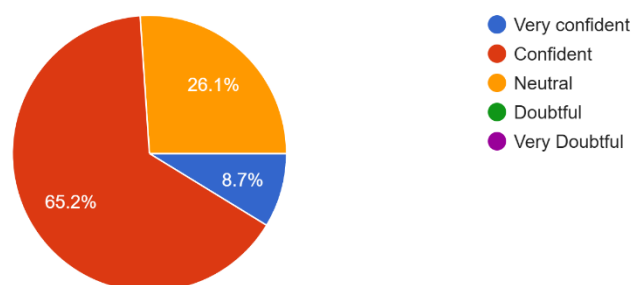


- A significant **82.6%** of students said “**yes**” to wanting personalized study suggestions.
- The remaining **17.4%** said “**maybe.**”
- No respondents rejected the idea.

4. Confidence in the System's Potential:

How confident are you that a smart academic assistant system could help you improve your academic performance?

23 responses

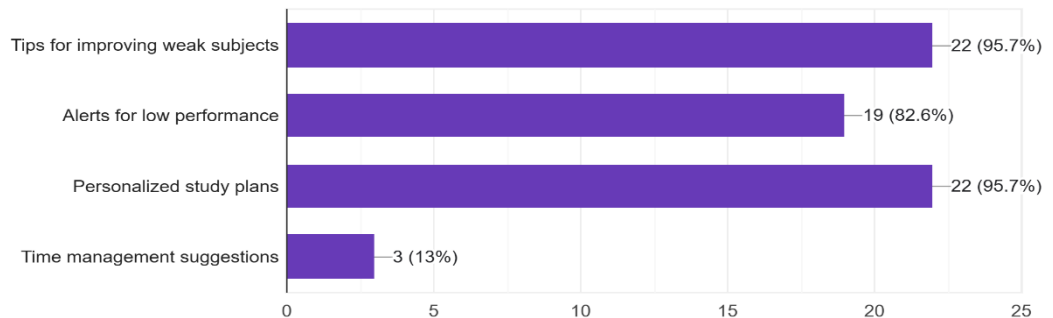


- **65.2%** were “**confident**” that a smart assistant could help them academically.
- **26.1%** were “**neutral.**”
- **8.7%** were “**very confident.**”
- Notably, **0%** selected “doubtful” or “very doubtful.”

Preferred Features & Willingness to Use:

5. Most Useful Feedback Features:

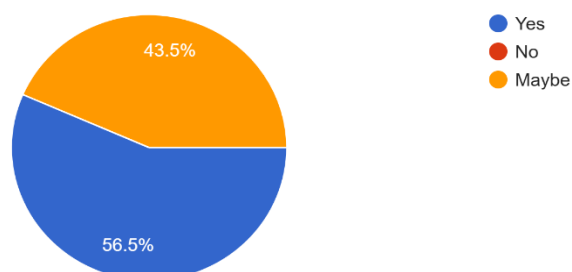
What type of feedback would you find most useful from an academic assistant system? (Select all that apply)
23 responses



- **95.7%** wanted tips for improving weak subjects.
- **95.7%** wanted personalized study plans.
- **82.6%** wanted alerts for low performance.
- Only **13%** selected time management suggestions, possibly indicating less perceived need for scheduling support.

6. Willingness to Input Academic Data:

Would you be willing to regularly input your grades, attendance, and quiz results into a smart academic assistant system?
23 responses



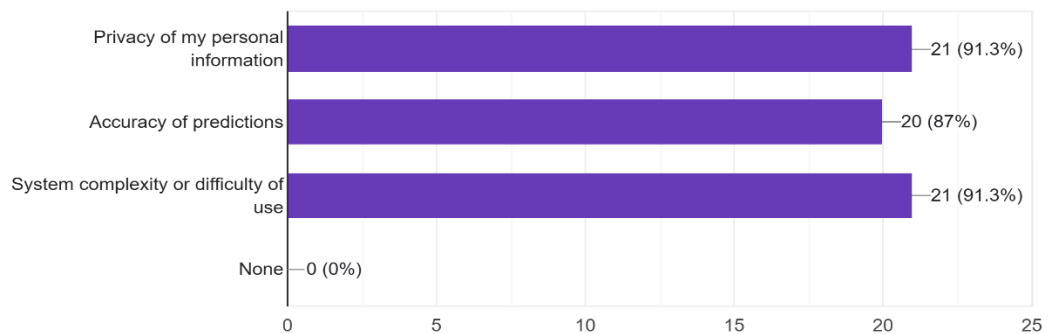
- **43.5%** of students said “**yes**” to regularly entering their academic data.
- **56.5%** said “**maybe.**”

- No respondents outright refused.

Concerns & Feedback Preferences:

7. Top Concerns Regarding System Use:

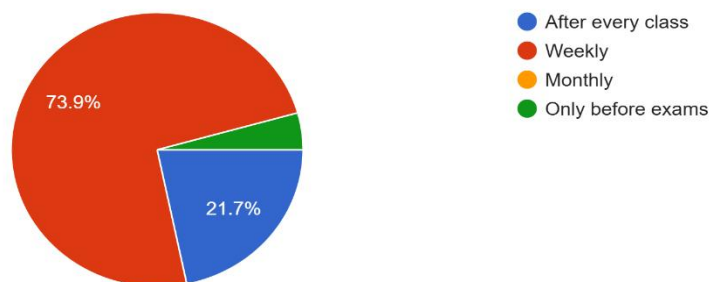
What concerns do you have about using a system that tracks your academic data? (Select all that apply)
23 responses



- **91.3%** cited **privacy of personal information** as a key concern.
- **91.3%** were also concerned about **system complexity or difficulty of use**.
- **87%** mentioned **accuracy of predictions** as a concern.
- No students selected “none,” confirming that concerns are widespread and must be addressed in the design.

8. Preferred Feedback Frequency:

How often would you like to receive feedback or insights from the system?
23 responses



- **73.9%** of students prefer to receive feedback on a **weekly basis**.
- **21.7%** would like feedback **after every class**.
- A small portion prefer updates **only before exams**.
- No students chose **monthly** updates.

Conclusion & Recommendations

The survey findings highlight a strong interest in an intelligent academic assistant system, especially among students who do not currently use digital learning tools. The majority of respondents occasionally face academic difficulties, suggesting a need for targeted support. Students showed high confidence in the potential of such a system to improve their performance and are most interested in features that offer personalized study recommendations, track weaknesses, and issue performance alerts.

However, privacy and ease of use are critical concerns that must be prioritized in the system's development. The willingness of students to enter their data though mixed shows promise if paired with reassurances about data security and system usability.

In conclusion, there is clear demand and strong potential for a smart academic assistant that provides personalized, real-time support while respecting user concerns about privacy and accessibility.