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Santo Niño MathWise: Revolutionizing Sustainable Education through Interactive E-Learning

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Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

Today, classrooms have students with numerous challenges who struggle to adapt to traditional teaching methods such as rote memorization, teacher-centered instruction, and minimal deployment or use of technology. In addition, traditional teaching methods can reduce opportunities for individual learning. A lack of interactive resources can possibly lower the motivation and retention of students who may struggle to connect theoretical concepts with real-world applications.

The study of Dr. Lohans Kumar Kalyani (2024) in *The Role of Technology in Education: Enhancing Learning Outcomes and 21st Century Skills*, highlighted that technology not only reduces the cost of education but also increases the collaboration, engagement, and personalization that will lead to the effective learning outcome. Encouraging critical thinking and digital literacy in students that align with modern educational paradigms was also MathWise support and allowed the students to pursue self-driven, lifelong education journeys through personalized learning paths.

Furthermore, the initiative of the researchers is to establish MathWise, a Math E-learning platform specifically designed for Grade 5 students at Santo Niño Elementary School in Parañaque. The platform name “MathWise” was decided by the results of the pre-survey that the researchers conducted. This platform aims to address the challenges identified in a pre-survey, which highlighted math as the most difficult subject for teachers to teach across grades 1 to 6. The primary goal is to provide a comprehensive



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resource that serves as a teaching aid for instructors, featuring well-structured video lessons and interactive, game-like features to enhance student participation, retention and improve their learning performance.

Significant efforts have been made to ensure that this educational tool is both effective and well-designed, playing a crucial role in helping teachers and grade 5 students in Santo Niño to make mathematics teaching and learning more accessible and enjoyable.

Theoretical Framework

An improved interactive learning platform can greatly improve the comprehensive educational journey and continuously developing the system for delivering interactive courses and tracking grade 5 students' performance

