ACADBRIDGE:An Academic Record System with Performance Visualization and Structured Communication for Goa Science High School

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***Abstract*— Challenges in academic record management and communication at Goa Science High School, including limited student grade access and informal teacher interactions, prompted this study. This paper presents AcadBridge, a web-based system designed to address these issues. AcadBridge offers a secure centralized database, performance visualization tools, and a structured messaging system. Developed with user-centered design, the system underwent rigorous security and usability evaluations—assessing effectiveness, efficiency, and satisfaction—with students, teachers, and administrators, aligning with established ISO 9241-11 usability standards. Evaluation results demonstrated high effectiveness, with users successfully completing all assigned tasks. High efficiency was also observed, with most tasks completed in consistent times and without any errors. User satisfaction was outstanding, as measured by the System Usability Scale (yielding an average score of 87.42), and core features like data visualization and messaging also received very high satisfaction ratings (average 4.40 out of 5). AcadBridge provides a comprehensive solution, significantly improving transparency, streamlining academic administration, and fostering better communication for the school community.**

***Index Terms*— Academic Record System, Performance Visualization, Structured Communication, ISO 9241-11, Educational Technology**

I. Introduction

A. Background of the Study

The complexity entailed in managing academic activities in educational institutions is becoming more clear, hence a centralized system can really be useful in enhancing transparency and workflow optimization. Centralized academic systems operate as an integrated platform for the management of grades, attendance, communication, and performance analytics; thereby reducing inefficiencies that are generated by fragmented tools and manual methods. Research in academic management systems has validated that such systems reduce administrative burdens, enhance accountability, and enable instantaneous decision-making [1], [6]. For instance, a well-structured centralized system has the ability to integrate functionalities such as data visualization tools and communication tools, which allow all stakeholders active access to critical information and analytics [2], [8].

Furthermore, research highlights the inefficiencies of manual tools in education, showing that they often lead to delayed feedback and higher administrative workloads, which can impact both students and teachers negatively [3], [7]. Additionally, the Bicol Region's susceptibility to typhoons and potential flooding adds another layer of complexity, as physical grade records are at risk of loss or damage [9], [10]. A centralized digital database for grades ensures secure and consistent access even in disaster scenarios. Leveraging technology in education has been a global trend, aimed at fostering transparency, collaboration, and improved educational outcomes [1], [8].

The implementation of such a system also aligns with the institution's vision to achieve academic excellence by fostering transparency and collaboration among educators and learners, as emphasized by recent advancements in education technology [4], [6].

B. Statement of the Problem

Twenty junior high school students and ten instructors participated in the pre-survey at Goa Science High School, which found that communication and academic record management were extremely difficult. Since report cards are only given out at the end of each quarter and need parental signatures before being given back to instructors, students feel that they have little access to their results. Although some students snap pictures of their report cards for reference, it is challenging to have constant access to them due to the lack of digital versions. Their capacity to remain informed and act promptly is further hampered by the frequent delays and lack of professionalism associated with inquiries concerning grades or academic performance made through unofficial channels like Facebook Messenger.

On the other hand, the lack of centralized resources makes it difficult for teachers to effectively manage grades. Despite using Microsoft Excel to record grades, each file is saved separately and is susceptible to corruption or loss. Though Excel contains features for data visualization according to teachers it is a difficult process because you have to manually do it to the specific data they want which makes it difficult to get comprehensive insights on student or class performance. Additionally, educators are turning to unofficial channels of contact, which not only adds to their burden but also leads to irregularities in the sharing of feedback and the timely resolution of student problems [3], [7].

The use of static report cards presents common issues for both teachers and students. Students and instructors find it challenging to spot patterns or performance gaps while using static report cards because they lack real-time updates and data

Presented to the Faculty of the Institute of Computer Science, University of the Philippines Los Baños in partial fulfillment of the requirements for the Degree of Bachelor of Science in Computer Science

visualization features. The absence of a cohesive, organized system for managing academic records and communication leads to delays, inefficiencies, and lost chances for prompt action. These common problems highlight the necessity of a safe, centralized system that tackles the distinct and overlapping difficulties faced by both groups, allowing for proactive, data-driven decision-making and encouraging efficiency and cooperation [4], [6].

This research addresses the fundamental computer science problem of designing an effective educational information system that integrates secure data storage, real-time access control, and interactive data visualization to replace manual, fragmented academic record management systems. The challenge involves creating a centralized digital platform that maintains data integrity while providing appropriate access levels to different stakeholders (students, parents, teachers) and includes analytical capabilities to transform static academic records into actionable insights. This work contributes to the computer science domains of database systems design, information security implementation, user interface optimization, data visualization algorithms, and real-time information systems development in educational contexts.

C. Significance of the Study

The creation of AcadBridge, an academic record system with organized communication and performance visualization that is specifically designed to meet the demands of Goa Science High School, is what makes this study significant. Through dynamic performance visualizations, real-time grade access, and a well-organized message system, the system encourages students to make better decisions and raise their academic standing. AcadBridge gives teachers the ability to efficiently assess performance patterns in their classrooms, reduces worries about data loss, and allows them to mentor students even when they are not in class. The system, which was created in accordance with ISO 9241-11 requirements, guarantees usability, efficiency, and user satisfaction. This study improves the school's academic experience and offers a scalable blueprint for organizations looking to update their academic administration procedures.

D. Objectives of the Study

The main objective of this study is to develop an academic record system with performance visualization and structured communication, designed to address the challenges of academic monitoring, data accessibility, and communication at Goa Science High School, while ensuring usability, efficiency, and user satisfaction in alignment with ISO 9241-11 standards.

- To create a secure, centralized database for academic records, ensuring accessibility for students and teachers.
- To integrate data visualization tools for identifying grade trends or performance insights in real time.
- To implement a messaging system for formal, timely communication among students and teachers, replacing informal platforms.
- To design the system in line with ISO 9241-11 principles, focusing on ensuring usability, efficiency, and satisfaction for students and teachers at Goa Science High School.

E. Scope and Limitations of the Study

The goal of this study is to create a responsive web application for Goa Science High School's academic record and communication management. To improve academic procedures and facilitate cooperation, the program will have features including data visualization, encrypted communications, and real-time grade monitoring. It prioritizes usability while adhering to ISO 9241-11 principles, guaranteeing efficacy, efficiency, and user satisfaction. With an emphasis on dependability and usefulness, the study is made for use on web browsers, which would be responsive both for desktop and mobile, and is restricted to academic record maintenance and messaging. Although the program will be first tested and used at Goa Science High School, it is intended to be flexible and scalable for future usage in other educational settings. For now, this study is limited to the Junior High School department of the school since there's a different grading system for Senior High School.

II. Review of Related Literature

Academic management systems (AMS) have improved grade processing and student performance management by centralizing tasks like record-keeping and attendance tracking, providing faster data access and better communication [1]. However, earlier systems often faced issues with scalability and data integrity during high usage. This study applies ISO 9241-11 standards to enhance AMS usability, focusing on user effectiveness, efficiency, and satisfaction, especially under increased demand [11]. For example, hospital information systems designed with usability principles can handle more users without sacrificing performance [12]. Data integrity, or the accuracy and consistency of data, is another key factor. The ISO standard highlights that data errors can harm user satisfaction and trust in the system [13]. This principle is also relevant to educational systems, where accurate course, schedule, and grade information is essential for user engagement and trust [14].

