LIPA GRACE ACADEMY STUDENT PERFORMANCE MONITORING WITH ANALYTICS

A Capstone Project Proposal Presented to the Faculty of
College of Informatics and Computing Sciences
BATANGAS STATE UNIVERSITY
The National Engineering University
Batangas City

In Partial Fulfillment
Of the requirements for the Degree
Bachelor of Science in Information Technology
Major in Business Analytics

by:

Thea Clarisse P. Delos Santos
Jussel Elejorde
Keanne E. Lopez

Dr. Maricel Grace Z. Fernando
December 2023

APPROVAL SHEET

This capstone project entitled **LIPA GRACE ACADEMY STUDENT PERFORMANCE MONITORING SYSTEM WITH ANALYTICS** prepared and submitted by Thea Clarisse P. Delos Santos, Jussel Elejorde, Keanne E. Lopez in partial fulfillment of the requirements for the degree **Bachelor of Science in Information Technology Major in Business Analytics**, has been examined and is recommended for acceptance and approval for oral examination.

MARICEL GRACE Z. FERNANDO, DIT
Adviser

Approved by the Committee on Oral Examination with a grade of _____.

PANEL OF EXAMINERS

LLOYD H. MACATANGAY, MSCS
Chairperson

LOVELY ROSE T. HERNANDEZ, MSCS
Member

DEAN CHARLIEMAGNE F. RAMOS, BSC
Member

Accepted and approved in partial fulfillment of the requirements for the degree of Bachelor of Science in Information Technology major in Business Analytics.

_____
Date

PRINCESS MARIE B. MELO, DIT
Dean, CICS

ABSTRACT

The advent of digital technologies had a profound impact on different facets of human existence, education being one of them. In recent times, technological advancements have presented novel possibilities for improving the monitoring of student performance.

Lipa Grace Academy is a private school that provides quality education to students in Lipa City, Batangas with a total population of 2,024 students and 57 faculty members from elementary to senior high school. As the school continues to grow, it faces various challenges. The current process of generating weekly reports using a macro spreadsheet and sending them individually through email to the students is time-consuming and prone to errors. Additionally, students cannot view their grades online, and the reports in the macro spreadsheet are only accessible by the teachers. Therefore, the developers proposed a Student Performance Monitoring System that can fully address their specific needs. The proposed system aims to provide features such as online grading, tracking students' weekly progress of activities and quizzes, and predictive analytics to determine the percentage required for students to qualify for academic honors., which can improve the overall learning experience for both students and teachers. By developing a Student Performance Monitoring System that meets the needs of both teachers and students, Lipa Grace Academy aims to contribute to the achievement of SDG 4 which is to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all and provide quality education to its students.

ACKNOWLEDGEMENT

The researchers would like to express their profound appreciation to the individuals who have contributed to the success of this research.

To **Dr. Maricel Grace Z. Fernando** who gives the researchers exceptional guidance and unwavering support that helped them complete this study.

To their **parents** who instilled in them the value of education and provided them with unconditional love and support.

To their **friends** and **classmates** who motivate them to excel and complete their tasks.

And above all, to the **Almighty God**, for guidance, for the knowledge and strength that made this research possible.

T.C.P.D.S

J.E

K.E.L

DEDICATION

This work is sincerely and completely committed to everyone.

Who assisted and directed us in shaping our future.

First and foremost, to the creator, ALMIGHTY GOD,

the creator of all things and the source of life and love,

To our Parents,

who have given us their limitless moral and financial support

for the study's development,

To our friends,

with whom we share our experiences daily laughter and headaches,

And thank you to our professors for sharing your expertise,

as well as the necessary competence to complete the project.

T.C.P.D.S

J.E

K.E.L

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Background of the Study

The introduction of digital technologies profoundly affected many facets of human existence, including education. Recent technological advancements have presented novel opportunities for enhancing student performance monitoring. Incorporating technology into educational institutions has brought about a revolutionary shift in the collection, analysis, and dissemination of educational data. By leveraging digital platforms, software applications, and analytics tools, schools can streamline and automate the monitoring of student performance.

Monitoring student performance is an essential component of educational institutions because it enables educators to assess and track students' academic progress, identify areas for development, and provide timely feedback. Monitoring performance among students has traditionally relied on manual techniques, such as record-keeping and paper-based reports. However, these methods are time-consuming, error-prone, and lack the efficacy necessary to meet the demands of the current educational environment.

The United Nations recognizes the significance of quality education as a fundamental human right and a catalyst for sustainable development. Hence, it has established Sustainable Development Goal 4 (SDG 4) to ensure inclusive and

equitable education and promote opportunities for lifelong learning for all. Through developing a Student Performance Monitoring that meets the requirements of both teachers and students, Lipa Grace Academy seeks to contribute to the achievement of SDG 4 and provide its students with a quality education.

Lipa Grace Academy is a private school located at 28 B. Morada Ave. 4217 Lipa City, Batangas, has been providing education to its students for 52 years, catering to more than 2,000 students from elementary to senior high school. It was founded on July 5, 1970, and has provided quality education to students for over five decades. The school is committed to equipping students with knowledge, skills, and values to make them responsible and productive citizens.

Many educational institutions continue to encounter difficulties in administering and monitoring student performance. The Lipa Grace Academy uses a macro spreadsheet to generate weekly student reports emailed to each student individually. Their weekly reports include their missing/completed/incomplete assignments and assessments. In addition, students cannot view their grades online, as only teachers can access the reports in the macro spreadsheet. Although this report generation method is well-intended, it is time-consuming, inefficient, and does not provide students instant access to their grades. In addition, the lack of an online platform for students to access their grades and monitor their progress hinders their ability to make informed academic decisions.

Instead of handing out physical report cards, the school prefers that students observe their grades within the system. The current system's inefficiencies and lack

of transparency make it difficult for instructors to monitor and manage student performance effectively. The inability of students to access their weekly progress within the system may impact their motivation and interest in learning. Therefore, the developers propose a Student Performance Monitoring System with comprehensive monitoring and tracking capabilities.

To address the issues, the researchers propose developing a Student Performance Monitoring System for elementary to senior high school pupils at Lipa Grace Academy. This system will enable instructors to manage student attendance and input grades and scores for various activities and assessments. In contrast, the system will provide students with a dashboard to view their grades and monitor their weekly progress regarding incomplete, missing, or failed activities and quizzes.

In addition, the system will include an honor roll function that allows teachers to identify the top-performing students in each grade. In addition, the system will generate progress reports that will enable teachers to identify pupils who are falling behind and provide targeted assistance to help them catch up. This report will be displayed in the Teachers' Dashboard using visualization charts.

The proposed system will also integrate analytics, enabling the system to provide valuable insights into student performance, such as attendance reports and predictive analytics for determining the required percentage for academic honors. The proposed system will provide the institution with a valuable tool for managing and monitoring student performance, improving communication between teachers and students, and enhancing the student's overall learning experience.

Objectives of the Study

The main objective of the study is to design and develop a Student Performance Monitoring System with Analytics for Lipa Grace Academy and contribute to the achievement of Sustainable Development Goal (SDG) 4.

Specifically, this study aims to:

1. enable teachers to:
    1.1. manage student attendance
    1.2. input grades and scores for various activities, assignments, and assessments
    1.3. monitor student weekly progress
    1.4. generate list of students who qualify for academic honors
2. provide students with a clear view of their grades, weekly progress which includes incomplete, missing, or failed activities and quizzes, and enables them to track their own performance over time
3. integrate analytics to analyze student performance and identify improvement areas through:
    3.1. attendance and tardiness reports
    3.2. predictive analytics to determine the percentage required for students to qualify for academic honors.

Significance of the Study

The challenges faced by Lipa Grace Academy have an impact on the academic performance of its students. These challenges include using macro

spreadsheets to generate weekly reports and allowing students to view their grades online. The proposed study will design and develop a Student Performance Monitoring System for the Lipa Grace Academy that utilizes analytics to monitor the student's performance to address these issues.

One of the main goals of the proposed study is to contribute to achieving Sustainable Development Goal 4. SDG 4 seeks to ensure inclusive and equitable education and promote opportunities for lifelong learning for all. By developing a Student Performance Monitoring System, the Lipa Grace Academy will be able to provide a more comprehensive platform that meets the specific requirements of its students and teachers.

Additionally, the students will benefit significantly from implementing the proposed system. They will have access to a platform that enables them to view their grades and monitor their weekly progress. This level of transparency and self-monitoring empowers students to assume responsibility for their education, set objectives, and make informed decisions regarding their academic journey. In addition, integrating analytics will provide students with valuable insights into their performance.

The teaching faculty of Lipa Grace Academy will also experience significant advantages from the adoption of this system. The tracking of student attendance, grading, and performance will reduce their administrative burden. With the availability of comprehensive student performance data, teachers will be able to identify individual student strengths and weaknesses, tailor their teaching

approaches accordingly, and provide targeted support to maximize student potential.

In addition to the benefits at the school level, the findings and outcomes of this study are relevant to the educational community as a whole. The proposed system works as a model for other educational institutions facing similar challenges in monitoring student performance. The insights gained from the development and implementation process can serve as a valuable reference for future research and development endeavors in educational technology and analytics. The study's success has the potential to encourage other institutions to implement innovative solutions that leverage technology and analytics for enhanced monitoring of student performance.

Additionally, the study is significant because it contributes to the growing body of knowledge regarding the use of technology in education. The study will provide insights into the challenges educational institutions face in administering and monitoring their students' performance, as well as how technology can assist in overcoming these obstacles. This study's findings can be helpful for educational institutions intending to implement a Student Performance Monitoring System or are currently facing similar obstacles.

In conclusion, the proposed study will address the challenges faced by the school through developing a Student Performance Monitoring System and utilizing analytics. The features of the system will provide a platform that teachers and students can use to monitor and improve academic performance. The significance

of the study lies in its contribution to the attainment of SDG 4, which is to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Scope and Limitations of the Study

This research intends to design, develop, and implement a Student Performance Monitoring System with Analytics for Lipa Grace Academy. The Student Performance Monitoring system will provide instructors and students with various features and functions.

For the teachers, the system will offer various features that streamline their administrative tasks and enhance their ability to monitor student performance effectively. Teachers can manage student attendance, record attendance data, and generate attendance reports efficiently. This will save valuable time and effort that can be redirected toward instructional activities. Additionally, teachers can input grades and scores for various activities, assignments, and assessments directly into the system. The system will provide a dashboard for teachers to record and update grades, eliminating manual record-keeping efficiently. This feature will simplify the grading process and provide teachers with a comprehensive overview of student performance.

On the other hand, students will have access to a dashboard to view their grades and performance in real time. They can track their progress over time, identifying areas where they excel and areas that require improvement. This will

enable students to clearly understand their academic standing and take proactive measures to enhance their learning outcomes. Additionally, the system will provide students with their weekly progress reports. These reports can be based on analyzing their assignments, quizzes, and other assessments, helping them identify and track school activities.

Despite this study's comprehensive approach, researchers considered certain limitations. This study will not include other features beyond the scope of the system, such as a forum for parent-teacher communication. The system will not provide online classes or synchronous communication channels between the teachers and students or generate automated reports or analyses without the users' input. The proposed system will only be implemented and tested in Lipa Grace Academy, and the results may not apply to other schools with different needs and situations. Lastly, it is worth mentioning that the system will be web-based, and the development of a mobile app is not within the scope of this study.

Definition of Terms

To facilitate the understanding of this study, different terms are defined herein.

Advent. As used in this study, it refers to a coming into place, view or being; arrival.

Analytics. Analytics refers to the application of mathematical, statistical, and computational methods to large volumes of data in order to discover patterns, extract insights, and derive actionable information. In the context of this study, analytics refers to the systematic process of collecting, organizing, analyzing, and interpreting data related to student performance.

Honor Roll. A list containing the students at a given school who have excelled academically.

Macro Spreadsheet. A macro spreadsheet refers to a large-scale spreadsheet document created using spreadsheet software, such as Microsoft Excel or Google Sheets. It is a tool commonly used at Lipa Grace Academy for generating weekly reports of student performance.

Predictive Analytics. Involves applying advanced statistical algorithms and machine learning models to analyze historical data, identify patterns, and generate predictions or forecasts based on the identified trends. In the context of the study, predictive analytics will be used in determining the percentage required for students to qualify for academic honors.

Visualization Charts. Visual representations, such as graphs, charts, or diagrams, used to present data and information in a clear and easily understandable

format. In the context of this study, graphical representations generated by the system that display relevant data, performance metrics, and trends using various types of charts or visual elements, enabling students and teachers to comprehend and interpret the information more effectively.

Self-Monitoring. The practice of students actively tracking and assessing their own academic performance and progress. The integration of features within the Student Performance Monitoring System that allow students to view their grades, attendance records, completed activities, and performance metrics, enabling them to monitor their own progress and take ownership of their learning journey.

Transparency. Transparency is the openness and accessibility of information. In the context of this study, the availability of comprehensive and up-to-date performance data, including grades, attendance, and assessment results.

CHAPTER II
REVIEW OF RELATED SYSTEMS AND STUDIES

This chapter presents the Technical Background, Related Studies, and Related Systems, which helped in familiarizing information relevant and similar to the present study.

Technical Background

This section aims to provide an in-depth discussion of the essential technical aspects of developing the Lipa Grace Academy Student Performance Monitoring System with Analytics. The technical background aligns with attaining the project objectives.

The researchers will use different programming languages in developing the system. These include React.js and Bootstrap for the front end and Python and SQL for the back end. Python is a programming language used for the system's back end, which will handle the system's data processing and management. SQL is a query language used for the system's database management.

In addition to these programming languages, the researchers will use various frameworks and libraries to build the system. Django, a Python-based web framework, will be used for the system's back end. React.js, a JavaScript library, will be used for the system's front end, which will help create a seamless and interactive user experience. Bootstrap, a CSS framework, will also be used for the front end, which will help create a responsive and mobile-friendly interface.

In this study, the proponents will use descriptive statistics to analyze student performance and identify improvement areas using Python libraries: numpy and pandas. Descriptive statistics is a branch of statistics that deals with the collection, analysis, interpretation, and presentation of data. It involves summarizing and presenting data meaningfully, which will help provide insights into student performance. Specifically, it will help the researchers to generate item analysis reports and track student engagement. By analyzing the data, teachers can provide targeted interventions to help struggling students, thus contributing to achieving the Sustainable Development Goal (SDG) 4 and the project's objectives.

To ensure reliable and secure hosting, the project will utilize a cloud server. This will provide scalability, high availability, and easy accessibility to the system for users. The cloud server will enable efficient storage and retrieval of data, facilitating seamless user interactions and data analytics.

The researchers will utilize an agile methodology to ensure the project is completed efficiently. This method is an iterative approach that involves collaboration between cross-functional teams to deliver a product that meets the client's needs. This methodology will allow the project to be completed promptly and efficiently, ensuring that the final product meets the objectives set.

Furthermore, the researchers will implement a testing plan to ensure the system's quality. International Organization for Standardization/International

Electrotechnical Commission 9126 will be used as the testing standard, which is a comprehensive testing plan that focuses on quality characteristics such as functionality, reliability, usability, efficiency, maintainability, and portability.

RELATED STUDIES

Famorca and Elivera (2020) state that technology, specifically learning analytics, can disrupt traditional teacher-centered learning environments. Learning analytics generates learning patterns based on learner interactions and is used in a metacognitive adaptive blended learning environment. By recording and analyzing learners' log files, activity status, progress indicators, scores, and visibility indicators, rule-based algorithms can be generated to control, regulate, and direct learners' progression in a blended learning environment. This research seeks to provide educational technologists with the necessary mechanisms and indicators for generating learning analytics and enhancing student-centered learning and teacher effectiveness. The study also identifies topics requiring additional research attention.

In a similar study conducted by Amazona and Hernandez (2019), academic performance monitoring is defined as the degree to which a student meets the course or program's established requirements. The mentioned study seeks to ascertain the acceptance level of users towards an information system that predicts students' academic performance Using the technology acceptance model and a survey conducted in a Philippine higher education institution. The results indicate that

perceived usability substantially affects its perceived usefulness. Additionally, there is no correlation between perceived usefulness and attitude toward technology adoption. The technology acceptance model clarifies the adoption determinants of predictive analytics in student academic performance, and the study discusses their practical and theoretical implications.

According to Raga et al.'s (2018) research, web-based learning environments in Philippine higher education institutions (HEIs) have enabled the accumulation of vast quantities of data on students' online activity. The difficulty resides in analyzing this vast quantity of data. This study proposes a data-driven method for analyzing student action records captured by the Learning Management System Moodle to generate graphical representations that instructors can use to monitor student activities throughout the course. The log data analysis from several blended courses using the Moodle platform at a university revealed variations in student behavior, such as patterns in resource access, assessment assignments, and engagement level. According to the study, data analytics enhances student engagement and performance.

A study conducted by Revano and Garcia (2021) states that higher education institutions are implementing new methods of assessing and monitoring student progress to improve student learning outcomes. Learning analytics, made possible by advanced analytics tools that utilize real-time data, has the potential to help attain these goals. However, the use of learning analytics tools is frequently hampered by their design, which only occasionally considers users' requirements and preferences.

To address this issue, a participatory design (PD) approach was used in this study to construct a human-centered learning analytics dashboard for higher education. The study gathered feedback and observations from students and instructors during multiple PD sessions. Four key factors were identified as essential for the development of the dashboard: data accessibility, time considerations, assisting students in their transition to university life, and discipline-specificity. The findings of this study emphasize the significance of human-centered design in the development of learning analytics tools and provide insight into how such tools can be optimized for use in an academic setting.

According to a study by Panadero et al. (2018), the proliferation of digital learning environments has made it more essential for students to monitor their learning, evaluate their progress, and determine their next course of action. Supporting self-regulated learning is difficult for instructors, particularly when students learn independently online. The authors propose utilizing learning analytics to address this issue to improve self-directed learning. They contend that it is crucial to comprehend what trace data from digital environments reveals about student progress to develop effective data-driven interventions. In addition, they suggest that the most effective interventions encourage students to reconsider their strategies, evaluate their progress, and make better decisions as they are learning instead of directly attempting to develop student capacity through feedback.