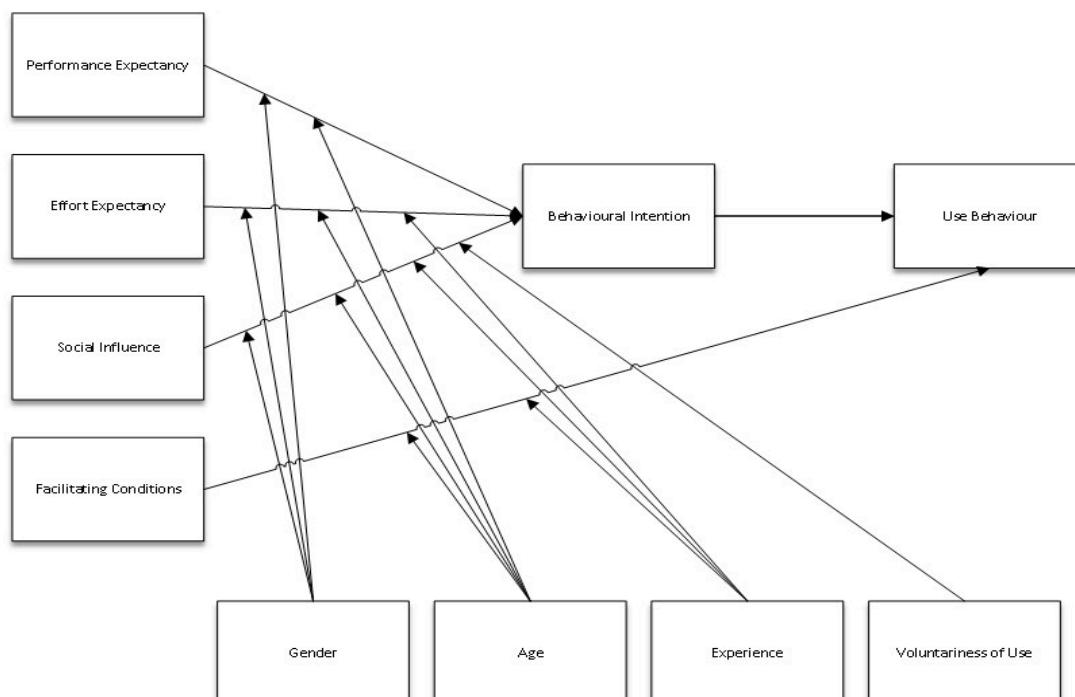


Figure 1. Unified Theory of Acceptance and Use of Technology



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This study adopts "*The Unified Theory of Acceptance and Use of Technology (UTAUT)*", proposed by Venkatesh et al. (2003) is commonly used to investigate technology adoption. There are four key determinants of technology acceptance based on UTAUT. Firstly, Performance Expectancy is a key concept of the UTAUT that measures whether students or teachers believe that using the system benefits them, assists them in their study or work, or yields improved educational outcomes. Secondly, Effort Expectancy refers to how intuitive and easy it is for students and teachers, or other users to perceive an e-learning platform to be, that will play a critical role in adoption and sustained use of e-learning systems. Thirdly, Social Influence refers to a person's behavior that can be especially prominent in environments where the behavior is largely driven by peers or hierarchy. At the early stage of the technology adoption lifecycle, social influence may play an important role, especially in a corporate or group environment. And lastly, Facilitating Conditions refers to support systems, resources and infrastructure that enable users to adopt and effectively use a specific technology. In the context of MathWise, this includes some conditions such as computers, reliable internet connection and devices for both students and teachers.



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Conceptual Framework

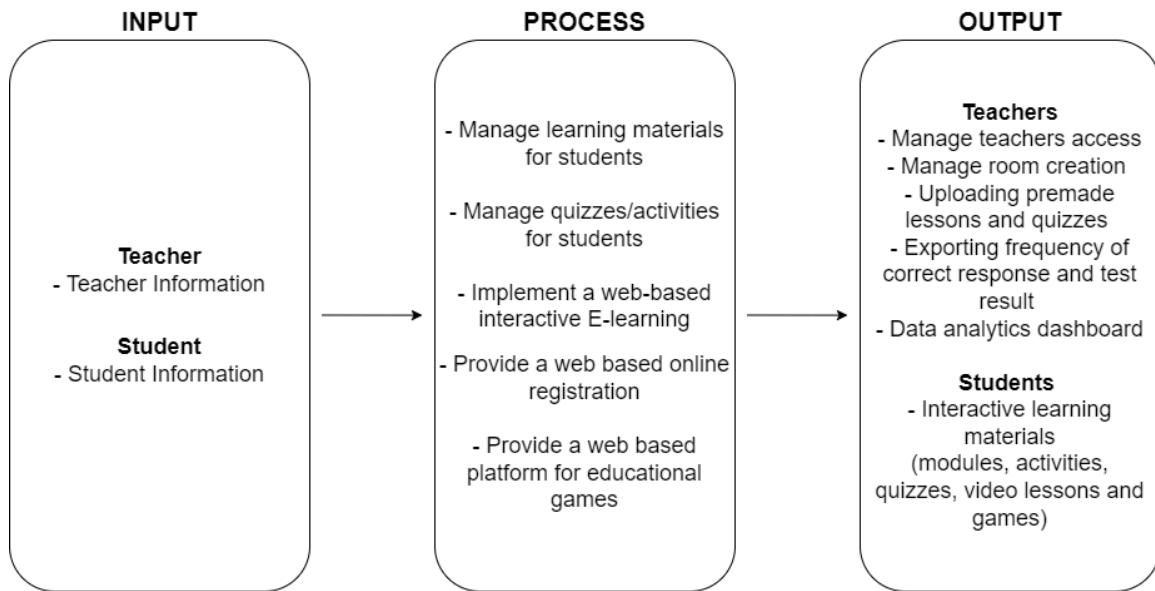


Figure 2. Conceptual Framework

Figure 2 illustrates the Input-Process-Output (IPO) that represents the development process of the proposed system. According to Adobe Experience Cloud Team (2023, July), Using an IPO diagram is another way to analyze and improve the system by breaking down a system into input, process and output to ensure all variables of a process and all its results are considered. It demonstrates crucial steps from the initial planning and preparation, moving through the core development processes, and concluding to the last step of deployment of the webpage.



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Statement of the Problem

The Santo Niño Elementary School Parañaque is currently facing a significant challenges in Mathematics subject (basic math operation and fractions), difficulty in understanding the contents, lack of engagements or interest on subjects and limited access to resources or support, base on the pre-survey that researcher conducted on Santo Niño Elementary school's faculty teachers. These challenges hinder the students' learning progress and academic performance in Mathematics.