The importance of mobile-grade viewers in providing real-time grade access was highlighted by research like Villanueva et al. [2], but their lack of strong cross-platform capability limited their use for some users. Furthermore, Banag [5] found that there were gaps in the engagement of stakeholders during the design process, which led to systems that did not fully satisfy the demands of users. By using a responsive web platform strategy and guaranteeing compatibility with both web and mobile platforms, the research tackles these issues. Additionally, it incorporates user-centered features like secure communication tools and real-time grade monitoring that are customized to meet the needs of instructors and students at Goa Science High School.

The operational efficiency of educational institutions has been seen to increase with the shift from manual to automated methods. For instance, Mappalotteng et al. [8] showed how automation improved the workflow for grade processing, but they lacked sophisticated analytics to aid in decision-making and performance assessment. In order to address this deficiency, the research incorporates interactive data visualization

tools that provide effective trend and insight analysis by stakeholders. In academic settings, this supports the goal of encouraging openness, cooperation, and data-driven decision-making.

III. Materials and Methods

The methodology for this research adopts a systematic approach to developing AcadBridge, combining software engineering best practices with user-centered design principles. The development process follows a structured framework encompassing requirements gathering, system design, implementation, and evaluation—all guided by ISO 9241-11 usability standards focusing on effectiveness, efficiency, and user satisfaction. This research employs both qualitative and quantitative methods to ensure comprehensive evaluation, beginning with pre-surveys to identify baseline challenges, followed by iterative development cycles, and concluding with rigorous user testing involving key stakeholders from Goa Science High School. The methodology prioritizes data-driven decision making throughout the development lifecycle while maintaining alignment with the specific needs identified in the academic environment, ensuring that the resulting system effectively addresses the communication and grade management challenges previously documented.

A. Development Tools

The web application was developed on a machine with the following specifications:

- Operating System: Windows 10 Home Single Language Version 10.0.19045 Build 19045
- Processor: 11th Gen Intel(R) Core(TM) i5-1135G7 @ 2.40GHz, 2419 Mhz, 4 Core(s), 8 Logical Processor(s)
- Memory: 4 GB soldered, 8 GB DDR4 @2666 MHz

The following software development tools and technologies were used for the development of the web application:

- **Visual Studio Code:** A lightweight but powerful source code editor that supports development operations like debugging, task running, and version control [22].
- **React:** A JavaScript library for building user interfaces, particularly single-page applications, that allows developers to create reusable UI components [23].
- **MongoDB Atlas:** A fully-managed cloud database service that provides global cloud database clusters with built-in operational and security practices [24].
- **Node.js:** An open-source, cross-platform JavaScript runtime environment that executes JavaScript code outside a web browser, enabling server-side scripting [25].
- **Express:** A minimal and flexible Node.js web application framework that provides a robust set of features for web and mobile applications [26].
- **ReCharts:** A composable charting library built on React components that allows developers to build charts with minimal code [27].
- **Render:** A unified cloud platform that offers instant deployment of static sites, databases, and Docker containers with automatic scaling and global CDN [28].
- **Socket.io:** A library that enables real-time, bidirectional and event-based communication between web clients and servers [29].
- **Tailwind CSS:** A utility-first CSS framework that provides low-level utility classes to build custom designs without leaving your HTML [30].
- **DaisyUI:** A plugin for Tailwind CSS that adds component classes to reduce repetitive utility classes and offers customizable themes [31].

B. Database Design

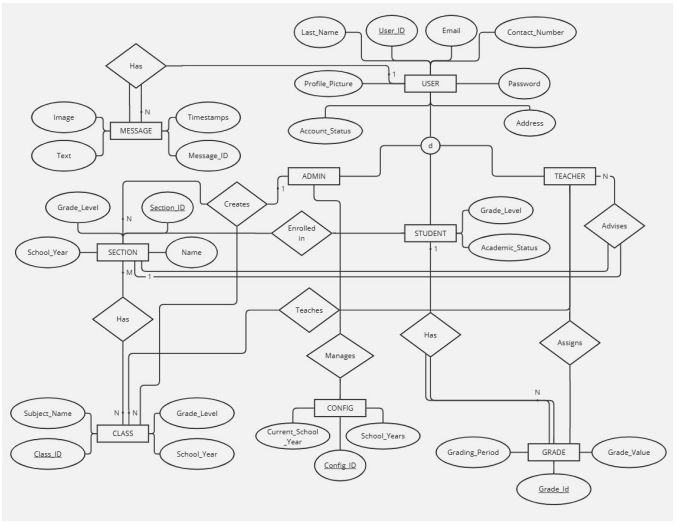

Fig. 1. Entity Relationship Diagram

The Entity-Relationship Diagram (ERD) of the application created for the MongoDB database, which controls the system's Create, Read, Update, and Delete (CRUD) operations, illustrates the relationships and data entities utilized within the application.

The ERD diagram defines several entities crucial for system operation, including USER, STUDENT, TEACHER, ADMIN, MESSAGE, SECTION, CLASS, GRADE and CONFIG. Each entity is clearly defined with unique identifiers and relevant attributes.Sections and classes organize students and courses, while grades are recorded in detail, indicating grading periods and grade values. The MESSAGE entity captures communication through image or text and timestamps to track real-time interactions. The CONFIG entity contains the current school year and a list of school years that will contain all the school year the system has data to.

Users (administrators, teachers, and students) is uniquely identified by it's userId and can view or receive messages in the systems. Administrators create sections, assign teachers to classes they create and manages the config. Teachers manage their assigned classes by viewing grades of student, inputting grades of student and also the grade trends of each student. If the teacher currently advises a section, they can manage student enrollment for a specific section and also view section grades. Students meanwhile primarily monitor their own grades and academic trends.

C. Application's Features

Users have different privileges according to their roles within the system. The following discusses the various features based on user type:

1) **User Authentication:** This feature authenticates registered users, ensuring secure access. Administrators verify teacher and student accounts during registration. Post-authentication, users see interfaces dynamically tailored to their roles, such as student, teacher, or administrator dashboards.
2) **Profile Management:** Users can update their personal information through a dedicated profile page, ensuring accuracy and keeping their information current.
3) **Grade Viewer and Management:** Students can track academic progress in real-time while also be able to check if they are honors for a specific quarter or for all quarters, while teachers have robust tools to input, edit, assign, and upload grades efficiently wherein they also be able to download grades for classes they are assigned to. Teachers oversee class performance comprehensively, simplifying the grade management process and providing transparent academic records accessible to both educators and students. If teachers are an adviser for a section they can view the specific grades of all student for that section and even the honors list for the class for a specific quarter or for all quarters.
4) **Data Visualization:** Provides visual analytics for performance data with accompanying data analysis:
   - **Students:** Personalized graphs and charts with filtering by school year and performance insights, such as single subject performance over time, comparing subjects across all quarters and also their performance for a specific quarter can be seen.
   - **Teachers:** Analyze classes they are assigned with by seeing trends specific for a single section or all sections they handle for a specific class whether it be for a specific quarter or for all quarters. For a single section, they can also filter out specific students to focus on their current performance for that class.
5) **Messaging:** Secure, one-on-one communication between users to facilitate clear and effective interactions among students, teachers, and administrators. Images can also be sent for better user satisfaction
6) **Class Assignment:** Teachers designated as section advisers can assign or remove students from specific sections which streamlines the enrollment process.
7) **Section and Class Management (Admin):** Administrators can create, retrieve, update, and delete sections. They also have the capability to create, update, and delete class records, ensuring effective administrative control and data integrity.
8) **Config Management (Admin):** Administrators can also change the config by changing the current school year but the system would check first if all student have grades before. If there are still some students who have grades for specific subjects, they would be prompted by the system and would be the shown the sections with missing grades data for each class.
9) **Registration and Verification:** Students and teachers undergo a controlled registration process with administrator verification required before gaining system access, maintaining platform security and integrity.