According to the study conducted by Duldulao et al. The online student academic performance monitoring and evaluation system at Quirino State

University is an automated platform that optimizes difficult, time-consuming, and repetitious data processing tasks such as exam scores, grade computation, and student record maintenance. Only one data entry is permitted into the system, and processing instructions for data manipulation are provided automatically. It was suggested that parents of students should be accommodated, that grades should be secured, and that it should be possible to evaluate student performance during midterm and final grading.

Predicting students' academic performance in education can enhance the teaching and learning process for both educators and students. According to Estrera et al. (2017), the researchers sought to create a system that integrates a dynamic web-based grade book with predictive analytics to evaluate student performance. Through a series of experiments, they determined that factors such as GPA, gender, study behavior, interest in studies, and study time significantly impacted prediction accuracy. Utilizing the Decision Tree Algorithm for forecasting purposes was determined by the study to be effective. Overall, the findings indicate that this system can facilitate systematic monitoring of student performance, allowing teachers and students to take the necessary steps to enhance academic outcomes. The researchers suggest that entrance exam scores and extracurricular activities be used to predict students' academic performance, thereby providing educators with additional insight.

According to Dayupay et al. (2022), students and teachers can use data mining techniques to uncover hidden knowledge and patterns that can improve the

educational system's decision-making processes. In e-learning systems or web-based education, student behavioral characteristics play an essential role, as they indicate the student's interactivity with the e-learning system. The authors aimed to demonstrate the significance of student behavioral features by gathering educational data from a learning management system (LMS). Feature analysis was performed on the dataset, followed by data preprocessing, a crucial step in knowledge discovery. To predict student academic performance, the researchers used different analytics or algorithms such as Naive Bayes (NB), Decision Tree (ID3), Support vector machines (SVM), and K-Nearest Neighbor (KNN). The results demonstrated that the proposed model using ensemble techniques achieved better accuracy, indicating its reliability for monitoring student performance.

According to the study by Borbon et al. (2021), the purpose of this study was to evaluate the online learning approach using MyLPU in terms of technology, coursework, course, instructor, communication, learning, satisfaction and preference, performance monitoring, and identifying the problems encountered in online education, as well as proposing an action plan to improve the online learning environment of the students and teaching strategies using MyLPU. The authors used descriptive and quantitative analysis to evaluate the online learning approach utilizing MyLPU among tourism and hospitality students in the College of International Tourism and Hospitality Management. Various statistical tools were used to collect and present the data, and the findings revealed that technology and coursework were integral components of online learning. Students responded

favorably to technology, coursework, and preferences. The teacher will support the student's initiative to be motivated to learn.

Several studies have investigated the impact of implementing learning management systems (LMS) in online learning environments on monitoring student performance. According to the research conducted by Tus et al. (2021), the use of Learning Management Systems (LMS) significantly correlates with the academic performance of Filipino students participating in online learning. Students who utilize LMS platforms frequently perform better academically than those who do not. In addition, the study discovered that students who often use LMS platforms have superior time management skills and are more self-directed learners. The study also revealed that using LMS platforms positively impacts student motivation and online learning engagement. The authors concluded that integrating LMS platforms with performance monitoring into online learning can enhance Filipino students' academic performance and learning outcomes.

Technological advancements have made innovative and interactive methods for conveying online courses possible; however, educators continue to face challenges associated with poor student performance and low success rates in these courses. Raza et al. (2021) state that monitoring and documenting online students' academic progress and experiences is arduous, especially when students are not physically present in the classroom and access course materials remotely. Therefore, automated student performance monitoring is essential to prevent underachieving students from slipping behind and leaving unnoticed.

The expansion of technology has paved the way for novel educational approaches, such as e-learning management systems (LMS). Learning management systems offer numerous advantages to academic institutions, including enhanced student engagement, academic progress monitoring, and personalized learning. According to Avci & Ergün (2022) study, the LMS participation rate was significant for student engagement and academic performance but not for information literacy. Closely monitoring student participation and performance within the LMS can assist instructors in determining their students' requirements and providing support accordingly. High participation rates enhance students' interest in online courses. Consequently, students can avoid learning difficulties in online environments. These discoveries influence how students learn online and how classes are taught to increase student success in online learning environments.

Providing a high-quality education is essential, but accurately predicting student academic performance is important for enhancing educational outcomes and assisting students in achieving success. According to the study of Asiah et al. (2019), the lack of accurate and efficient prediction models is a significant obstacle. Predictive analytics can improve institutional decision-making and contribute to improved outcomes. The purpose of this paper is to review current research on academic analytics, with a particular emphasis on predicting student academic performance. Previous researchers have proposed various methods for developing performance models utilizing multiple categories of student data, techniques, algorithms, and tools. Techniques for predictive modeling include classification,

regression, and clustering tasks. Numerous variables have been investigated to determine the most influential characteristics for accurate prediction. The ability to precisely predict performance is valuable for guiding the learning process and assisting students in avoiding low grades. In addition, predictive models can help instructors predict course completion and final grades, which are directly related to student performance. It is essential to have high-quality input data, appropriate predictive methods, and robust prediction models to construct effective predictive models.

The study of Qazdar et al. (2022) investigated learning analytics for monitoring and enhancing students' progress in LMS to identify key performance indicators (KPIs) that instructors can use to track student progress and identify struggling students. The student's progress in a learning experience indicates how they interact with courses and learning materials, which instructors can use to identify underachievers, predict students' progress, and identify those who are at risk and require intervention.

In a similar study, Murad et al. (2022) propose a learning analytics dashboard called DashLearn that includes a predictive analytic component to monitor and predict students' academic performance based on their learning activities. The study results indicate that DashLearn enables students to monitor their academic performance, attendance, and assignment submission status and predict their grades in advance, resulting in enhanced learning outcomes.

Learning analytics is a dynamic research field that uses data analysis to improve student's learning experience and environment (Ismail, Ismail, & Ismail, 2021). The research conducted by S. Nizam Ismail et al. (2021) examines the level of student engagement with the Learning Management System (LMS) using learning analytics. Using a learning analytics tool, the study analyzes student engagement with the LMS, investigates the approaches students use to manage their studies, and examines various learning analytic techniques for analyzing student data. The authors conclude that learning analytics can boost student engagement and optimize the LMS, improving learning outcomes.

Predicting students' performance is essential for the success of the education industry. Nonetheless, this endeavor is complicated by the vast amounts of data stored in educational databases, and some institutions need systems capable of analyzing and monitoring student performance. According to Lynn & Emanuel (2021), insufficient research on performance prediction methods and a lack of awareness regarding the significance of predicting student performance contribute to this issue. To address this issue, the review concentrates on examining commonly employed data mining techniques for predicting students' performance in previous studies to identify the most accurate prediction technology. The findings indicate that the decision tree algorithm is the most reliable classification method for predicting pupil performance, yielding accurate and trustworthy results. Predicting students' performance facilitates monitoring their progress, identifies both successful and struggling students and enables educators to make timely

interventions and well-informed decisions. This opportunity contributes significantly to the development of the education sector by improving academic standards in educational institutions.

According to Park et al. (2021) study, "Change of Paradigm on LMS for Online Education: LMS Implementing Learning Analytics and Online," LMS should be designed based on learning analytics that indicates students' learning progress and predict their achievement. The LMS should also incorporate an online assessment that measures students' learning in online education on the move. Based on these LMS characteristics, the authors developed CLASS, an LMS.

Modern education is fundamentally focused on ensuring academic success for all students. To accomplish this, educators require effective tools to identify students who may be academically at risk and adapt instructional strategies to meet their specific requirements. Monitoring student progress is a valuable practice that enables instructors to utilize student performance data to continuously evaluate the efficacy of their teaching methods and make educated decisions about instruction. According to Vilanova et al. (2019), the main outcome of the SPEET project was the creation of an IT tool that incorporated specialized algorithms to address the project's most pressing challenges, including classification, clustering, and dropout prediction. This tool seeks to provide educators with a data-driven method for monitoring student performance and guiding decision-making regarding instructional interventions.

According to Warnars et al.'s (2020) study, students play an essential role as psychologically prepared individuals to receive instruction and guidance from their school. However, each student demonstrates outstanding performance and growth, highlighting the significance of tracking their development to ensure continual improvement of student quality. In addition, evaluating students' educational accomplishments includes the provision of rewards, words of encouragement, and motivation, all of which contribute to improving their learning outcomes and participation in school activities. When selecting students based on their performance or evaluating their developmental trajectory, schools should employ multiple criteria to arrive at widely accepted decisions. It is imperative that colleges and other relevant parties continuously monitor student performance.

In a similar study, Costa et al. (2019) found that tracking students' progress and performance in modern educational systems can be beneficial for instructors and researchers. The authors investigate the use of learning objectives and student interactions in Learning Management Systems to track student performance, with the intent of implementing a software architecture known as Student Academic Performance Evaluation System (SapeS). The author created SapeS based on Learning Analytics and Learning Objectives to aid the instructor in the evaluation procedure. It is anticipated that the system will assist educators in promoting and enhancing learning by supplying student performance and progress data.

Implementing an Education Management Information System (EMIS) is widely acknowledged as a crucial instrument for enhancing education quality and

attaining sustainable development. According to Nkata & Dida (2019), in developing nations like Tanzania, many secondary institutions manually collect, store, and disseminate education data. This manual system hinders the accurate, timely, and reliable dissemination of educational information, making it difficult for parents to track their child's academic progress. Frequently, parents must physically visit schools or wait until the end of the term or academic year to receive their child's academic report. Social and economic factors limit parental involvement in monitoring and tracking academic progress, resulting in poor student performance. To address this issue, the study used structured interviews and questionnaires to obtain data from education stakeholders in secondary schools. According to the study's findings, poor parental involvement contributes to the academic underachievement of secondary school pupils in Tanzania. The study developed and implemented a centralized EMIS to facilitate better monitoring and tracking of student progress to increase parental involvement and academic achievement.

According to a study by Bajracharya (2019), learning analytics analyzes, monitors, and reports educational data displayed on the educators' and students' applications called the learning analytics dashboard, which measures the learners' activities and visualizes the overall results at a glance. Blended learning systems, which combine classroom-based instruction with online learning, have gained popularity and rely on LMS for content delivery.

According to Kew and Tasir (2022), the education industry has benefited from learning analytics because it can be used to analyze student factual data to

identify problems with e-learning and provide interventions to assist students. However, the development of Learning Analytics interventions to provide students with personalized learning materials to suit their needs and improve their learning performance is not yet fully understood. Consequently, the author intends to implement Learning Analytics in e-learning in order to enhance student performance. The findings demonstrated that Learning Analytics assisted the majority of students in improving their motivation, academic achievement, cognitive engagement, and cognitive retention in e-learning.

According to Toktarova and Popova (2022), educational data analysis is a rapidly developing field that enhances the quality and effectiveness of student learning in e-learning systems and environments. Visual analytics techniques are regarded as the most effective method for reviewing and presenting educational data in a format that is both accessible and informative. The authors conclude that visualization makes it possible to present data in a visual and informative format for perception and can aid in analyzing a student's digital footprint and constructing their digital profile.

The study of Şahin and Yurdugül (2022) found that learners desire more entertaining and self-monitoring learning environments and want the LMS to have reporting and predictive capabilities on student achievement. The researchers suggest that the needs and expectations of learners align with third-generation learning management systems, which can be developed through learning analytics.

The study discusses the learner expectations and needs in the context of third-generation learning management systems, interventions, and types of intervention.

In a similar study of Bystrova et al. (2018), learning analytics in massive open online courses (MOOCs) can help predict learner performance, mainly as higher education adopts adaptive learning approaches. The authors employ interdisciplinary methods to analyze qualitative data on performance in various categories of course assignments to predict and improve learner performance while enhancing the overall quality of MOOCs. Learning analytics can provide valuable insights regarding learners' engagement with information and their entry-level skill levels. The study describes the outcomes of implementing the proposed learning analytics algorithm to evaluate learner performance in specific MOOCs.

According to Koh and Kan's (2021) study, despite continuous enhancements, students utilize the administrative functions of learning management systems (LMS) more frequently than learning applications. As learning management systems (LMS) evolve into next-generation digital learning environments that can support user accessibility, content creation and curation, performance monitoring, interoperability, personalized adaptive learning, collaborative learning, and analytics-driven performance management, it is essential to consider students' readiness to engage with these features. Results indicate that students who frequently use LMS for content learning and discussion are also interested in engaging in student-centered e-learning activities and operating systems that

support content curation, performance monitoring, remote group administration, and mobile interoperability.

Information systems play a crucial role in the dissemination of academic and non-academic information in the field of education. According to Trison and Suryawinata (2021), there is a lack of an information system that facilitates mobile device access to student development updates. In response to this absence, the purpose of the mentioned study was to develop a student monitoring information system that enables teachers and guidance counselors to provide parents with information regarding grades, attendance, achievements, and disciplinary actions efficiently and on time. As a result, the Android-based Student Monitoring Information System proved to be a helpful tool, simplifying the process of providing student progress updates to parents for the development of their children.

In the study conducted by Nasution et al. (2022), a web-based learning system is required to facilitate instructors' online monitoring and evaluation of the learning process. The mentioned study sought to develop a monitoring and evaluation system for blended learning. The study employed a research-and-development research design with a waterfall analysis that included requirements analysis, system design, implementation, integration and testing, and operation and maintenance. The outcome of the research is the development of an application for monitoring and evaluating learning assessments, which the monitoring and evaluation team can readily implement during the evaluation process. The system can also display a description of monitoring and learning assessment results, and it

is currently used at a college for monitoring and assessing integrated learning activities.

The researchers reviewed these studies to highlight technology's importance in enhancing student engagement and monitoring academic performance. Most studies have also explored using learning analytics to monitor and improve student progress using LMS. Moreover, other related studies show that monitoring student participation, performance, activities, attendance, and grades can help instructors support learning accordingly, which will also be implemented in the proposed study. Other studies also stated that predictive analytics in predicting academic performance would help students identify at-risk courses. The researchers will incorporate those features into the proposed study by tracking student performance. Overall, the studies' findings demonstrate that the Student Performance Monitoring System, combined with analytics, can significantly improve educational institutions' teaching and student progress and performance monitoring. The mentioned studies above support the proposed study's objective of developing a comprehensive Student Performance Monitoring platform with Analytics to monitor within the system.

RELATED SYSTEMS

E-learning or distance learning has become the most common form of education. According to Cambronero Jr. (2018), Universities must consider cost-effective and efficient operational strategies. The current Graduate Program

Classroom Management System at Central Philippine University utilizes a manual class record. This record contains all necessary data regarding a specific class, including each student's attendance, test scores, and grade components. Exams are manually graded and administered, which can be difficult in large classes. Teachers submit grades to the school record system at the end of each semester, and final grades are mailed to students. Email and social sites for communication and grade submission can be unreliable and disorganized. To address these issues, researchers developed an E-Learning system that could streamline these processes and enhance the Classroom Management System's efficacy and effectiveness. A centralized E-Learning system could facilitate communication, the submission of requirements and assignments, the distribution of course materials, the administration of examinations, and the online viewing of grades and academic monitoring. It could help instructors and students save time and enhance the learning experience.

According to Domingo et al. (2021), the K-12 Basic Education program in the Philippines employs standards and a competency-based grading system, with grades determined by the weighted raw score of students' summative written work, performance tasks, and quarterly assessments. Technology has played a crucial role in assisting instructors with various aspects of assessment, such as progress monitoring, communication, application, and grading. This study seeks to develop a computerized grading system to address teachers' difficulties and problems when recording and monitoring grades. The decision support system integrated into the developed system facilitated monitoring of academic and non-academic student

grades and performance. In addition, it allowed for identifying students whose academic performance may be at risk.

Monitoring university students' attendance is essential for identifying potential problems early. According to the system developed by Bakhri et al. (2020) Students Attendance Monitoring System with SMS Notification (SAMS) was designed to address this need. The system identifies students who may exceed the permissible percentage of absences and notifies the Academic Affairs Division (AAD), parents, and students via SMS. SAMS was developed using the Waterfall Model, which included analysis, design, implementation, testing, and documentation phases. Usability testing revealed that SAMS makes it significantly easier for instructors to monitor absenteeism, thereby increasing efficiency and effectiveness. SMS notifications have proven extremely beneficial, enabling direct communication with parents regarding their children's attendance issues.

Implementing the K-12 program in the Philippines has highlighted the need for effective e-learning administration systems to support education in senior high schools. According to Santos, Durano, and Hortillosa (2023), they have designed a learning management system (LMS) for monitoring student performance in Philippine senior high schools. The developers of the LMS designed it so that an administrator can manage, maintain, and update learning materials. At the same time, instructors can create and deliver content, monitor student engagement, and evaluate student performance. In addition, the system allows students to upload assignments, take tests, and examine their performance. The LMS is designed to

operate on a distributed network, allowing for more excellent service coverage, and is developed using agile software development based on the features desired by the principals, instructors, and students.

The system developed by Duldulao (2018) seeks to design and develop a computerized system that will monitor the academic performance of every student enrolled at Quirino State University from admission until course completion. Several features of the developed system are intended to resolve issues encountered in the current processes of monitoring and evaluating student performance. These features include reducing data entry by allowing data to be inputted only once and providing automatic processing instructions, automating the master list of students by providing an electronic database for data storage, expediting credits evaluation by containing a complete listing of subjects required in the university's courses, generating reports on academic progress, and providing alerts to students.

In the system developed by Bias et al. (2022), the CLASSALI online learning tool was designed to assist Makati Public Elementary Schools in identifying at-risk students and adjust their educational strategies to meet their academic needs. The software includes a Virtual Classroom, an Online Quiz, a Grading System based on DepEd grades, a CLASSALI Forum, and Data Analytics Reports for monitoring learner progress and learning contexts. The system is intended to serve as a collaborative online space where instructors and students can work simultaneously, providing students with cognitive exercises to assess their knowledge of specific subjects. The CLASSALI Forum is designed to facilitate student connection and

social interaction. Overall, the system seeks to improve academic performance and meet the educational requirements of elementary school students in Makati.