Specific questions to be addressed:

1. What strategies or interventions can be implemented to improve student engagement and understanding of mathematics subjects?
2. What features are essential for an e-learning platform tailored to the specific needs of Santo Niño Elementary School's faculty teachers and grade 5 students?
3. What functionalities are important to make the overall experience of both students and teachers better and smoother?

General objective:

The purpose of this research is to develop MathWise, an e-learning program for Santo Niño Elementary School teachers, featuring detailed lesson plans, instructional videos, and a gamification system to address challenges in teaching mathematics—such as number operations—and thereby enhance teaching efficiency and student performance in the subject.



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Specific objectives:

To enhance the efficiency and effectiveness of Mathematics education at Santo Niño Elementary School, this research aims to develop MathWise, an advanced Math e-learning platform. The platform will be designed to meet the requirements set forth by the ISO/IEC 25010 standards, ensuring high quality in all aspects of the software.

MathWise will be designed with the following objectives:

1. **Instructional Content Delivery:** This software will provide instructional videos for each lesson featuring clear, step-by-step explanations for solving Math problems.
2. **Gamification and Engagement:** This software will develop a gamification system to make learning mathematics engaging and interactive for grade 5 students.
3. **Practice Exercises and Assessments:** This software will provide exercises, such as quizzes, tailored to each lesson.
4. **Platform Quality Assurance:** This software will adhere to high standards of quality throughout the platform's development and deployment phases.

The following are the requirements set forth by the ISO/IEC 25010 standards that the platform was designed to meet:

- **Instructional Content Delivery:** Ensure Functional Suitability by providing comprehensive and accurate instructional content, Usability by creating



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user-friendly video interfaces, and Performance Efficiency by optimizing video playback to minimize buffering.

- **Gamification and Engagement:** Enhance Usability and User Experience through interactive elements and game-based learning, ensuring Performance Efficiency to handle dynamic content and Reliability to provide consistent game functionality.
- **Practice Exercises and Assessments:** Ensure Functional Suitability by including relevant and varied practice exercises, Maintainability by allowing for easy updates and additions to exercise content, and Reliability by providing accurate feedback and assessments.
- **Platform Quality Assurance:** Incorporate Compatibility with various devices and browsers, Security measures to protect user data, Maintainability to facilitate ongoing updates and bug fixes, and Portability to allow the platform to be used across different environments.

Scope and Limitations

This system aims at the development, implementation, and evaluation of a customized mathematics focused educational tool for grade 5 students at Santo Niño Elementary School. The system is designed to identify subject areas where grade 5 students are struggling, with a specific focus on Mathematics, particularly math operations. It provides support through video lessons, interactive games, and quizzes. The system includes features such as assessment tools to identify and evaluate areas of



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difficulty, multimedia educational aids, and a user-friendly interface for easy access by both students and teachers. Additionally, it includes basic data analysis tools to monitor the grade 5 student's progress and adjust the system accordingly.

The limitation of the system is its initial scope, as it will focus only on a specific subject (Mathematics) where grade 5 students have demonstrated difficulties in understanding, potentially excluding other subjects. Additionally, the system's effectiveness will be influenced by the availability of resources such as videos and educational games. If these resources are limited, it could restrict the range of interactive aids provided. Finally, the usability of the system is dependent on access to technology, including computers, phone or tablets, as well as a stable internet connection, which may not be consistently available for all students.

Significance of the study

The development and implementation of MathWise: Revolutionizing Sustainable Education through Interactive E-Learning at Santo Niño Elementary School carries important meaning in addressing the specific learning challenges faced by grade 5 students in their math subjects. This system aims to improve educational outcomes by providing targeted support where it is most needed, particularly in areas like math operations.

Enhanced Learning Outcomes: By focusing on the subjects where grade 5 students struggle the most, the system offers an educational experience that can necessarily improve students' comprehension and performance in Math. The use



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of multimedia content such as video lessons, interactive games, and quizzes is expected to engage students more effectively, making complex concepts easier to understand.

Support for Teachers: The system provides valuable tools for teachers by identifying the specific areas where grade 5 students are facing difficulties. This allows educators to allocate their time and resources more efficiently, focusing on the topics that require the most attention. The system's data analysis capabilities also enable teachers to track students' progress over time and adjust their teaching strategies accordingly.