D. Activity and Use Case Diagram

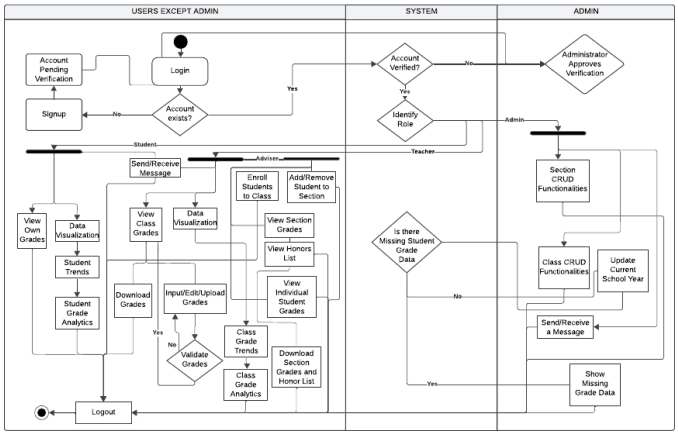

Fig. 2. Activity Diagram

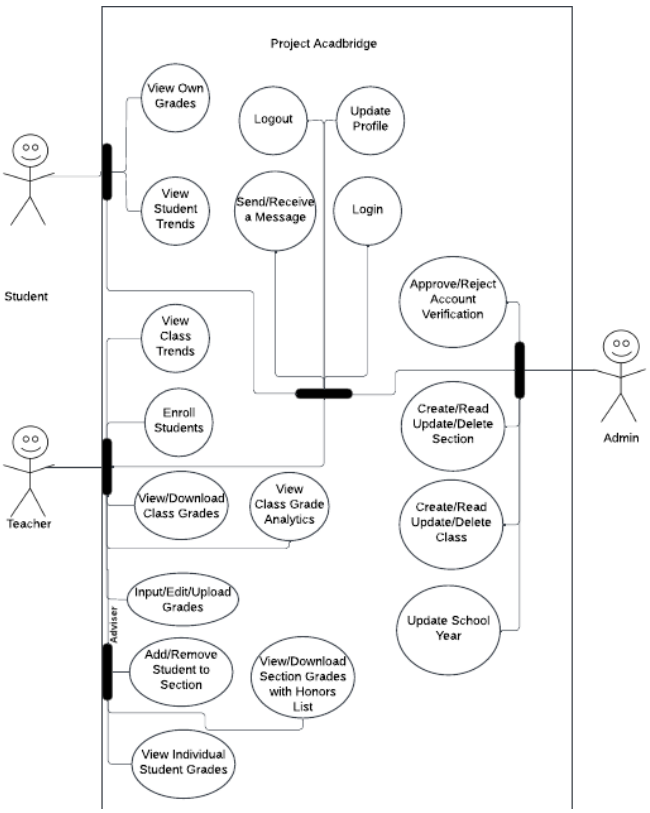

Fig. 3. Use Case Diagram

The functional scope and operational procedures of the "AcadBridge" system for various user roles are represented by the updated Activity and Use Case diagrams. The Activity Diagram illustrates the flow of actions and decisions taken

by students, teachers, and administrators within the system. It begins with user authentication and clearly delineates role-specific actions such as managing class enrollments, inputting grades, viewing performance data, and handling communication through messages. The diagram explicitly defines the branching decisions, role-based tasks, and system interactions, effectively capturing the dynamics of user engagement.

Students use the system to monitor their academic progress by viewing their grades and viewing trends in their academic performance along with data analysis provided for them in the system. They also have capabilities for secure messaging, enhancing direct communication with teachers and administrators.

Teachers manage critical academic functions including updating and managing grades, and analyzing performance trends for individual students and assigned classes. If teachers are assigned as advisers they are in charge of adding student to the sections they are assigned to and will be able to see the grades of the students for that specific section and also can download the section grades including the honors list, Messaging functionality supports structured communication, allowing teachers to efficiently oversee and support student development.

Administrators have overarching responsibilities such as user account verification, management of class and section data, and the approval or rejection of account access requests. This ensures secure, organized, and seamless administrative control within the system. They also have the capability to update the school year but only if all grade data is available for students.

The Use Case Diagram succinctly defines the system's core interactions, clarifying user roles and their respective permissions and functionalities. It complements the Activity Diagram by clearly outlining user capabilities such as account verification, class management, grade input and analysis, and messaging.

Together, these diagrams provide a detailed representation of "AcadBridge," highlighting its comprehensive capabilities in academic management and communication tailored specifically to the needs of Goa Science High School.

E. Security Measures and Testing

To ensure the security of the academic records database, a comprehensive testing strategy was implemented. This involved rigorous testing of security measures across various layers of the web application. The testing focused on the following key security aspects:

1) Authentication Testing:

- JWT-based authentication, managed by the `protectRoute` middleware, underwent testing using scenarios designed to simulate unauthorized access attempts.
- Test cases included sending requests to protected endpoints under various conditions: without a JWT, with an empty JWT, an expired JWT, a malformed JWT, a tampered JWT, a JWT containing a non-existent user ID, and using an incorrect cookie name.
- The middleware's ability to restrict access based on account status (e.g., pending or rejected) was also verified by attempting route access with users in these states.

2) Authorization Testing:

- Role-Based Access Control (RBAC) mechanisms, implemented via dedicated middleware (`studentSpecificRoute`, `teacherSpecificRoute`, `adminSpecificRoute`), were tested.
- Test scenarios involved users with incorrect roles attempting to access role-specific endpoints to confirm that only authorized users could access designated routes, thereby verifying permission enforcement.

3) NoSQL Injection Prevention Testing:

- The `express-mongo-sanitize` middleware that was used on all endpoints was tested for its effectiveness in preventing NoSQL injection attacks which was tested on selected critical endpoints like the (login, protected update, and signup).
- Tests involved submitting payloads containing MongoDB operators (e.g., `$ne`, `$gt`, `$where`) in input fields to confirm successful sanitization by the middleware.
- Comparative tests, conducted both with and without the sanitization middleware active, demonstrated its protective impact.

4) Input Validation Testing:

- Input validation, implemented using the `express-validator` middleware, was tested across selected authentication, student, and teacher endpoints.
- Test scenarios included submitting requests with missing required fields, invalid data formats (e.g., for email, role, image URL, school year), excessively short passwords, and incorrect data types for expected parameters.