According to Ayuyang (2019), Interactive Learning (iLEARN) is a MOODLE-based e-learning portal that enables students and teachers to share knowledge anytime and anywhere. This platform's primary objective is to assist educators in developing online courses where instructors and students can collaborate and interact online. Instructors can deliver lessons, administrate exams, and manage students' scores and grades online. In contrast, students can submit their requirements online, download resources, take exams, and track their progress based on their teachers' grades. The platform was stored on a Ubuntu Linux Server 14.04 LTS server, with Apache as the web server, MySQL as the backend database, and PHP as the parser. As a result, the platform makes the instructional process more efficient and accessible, improving instructors' teaching methods and strategies and students' academic performance.

According to the system developed by Jhoan (2023), TelEducation LMS is a specialized learning management system developed for Isabela State University-Ilagan Campus in the Philippines. The system is user-friendly, extremely adaptable, and includes cohort management. The TelEducation LMS integrates collaborative communication tools and notifications for faculty and students, facilitating the uploading and downloading of lecture notes. Additionally, it allows teachers and students to monitor progress. The teacher's course website functions as a virtual classroom for teachers to manage their learning resources, whereas the student's

course website gives students access to enrolled courses, modules, quizzes, and their progress.

Tubongbanua (2017) developed a system that improves operations by implementing a web-based information and monitoring system for the Cagayan de Oro Academy for International Education. The system was designed to facilitate a variety of school-related transactions and to provide a complex and flexible online platform. The researchers used the Prototyping Life Cycle Model to develop the proposed system to streamline traditional transaction processing and reduce the routine and repetition of manual tasks performed by staff members. The system included grade posting, class schedules, student profiles, guardian profiles, staff profiles, and other essential data. By implementing this Web-based Information and Monitoring System, the academy intended to enhance the quality of service provided to its students while reducing administrative burden and saving time for the school administration. The study has significant implications for improving school monitoring and information management, leading to more efficient operations and enhanced service delivery.

ICTeachMUPO is an e-learning module system designed for faculty and students at Laguna State Polytechnic University in the Philippines, developed by Urera and Balahadia (2019). This system allows instructors to construct classes, approve student enrollment, upload modules or lessons, schedule pre-and post-tests, and track student progress. In the meantime, students can join classes, access pre-test and post-test exams and learning materials, and observe test results. The

ICTeachMUPO e-learning module system provides faculty members and students with a comprehensive platform for managing academic activities and tracking learning progress.

Several Student Performance Monitoring Systems in the Philippines have been developed and implemented in response to the need for effective and efficient teaching and learning methods. Some of the monitoring system are integrated within the LMS. The Central Philippine University Graduate Program's current Classroom Management System relies on manually recording student attendance, scores, and grade components, which can be tedious for instructors. To address this, the researchers developed an E-Learning system that could streamline these processes and improve the efficiency and effectiveness of the Classroom Management System. The system developed by Santos, Durano, and Hortillosa (2023) is designed to have an administrator who can manage, maintain, and update learning materials while instructors can create and deliver content, monitor student participation, and assess student performance. The system developed by Duldulao (2018) aims to monitor the academic performance of every student enrolled in Quirino State University from admission until course completion. The system developed by Biñas et al. (2022) called CLASSALI is an online learning tool that helps identify at-risk students and adjust their educational strategies to meet their academic needs. These studies serve as valuable references for the researchers' proposed study, which aims to develop a student performance monitoring system with analytics that could facilitate the efficient and effective delivery of courses and performance monitoring

in an academic institution in the Philippines. Unlike the other systems, the proposed study also features predictive analytics to determine the percentage required for students to qualify for academic honors and an analytics dashboard that allows instructors to monitor and evaluate their students' performance comprehensively.

The system developed by Rabiman et al. (2020) provides an all-inclusive platform for delivering and managing diverse learning materials and monitoring student performance. The system was developed to facilitate the packaging interactive multimedia, instructional materials, lecture assignments, online discussions, learning videos, and even interactive video conferences. It provides class schedules, online grading, attendance monitoring, Study Result Cards, Study Plan Cards, academic information, video conferences, lecture materials, lecture assignments, learning videos, online discussions, and file sharing, among other functions. The developers discovered that using LMS substantially improves student satisfaction and the quality of their learning experiences. Consequently, LMS has emerged as an indispensable instrument for educators, enabling them to provide engaging and interactive learning experiences to students regardless of their location or background. The adoption of LMS has also facilitated the integration of various teaching and learning resources, allowing instructors to adapt their teaching methods to meet the varied requirements of their students.

Simanullang and Rajagukguk (2020) developed a Moodle-based LMS that enables students to browse videos, courses, discussion forums, messaging, and materials and monitor weekly progress. The developers investigate using Moodle-

based learning management systems to enhance student learning activities. The authors describe how this platform facilitates the development and delivery of online courses, enables instructors to monitor student progress, and facilitates student communication and collaboration. Implementing such systems may result in increased student engagement and academic performance and a more flexible and convenient learning environment.

Based on the TaBAT system developed by Safsouf, Y., Mansouri, K., and Poirier, F. (2021), which is designed to work with various Learning Management Systems (LMS) and allows teachers to monitor the progress of their students while also allowing students to visualize their learning process. The authors propose an interpretable visual communication aid as a dashboard for monitoring and controlling the learning process. The authors conclude that TaBAT can effectively increase online learner engagement and success rates.

According to Jayashanka, Hettiarachchi, and Hewagamage (2022), the COVID-19 pandemic has caused Sri Lankan universities to implement entirely online or blended learning environments, making it difficult for students to monitor their progress, performance, and engagement in the course. To address this issue and facilitate student learning, the authors designed and developed a Technology Enhanced Learning Analytics (TELA) interface for the University of Colombo School of Computing (UCSC) utilizing Learning Analytics. Using the Design Science research method, the authors conducted a literature review and two surveys

with 136 undergraduate students and 12 instructors to determine the required TELA system features. The TELA dashboard was developed as a Moodle plugin and tested with third-year undergraduate students at UCSC. The results indicated that the TELA interface could increase students' motivation, engagement, and grades by allowing them to compare their progress and performance to those of their peers. It helps to increase their motivation to engage more in the course and boosts their self-confidence, thereby enhancing their grades. The TELA interface is an innovative solution that can improve the quality and effectiveness of student learning in entirely online or blended learning environments.

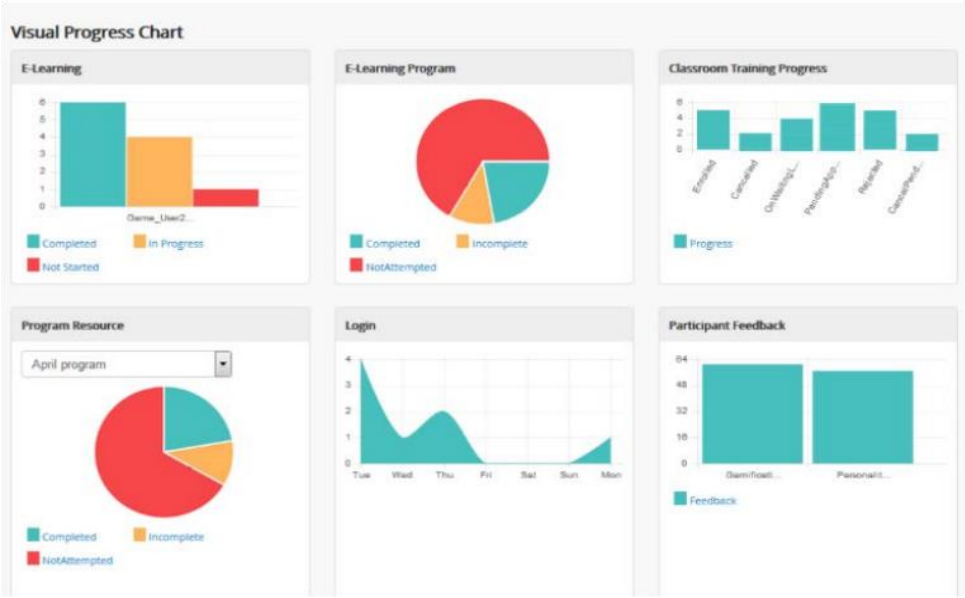
According to Song and Robinson (2019), monitoring student performance over a semester is crucial for students and teachers because it can motivate course redesign, effective student intervention, and practical classroom enrichment strategies. The authors propose a Student Academic Performance System (SAPS) to monitor student progress, which can enhance academic learning and growth. However, an effective SAPS must be simple to implement, straightforward to interpret, and adaptable to any educational level or course format. In this study, the authors contend that it is essential for educators to implement a SAPS system in every classroom at all instructional levels to track student progress and assist students in achieving their academic goals. They provide evidence that their SAPS system is an effective and complementary aid for monitoring student performance by educators.

Developing Learning Management Systems (LMS) overcomes the limitations of time, place, and frequency of meetings between teachers and students. According to Muhardi et al. (2020), LMS can offer several advantages, such as providing a medium for disseminating subject matter, distributing assignments, facilitating student discussion forums, monitoring student performance, and viewing grades online. A web-based LMS was developed for Sma Negeri 1 Kampar Kiri Hilir to address these needs using the PHP programming language and MySQL. The LMS application has three admin actors: administrators, teachers, and students. The administrators manage the curriculum data, semester years, teachers, students, and subjects. The teachers are responsible for uploading materials, assignments, and activities for the students to complete and monitoring student progress. In contrast, the students can download these materials and complete the assignments and activities. The LMS application has increased teacher and student interaction, providing a support system for learning activities and promoting learning beyond the traditional classroom.

Numerous educational institutions have adopted online learning, necessitating the development of new methods for monitoring and assessing the student's learning process. Widodo J et al. (2022) created The eLSIDA LMS as an interactive learning model by integrating several components, including uploading materials and video animation, video interactive, images, audio, interactive quiz, writing, and progress tracking that could aid students in the lecture process. Developing interactive learning media models can result in two-way interactions,

particularly between users and the media, to prevent users from becoming bored rapidly.

Ong Kiat Xin and Dalbir Singh (2021) developed a learning analytics dashboard that is based on Moodle. This dashboard seeks to improve learning outcomes for educators and students by analyzing user usage data. This system can extract data from the Moodle LMS and transform it into meaningful data visualizations, such as tables, line charts, and bar charts. It includes students' achievement in terms of learning outcomes in a line graph, their grades for homework, quizzes, attendance, project marks, and cumulative grades in bar charts. Figure 1 depicts the visual development of students within the system.



Source: (Ong et al., 2021)

Figure 1. Analytics Dashboard.

Santoso et al. (2018) developed a learning dashboard that enables lecturers to monitor student activities in a Student-Centered e-Learning Environment (SCELE) and a learning monitoring tool to visualize and capture data in an easy-to-observe, -analyze, and -target specific concepts. The system resulted in a Moodle plugin dubbed the learning dashboard, which instructors can use to monitor student's learning environments effectively. The dashboard is intended to provide vital information on a single screen in the form of text and graphs, making monitoring activities simpler for instructors.

Amelia and Gufron (2018) have developed an e-learning system that utilizes a student performance monitoring system to increase student motivation in the web programming course. The system is built using the Waterfall Model and utilizes Moodle's content management system. The LMS features multimedia files such as video, audio, images, flash animation, and online exam facilities with various questions, exercises, and quizzes. The system has three user levels: Student (Registered), Teacher (Administrator), and Admin (Super Administrator). Students can only log in through the frontend display website and can only participate in community forums, practice questions, read courses, and track their progress. Lecturers can log in through the backend and post articles, upload material files for students to download, create exercise questions, and monitor student performance. The Admin has the highest control and can add additional features, set global configurations, manage users, and perform other tasks in the system.

The mentioned systems are similar to the current study as they share a common goal of enhancing the quality of education through technology. The Lipa Grace Academy study aims to design and develop a Student Performance Monitoring with Analytics, while the mentioned studies offer a comprehensive platform for monitoring student performance. Most of the studies are about integrating student monitoring within the LMS. Most cited studies still need the Lipa Grace Academy study feature, which enables teachers to monitor student progress, including incomplete, missing, or failed activities and quizzes, and generate honor rolls. The system also features predictive analytics to determine the percentage required for students to qualify for academic honors and an analytics dashboard that allows instructors to monitor and evaluate their students' performance comprehensively. These features enable teachers to identify areas where students may be struggling and provide targeted support to help them succeed.

Based on the mentioned systems, Student Performance Monitoring has been shown to enhance students' satisfaction and quality of learning experience significantly. LMS can also aid in creating and delivering online courses, monitor student progress, and enable student communication and collaboration. LMS, like TaBAT and TELA dashboards, can effectively improve engagement and success rates among online learners. Incorporating a Student Academic Performance System (SAPS) into every classroom is essential for educators to monitor student progress and help students achieve their academic goals. Developing LMS for

schools such as Sma Negeri 1 Kampar Kiri Hilir and using a learning analytics dashboard like the one developed by Ong Kiat Xin and Dalbir Singh (2021) can create a support system for learning activities and promote learning beyond the traditional classroom. The studies demonstrate that LMS, Student Performance Monitoring, and learning analytics dashboards are effective tools for educators to provide students with engaging and interactive learning experiences, regardless of their location or background. These studies are aligned with the proposed project, which utilizes a Student Performance Monitoring platform to track student progress and a dashboard that analyzes learning data to facilitate monitoring and control of the learning process.

Conceptual Framework

The conceptual framework is used to conceptualize and execute the project. The project focuses on Student Performance Monitoring with Analytics, and Figure 2 illustrates the conceptual framework for this project.

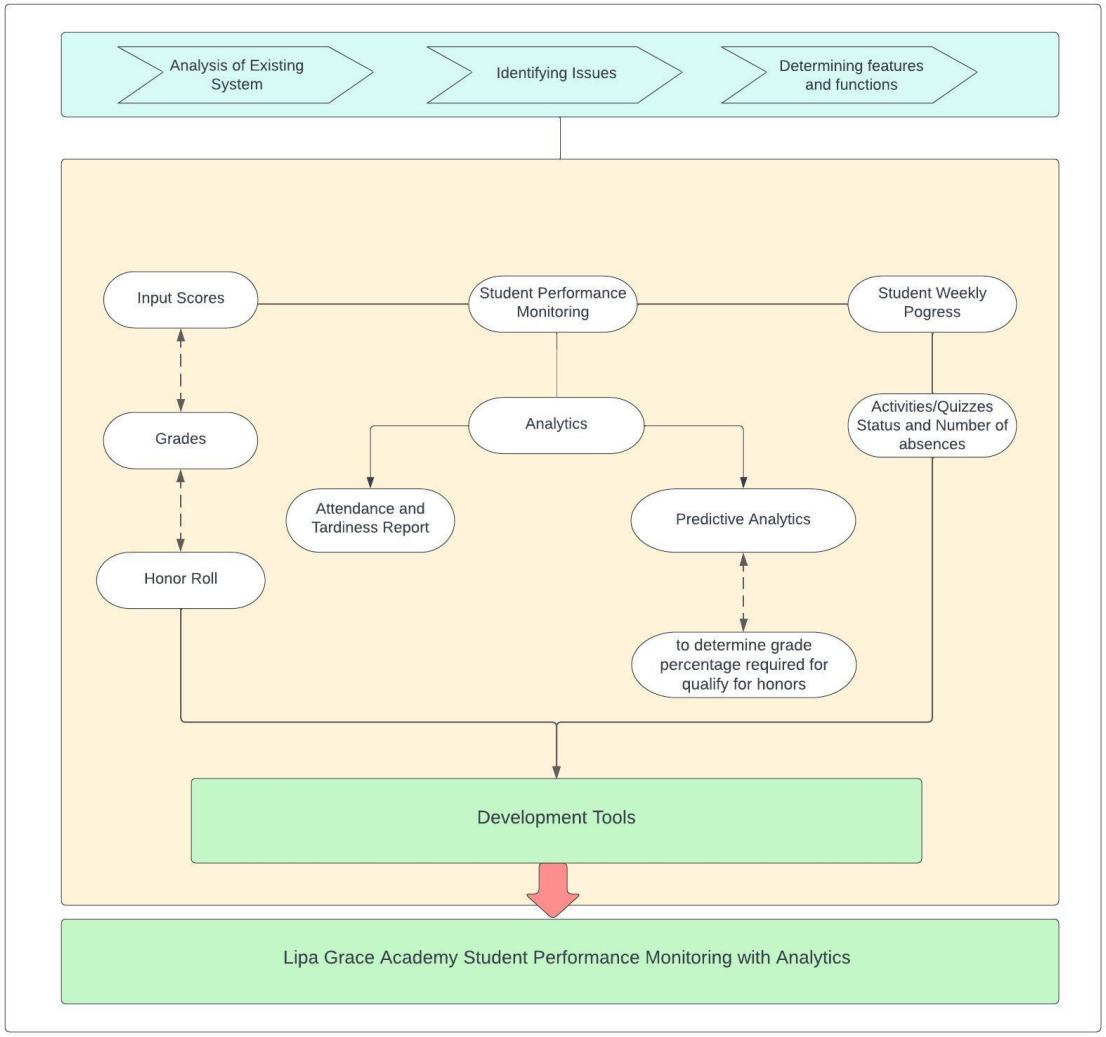


Figure 2. Conceptual Framework

The proponents first considered analyzing the existing systems and identifying problems with the school's current system, such as using a macro spreadsheet to generate weekly reports and the inability of students to access their grades online. In addition, it describes the process for designing and developing a Student Performance Monitoring System that allows instructors to input student grades and test scores, manage student attendance, and track weekly student progress. The framework also includes the development of a dashboard that

provides students with a clear view of their grades and weekly progress, including incomplete, absent, or failed quizzes and activities. In addition, the framework integrates analytics into the Student Performance Monitoring System, allowing instructors to analyze student performance and identify areas for improvement. The analytics capabilities include monitoring each student's attendance and tardiness data and predictive analytics for determining the minimum grade point average required for students to qualify for academic honors.