Data-Driven Decision Making: The incorporation of data analysis tools in the system will allow for ongoing monitoring of grade 5 students' performance. This data driven approach will enable the school to make informed decisions about curriculum adjustments, resource allocation, and the development of future educational aids, through continuously improving the quality of education provided.

Educational Equity: The system's focus on Math, a critical subject for academic and career success, ensures that all students, regardless of their initial skill level, have access to the resources they need to succeed. This contributes to reducing the educational gap within the school, promoting a more equitable learning environment.

Scalability and Future Development: Although the initial implementation is limited to Math, the success of this system could prepare the way for its expansion to other subjects. The insights gained from this project will be



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invaluable for future developments, allowing for the continuous enhancement of educational aids across various disciplines.

Definition of Terms

Autonomy - The need for individuals to feel in control of their own actions and decisions, allowing them to guide their learning journey. It's one of the three intrinsic psychological needs identified by Self-Determination Theory.

Competence/Capability - A person's desire to feel skilled, competent, and capable in their activities, which is one of the three key components of motivation according to Self-Determination Theory.

Data Analysis Tools - Software features that allow for the collection and analysis of data, often used to monitor student performance, identify areas of difficulty, and make informed decisions about educational strategies.

Educational Equity - The principle of fair and inclusive education where all students, regardless of their background or abilities, have access to the resources and opportunities they need to succeed.

E-learning Platform - An online educational tool or system that provides learning resources and materials, often incorporating multimedia elements like videos, quizzes, and interactive games.



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Gamification - The application of game-design elements (such as points, badges, and leaderboards) in non-game contexts to enhance engagement and motivation.

Input-Process-Output (IPO) - Represents the development process of the proposed system.

Interactive Games - Games that require active participation from students, often used in educational settings to make learning more engaging and enjoyable.

Leaderboards - A gamification feature that ranks users based on their performance, often used to foster competition and motivate students by showing their progress relative to others.

Math Operations - Basic arithmetic functions such as addition, subtraction, multiplication, and division that are fundamental to mathematics learning.

Multimedia Educational Aids - Learning materials that use a combination of different content forms such as text, audio, images, animations, or video to enhance the learning experience.

Relatedness - The desire to connect with others and feel a sense of belonging, which is essential for motivation according to Self-Determination Theory.

Rote memorization - A learning technique that involves repeating information until it is memorized. It's a traditional teaching method that's been used for centuries.

Scalability - The potential for a system or project to be expanded and applied to other subjects or contexts, allowing for broader use and impact.



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Self-Determination Theory (SDT) - A theory of motivation proposed by Deci & Ryan (1985) that suggests that people are motivated when their needs for competence, autonomy, and relatedness are fulfilled.

User Interface (UI) - It serves as the interface between people and computers. The user interface includes every piece of technology that you utilize.

Unified Theory of Acceptance and Use of Technology (UTAUT) - Examines the acceptance of technology, determined by the effects of performance expectancy, effort expectancy, social influence and facilitating conditions.



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Chapter 2

REVIEW OF LITERATURE AND STUDIES

This chapter summarizes the existing literature about MathWise: Revolutionizing Sustainable Education through Interactive E-Learning system. Researchers have examined data from several sources to develop an understanding of concepts regarding the system, comprehending its features and potential benefits and drawbacks. This section also explores the system's potential advantages.

Technological Background

The utilization of a web-based interactive e-learning system elementary School offers numerous advantages for enhancing student learning and fostering engagement through interactive content, personalized learning experiences and promoting sustainable education practices. This system discourses the common challenges encountered during student learning, such as lack of motivation, engagement and learning outcomes (Sappaile, et al., 2024).

The Interactive web-based e-learning system development for elementary school children tackles major issues that affect traditional education, for example, lack of interest in subjects like Math and low motivation levels. Through gamified educational methods, the platform comes up with a system where students can learn better through interactive contents that increase their motivation to become more involved with what they are studying. Achievements are integrated into the learning process to make schooling not only fun but also provides an opportunity for active student engagement which results in improved academic outcomes. (Hartayu & Albana, 2023).



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Furthermore, gamified education can promote the inner motivation of students at elementary schools. Extrinsic motivation is when you encourage or praise you. Things like achievements, awards, or commendations. In a gamified context, many students can be motivated to complete the task because of the points and prizes or levels that can grow their social status (Sappaile, et al., 2024).