5) Testing Tools and Environment:

- Security tests were executed using the Jest framework for unit and integration testing.
- Supertest was employed to simulate HTTP requests to the application's endpoints, allowing verification of application responses under various conditions, including normal operation and simulated malicious inputs.

F. User Evaluation and Testing

The user evaluation process was designed to systematically assess the application's usability and efficiency. This process evaluated the system against key objectives:

- Effectiveness of the centralized database and its associated access controls.
- Usability of data visualizations for identifying grade trends and performance insights.
- Efficiency and suitability of the formal communication system for students and teachers.
- Overall effectiveness, efficiency and user satisfaction aligning with ISO 9241-11 principles.

The evaluation involved four key stages:

TABLE I
USER TESTING TASKS BY ROLE

Role	Task ID	Task Description
Student	T1	View Grades - Specific Subject for a Specific Quarter
Student	T2	View if an Honor for a Specific Quarter
Student	T3	View Performance for All Subjects Across All Quarters (Highest/Lowest Overall)
Student	T4	View Performance for a Single Subject Across All Quarters (Highest/Lowest for Subject)
Student	T5	View Performance of All Subjects in a Single Quarter (Highest/Lowest for Quarter)
Student	T6	Message - Send a Text Message
Student	T7	Message - Send an Image message
Student	T8	Message - Send a text with an image message
Teacher	T1	Add and Remove Student To Class
Teacher	T2	View Section Grades
Teacher	T3	View Grade of A specific student
Teacher	T4	View Honors List
Teacher	T5	Download Section Grades
Teacher	T6	View grades of a specific class
Teacher	T7	Edit grades of a specific student in class
Teacher	T8	Download Template and input some grades and use upload grades feature
Teacher	T9	Download Current Class Grades
Teacher	T10	View Single Section Performance for all quarters
Teacher	T11	View Single Section Performance for a single quarter
Teacher	T12	View All Section Performance for all quarters
Teacher	T13	View All Section Performance for a single quarter
Teacher	T14	Send a text message
Teacher	T15	Send an image message
Teacher	T16	Send a text with image message
Admin	T1	Verify/Reject Account
Admin	T2	Add New Section
Admin	T3	Edit Section
Admin	T4	Delete Section
Admin	T5	Add Class
Admin	T6	Edit Class
Admin	T7	Delete Class
Admin	T8	View Grades of a Specific Class
Admin	T9	Edit Grades of a Specific Student in Class
Admin	T10	Download Template and input some grades and use upload grades feature
Admin	T11	Download Current Class Grades
Admin	T12	Update School Year
Admin	T13	Send a text message
Admin	T14	Send an image message
Admin	T15	Send a text with image message

TABLE II
TASK INSTANCE OBSERVATION LOGS

Task ID	Trial No.	Assigned Participant	Task Success (Y/N)	Completion Time (min:sec)	Errors Encountered (Y/N/Details)
T#	Trial #	P#	Y/N	MM:SS	Y/N/Details of errors encountered during the task performance would go here. This column needs to wrap text properly.
...	...	...	...	...	...
T#	Trial #	P#	Y	01:30	N
T#	Trial #	P#	Y	02:15	Y/Clicked wrong button initially, then corrected.
T#	Trial #	P#	N	05:00	Could not find the download feature.

1) Pre-Survey: A preliminary survey was conducted with 20 students and 10 teachers from Goa Science High School to identify existing challenges in academic record management and communication. Participants rated difficulties on a 10-point scale (1: No Problem, 10: Major Obstacle) and provided qualitative feedback on current practices. The findings from this phase guided system refinement.

2) User Testing and Evaluation: System functionalities were evaluated through structured usability testing to assess usability in alignment with ISO 9241-11 principles, focusing on Effectiveness, Efficiency, and Satisfaction. As highlighted by Golondrino et al. (2023) [15], determining effectiveness is central to usability testing. Effectiveness relates to the accuracy and completeness with which users achieve specified goals, while Efficiency concerns the resources expended (e.g., time, mental effort) in relation to effectiveness. Satisfaction covers users' subjective responses to using the system.

Representative users (Teachers, Students and Admin) performed predefined tasks under controlled conditions. The core tasks evaluated, based on user roles, are detailed in Table I. To gather robust data, each task type for each role was performed across three trials by participants representative of that role, as documented in the observation logs based on sources like Yildiz et al. [16]. Structured observation forms (structured as shown in Table II) were used to record performance during each task instance.

The following metrics were measured during the testing sessions:

- **Effectiveness:** Measured via **Task Success** (whether each task instance was successfully completed, recorded as 'Y/N' in observation logs).
- **Efficiency:** Measured via:
  - **Task Completion Time** (time taken for each task instance, recorded in seconds in observation logs).
  - **Errors Encountered** (occurrence and details of errors during each task instance, recorded in observation logs).
- **Satisfaction:** Measured quantitatively using standardized questionnaires administered post-test.
  - Users completed the **System Usability Scale (SUS)** questionnaire. The use of standardized questionnaires like SUS, derived from ISO guidelines, is supported by Syafrizal et al. [17]; the SUS is a widely recognized tool for measuring perceived system usability, consisting of 10 statements rated on a 5-point Likert scale ("Strongly Disagree" to "Strongly Agree"). Tsai et al. [18] emphasize the role of such standardized user feedback in iterative design improvement and enhancing user satisfaction.
  - Supplementary metrics focused on system-specific features for the **data visualization tools** and the **messaging feature** were collected using separate 5-point Likert scale questions (Strongly Disagree to Strongly Agree) to gauge user perceptions of these specific components.

These measurements provided the raw data for assessing the system's usability according to ISO 9241-11 principles.

3) Data Analysis: Data analysis employed a quantitative approach focused on interpreting the metrics collected during the user testing sessions:

- **Effectiveness Analysis (Task Success):** The **Task Success Rate** for each task type was calculated as the percentage of successfully completed instances ('Task Success' = Y) across all participants and trials. This directly measured the users' ability to achieve task goals.
  Target: Task Success Rate $\geq 85\%$ for each task type. Sauro and Lewis (2016 [20]) note that the average task completion rate across many studies is around 78%, so aiming for 85% indicates a desire for above-average performance.
- **Efficiency Analysis (Time):** The **Standard Deviation (SD)** and **Average Task Completion Time (Avg)** were computed across the completion times (recorded in seconds) for the different participants who performed each specific task type (one user per trial), using the recorded 'Completion Time'. The analysis focused on assessing the variability in performance time *between different users* for each task by calculating the Coefficient of Variation (CV = SD / Avg).
  Target: The Coefficient of Variation (CV) for completion times across the different participants for each task type should ideally be less than **0.33 (or 33%)**. This specific target (CV ¡ 33%) is often highlighted by Jeff Sauro, drawing upon earlier work by Bailey or others in Human Factors, who suggests that a CV greater than around 30-35% indicates high variability that might warrant investigation (e.g., some users are struggling much more than others).
- **Efficiency Analysis (Errors): Error analysis** focused on the frequency and nature of errors recorded ('Errors Encountered') during task performance. This involved identifying common or critical error types and calculating an overall error rate by considering all errors across all attempted task instances.
  Target: The overall task error rate, calculated as (total number of task instances where any error was recorded / total number of task instances attempted across all tasks), should be less than **5%**. Data from Sauro (2010, p. 71 [21]) indicates that an average task error rate (per opportunity) is around 18%, with an error rate of 9% already representing the 99th percentile in a dataset of usability tasks. This context underscores that aiming for an overall task error rate of ¡5% is an ambitious but good goal for high usability.
- **Overall Satisfaction Analysis (SUS):** Individual **System Usability Scale (SUS)** scores were calculated for each participant based on their questionnaire responses (resulting in a score on a 0-100 scale). These individual scores were then averaged across all participants to obtain an overall SUS score, interpreted against standard benchmarks.
  Target: Average overall SUS score ≥ 70.
- **Feature-Specific Satisfaction Analysis:** User satisfaction with the **Data Visualization** and **Messaging System** features was analyzed by calculating the average scores from the supplementary 5-point Likert scale questions for each feature (assuming 1=Strongly Disagree, 5=Strongly Agree).
  Target: Average Likert score for Data Visualization specific questions ≥ 3.5, AND Average Likert score for Messaging System specific questions ≥ 3.5.