CHAPTER III
DESIGN AND METHODOLOGY

This chapter discusses the research methodology and procedures used in the study. It also includes a discussion on research design and schematics diagrams.

Software Methodology Model

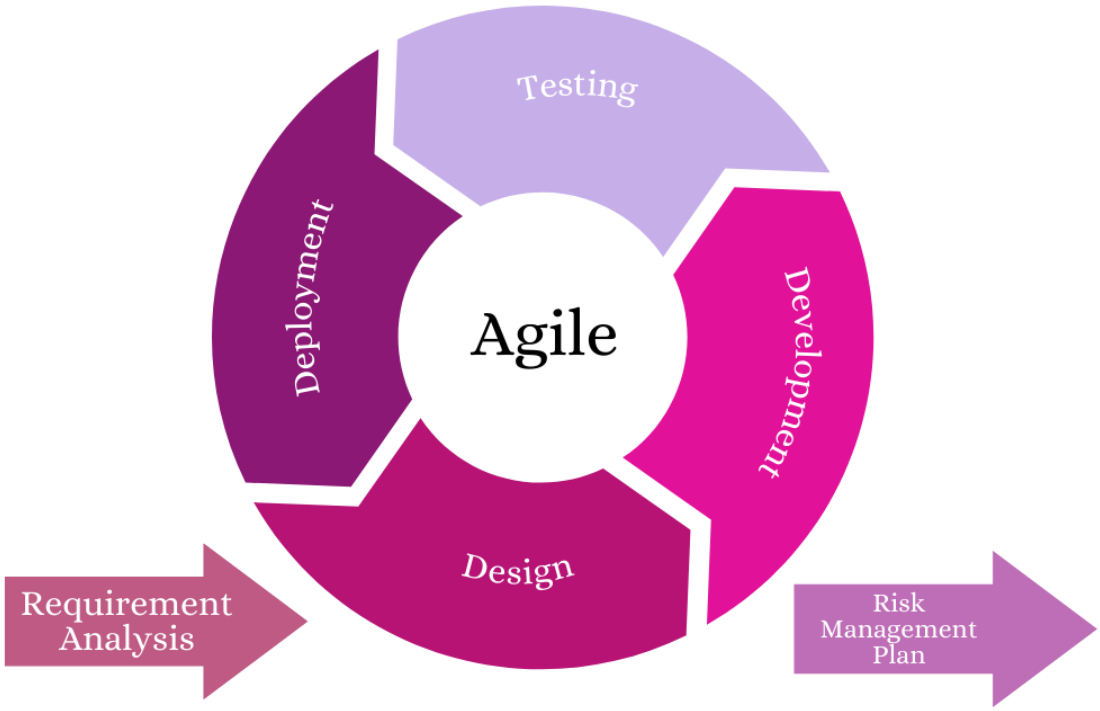


Figure 3. SDLC Model - Agile Method

Figure 3 depicts the prevalent illustration of Agile software development utilized in the system's development. This model comprises seven distinct phases, namely planning, design, development, testing, deployment, review, and launch.

Requirement Analysis

The requirement analysis phase is essential in developing Student Performance Monitoring with Analytics for the Lipa Grace Academy. The

researchers have collected all the required data to identify and document the stakeholders' needs and expectations. This phase involves identifying, prioritizing, and documenting the system requirements, forming the system's design and implementation basis. The researchers have conducted interviews and surveys with the stakeholders to gather their feedback on the features and functionalities that the new system should have. The requirement analysis phase will produce a detailed report that outlines the system's functional and non-functional requirements, including the user interface, performance, security, and scalability.

Analysis of Existing System

After the researchers conducted the literature review and journals, the proponents found numerous existing Student Performance Monitoring Systems. The differences between the existing and proposed system are shown in table 1.

Table 1

Analysis of Existing System

Existing System	Proposed System
No feature for predictive analytics to determine the percentage required for students to qualify for academic honors.	Provides predictive analytics for teachers and students

No feature for weekly progress reports	Generate weekly progress reports for students and teachers
Does not generate honor roll quarterly	System can generate honor roll quarterly
Does not allow teachers to enter student grades	Teachers can input student grades within the system
No attendance and tardiness tracking feature	Provides attendance and tardiness tracking for teachers
Students' can't view their grades	Students' can view their grades within the system

Table 1 shows the analysis of the existing system compared to the developed system. Many existing Student Performance Monitoring Systems lack predictive analytics, the ability to input grades, generate weekly progress reports, generate honor roll, track attendance and tardiness, and view grading cards. On the other hand, the proposed system offers those features. The developed system also provides an interactive student dashboard that allows students to view their grades and progress, including incomplete, missing, or failed activities and quizzes, and track their performance over time.

Fishbone Analysis

The Fish Bone Analysis is a structured diagram that employs a visual representation to identify potential causes of a problem. It proved effective in identifying and disclosing the system's underlying problems and deficiencies. This

tool facilitates a comprehensive brainstorming session to determine the problems' cause-and-effect relationships and interconnections.

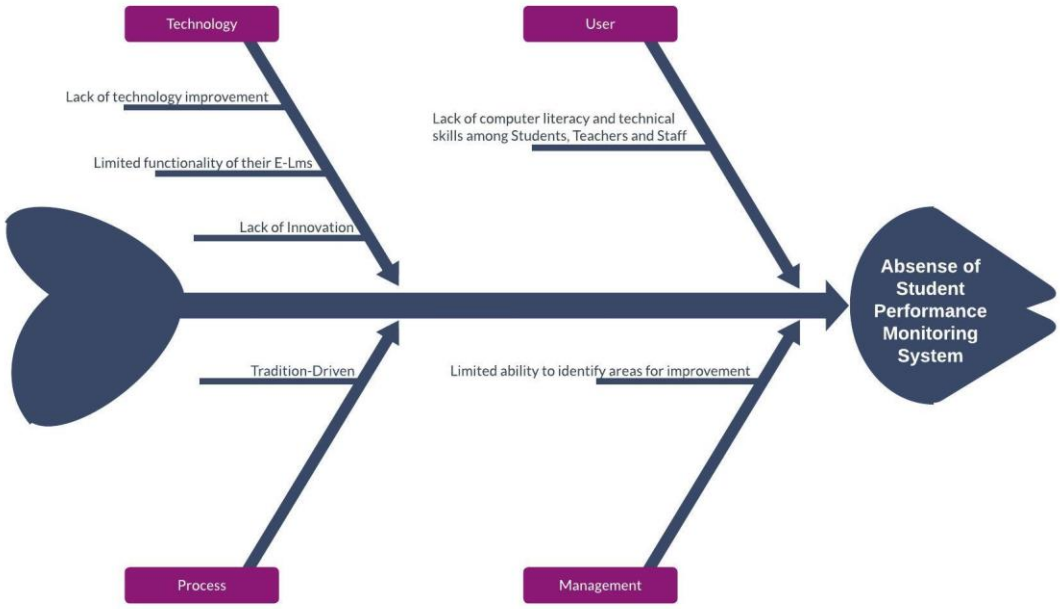


Figure 4. Fishbone Analysis

Figure 4 provides a clear visual representation of factors contributing to the absence of a Student Performance Monitoring System at Lipa Grace Academy. The diagram is divided into four main categories: users, technology, process, and management, each connected to the effect, which is the absence of a student performance monitoring system. Under the user category, the lack of computer literacy and technical skills among students, teachers, and staff significantly contributes to the problem. The system requires specific technical knowledge and skills to navigate and utilize effectively. If users lack these skills, they will not be able to take full advantage of the features offered by the system, including the ability

to monitor student performance. Under the technology category, limited technological improvement and lack of innovation are identified as significant contributors to the problem. It could be due to budgetary constraints or a lack of emphasis on technology as a tool for academic improvement. Under the process category, the tradition-driven nature of the school's academic processes is identified as a barrier to implementing a student performance monitoring system. It may be due to the school's resistance to change or adopting new practices and systems. Under the management category, the limited ability to identify areas for improvement is identified as a key challenge. It could be due to a lack of data analysis capabilities or a need for more emphasis on data-driven decision-making.

System Boundary

A system boundary is a visual tool that indicates the separation of the system from other entities. It can segregate the system from external factors that may impact or be impacted by it.

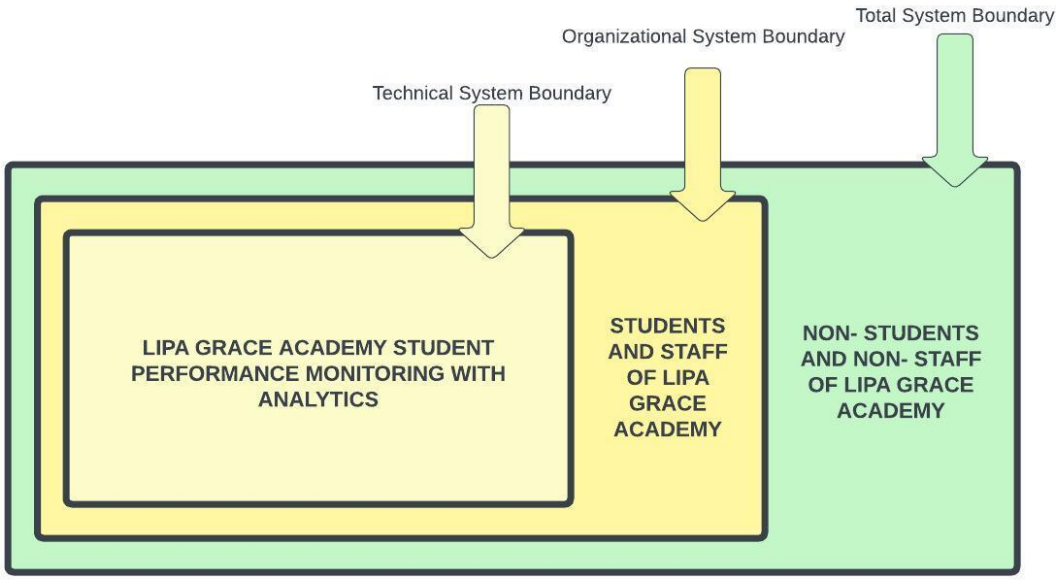


Figure 5. System Boundary

Figure 5 depicts the system boundary for the Lipa Grace Academy Student Performance Monitoring with Analytics. This figure is a plain and concise illustration of the system's scope. The system is intended to assist the students and faculty of Lipa Grace Academy. Non-students and non-employees of the Lipa Grace Academy are expressly excluded from the system, as defined by the system boundary. Defining the system boundary this way ensures that all stakeholders comprehend its purpose and scope, allowing them to collaborate effectively on its development and implementation. The system boundary is the basis for successful collaboration and effective system implementation.

Hardware Requirements

To use the system, users must have the hardware specifications listed in Table 2. These specifications have minimum and recommended requirements, which users must follow to ensure the system is easy to use and interact with.

Table 2
Hardware Requirements Specification

Hardware	Minimum Requirements	Recommended Requirements
Processor	Dual-core processor (2 GHz or faster)	Quad-core processor (2.5 GHz or faster)
RAM	2 GB	4 GB or Higher
Storage	16 GB	32 GB or Higher
Internet Connectivity	10 Mbps speed	20 Mbps speed or faster

The system's hardware requirements are displayed in Table 2. Dual-core processors with speeds of 2 GHz or higher are required, while quad-core processors with speeds of 2.5 GHz or higher are recommended. The minimum amount of RAM required is 2 GB, while 4 GB or higher is recommended. Minimum storage capacity is 16 GB, while 32 GB or higher is recommended. A minimum bandwidth of 10 Mbps is required for internet connectivity, while a speed of 20 Mbps or higher is recommended for optimal system operation.

Software Requirements

The software specifications and requirements for using the application are presented in Table 3. These specifications and requirements are essential to ensure compatibility and proper functioning of the application.

Table 3
Software Requirements Specifications

Software	Specification
Operating System	Windows, Linux, Mac
Web Browser	Google Chrome, Mozilla Firefox, or Microsoft Edge

Table 3 illustrates the specifications of the software requirements that are essential for the application to operate seamlessly on the user's devices. The application can be operated on Windows, Linux, or Mac operating systems. It is also necessary to use web browsers such as Google Chrome, Mozilla Firefox, or Microsoft Edge to run the application without any difficulties.

Functional Requirements

In developing the system, certain requirements were incorporated into the backbone design. This phase tackles the functions of the system to be developed. The requirements will be categorized based on the system users, including teachers, students, and administrators. The functional requirements for each user will detail the necessary features and functionalities needed to fulfill their tasks. This will provide the framework for the system's design, development, and testing, ensuring

that it meets the needs and expectations of its users. The system must have the following capabilities:

1. User Management
    1.1. The system should permit administrators to create and handle user accounts for teachers and students.
    1.2. User roles and permissions should be defined to ensure appropriate access levels and data security.
2. Attendance Management
    2.1. The system should allow teachers to record and manage student attendance through an interface.
    2.2. It should permit the customization of attendance parameters and criteria, including markings of tardiness and excused absences.
    2.3. To generate attendance reports, attendance data should be safely stored and readily accessible.
3. Grade and Score Management
    3.1. The system should enable teachers to input and update grades and scores for various activities, assignments, and assessments.
    3.2. It should support different grading scales, such as percentages, letter grades, or grade points.
    3.3. Teachers should be able to view and analyze grade distributions for individual students and the entire class.
4. Progress Monitoring

4.1. The system should allow teachers to generate progress reports for individual students, showcasing their performance over a specific period.

4.2. It should allow students to view weekly progress, which includes incomplete, missing, or failed activities and quizzes.

4.3. Progress reports should include comprehensive summaries of student performance in different subject areas.

5. Analytics and Insights

5.1. The system should integrate analytics tools to analyze student performance data and provide valuable insights.

5.2. It should generate attendance and tardiness reports, allowing teachers to identify attendance patterns and address attendance-related issues.

5.3. The system should provide predictive analytics to determine the percentage required for students to qualify for academic honors.

6. User Interface and Accessibility

6.1. The system should have a user-friendly interface, intuitive navigation, and a clear information display.

6.2. It should be accessible to teachers and students from various devices, including computers, tablets, and smartphones.

Non-Functional Requirements

This section demonstrated the efficiency and effectiveness of the developed system. The researchers established four standards for evaluating the system's workability: performance, security, usability, and reliability.

1. **Performance**

It must handle many users and concurrent transactions without significant performance degradation. Response time for user interactions should be within under 2 seconds.

2. **Security**

The research team should incorporate robust protocols to guarantee the system's data and features' confidentiality, integrity, and availability. Implementing user authentication and authorization mechanisms ensures only authorized users can access the system's data and functionalities.

3. **Usability**

The system must be user-friendly and easy to use. It should have clear and intuitive interfaces that are easy to navigate.

4. **Reliability**

The system must be reliable and recover quickly from unexpected errors or system failures. The system should be able to handle heavy usage without experiencing crashes or downtime. Developers should conduct rigorous testing to ensure the system meets these reliability requirements.

Constraints

This section details the software utilized for the system and underwent a comprehensive evaluation for its deployment and implementation. A constraint refers to the restrictions on software development that must be met. This enables the team to limit the software options for use in creating and implementing the system.

Table 4
Constraints

Programming Languages	Speed	Flexibility
PHP	Moderate	Flexible
Laravel	Moderate	Highly Flexible
AngularJS	Fast	Flexible

Table 4 shows the software limitations or constraints. The developers rated different software options based on their speed and flexibility. Php was ranked moderately fast and flexible, while Laravel was also moderately fast but highly flexible. On the other hand, AngularJS is rated as fast and also highly flexible.

Trade-Offs

To develop the system, developers can utilize multiple programming languages for project development. Here are some potential programming languages options that could benefit the project.

Table 5
Trade-Offs

Options	Programming Languages
Design A	Python Django React.js Bootstrap MySQL
Design B	PHP Laravel Vue.js MongoDB
Design C	Ruby Ruby on Rails PostgreSQL

Table 5 shows the three options of programming languages that the developers will use in developing the system. Design A consists of Python as the primary programming language, with Django as the web framework for server-side development. React.js is the library used for front-end development and Bootstrap for CSS styling. MySQL is the choice of database management system used to store and manage data.

Design B uses PHP as the primary programming language, with Laravel as the web application framework. Vue.js is the library used for front-end development, and MongoDB is the database management system used for data storage and retrieval.

Design C uses Ruby as the primary programming language, with Ruby on Rails as the web application framework. PostgreSQL is the database management system used for data storage and retrieval.

Design

System Architecture

Figure 6 illustrates the system architecture of Student Performance Monitoring with Data Analytics and E-Learning Management System for Lipa Grace Academy. System Architecture is a critical aspect of any software project and serves as the backbone of the entire system. It is responsible for organizing the different layers of the system and ensuring that they work together seamlessly.