An Overview of the Current Status of the E-Learning System

According to the study of Caraig Glyo G., Kelechi E., et al. (2021), It was found through mobile-based investigation of the e-learning system that this learning platform is dependable and reliable, effective, powerful as well functional, and easy to use. This study also indicates no significant difference in both nondisabled students and students with impairments evaluation by using the E-Learning System. As the participants have expressed their view, creating an E-learning system that contains extensible media types leads to high-quality learning.

Similarly, Ouadoud, et al. (2021) discuss the significant progress of e-learning facilitated by ICT, which now includes both synchronous (real-time interaction) and asynchronous (on-demand access) platforms, catering to diverse learning modes such as self-learning, tutored sessions, and cooperative productions. Despite facing challenges like resistance from educators accustomed to traditional teaching methods, the growing recognition of e-learning's benefits and ongoing technological advancements position it as a viable and increasingly popular alternative to traditional classroom education.

A study by Osadcha et al. (2021) also discusses that blended learning, which combines traditional classroom methods with online educational materials, is



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increasingly being adopted to enhance the learning experience. This approach leverages the strengths of both traditional and online learning formats to create a more comprehensive and engaging educational experience. Furthermore, adaptive learning technologies are being employed to tailor educational experiences to individual learners' needs, making learning more personalized and effective.

E-learning has become a critical component of modern education, driven by the rapid advancement of technology and the necessity for more flexible learning environments. The adoption of e-learning platforms, especially during the COVID-19 pandemic, has transformed traditional education models, providing broader access to learning resources and enabling institutions to continue operations despite global disruptions (Sofiadin & Azuddin, 2021).

Identifying Challenges in the Current E-Learning System

A study by Erlangga (2022) found that one challenge of e-learning is that students often perceive online learning as boring. While online learning is intended to address the monotony of traditional classroom-based education, it does not always succeed. Many e-learning courses are composed of lengthy texts followed by extensive lists of multiple-choice questions, which can fail to engage students. As a result, these courses may feel more like e-reading than an interactive learning experience.

Based on the study of Quimsing M., and Ortega Derez C. (2024). The significant portion of grade 6 students at San Antonio Elementary School, Santo Tomas Batangas are facing learning challenges, specifically in reading. In response to this situation, they recommend using a technology-based reading app READTECH 1.0 as an intervention tool and curriculum material for struggling readers to enhance literacy skills by offering



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interactive lessons that will help them engage through utilizing these technologies during instruction.

According to Angelo & Fullente (2023), they examined how 31 private school mathematics teachers in Sorsogon, Philippines, used the Moodle Learning Management System (LMS) for instruction. While most teachers were proficient in content management, only about half were skilled in using Moodle's assessment and feedback tools. The LMS training focused more on content management, leaving gaps in assessment and feedback skills. Teachers also struggled with inserting mathematical equations. The paper recommends enhancing LMS training to cover assessment tools, feedback, and support for integrating mathematical equations, ensuring it meets the diverse needs of both teachers and students.

Universities have been using e-learning platforms more frequently in recent years as a contemporary addition to, and occasionally as a substitute for, traditional education (Górska, 2016). With the start of the COVID-19 pandemic, the demand for online learning platforms increased, forcing colleges and universities to switch from traditional face-to-face instruction to online formats to maintain educational continuity (Sofiadin & Azuddin, 2021). However, there are a number of difficulties associated with the transition to digital learning settings. These include dwindling student motivation, which lowers participation and engagement in classes, and instructors' challenges keeping students' attention, which can ultimately cause online education systems to be abandoned.

Studies and Literature about the E-Learning System

Interactive e-learning platforms provide personalized learning experiences, allowing students to learn at their own pace and according to their individual needs. This



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is in line with the findings of Jimenez (2020), who highlighted the significant impact of contextualized e-learning resources on students' academic performance. By tailoring educational content to the learners' context, such platforms can enhance understanding and retention, leading to better academic outcomes. Specifically, the study finds that Mathematics in grade 3 learners has a significant effect on increasing learners' academic performance, contributing to improved comprehension and mastery of mathematical concepts.