This analysis provided a comprehensive assessment of the system's usability, evaluating effectiveness, efficiency, and satisfaction against defined targets.

IV. Results and Discussion

A. Pre-Survey

A pre-survey at Goa Science High School identified significant challenges for both students and teachers regarding communication and academic record management, revealing systemic inefficiencies. Students expressed considerable difficulty (mean score 8.05) in tracking their academic progress and interacting with educators, largely due to delayed feedback from the quarterly report card system which requires parental signatures and prevents continuous monitoring. While some students take photos of reports, this isn't an organized solution, hindering their ability to promptly identify and address academic issues. Furthermore, their reliance on informal channels like Facebook Messenger for academic communication often results in delays and lacks professionalism.

Teachers echoed these frustrations, reporting similar high difficulty (mean score 8.1) with grade management and student

TABLE III
PRE-SURVEY RATINGS OF SOME GSHS STUDENTS FOR DIFFICULTY IN ACADEMIC RECORDING AND COMMUNICATIONS

Respondents	**Rating**
R1	7
R2	9
R3	7
R4	8
R5	8
R6	8
R7	7
R8	8
R9	7
R10	7
R11	7
R12	10
R13	8
R14	9
R15	9
R16	10
R17	9
R18	9
R19	7
R20	7
Mean Difficulty Rating	**8.05**

TABLE IV
PRE-SURVEY RATINGS OF SOME GSHS TEACHERS FOR DIFFICULTY IN ACADEMIC RECORDING AND COMMUNICATION

Respondents	**Rating**
R1	7
R2	7
R3	8
R4	8
R5	8
R6	8
R7	9
R8	9
R9	9
R10	8
Mean Difficulty Rating	**8.1**

communication. Their use of decentralized Microsoft Excel files complicates data consolidation and analysis, risks data loss, and hinders the effective visualization of performance trends needed to identify struggling students or areas needing pedagogical focus. Teachers also find the prevalent use of Facebook Messenger inappropriate and inefficient for professional educational exchanges, adding to their workload and leading to inconsistencies. These shared difficulties underscore structural weaknesses in the current system, highlighting the need for a centralized solution like AcadBridge. This proposed platform aims to rectify these issues by offering real-time grade access, structured communication tools, and data visualization capabilities, thereby empowering students to track their progress continuously and enabling teachers to make timely, data-driven interventions, ultimately improving transparency, streamlining processes, and enhancing academic outcomes for all stakeholders.

B. Security Results

The results of the comprehensive security testing demonstrate the effectiveness of the implemented security measures in protecting the academic records database. All test cases across the different security layers were successfully passed, indicating a robust security posture. The detailed results for each security layer test are presented in Tables V through IX below.

TABLE V
UNAUTHORIZED ACCESS TESTS

Test Case Description	Expected Behavior	Result
No cookie	Denied	Passed
Empty JWT cookie	Denied	Passed
Expired token	Denied	Passed
Malformed token	Denied	Passed
Tampered token	Denied	Passed
Token with fake user ID	Denied	Passed
Wrong cookie name	Denied	Passed

TABLE VI
ACCOUNT STATUS RESTRICTION TESTS

User Type	Route	Access Result
Pending User	`/api/auth/check`	Allowed
Pending User	`/api/auth/logout`	Allowed
Rejected User	`/api/auth/check`	Allowed
Rejected User	`/api/auth/logout`	Allowed
Pending User	Restricted routes	Denied
Rejected User	Restricted routes	Denied
Verified User	Restricted routes	Allowed

TABLE VII
ROLE-BASED ACCESS CONTROL TESTS

Scenario	Role	Access Result
Admin accessing admin route	Admin	Passed
Admin accessing student route	Admin	Passed
Admin accessing teacher route	Admin	Passed
Teacher accessing admin route	Teacher	Denied
Teacher accessing student route	Teacher	Denied
Teacher accessing teacher route	Teacher	Passed
Student accessing admin route	Student	Denied
Student accessing student route	Student	Passed
Student accessing teacher route	Student	Denied

TABLE VIII
MONGODB SANITIZATION MIDDLEWARE TESTS

Endpoint	Test Scenario Description	Sanitization Result
Login	Normal login (with/without sanitization)	Passed
Login	NoSQL injection with $ne, $gt, $where	Blocked
Protected update	Normal update with sanitization	Passed
Protected update	Injection in contact number/address	Blocked
Signup	Normal signup attempt	Passed
Signup	Injection in email and $where operator	Blocked

The comprehensive security testing results validate the effectiveness of the multi-layered security measures implemented to protect the academic records database. Successful

TABLE IX
INPUT VALIDATION MIDDLEWARE TESTS

Endpoint Type	Test Case Description	Result
Auth Endpoint	Missing required fields	Passed
	Invalid email format	Passed
	Invalid role	Passed
	Password too short	Passed
	Invalid image format	Passed
Student Endpoint	Missing school year	Passed
	Invalid school year format	Passed
	Missing required parameters	Passed
	Invalid data type	Passed
	Missing required quarter	Passed
Teacher Endpoint	Missing required parameters	Passed
	Invalid grade level	Passed
	Missing student IDs	Passed
	Invalid grading period	Passed
	Invalid class ID format	Passed
Class Endpoint	Missing required fields	Passed
	Invalid section IDs	Passed
	Invalid grade level	Passed

outcomes across all test cases, detailed in the accompanying tables (Tables V-IX), indicate a sound security posture.

User access is *rigorously* controlled through robust authentication and authorization mechanisms. Authentication tests (Table V) *confirmed* the reliability of the `JWT`-based system, demonstrating that access was consistently denied when presented with missing, empty, expired, malformed, tampered, or otherwise invalid tokens (e.g., fake user ID, wrong cookie name). Building upon successful authentication, Role-Based Access Control (`RBAC`) (Table VII) *effectively* enforced privilege separation, ensuring that users could only access routes appropriate for their assigned role (`Admin`, `Teacher`, `Student`), preventing unauthorized access to administrative or other restricted functionalities. Furthermore, account status restrictions (Table VI) added another layer of control, correctly limiting `'Pending'` and `'Rejected'` users to basic functions like checking status or logging out, while denying access to protected application routes until verification.