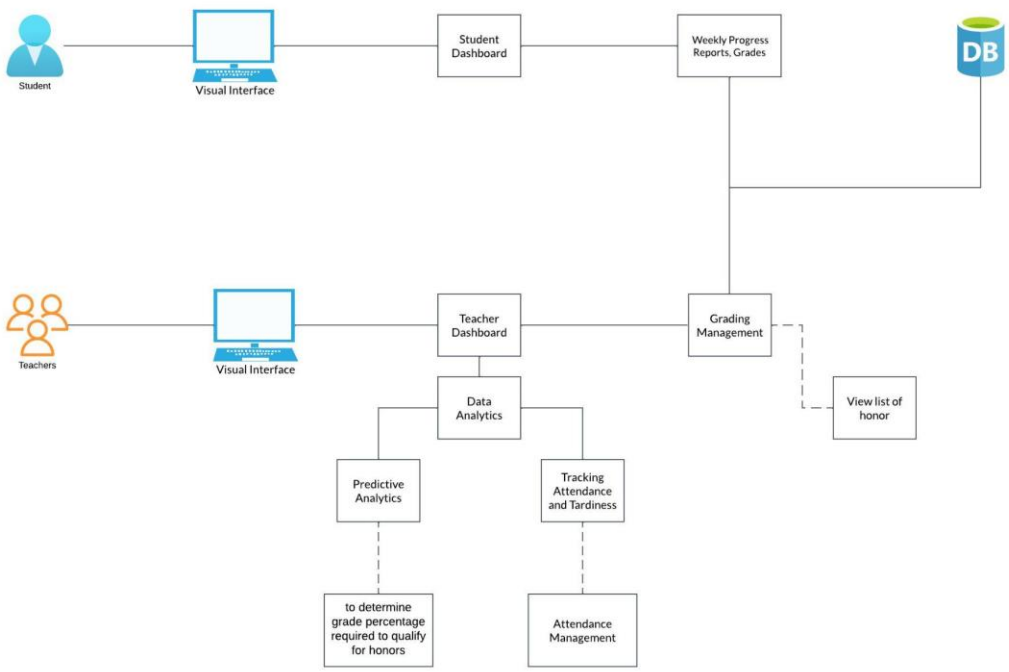


Figure 6. System Architecture

Data Flow Diagram

This section is a graphical representation of the functions or processes involved in capturing, manipulating, storing, and distributing data between the E-Learning Management system and its environment, as well as between different components of the system. The following diagram helps to visualize the flow of information through symbols.

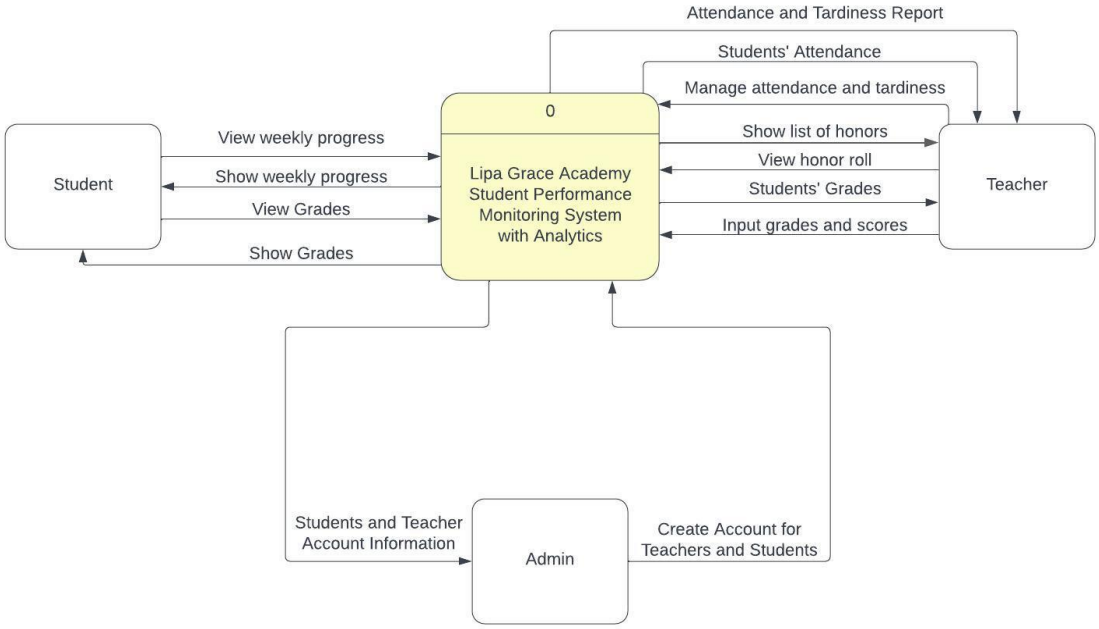


Figure 7. Context Diagram

Based on the context diagram shown in Figure 7 refers to the system under consideration as a single high-level process. Also, the system's relationship with other external entities such as Students, Teachers, and Admin is illustrated.

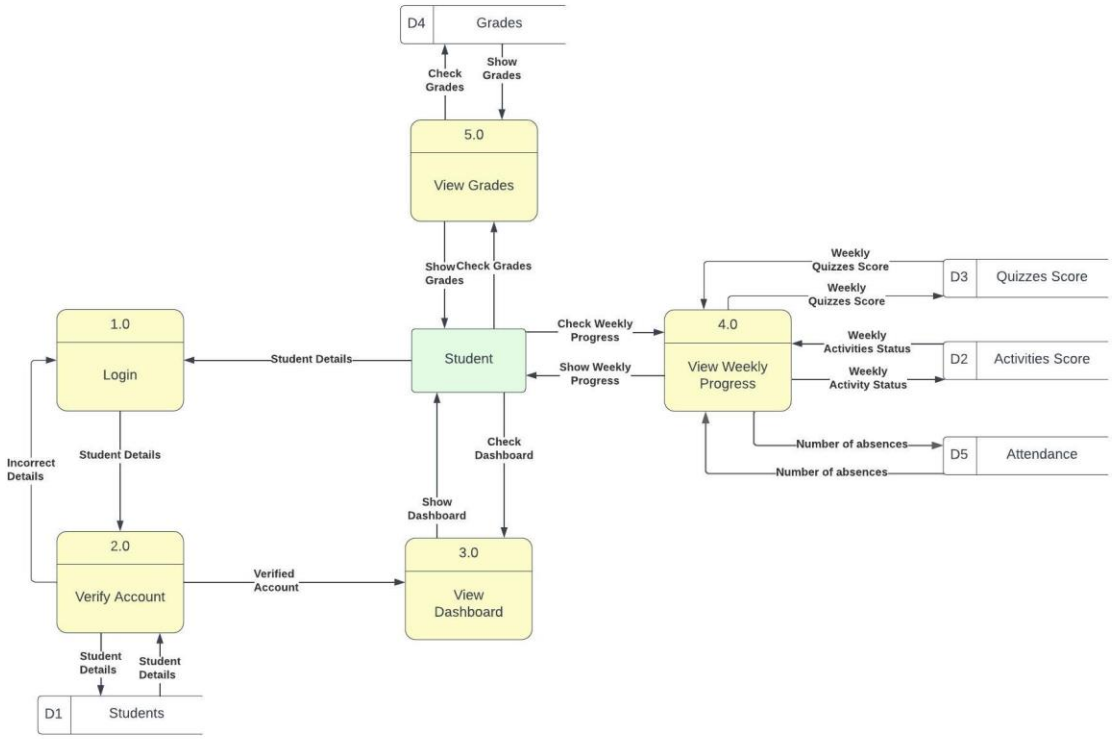


Figure 8. Level 0 DFD for Students

Figure 8 shows the Level 0 DFD for students. It shows the different processes by which students can interact with the system. These include login, viewing the dashboard, and viewing weekly progress and grades. The arrows between the entities and processes indicate the system's data flow and operations. It also shows the four data stores responsible for storing and managing data.

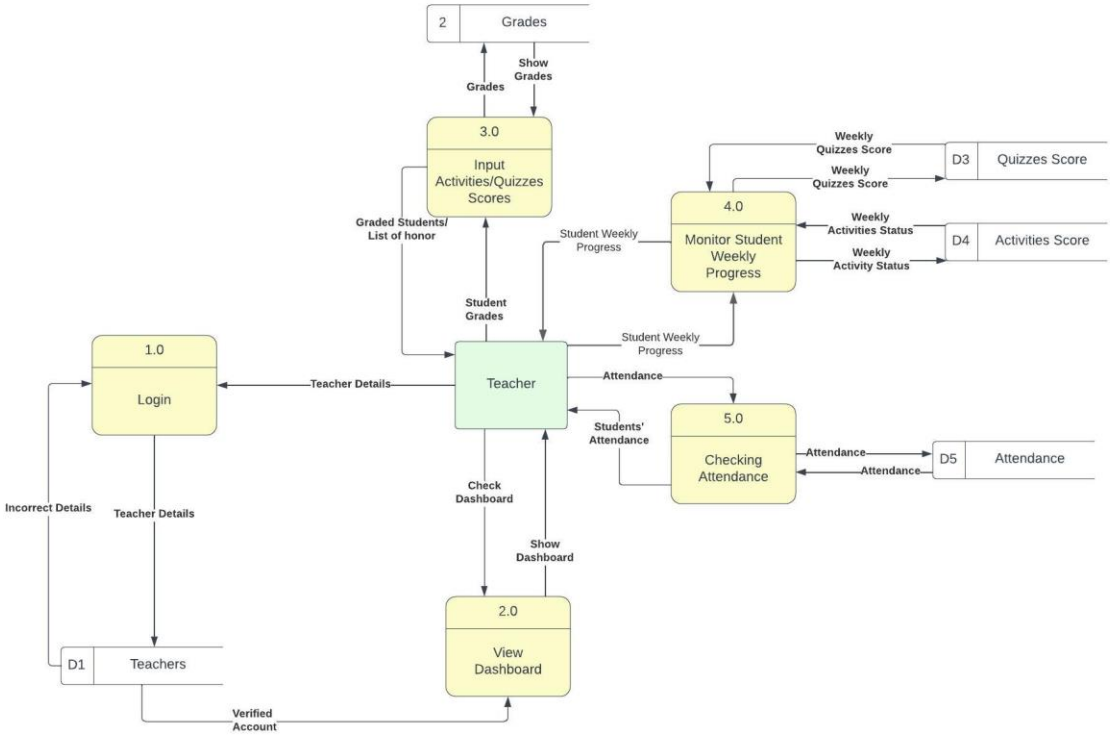


Figure 9. Level 0 DFD for Teachers

Figure 9 shows the Level 0 DFD for teachers. It shows the different processes by which teachers can interact with the system. These include login, viewing the dashboard, inputting quizzes and scores, checking attendance, and monitoring student weekly progress. The arrows between the entities and processes indicate the system's data flow and operations. It also shows the five data stores responsible for storing and managing data.

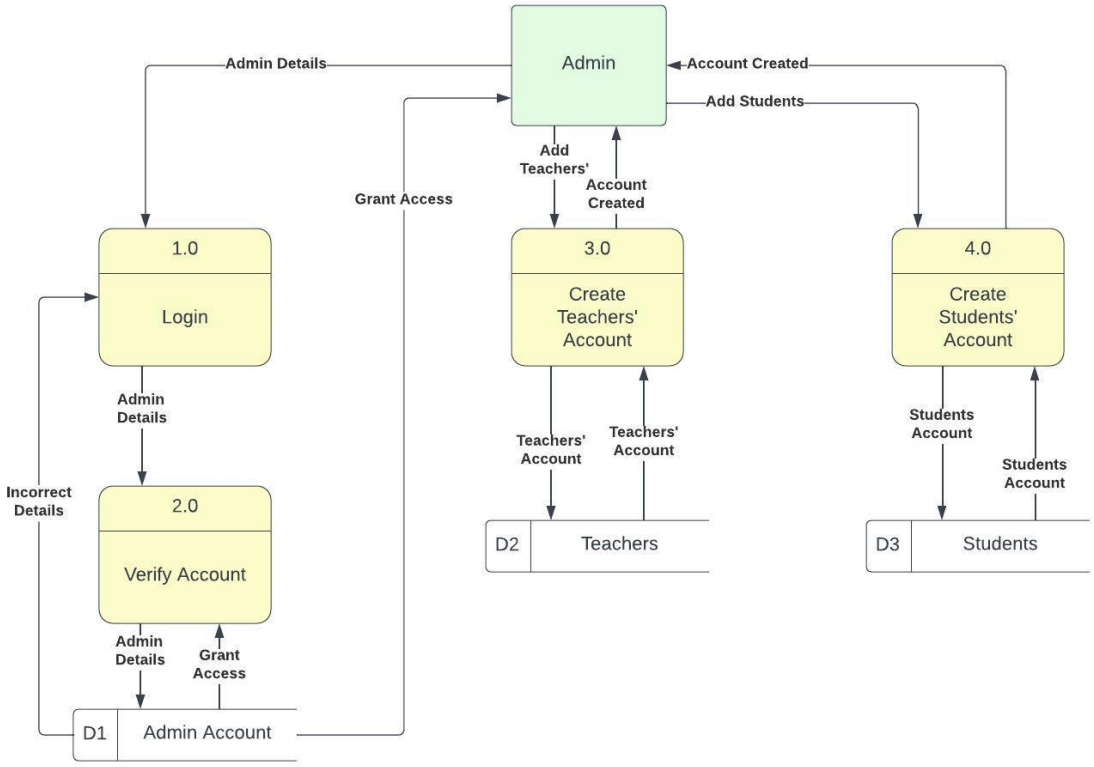


Figure 10. Level 0 DFD for Admin

Figure 10 shows the Level 0 DFD for admin. It shows the different processes by which the admin can interact with the system. These include login and creating teachers' and students' accounts. The arrows between the entities and processes indicate the system's data flow and operations. It also shows the three data stores responsible for storing and managing data.

Use Case Diagram

Figure 11 presents the Use Case diagram, showcasing various user categories, including Students, Teachers, and Admin, and their corresponding use cases. The interactions depicted with the Student Performance Monitoring System

outline the relationships between the users and the various use cases they may encounter.

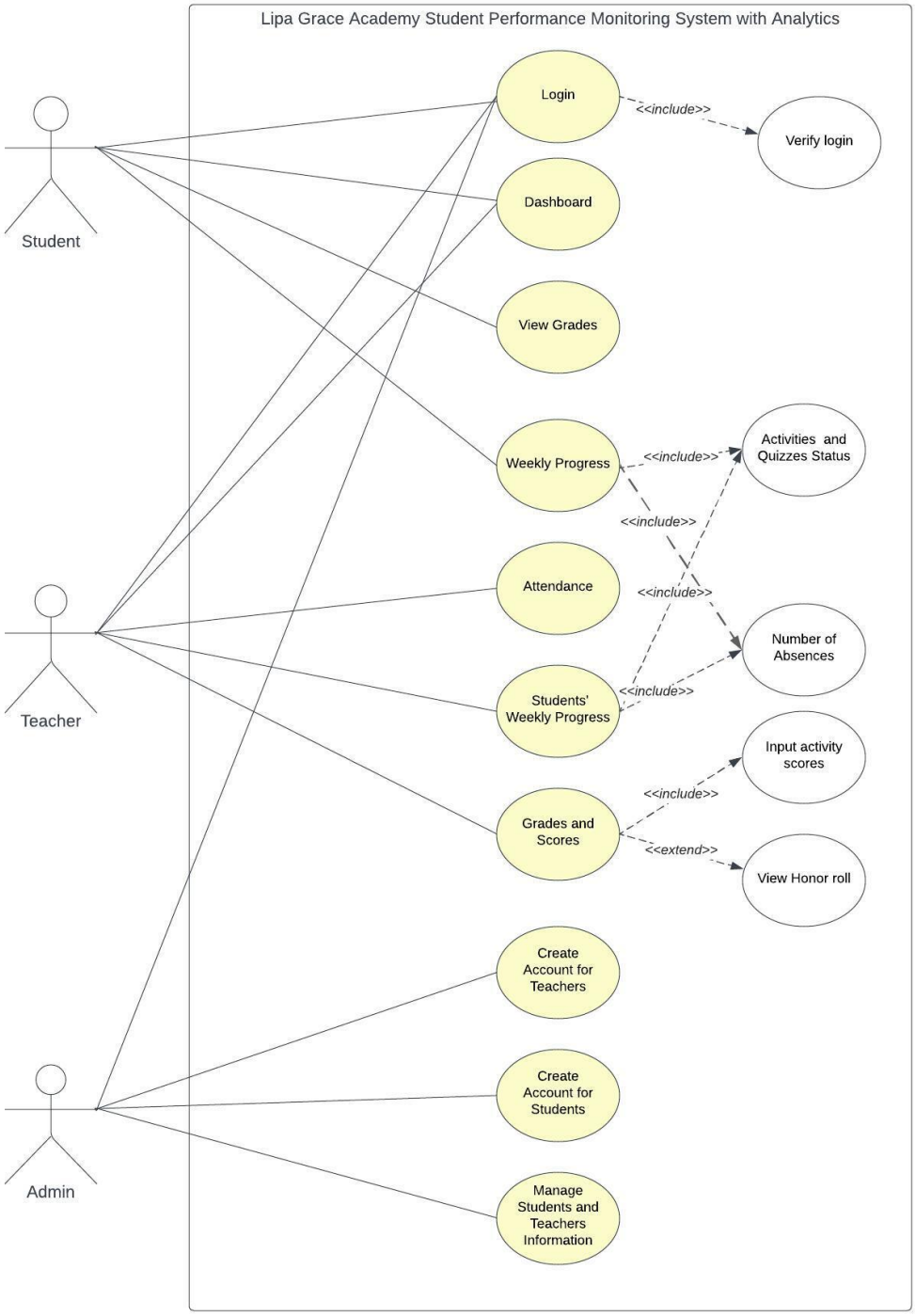


Figure 11. Use Case Diagram

Based on the Use Case Diagram, the teacher can view the student's weekly progress, including the attendance and tardiness report, and Activities/Quizzes Status. Moreover, students can monitor their weekly progress, including Activities and Quizzes status and number of absences. They can also view their grades online. This dashboard provides students with a comprehensive view of their weekly progress and allows them to monitor their learning. Moreover, the admin is responsible for managing all information accounts of teachers and students. In addition, they can create accounts for teachers and students.