Similarly, a study conducted by Encarnacion et al. (2020) found that e-learning platforms significantly improve the delivery of instruction by incorporating a range of multimedia resources and interactive tools. The flexibility provided by e-learning allows educators to present content in various formats that cater to different learning styles, thereby improving the overall effectiveness of teaching. This approach can significantly boost students' motivation and foster independent learning. By providing practical exercises and educational videos, e-learning platforms enable students to apply their knowledge to various contexts, thereby reinforcing their understanding and promoting deeper learning.

Cayang, J. and Ursabia, E. (2024) conducted a study intended to determine the effectiveness of game-based learning in teaching mathematics in Aleosan, North Cotabato, Philippines. The study utilized 16 game-based learning instructional materials specialized for specific mathematics topics, validated by 3 experts before implementation that significantly enhanced the academic performance of learners in mathematics compared to traditional teaching methods.



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Purnama H., Wilujeng I., Safrudin C., et al. (2021) also conducted a study related to web-based e-learning in elementary schools in Taiwan. The purpose of this study is to review the existing literature on the idea, implementation, and effects of web-based e-learning in primary schools. The researchers utilized a systematic literature review (SLR) method to obtain the results on web-based e-learning. In addition, the researchers followed the PRISMA protocols to identify, filter, and test feasibility, among other steps. The findings indicate that web-based e-learning has several positive impacts on students such as improved critical thinking, learning outcomes, increased interest in learning, and more.

The landscape of e-learning has seen transformative changes, especially with its adoption during unprecedented times like the COVID-19 pandemic. Rakic et al. (2020) investigated e-learning using Social Network Analysis, K-Means Clustering, and Multiple Linear Regression, focusing on engineering students at the University of Novi Sad. Their findings indicate that students with similar performance levels tend to utilize similar resources and that higher-performing students are often more centrally positioned within their learning networks. This central positioning is correlated with better academic outcomes, suggesting that targeted e-learning strategies which consider resource usage and network dynamics could enhance student success.

On the other hand, Ignacio & Ignacio (2021) analyzed the shift to e-learning during the COVID-19 pandemic in the Philippines. They identified both positive and negative effects of this transition. Positively, the shift ensured educational continuity, accelerated digital technology integration, offered greater flexibility and accessibility, fostered innovation in online learning, and improved digital literacy among students and



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educators. However, it also highlighted challenges that need addressing. Combining these insights underscores the dual impact of e-learning advancements and the importance of strategic implementation to maximize benefits while navigating associated challenges.

Gamification, defined as the use of game-based mechanics, aesthetics, and thinking to engage people, promote learning, and solve problems in non-game contexts, has emerged as a key area of interest within e-learning research (Kapp, 2012). It involves the incorporation of game elements such as points, tasks, challenges, goals, or immediate feedback to foster a gameful attitude that can benefit learning outcomes (Lämsä et al., 2018). This approach contrasts with traditional pedagogies, which often struggle to maintain student engagement, particularly in subjects such as mathematics, where learner disengagement has been a persistent issue (Clements, 2004; Duru, 2010).

Research has shown that gamification can have positive outcomes in specific areas of mathematics, such as geometry, where it supports learner engagement and achievement (Aridi & Saad, 2020; Baldeón et al., 2015). The effectiveness of gamification in mathematics education underscores the potential of active learning pedagogies to transform traditionally dull learning environments into dynamic, interactive, and smart learning spaces (Nand et al., 2019; Ting et al., 2019).

Synthesis

E-learning has dramatically transformed how learning is delivered from the traditional approaches to encompass more and more modern techniques such as introducing interaction modules and learning through games. One of the features of



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e-learning platforms is individual approaches: the content is provided and arranged correspondingly to the learner, and the pace, and frequency of the lesson, make it easier to understand and remember. This kind of approach mostly benefits in subjects such as mathematics, whereby students have benefited from element-specific resources such as tutoring to get high grades and levels of mastery.

Current studies look at the transformations that e-learning has made in multiple educational settings. Evidence from several studies conducted in Aleosan, North Cotabato, Philippines, shows that game invocations during tutorials showed improved learning performance in mathematics compared with the conventional way of teaching.