The input validation middleware (Table IX) proved *crucial* for maintaining data integrity and system stability. On the selected endpoints it was tested on, it consistently rejected requests containing missing required fields, invalid data formats (e.g., email, roles, school years, image types), incorrect data types, or other improper parameters across authentication, student, teacher, and class endpoints. Complementing this, the `MongoDB` sanitization middleware (Table VIII) specifically targeted database-level threats, successfully blocking attempts to inject `MongoDB` operators (`$ne`, `>`, `$where`) into queries via login or update operations, mitigating the risk of NoSQL injection attacks.

In conclusion, the successful results across authentication, account status checks, `RBAC`, NoSQL sanitization, and input validation, demonstrate a comprehensive and effective security strategy. These integrated layers work in concert to provide substantial protection for the integrity and confidentiality of the academic records managed by the system. The use of automated testing tools like `Jest` and `Supertest` was instrumental in achieving this thorough validation.

C. User Evaluation Results

This section presents the results of the user evaluation conducted with 20 students and 10 teachers from Goa Science High School. The analysis assesses the system's usability based on the metrics defined in the methodology section: effectiveness (task success), efficiency (time, errors), and satisfaction (SUS, feature-specific), aligning with ISO 9241-11 principles.

1) Effectiveness (Task Success): Effectiveness, measured by the Task Success Rate, indicates the accuracy and completeness with which users achieved their goals for predefined tasks. The target was set at $\geq 85\%$ success rate for each task type.

TABLE X
TASK EFFECTIVENESS (SUCCESS RATE)

Task ID	Role	Success Rate (%)	Target Met
T1	Student	100.0	Yes
T2	Student	100.0	Yes
T3	Student	100.0	Yes
T4	Student	100.0	Yes
T5	Student	100.0	Yes
T6	Student	100.0	Yes
T7	Student	100.0	Yes
T8	Student	100.0	Yes
T1	Teacher	100.0	Yes
T2	Teacher	100.0	Yes
T3	Teacher	100.0	Yes
T4	Teacher	100.0	Yes
T5	Teacher	100.0	Yes
T6	Teacher	100.0	Yes
T7	Teacher	100.0	Yes
T8	Teacher	100.0	Yes
T9	Teacher	100.0	Yes
T10	Teacher	100.0	Yes
T11	Teacher	100.0	Yes
T12	Teacher	100.0	Yes
T13	Teacher	100.0	Yes
T14	Teacher	100.0	Yes
T15	Teacher	100.0	Yes
T16	Teacher	100.0	Yes
T1	Admin	100.0	Yes
T2	Admin	100.0	Yes
T3	Admin	100.0	Yes
T4	Admin	100.0	Yes
T5	Admin	100.0	Yes
T6	Admin	100.0	Yes
T7	Admin	100.0	Yes
T8	Admin	100.0	Yes
T9	Admin	100.0	Yes
T10	Admin	100.0	Yes
T11	Admin	100.0	Yes
T12	Admin	100.0	Yes
T13	Admin	100.0	Yes
T14	Admin	100.0	Yes
T15	Admin	100.0	Yes

As shown in Table X, all tasks for both student and teacher roles achieved a 100% success rate. This indicates that participants were consistently able to complete the core functionalities of the system accurately, meeting the effectiveness target comprehensively.

2) Efficiency (Time and Errors): Efficiency evaluates the resources expended (time, errors) relative to the effectiveness achieved. The target for time efficiency was a Coefficient of Variation (CV) of less than 0.33 across participants for each task, indicating consistent performance times. The target for

error efficiency was an overall task error rate of less than 5%.

Table XI details the average completion times (in seconds), standard deviations (in seconds), and the calculated Coefficient of Variation (CV) for each task performed by student, teacher, and admin participants. The target for task efficiency was a CV of less than 0.33.

Analysis of student tasks (T1-T8) indicates that all tasks successfully met this target, with CVs ranging from 0.038 (T5) to 0.204 (T6). This suggests consistent performance and good learnability for students across these tasks.

For teacher participants, the majority of tasks also met the target CV. Specifically, tasks T1-T6 and T8-T16 were within the desired threshold, with CVs for these successful tasks ranging from 0.030 (T10) to 0.223 (T13). However, Teacher task T7 significantly exceeded the target threshold with a CV of 0.376, and is thus marked as not meeting the target.

Regarding admin tasks (T1-T15), a similar pattern is observed. Most tasks (T1-T6 and T8-T15) successfully met the efficiency target, with CVs for these tasks ranging from 0.015 (T11) to 0.108 (T13).

In summary, while all student tasks and the vast majority of teacher and admin tasks demonstrated efficient and consistent performance times by meeting the CV target of ¡0.33, specific tasks warrant further attention. Teacher task T7 (CV 0.376) showed high variability wherein it may have presented greater challenges, inconsistencies in completion time, or other underlying issues for their respective user groups. The generally low CV values for the other tasks suggest good learnability and efficient workflow design for those operations.

Regarding error efficiency, analysis of the observation logs across all 330 attempted task instances (from 30 participants) indicated that no errors were encountered ('Errors Encountered' = 'N' for all instances). This results in an overall error rate of 0%. This is significantly below the target of $< 5\%$, demonstrating excellent efficiency in terms of error prevention and indicating that users could perform the tasks without making mistakes that were noted by the observer.

3) Satisfaction (SUS and Feature-Specific): User satisfaction was measured using the standardized System Usability Scale (SUS) questionnaire and supplementary questions focusing on the data visualization and messaging features. The target for the overall average SUS score was ≥ 70. The target for feature-specific satisfaction was an average Likert score of ≥ 3.5 (on a 5-point scale).

The average overall SUS score, calculated across all 30 participants (20 students and 10 teachers), was $\mathbf{87.42}$. This score significantly exceeds the target of 70, falling into the 'Excellent' range for perceived usability according to standard SUS benchmarks. This indicates a high level of overall user satisfaction with the AcadBridge system.

Table XIII shows the average satisfaction scores for the specific features. Both the Data Visualization tools (average score: 4.40) and the Messaging System (average score: 4.40) achieved average scores well above the target of 3.5. This suggests users found these specific components helpful, clear, and easy to use, positively contributing to the overall usability and satisfaction.

4) Discussion of Evaluation Results: The user evaluation results strongly indicate that the AcadBridge system successfully meets its usability objectives based on the ISO 9241-11 framework. The system demonstrated high effectiveness (100% task success rates), excellent efficiency (0% error and consistent task completion times with CVs below 0.33), and outstanding user satisfaction (average SUS score of 87.42). The positive feedback on specific features like data visualization and messaging further confirms their value and usability. These findings suggest that AcadBridge effectively addresses the identified challenges in academic record management and communication at Goa Science High School, providing a usable, efficient, and satisfactory solution for both students and teachers.