Sequence Diagram

Figure 12 depicts an interaction diagram that elucidates the procedure of executing operations in Student Performance Monitoring with Analytics. The diagram outlines the messages being sent and received. The sequence of events is arranged chronologically to depict how a user progresses through a page. The researchers also enumerated the objects implicated in the operation, such as Admin, Teacher, and Student, which are listed from left to right about when they would take part in the message sequence

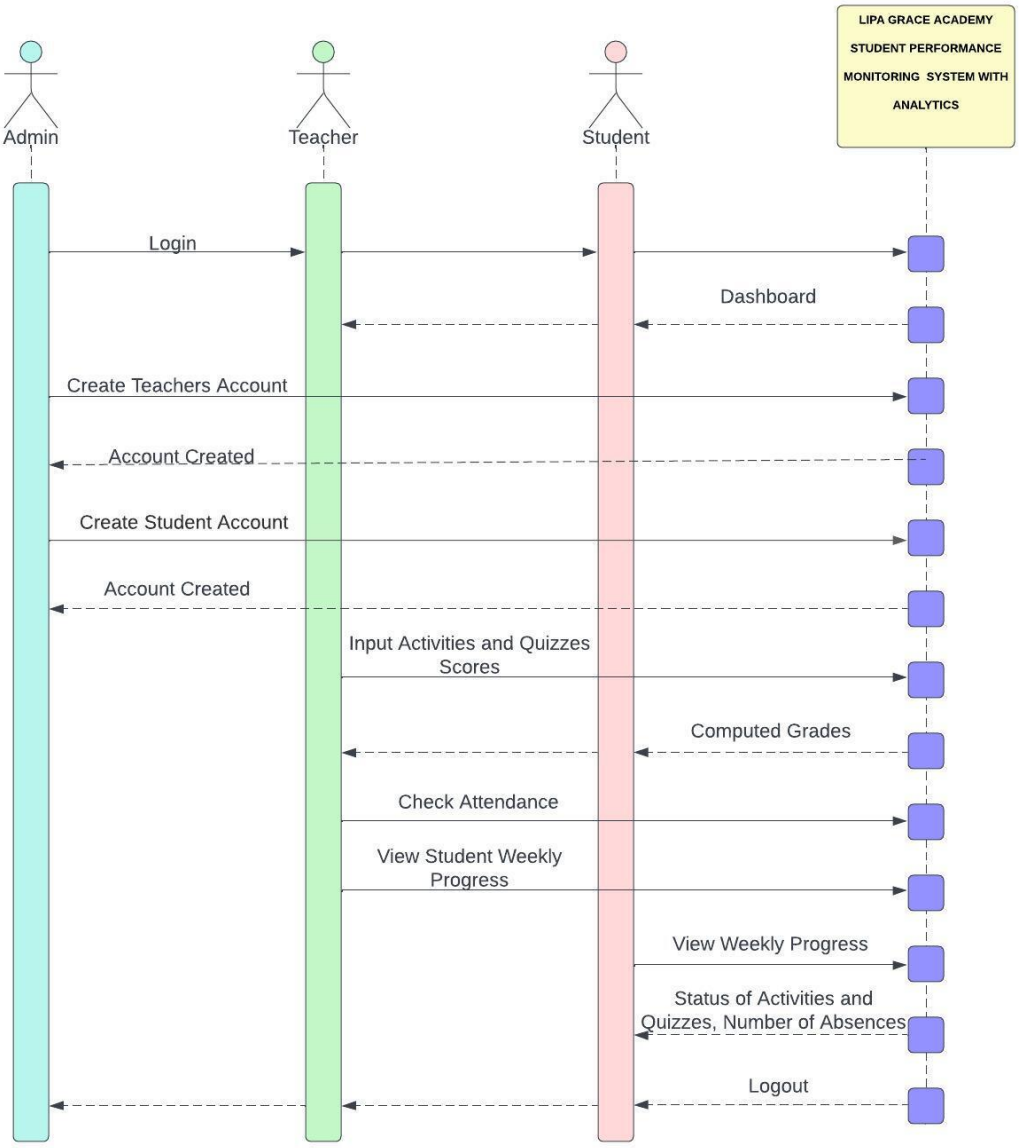


Figure 12. Sequence Diagram

Database Design

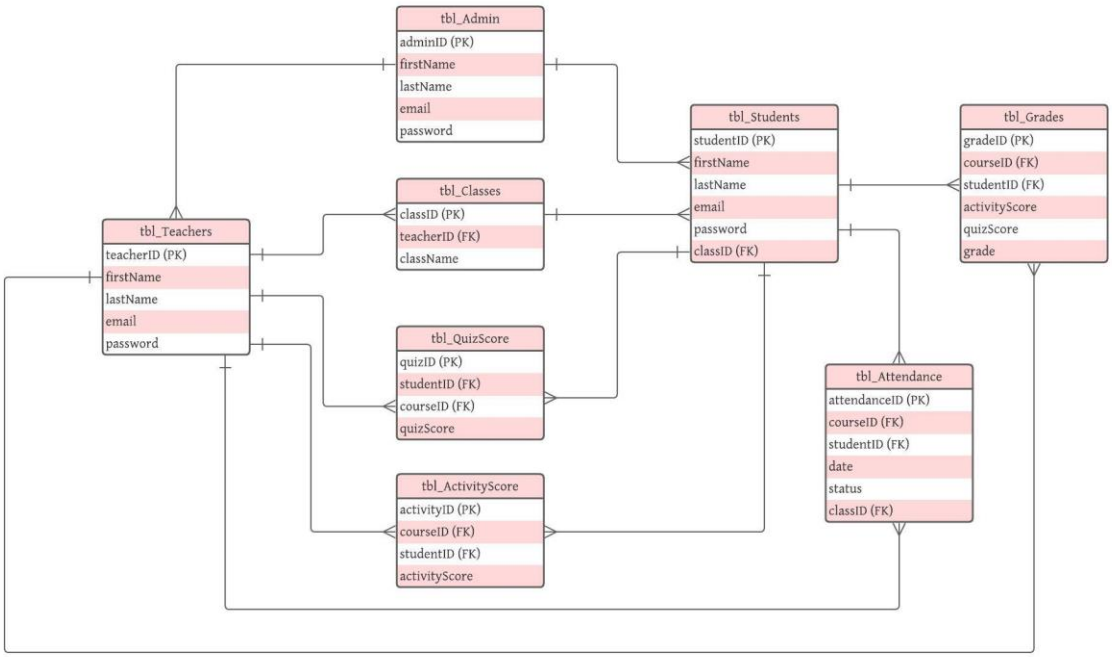


Figure 13. Database Design

Figure 13 shows the proposed system's database design, including several interconnected databases. The system has three main types of users: administrators, teachers, and students. The Admin database is connected to the Teachers database through a one-to-many relationship, where one admin can manage many teachers. The Admin database is connected to the Students database through a one-to-many relationship, where one admin can manage many students. The class database has a one-to-many relationship with students because one class can have many students. Similarly, the teachers' database has a one-to-many relationship with classes since a teacher can have many classes. Additionally, the Teachers database is linked to the Quiz Score database through a one-to-many relationship, where one teacher can input many quizzes scores. The Students database is related to the Attendance

database through a one-to-many relationship, where one student can have many attendance records. The Students database is connected to the Activity Score database through a one-to-many relationship, where one student can have many activity scores. Finally, the Students database is related to the Grades database through a one-to-many relationship, where one student can have many grades.

Graphical User Interface

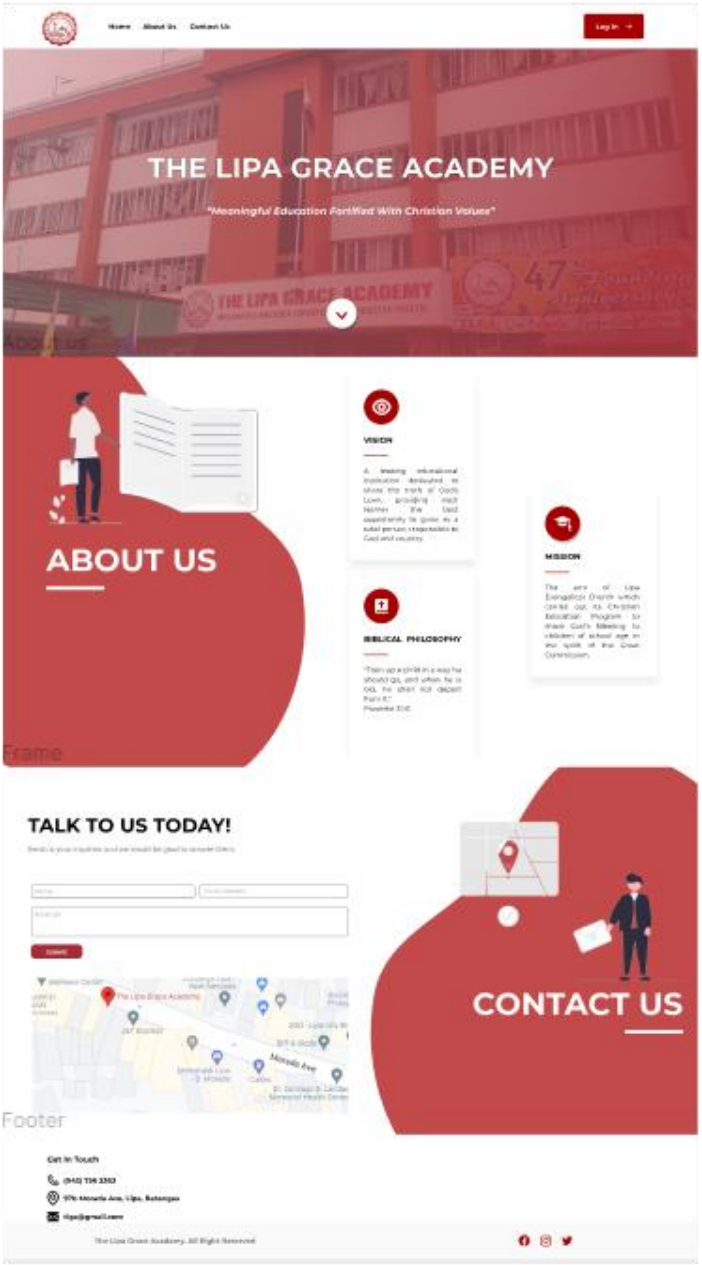


Figure 14. Landing Page

Figure 14 shows the system's landing page, which is designed to provide users with a clear and concise introduction to our software application. It features three main sections: Home, About Us, and Contact Us. The About Us section

explains the school's vision, mission, and biblical philosophy. The Contact Us section includes a form users can fill out to contact us directly.

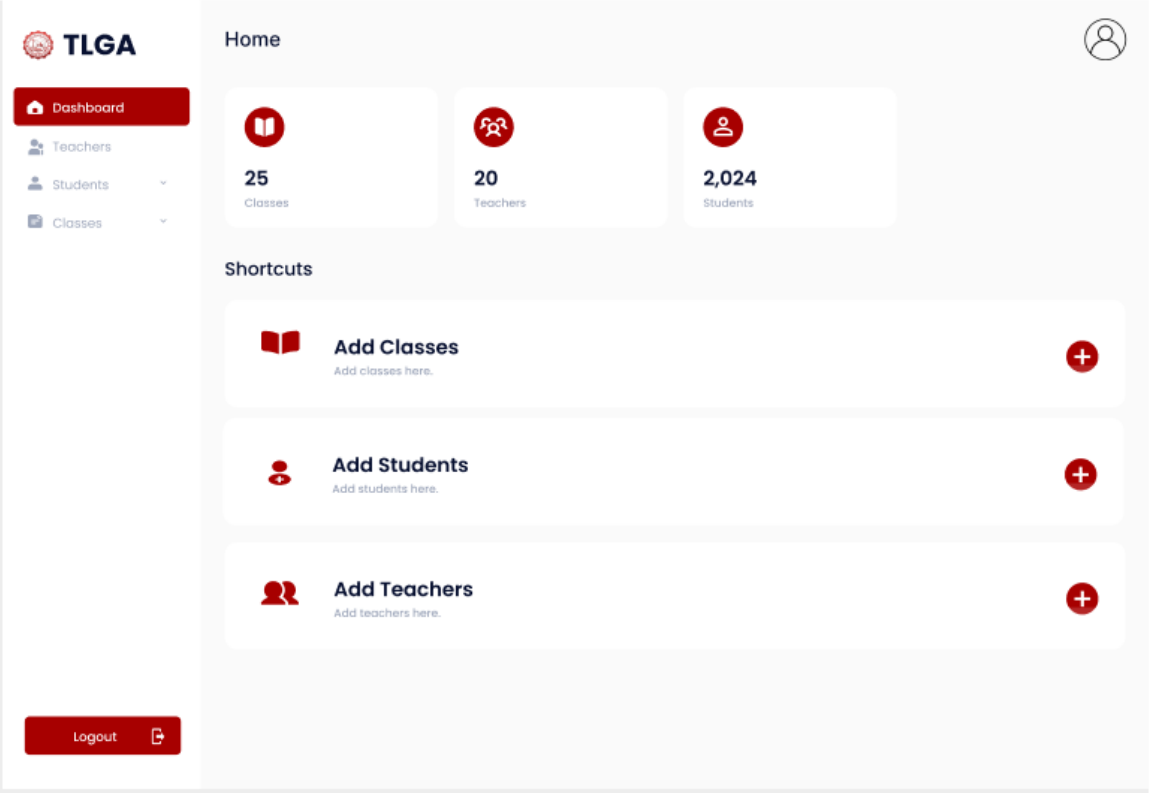


Figure 15. Admin Dashboard

Figure 15 shows the admin dashboard page of the system. Administrators can create accounts for teachers and students, assign classes to specific teachers, and enroll students in their respective classes.

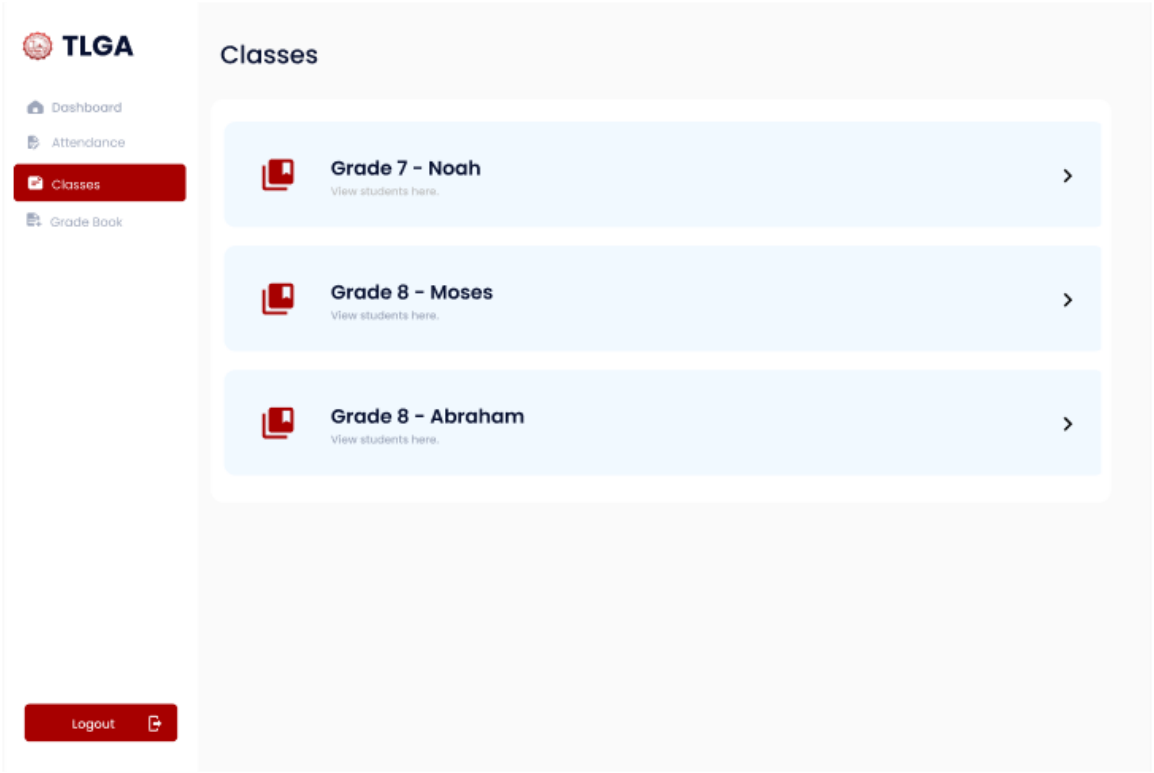


Figure 16. Teacher's Classes Page

Figure 16 shows the teacher's classes page of the system. Teachers can upload course materials such as lecture notes, slides, and videos. This page provides teachers with a comprehensive overview of their assigned classes, allowing them to easily navigate and monitor their students' weekly progress.

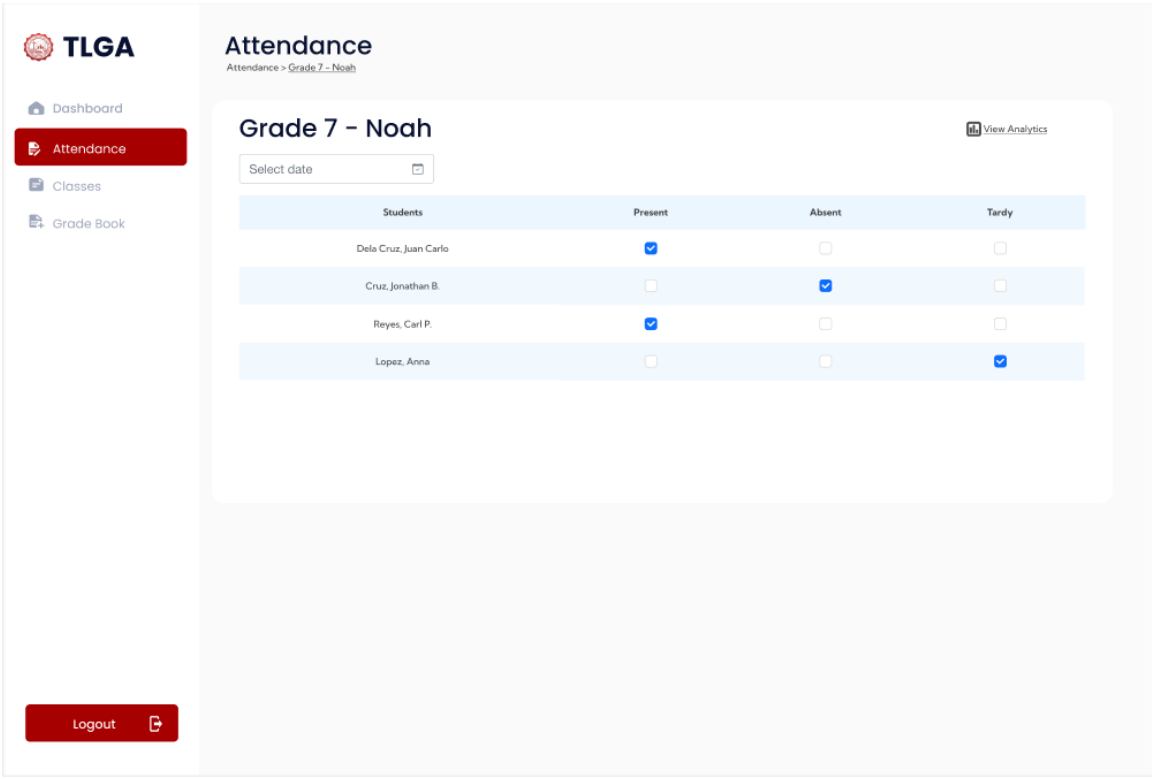


Figure 17. Attendance

Figure 17 shows where teachers can easily track the attendance of their students. This page provides teachers with a clear view of each student in their class and allows them to mark the attendance status of each student for a given day or period. Teachers can mark a student as present, absent, or tardy by ticking the corresponding checkbox.