V. Conclusion

This study successfully developed and evaluated AcadBridge, an academic record system designed to address the specific needs of Goa Science High School by integrating performance visualization and structured communication features. The development and evaluation process adhered to the study's objectives, leading to the following conclusions based on the presented results:

- **Objective 1 (Secure, Centralized Database):** A secure, centralized database for academic records was successfully created using MongoDB Atlas. Rigorous security testing confirmed the effectiveness of implemented measures, including JWT-based authentication, role-based access control (RBAC), input validation, and NoSQL injection prevention (as detailed in Tables V-IX). User evaluation further demonstrated high effectiveness in tasks involving data retrieval and management (100% success rates for all relevant user tasks as per Table X), confirming secure and appropriate accessibility for students and teachers.
- **Objective 2 (Integrated Data Visualization):** Data visualization tools using ReCharts were integrated into the system. User testing revealed that both students (Tasks T3-T5) and teachers (Tasks T10-T13) could effectively use these tools to identify grade trends and performance insights with 100% task success rates (Table X). Feature-specific satisfaction analysis yielded a high average score of 4.40 out of 5 for data visualization usability (Table XIII), confirming the successful integration and user acceptance of these tools for real-time performance analysis.
- **Objective 3 (Structured Messaging System):** A secure, real-time messaging system using Socket.io was implemented to replace informal communication channels. User evaluation showed high effectiveness (100% success for Tasks T6-T8 for students, T14-T16 for teachers, as per Table X) and strong user satisfaction, with an average score of 4.40 out of 5 for the messaging feature's usability (Table XIII). This indicates the system provides a suitable platform for formal and timely communication between students and teachers.
- **Objective 4 (ISO 9241-11 Alignment):** The system was designed and evaluated according to ISO 9241-11

TABLE XI
TASK EFFICIENCY (TIME VARIABILITY)

Task ID	Role	Avg Time (s)	Std Dev (s)	CV	Target Met (CV <0.33)
T1	Student	9.377	0.465	0.050	True
T2	Student	8.270	0.403	0.049	True
T3	Student	15.743	1.913	0.122	True
T4	Student	12.670	1.822	0.144	True
T5	Student	15.740	0.583	0.038	True
T6	Student	8.053	1.644	0.204	True
T7	Student	7.040	1.399	0.199	True
T8	Student	7.633	0.690	0.090	True
T1	Teacher	12.817	1.158	0.090	True
T2	Teacher	9.560	0.655	0.069	True
T3	Teacher	9.750	1.676	0.172	True
T4	Teacher	9.567	0.804	0.084	True
T5	Teacher	16.583	1.407	0.085	True
T6	Teacher	9.517	1.467	0.154	True
T7	Teacher	14.817	5.566	0.376	False
T8	Teacher	17.950	1.226	0.068	True
T9	Teacher	17.417	2.377	0.136	True
T10	Teacher	17.567	0.535	0.030	True
T11	Teacher	16.517	1.497	0.091	True
T12	Teacher	13.667	2.060	0.151	True
T13	Teacher	16.967	3.792	0.223	True
T14	Teacher	9.233	0.333	0.036	True
T15	Teacher	8.100	0.638	0.079	True
T16	Teacher	9.133	0.797	0.087	True
T1	Admin	8.743	0.510	0.058	True
T2	Admin	13.203	0.962	0.073	True
T3	Admin	11.103	0.949	0.085	True
T4	Admin	8.207	0.685	0.084	True
T5	Admin	19.087	0.874	0.046	True
T6	Admin	16.233	0.628	0.039	True
T7	Admin	10.823	0.711	0.066	True
T8	Admin	15.727	0.669	0.043	True
T9	Admin	17.213	0.886	0.051	True
T10	Admin	21.117	0.942	0.045	True
T11	Admin	16.139	0.250	0.015	True
T12	Admin	19.190	0.680	0.035	True
T13	Admin	7.943	0.856	0.108	True
T14	Admin	8.710	0.320	0.037	True
T15	Admin	9.180	0.909	0.099	True

TABLE XII
SYSTEM USABILITY SCALE (SUS) RESULTS BY ROLE

Role	N	Average SUS Score
Student	20	86.62
Teacher	10	89.00
Overall	30	87.42

TABLE XIII
FEATURE-SPECIFIC SATISFACTION SCORES

Feature	Average Score (1-5)	Target Met (>=3.5)
Data Visualization	4.40	Yes
Messaging System	4.40	Yes

principles. The user evaluation results demonstrated high overall usability: Effectiveness was confirmed by 100% task success rates across all tested functionalities (Table X). Efficiency was demonstrated through consistent task completion times for all student tasks and the vast majority of teacher and admin tasks, with 38 out of 39 total evaluated tasks meeting the target Coefficient of Variation (CV) of < 0.33 (Table XI); only one teacher task (T7) exhibited higher variability. Furthermore, excellent error prevention was observed, achieving a 0% error rate across all task instances. User satisfaction was exceptionally high, reflected by an average System Usability Scale (SUS) score of 87.42 (Table XII), significantly exceeding the target of 70.

In summary, AcadBridge successfully met all its objectives, providing a secure, usable, and effective platform that enhances academic record management, facilitates data-driven insights through visualization, and streamlines communication at Goa Science High School. The system addresses the core problems identified in the pre-survey and offers a significant improvement over previous fragmented and manual methods.

VI. RECOMMENDATIONS

Based on the successful development and evaluation of AcadBridge, several key areas for future enhancement are recommended to build upon its foundation. Firstly, developing dedicated native mobile applications (iOS and Android) would significantly improve accessibility and user experience beyond the current responsive web design, offering potential benefits

like enhanced performance, offline grade viewing capabilities, and push notifications for timely updates or messages. Secondly, incorporating a distinct user role for parents or guardians is highly advised; providing them with controlled access to view their child's academic performance and utilize the structured communication features would directly address the need for improved parent-school engagement. Finally, expanding the system's analytical capabilities—perhaps through more advanced data visualizations, predictive modeling to identify students needing early support, or automated summary reporting features—would further increase the value derived from the collected academic data for students, teachers, and administrators alike. These enhancements would broaden the system's utility and impact within Goa Science High School and potentially other educational settings.

APPENDIX

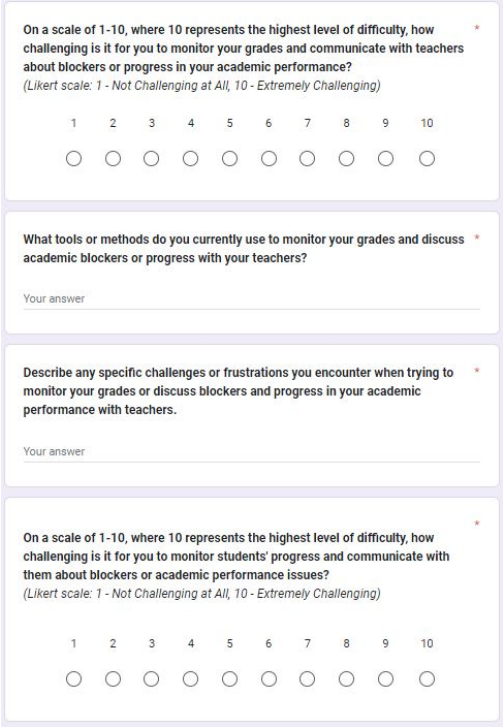

Fig. 4. Pre-Survey Questionnaire for Students

SYSTEM USABILITY SCALE (SUS) RATING CRITERIA

1) I think that I would like to use this system frequently.
   - 1: **Strongly Disagree** – I would not want to use this system at all.
   - 2: **Disagree** – I would not like to use this system frequently.
   - 3: **Neutral** – I have no strong feelings about using this system.
   - 4: **Agree** – I would like to use this system frequently.
   - 5: **Strongly Agree** – I would definitely want to use this system frequently.