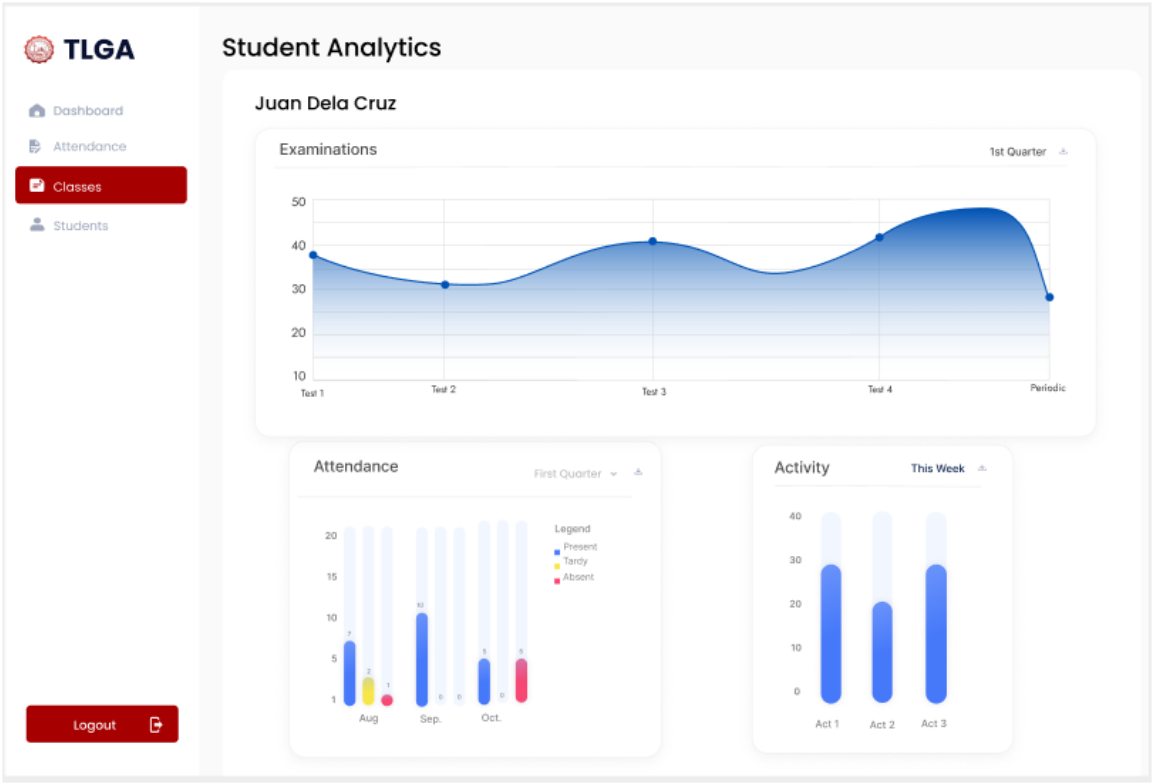


Figure 18. Student Analytics Page

Figure 18 shows the Student Analytics page in the Student Performance Monitoring System that provides teachers with visual insights into students' quarterly exam results through a line chart, as well as activities and attendance reports presented in a bar chart.

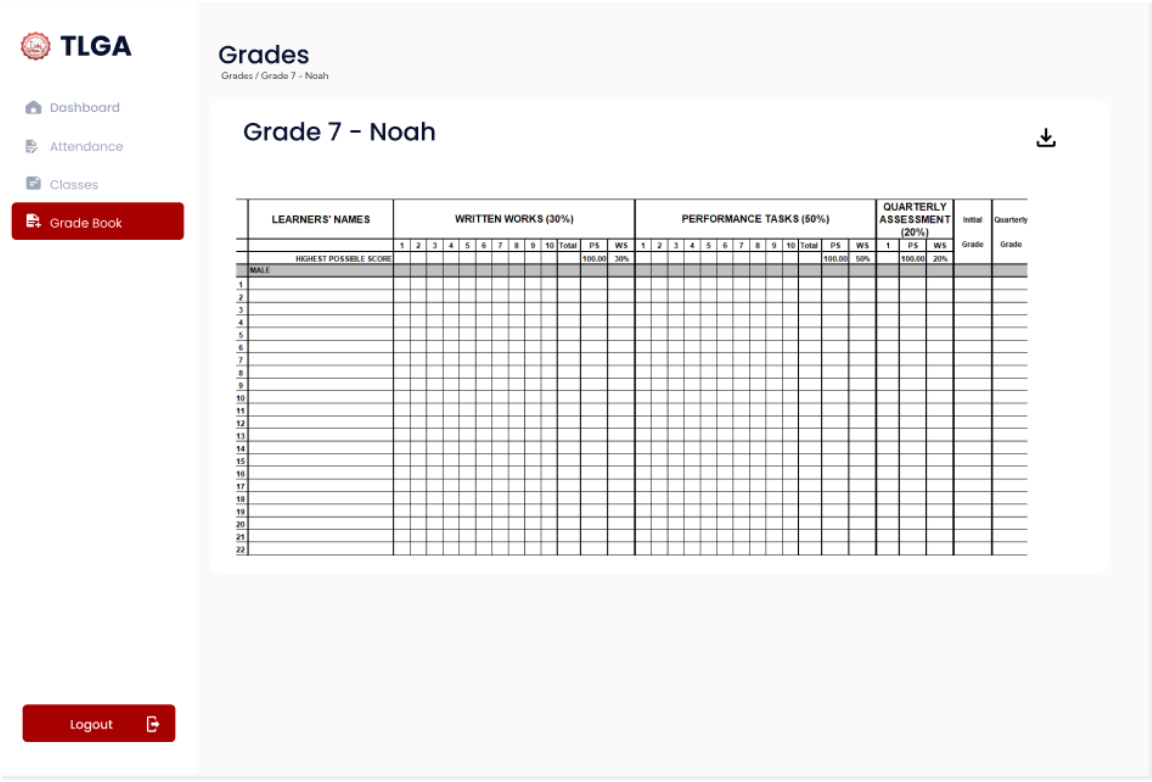


Figure 19. Grade Book

Figure 22 shows where the teacher can input activities and assessment scores. This page simplifies the process of recording and grading students.

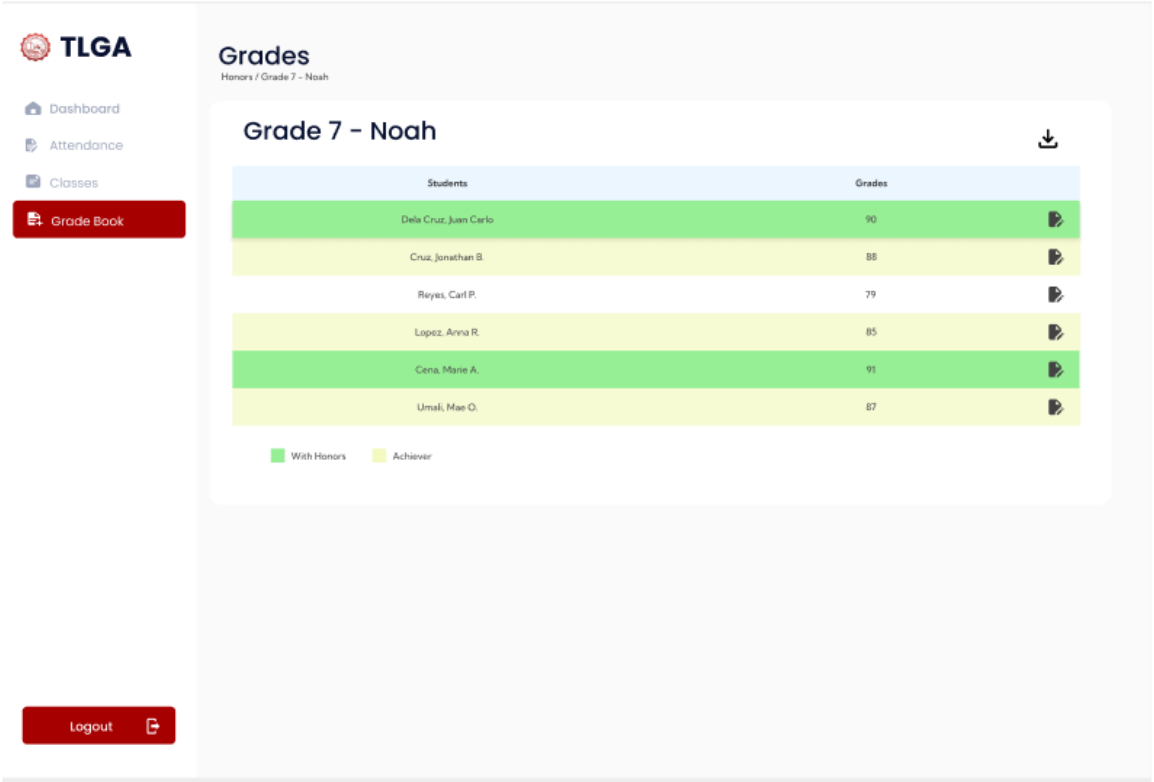


Figure 20. Honor roll

Figure 20 displays a list of all students in the class and their corresponding grades, making it easy for teachers to quickly identify top-performing students and those struggling. Additionally, the interface includes a green highlight for with-honor students with a 90 average and up and a yellow highlight for achievers, providing a visual representation of student performance. Moreover, teachers can also download the honor roll too.

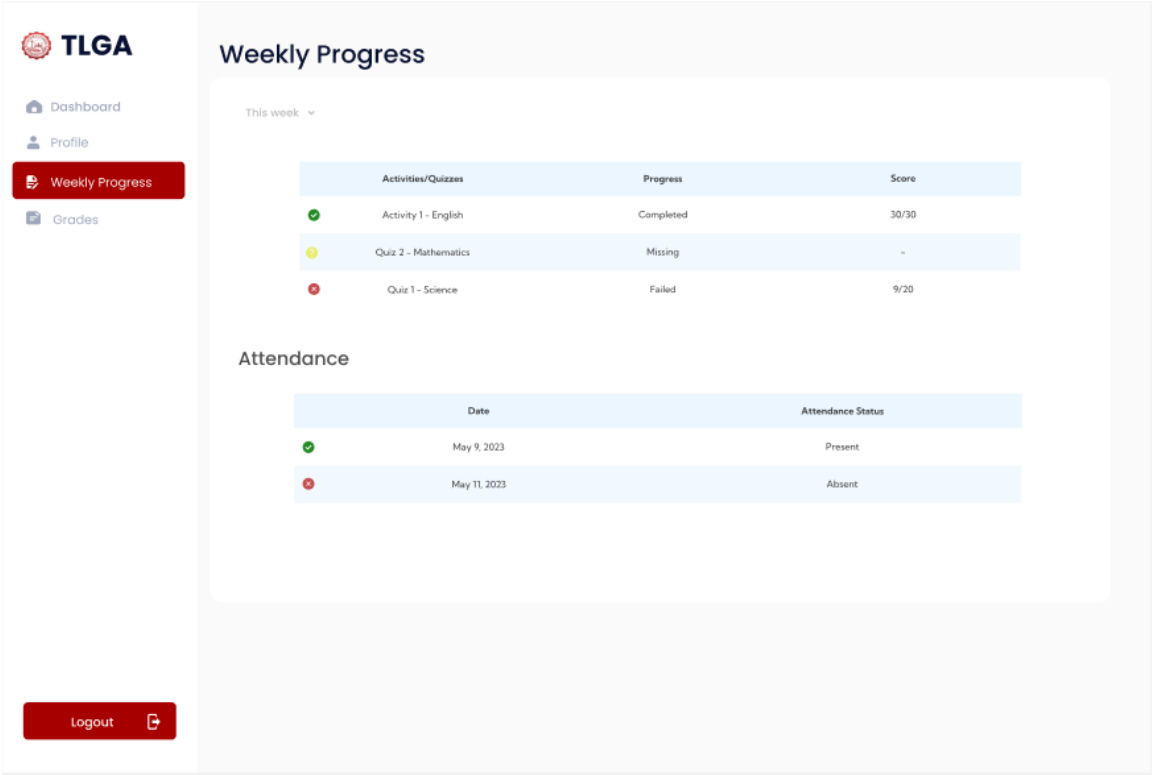


Figure 21. Weekly Progress Page

Figure 21 shows the students' weekly progress page of the system. It includes information such as activity and quiz status, giving students an overview of how much they have accomplished in the activities and quizzes over the past week.

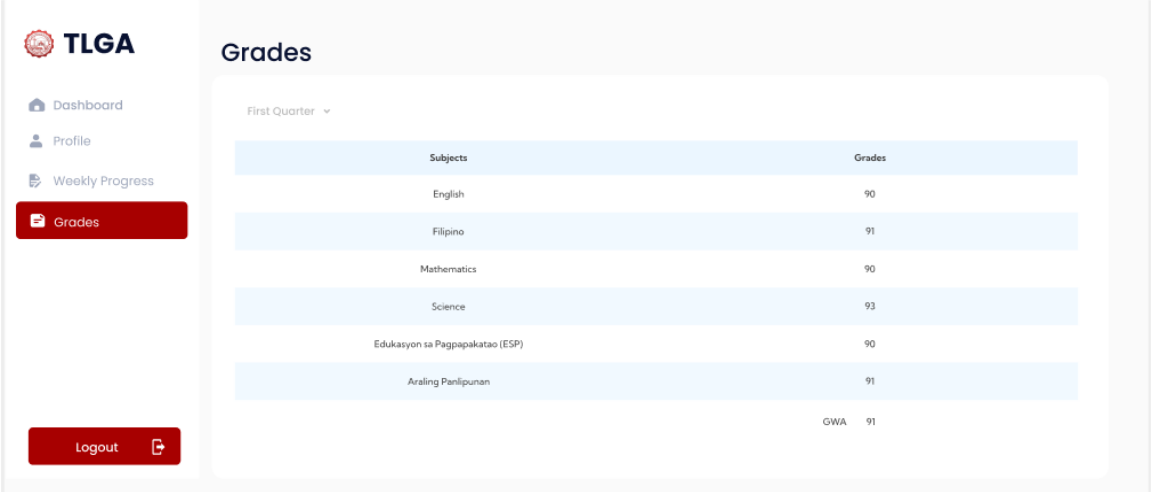


Figure 22. Grades

Figure 22 shows the student's grade report, where students can view their grades per course and their general weighted average (GWA) on a quarterly basis.

Deployment

The researchers will use this phase as a guide for implementing the Student Performance Monitoring System with Analytics at Lipa Grace Academy. Table 6 lists the activities associated with this phase.

Table 6
Deployment Process Activities

Activities	Development	Testing	Deployment	Maintenance
Develop system requirements and specifications				
System design and architecture				
Database design and implementation				
Front-end development				
Back-end development				
Unit testing				
User acceptance testing				
Data migration and system installation				
Training for teachers, students, and admin				
System launch				
Bug fixes and updates				

Maintenance

Maintenance is essential in software development to preserve the system's dependability, effectiveness, and stability. Table 7 depicts the completed maintenance plan, which includes adaptive, corrective, preventative, and corrective maintenance categories. In addition, the plan specifies the time intervals at which each type of maintenance must be performed.

Table 7
Maintenance Plan

System	Maintenance Type	Time Interval	Owner
Lipa Grace Academy Student Performance Monitoring System with Analytics	Adaptive	As needed	Thea Clarisse P. Delos Santos
	Corrective	As needed	Keanne E. Lopez
	Preventive	Quarterly	All researchers
	Perfective	As needed	Jussel Elejorde

In Table 7, the researchers included corrective maintenance, which entails resolving issues within the system, such as bugs or errors, to restore it to its normal operation state. This form of maintenance is essential for ensuring the system operates smoothly and uninterruptedly. Adaptive maintenance, on the other hand, entails modifying the system to accommodate the changing requirements of the users or adapting to new technologies. As the academy's and its students' requirements change, the system must evolve to accommodate these alterations. Preventive maintenance entails actions designed to avert the occurrence of

prospective system problems. This form of maintenance includes routine system updates, data backups, and security checks to safeguard the system against cyber threats and data loss.

Lastly, perfective maintenance focuses on enhancing the system's efficacy and functionality. This form of maintenance aims to optimize the system's functionality, improve the user experience, and introduce new features that will benefit the users.

Approximately 20% of the maintenance work involves addressing errors, while the remaining 80% consists of modifying existing systems to accommodate external changes, incorporating user-requested enhancements, and re-engineering applications for use.

Risk Management

Risks are possible occurrences that, if they occur in a project management setting, can be considered problems that must be effectively addressed. To ensure that a project remains on track and achieves its objectives, it is essential to identify, analyze, and respond to any potential risks that may arise throughout its life cycle. Risk analysis and management will be critical project management practices throughout the investigation to minimize the occurrence or impact of unexpected circumstances. Although it is impossible to forecast the future with absolute certainty, a simple risk management process to anticipate project uncertainties and mitigate their effects could substantially impact the entire project. This strategy

increases the probability that the project will be completed successfully and mitigates potential hazards. Five risks that could substantially impact the proposed monitoring system have been identified.

Risk 001: Technical issues. Complex technical procedures may fail or break down during the development and deployment of a student performance monitoring system, resulting in a system outage or data loss. Technical issues such as software bugs, server crashes, hardware malfunctions, compatibility issues, and slow response time could significantly affect the system's functionality and performance.

Risk 002: Data privacy and security. The system will collect and retain sensitive information, including student grades and attendance records. The system's security and privacy measures must be robust enough to prevent unauthorized access, data intrusions, and cyberattacks that could compromise the integrity and confidentiality of the system.

Risk 003: User adoption. The system is success depends on teacher, student, and administrator adoption. If users find the system difficult, time-consuming, or unresponsive, they may not implement it, resulting in low system adoption and decreased engagement.

Risk 004: Resource availability. To develop, deploy, and maintain the system, sufficient hardware, software, and technical expertise are required. The system may not operate as intended if resources are insufficient or unavailable, leading to system failure or performance issues.

Risk 005: Lack of training and support. To effectively use the system, instructors, students, and administrators may need to acquire new skills and adapt to new procedures. Without appropriate training and support, users may find it difficult to understand and employ the system's capabilities effectively. This may result in dissatisfaction, system errors, or low usage, reducing engagement and productivity. Inadequate training and support may also result in improper system usage, resulting in data errors or security breaches.

Risk Matrix	**SEVERITY**					
LIKELIHOOD		Negligible	Minor	Moderate	Significant	Severe
	Very likely	Low med	Medium	Med High	High	High
	Likely	Low	Low Med	Medium	Med High	High
	Possible	Low	Low Med	Medium	Mid High	Med High
	Unlikely	Low	Low Med	Low Med	Medium	Med High
	Very unlikely	Low	Low	Low Med	Medium	Medium

Figure 23. Risk Matrix

Figure 23 illustrates the Risk Matrix, which classifies and provides additional information about the previously mentioned risk. This matrix will serve as the basis for Table 8 risk analysis.

Table 8
Risk Analysis

ID	RISK	Category	Likelihood	Severity	Impact
001	Technical issues	Technical	Very Likely	Significant	High
002	Data privacy and security	Security	Likely	Significant	High
003	User Adoption	User	Possible	Moderate	Medium
004	Resource availability	Resource	Possible	Significant	Med High
005	Lack of training and support	People	Likely	Moderate	Medium

Table 8 illustrates the most significant risks that could significantly impact the e-learning management system are Technical Issues, Data Privacy and Security, and User Adoption. Technical issues, such as software bugs, server crashes, hardware malfunctions, and slow response time, are highly probable and may result in system downtime or data loss. With sensitive data such as student and teacher information, student grades, and attendance being collected and stored, there are also significant risks associated with data privacy and security. Integrity and confidentiality of the system could be compromised by unauthorized access, data breaches, or cyberattacks. User adoption is also a potential risk, as the success of the system is contingent on the users' willingness to implement and effectively utilize the system. If users find the system to be difficult time-consuming, or unresponsive, they may not employ it, resulting in low system usage and decreased

engagement. To ensure the success and sustainability of the system, it is crucial to manage and mitigate these risks.

Table 9
Risk Treatment

Risk	Risk Treatment
Risk 001: Technical Issues	To mitigate this risk, the risk treatment could entail conducting thorough testing and quality assurance processes before system deployment to identify and resolve potential technical issues. In addition, regular system maintenance and modifications could be implemented to keep the system optimized and in line with the most recent technological standards.
Risk 002: Data Privacy and Security	The system should be designed with robust security and privacy measures to mitigate data security and privacy risks. The system should employ robust encryption to safeguard sensitive data such as student grades, attendance, and information. Access to the system should be restricted to only authorized personnel using secure login credentials and multi-factor authentication.
Risk 003: User Adoption	User Adoption entails addressing potential user issues by designing the system to be intuitive and user-friendly, undertaking user testing and feedback, providing comprehensive training and support materials, and involving users in the development and enhancement of the system.
Risk 004: Resource Availability	Identifying and securing the resources required for system development, deployment, and maintenance. This may involve hardware, software, and technical knowledge. It is crucial to assess the available resources exhaustively and identify any potential gaps.
Risk 005: Lack of Training and Support	Provide users with adequate training and support. The training should cover the system's capabilities, best practices for system utilization, and cybersecurity precautions to prevent data breaches. Additionally, the training should be tailored to various user groups, such as teachers, students, and administrators, to ensure they have the necessary skills and knowledge to use the system effectively.

Table 9 outlines various risk management strategies, but only one team member is required to monitor the risk trigger and implement the outlined countermeasures. Table 10 describes the role of the risk proprietor, who is responsible for promptly reporting any modifications and implementing countermeasures.

Table 10
Risk Ownership

ID	Risk	Owner
001	Technical Issues	Thea Clarisse P. Delos Santos
002	Data Privacy and Security	Thea Clarisse P. Delos Santos
003	User Adoption	Keanne E. Lopez
004	Resource Availability	Jussel Elejorde
005	Lack of Training and Support	Jussel Elejorde

Bibliography

Ajibade, S. S. M., Dayupay, J., Ngo-Hoang, D. L., Oyebode, O. J., & Sasan, J. M. (2022). Utilization of Ensemble Techniques for Prediction of the Academic Performance of Students. Journal of Optoelectronics Laser, 41(6), 48-54.

Amazona, M. V., & Hernandez, A. A. (2019, October). User acceptance of predictive analytics for student academic performance monitoring: Insights from a higher education institution in the philippines. In 2019 IEEE 13th International Conference on Telecommunication Systems, Services, and Applications (TSSA) (pp. 124-127). IEEE.

Amelia, R., & Gufron. (2018). E-learning design based on learning management system in web programming course. International Journal of Scientific and Technology Research, 7(9), 106–109.

Arsenia V. Duldulao, Jay - R R. Duldulao (2021). Online Student Academic Performance Monitoring and Evaluation System of the Quirino State University

Avcı, Ü., & Ergün, E. (2022). Online students' LMS activities and their effect on engagement, information literacy and academic performance. Interactive Learning Environments, 30(1), 71–84. https://doi.org/10.1080/10494820.2019.1636088

Ayuyang, R. R. (2019). Interactive learning (ILEARN) tool: An elearning portal designed using Moodle for Cagayan State University in the Philippines. In ACM International Conference Proceeding Series (pp. 11–16). Association for Computing Machinery. https://doi.org/10.1145/3330482.3330507

Azmi Murad, M. A., Shah Jahan, A. F., Mohd Sharef, N., Ab Jalil, H., Ismail, I. A., & Mohd Noor, M. Z. (2022). An Analytics Dashboard for Personalised E-learning: A Preliminary Study. In Lecture Notes in Electrical Engineering (Vol. 835, pp. 855–866). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-981-16-8515-6_65

Bajracharya, B. (2019). Learning Analytics and Dashboards for Education Systems. The CTE Journal, 7(2), 2–9.

Bakhri, F., Mohd Ekhsan, H., & Hamid, J. N. (2020). Students' Attendance Monitoring System with SMS Notification. Journal of Computing Research and Innovation, 5(1), 19–24. https://doi.org/10.24191/jcrinn.v5i1.159

Biñas, V. J. P., Carreon, M. J. Z., Concilles, M. P., Congzon, J. P. D., & Mansueto, C. M. M. (2022). Development of CLASSALI: An Online Learning Tool and Academic Performance Report for Makati Public Elementary Schools. International Journal of Computing Sciences Research, 6, 723-740.

Borbon, N. M., Apritado, J. M., & Marasigan, M. A. (2021, September). An Integrative Innovation on Higher Education: Teaching and Learning Performance based on the Online Learning Approach using MyLPU. In Proceedings of the 5th International Conference on Digital Technology in Education (pp. 23-29).

Bystrova, T., Larionova, V., Sinitsyn, E., & Tolmachev, A. (2018). Learning analytics in massive open online courses as a tool for predicting learner performance. Voprosy Obrazovaniya / Educational Studies Moscow, 2018(4), 139–166. https://doi.org/10.17323/1814-9545-2018-4-139-166

Cambronero Jr, P. P. R. B. (2018). *E-Learning system for graduate program of Central Philippine University*. Scientia et Fides, 1(1), 13-21.

Costa, L. A., Do Nascimento Salvador, L., Das Santos E Souza, M. V., & Rocha Amorim, R. J. (2019). Monitoring students performance in e-learning based on learning analytics and learning educational objectives. In Proceedings - IEEE 19th International Conference on Advanced Learning Technologies, ICALT 2019 (pp. 192–193). Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ICALT.2019.00067

Duldulao, J. R. R. (2018). ACADEMIC PERFORMANCE MONITORING SYSTEM OF QUIRINO STATE UNIVERSITY. QSU Research Journal, 7(1), 1-1.

Estrera, P. J. M., Natan, P. E., Rivera, B. G. T., & Colarte, F. B. (2017). Student Performance Analysis for Academic Ranking Using Decision Tree Approach in University of Science and Technology of Southern Philippines Senior High School. International Journal of Engineering and Technology, 3(5), 147-153.

Famorca, L., & Elivera, A. APPLYING LEARNING ANALYTICS IN ACHIEVING ADAPTIVE BLENDED LEARNING. education, 7(19), 2020.

G. Domingo, W., N. Lardizabal, E., & Marie V. Toledo, S. (2021). K12 Senior High School Students Academic Performance Monitoring System for Private Institutions with Decision Support System (pp. 143–157). Academy and Industry Research Collaboration Center (AIRCC). https://doi.org/10.5121/csit.2021.112011

Ismail, S. N., Hamid, S., Ahmad, M., Alaboudi, A., & Jhanjhi, N. (2021). Exploring students engagement towards the learning management system (LMS) using learning analytics. Computer Systems Science and Engineering, 37(1), 73–87. https://doi.org/10.32604/CSSE.2021.015261

Jayashanka, R., Hettiarachchi, E., & Hewagamage, K. P. (2022). Technology Enhanced Learning Analytics Dashboard in Higher Education. Electronic Journal of E-Learning, 20(2), 151–170. https://doi.org/10.34190/ejel.20.2.2189

Kew, S. N., & Tasir, Z. (2022). Developing a Learning Analytics Intervention in E-learning to Enhance Students' Learning Performance: A Case Study. Education and Information Technologies, 27(5), 7099–7134. https://doi.org/10.1007/s10639-022-10904-0

Koh, J. H. L., & Kan, R. Y. P. (2021). Students' use of learning management systems and desired e-learning experiences: are they ready for next generation digital learning environments? Higher Education Research and Development, 40(5), 995–1010. https://doi.org/10.1080/07294360.2020.1799949

Lynn, N. D., & Emanuel, A. W. R. (2021). Using Data Mining Techniques to Predict Students' Performance. a Review. IOP Conference Series: Materials Science and Engineering, 1096(1), 012083. https://doi.org/10.1088/1757-899x/1096/1/012083

Muhardi, Gunawan, S. I., Irawan, Y., & Devis, Y. (2020). DESIGN OF WEB BASED LMS (LEARNING MANAGEMENT SYSTEM) IN SMAN 1

KAMPAR KIRI HILIR. Journal of Applied Engineering and Technological Science, 1(2), 70–76. https://doi.org/10.37385/jaets.v1i2.60

Nasution, N., Darmayunata, Y., & Wahyuni, S. (2022). Information System Design for Monitoring and Evaluation of Learning on Blended Learning. AL-ISHLAH: Jurnal Pendidikan, 14(2), 1633–1644. https://doi.org/10.35445/alishlah.v14i2.1368

Paguirigan, J. V. (2023). Customized Learning Management System for the Students and Teachers of Isabela State University-Ilagan Campus, Philippines. Journal for Educators, Teachers and Trainers, 14(1), 302-313.

Panadero, E., Lodge, J. M., Broadbent, J., & de Barba, P. G. (2018). Supporting self-regulated learning with learning analytics. In Learning analytics in the classroom (pp. 45-55). Routledge.

Park, H. J., Ryoo, H. S., Kwon, J., & Ryoo, J. H. (2022). Change of Paradigm on LMS for Online Education: LMS Implementing Learning Analytics and Online Assessment. The Institute for Educational Research, 35(2), 49–72. https://doi.org/10.35283/erft.2022.35.2.49

Qazdar, A., Qassimi, S., Hassidi, O., Hafidi, M., Abdelwahed, E. H., & Melk, Y. (2022). Learning Analytics for Tracking Student Progress in LMS. ResearchSquare. https://doi.org/10.21203/rs.3.rs-1505417

Rabiman, R., Nurtanto, M., & Kholifah, N. (2020). Design and development E-learning system by learning management system (Lms) in vocational education. International Journal of Scientific and Technology Research, 9(1), 1059–1063.

Raga Jr, R. C., Raga, J. D., & Cariño, I. V. (2018). Visualizing Student Activity in Blended Learning Classroom by Mining Course Log Data. International Journal of Learning and Teaching, 4(1), 1-6.

Raza, S. H., Sharma, B. N., & Chaudhary, K. (2021). A New Pair of Watchful Eyes for Students in Online Courses. Frontiers in Applied Mathematics and Statistics, 7. https://doi.org/10.3389/fams.2021.620080

Revano, T. F., & Garcia, M. B. (2021, November). Designing Human-Centered Learning Analytics Dashboard for Higher Education Using a Participatory

Design Approach. In 2021 IEEE 13th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM) (pp. 1-5). IEEE.

Safsouf, Y., Mansouri, K., & Poirier, F. (2021). TABAT: DESIGN AND EXPERIMENTATION OF A LEARNING ANALYSIS DASHBOARD FOR TEACHERS AND LEARNERS. Journal of Information Technology Education: Research, 20, 331–350. https://doi.org/10.28945/4820

Şahin, M., & Yurdugül, H. (2022). Learners' Needs in Online Learning Environments and Third Generation Learning Management Systems (LMS 3.0). Technology, Knowledge and Learning, 27(1), 33–48. https://doi.org/10.1007/s10758-020-09479-x

Santos, M. S. M. D., Durano, D. C., & Hortillosa, A. D. (2023). The Development of a Proposed Learning Management System for Senior High Schools in the Philippines. International Journal of Information and Education Technology, 13(3), 430–438. https://doi.org/10.18178/ijiet.2023.13.3.1823

Santoso, H. B., Batuparan, A. K., Isal, R. Y. K., & Goodridge, W. H. (2018). The development of a learning dashboard for lecturers: A case study on a student-centered e-learning environment. The Journal of Educators Online, 1.

Simanullang, N. H. S., & Rajagukguk, J. (2020). Learning Management System (LMS) Based on Moodle to Improve Students Learning Activity. In Journal of Physics: Conference Series (Vol. 1462). Institute of Physics Publishing. https://doi.org/10.1088/1742-6596/1462/1/012067

Song, J. J., & Robinson, S. E. (2019). Student academic performance system: quantitative approaches to evaluating and monitoring student progress. International Journal of Quantitative Research in Education, 4(4), 332. https://doi.org/10.1504/ijqre.2019.10021827

S. NKATA, A., & A. DIDA, M. (2019). Centralized Education Management Information System for Tracking Student's Academic Progress in Tanzanian Secondary Schools. International Journal of Modern Education and Computer Science, 11(10), 25–32. https://doi.org/10.5815/ijmecs.2019.10.03

Toktarova, V. I., & Popova, O. G. (2022). Visual Analytics of Students' Educational Data within the e-Learning System. Siberian Pedagogical Journal, (1), 61–71. https://doi.org/10.15293/1813-4718.2301.06

Trison Septianto, A., & Suryawinata, M. (2021). Android Based Student Monitoring Information System. Procedia of Engineering and Life Science, 1(2). https://doi.org/10.21070/pels.v1i2.965

Tus, J., Espiritu, N. A., & Paras, N. E. Amidst the Online Learning Modality: The Usage of Learning Management System and Its Relationship to the Academic Performance of the Filipino Senior High School Students.

Tubongbanua, J. P., Dahilan, K. V., Sagun , K. A. & Ruiz, J. L. (2017). Web-Based Information and Monitoring System of Cagayan de Oro City Academy for International Education. SMCC Higher Education Research Journal, 5(1).

Urera Jr, F. L., & Balahadia, F. F. (2019). ICTeachMUPO: an evaluation of information e-learning module system for faculty and students. International Journal of Computing Sciences Research, 3(1), 163-188.

Vilanova, R., Dominguez, M., Vicario, J., Prada, M. A., Barbu, M., Varanda, M. J., … Paganoni, A. (2019). Data-driven tool for monitoring of students performance. In IFAC-PapersOnLine (Vol. 52, pp. 190–195). Elsevier B.V. https://doi.org/10.1016/j.ifacol.2019.08.188

Wagner, A. (2020, June 16). LMS Data and the Relationship Between Student Engagement and Student Success Outcomes. Association for Institutional Research.https://www.airweb.org/article/2020/06/17/lms-data-and-the-relationship-between-student-engagement-and-student-success-outcomes

Warnars, H. L. H. S., Fahrudin, A., & Utomo, W. H. (2020). Student performance prediction using simple additive weighting method. IAES International Journal of Artificial Intelligence, 9(4), 630–637. https://doi.org/10.11591/ijai.v9.i4.pp630-637

Widodo, J. P., Musyarofah, L., & Slamet, J. (2022). Developing A Moodle-Based Learning Management System (LMS) for Slow Learners. Jurnal Inspirasi Pendidikan, 12(1), 1–10. https://doi.org/10.21067/jip.v12i1.6346

Xin, O. K., & Singh, D. (2021). Development of learning analytics dashboard based on moodle learning management system. International Journal of Advanced Computer Science and Applications, 12(7).