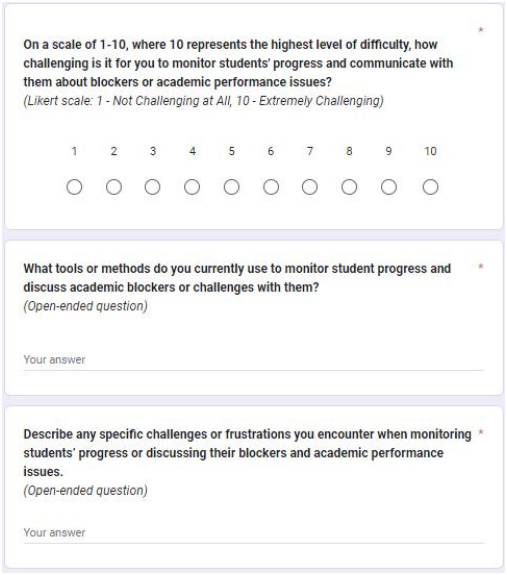

Fig. 5. Pre-Survey Questionnaire for Teachers

2) I found the system unnecessarily complex.
   - 1: **Strongly Disagree** – The system was very simple and easy to understand.
   - 2: **Disagree** – The system was mostly straightforward, with only a few complexities.
   - 3: **Neutral** – I did not feel that the system was either complex or simple.
   - 4: **Agree** – The system was somewhat complex but manageable.
   - 5: **Strongly Agree** – The system was unnecessarily complex.
3) I thought the system was easy to use.
   - 1: **Strongly Disagree** – The system was very difficult to use.
   - 2: **Disagree** – The system was somewhat difficult to use.
   - 3: **Neutral** – I neither found it easy nor difficult to use.
   - 4: **Agree** – The system was generally easy to use.
   - 5: **Strongly Agree** – The system was extremely easy to use.
4) I think that I would need the support of a technical person to be able to use this system.
   - 1: **Strongly Disagree** – I wouldn't need any technical support at all to use this system.
   - 2: **Disagree** – I could manage using the system with minimal technical support.
   - 3: **Neutral** – It's unclear if I would need technical support to use the system.
   - 4: **Agree** – I would need some technical support to use the system.
   - 5: **Strongly Agree** – I would need a lot of help from a technical person to use this system.
5) I found the various functions in this system were well integrated.
   - 1: **Strongly Disagree** – The system's functions were

poorly integrated and didn't work well together.
- 2: **Disagree** – The system's functions were not integrated well but still usable.
- 3: **Neutral** – I didn't notice any issues with integration, but nothing stood out as especially well-integrated either.
- 4: **Agree** – The functions in the system were well-integrated.
- 5: **Strongly Agree** – The functions were seamlessly integrated, working very well together.

6) I thought there was too much inconsistency in this system.
- 1: **Strongly Disagree** – The system was perfectly consistent, with no inconsistencies.
- 2: **Disagree** – The system had some inconsistencies but they didn't impact the experience significantly.
- 3: **Neutral** – I didn't notice much inconsistency or consistency in the system.
- 4: **Agree** – The system was somewhat inconsistent.
- 5: **Strongly Agree** – The system was very inconsistent.

7) I would imagine that most people would learn to use this system very quickly.
- 1: **Strongly Disagree** – It would take a very long time for most people to learn how to use this system.
- 2: **Disagree** – Most people might take some time to learn to use this system.
- 3: **Neutral** – I'm unsure how long it would take for people to learn to use the system.
- 4: **Agree** – Most people could learn to use this system fairly quickly.
- 5: **Strongly Agree** – Most people could easily learn to use this system.

8) I found the system very cumbersome to use.
- 1: **Strongly Disagree** – The system was very easy to use, not cumbersome at all.
- 2: **Disagree** – The system was mostly easy to use, with only a few cumbersome aspects.
- 3: **Neutral** – I didn't find the system particularly cumbersome or easy to use.
- 4: **Agree** – The system was somewhat cumbersome, but still manageable.
- 5: **Strongly Agree** – The system was very cumbersome and frustrating to use.

9) I felt very confident using the system.
- 1: **Strongly Disagree** – I felt unsure and lacked confidence while using the system.
- 2: **Disagree** – I had some doubts and lacked confidence using the system.
- 3: **Neutral** – I was neither confident nor unconfident using the system.
- 4: **Agree** – I felt confident using the system most of the time.
- 5: **Strongly Agree** – I felt very confident using the system.

10) I needed to learn a lot of things before I could get going with this system.
- 1: **Strongly Disagree** – I could start using the system immediately without any prior learning.
- 2: **Disagree** – I needed to learn a few things, but it wasn't a lot to get started.
- 3: **Neutral** – I needed to learn some things, but I could still use the system right away.
- 4: **Agree** – I needed to learn quite a bit before using the system effectively.
- 5: **Strongly Agree** – I needed to learn a lot of things before I could get going with this system.

Data Visualization Usability Assessment

1) The visualizations helped me understand grade trends easily.
- **Strongly Disagree** – The visualizations were confusing and did not help at all.
- **Disagree** – I had some difficulty interpreting the trends.
- **Neutral** – The visualizations were somewhat helpful, but not clear.
- **Agree** – The visualizations made it easier to understand my performance.
- **Strongly Agree** – I clearly understood grade trends through the visualizations.

2) The visual elements were clear and easy to interpret.
- **Strongly Disagree** – The charts and graphs were messy or hard to read.
- **Disagree** – Some elements were hard to interpret or too small.
- **Neutral** – The clarity of the visuals was average.
- **Agree** – Most elements were well-presented and understandable.
- **Strongly Agree** – All visuals were clear, clean, and easy to interpret.

3) The system provided useful analysis to understand my academic performance
- **Strongly Disagree** – The system gave no helpful analysis.
- **Disagree** – The analysis was limited or not meaningful.
- **Neutral** – The analysis was okay but could be improved.
- **Agree** – The analysis helped me understand my grades better.
- **Strongly Agree** – The analysis was very helpful and gave useful insights.

Messaging System Usability Assessment

1) The messaging system helped facilitate timely communication with my teachers.
- **Strongly Disagree** – I was not able to communicate with my teachers in time.
- **Disagree** – Communication was often delayed or ineffective.
- **Neutral** – It was somewhat helpful, but not consistently timely.

- **Agree** – I could generally communicate with my teachers on time.
- **Strongly Agree** – The system allowed me to communicate promptly and effectively.

2) The messaging interface was easy to use
   - **Strongly Disagree** – The interface was confusing and difficult to use.
   - **Disagree** – It took effort to understand how to use it properly.
   - **Neutral** – I didn't have strong feelings either way.
   - **Agree** – The interface was easy to navigate and understand.
   - **Strongly Agree** – It was very intuitive and user-friendly.
3) The image feature enhanced the clarity of my communication.
   - **Strongly Disagree** – The image feature did not help or made things confusing.
   - **Disagree** – The feature was rarely useful in my conversations.
   - **Neutral** – It was occasionally helpful, but not essential.
   - **Agree** – The ability to send images helped explain my points better.
   - **Strongly Agree** – The image feature greatly improved how I communicated.

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