This was consistent with some recent studies in e-learning where critical thinking and learning were improved, especially students' engagement. As a result of the COVID-19 pandemic, e-learning has no choice but to be quickly adopted, where its benefits and shortfalls came bursting through. Beneficial results result in greater accessibility, flexibility, and innovation in teaching practices. On the other side of this transition, it has unveiled difficulties, including requirements for strategic implementation to tackle emerging problems. Within e-learning, a very powerful tool known as "gamification," or the implementation of game mechanics such as points, is emerging. Gamification has the potential to turn something mundane like math into interactive and game-like experiences that trigger healthy competition amongst students. This method works to increase motivation and boost learning outcomes among students.

Finally, advanced analytical methods such as social network analysis suggest that e-learning networks are the main pillars of academic success. As expected, the higher-performing students were also located more centrally within these networks,



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indicating that understanding resource utilization and network dynamics can lead to improved focus of e-learning strategies on specific groups. In conclusion, when these personalized e-learning platforms combine multimedia and gamification strategies, we see a huge leap in education. These innovations serve the dual purpose of increasing engagement and comprehension as well as catering to different learning styles, which helps learners succeed. The future potential of e-learning is large when combined with proper implementation and advanced analytic tools that will further enhance educational experiences for students in a more complex form than traditional methods could provide.



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Chapter 3

RESEARCH METHODOLOGY

Research Design

This study aims at developing Revolutionizing Sustainable Education through Interactive E-Learning for Santo Niño Elementary School, Parañaque City. The researchers used descriptive quantitative research methods to conduct this study to understand the perceptions of various grade 5 students and teachers on this study and to support and fulfill the study's objectives.

Quantitative research approach uses self-made surveys or questionnaires to measure variables and to identify relationships existing between them. It introduces a population, situation or issue, and what, where, when, and how questions without looking at the "why". They resort to statistical analyses in order to identify patterns and trends and even correlations; this helps construct these events only where some reasonable measurement or quantification needs to be developed. The quantitative research methodology may include qualitative elements in order to make understanding richer. Quantitative analysis helps one to understand the "how, when, and where" by which the "results were produced" so that we may then move on to evaluate "why" these happen. The exact nature of the study method is crucial because it has an immense influence on its validity and reliability which are the assurance for conjectures based on evidence.



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Source of Data

This study utilizes a variety of data sources to evaluate the effectiveness of the MathWise e-learning platform:

- Teachers – The researchers conducted a pre-survey with the teachers at Santo Niño Elementary School to figure out which subject (Mathematics) the students had the most challenges with. The results also showed that a specific grade level (Grade 5) student was the grade level that needed help with the subject the students struggled with.
- IT Experts – The researcher reached out to 10 IT Experts to have their systems validated. The researchers also conducted a post-test survey that adhered to the ISO/IEC 25010 Standard.

Due to the age gap and current knowledge of the grade 5 students, the researchers considered not including the grade 5 students in the post-test survey. It was anticipated that their level of understanding might differ from the expectations of the survey, which could lead to inconsistencies in the results.

Research Instrument

A research instrument is a tool that could be used in the collection, measurement, and analysis of data relating to your subject (Duquesne University, n.d.). In this study, the researchers have used the following research instrument:

Surveys: Surveys were forwarded to both teachers and IT Experts that comprise open-ended and closed questions. Surveys give qualitative information regarding the



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quality of the materials, user experience, and the influence the platform has on teaching and learning. The merging of qualitative insights with quantitative data helps in giving a holistic view of its effectiveness. The researchers also made sure to adhere to the ISO/IEC 25010 Standards.

Ethical Considerations

All subjects have the right to be informed of the research purpose, procedures, and attendant risks or benefits. Each subject has to provide consent prior to the data collection period. A minor requires assent in addition to the parental/guardian's consent.

Informed Consent: All subjects have the right to be informed of the research purpose, procedures, and attendant risks or benefits. Each subject has to provide consent prior to the data collection period.

Confidentiality and Anonymity: Researchers will assure the privacy of participants by de-identifying their data and keeping it safe as this corresponds to the Republic Act 10173 - Data Privacy Act of 2012. Only authorized researchers will have access to these data.

Voluntary Participation: All participation in this study shall be absolutely voluntary. Participants may withdraw from this study at any time, ensuring non-coercion and control over participation without influencing the involvement of other factors.

Data Integrity and Reporting: Research data integrity will be worked out to ensure all data collected are valid. All changes or distortion of data should be recorded along with their rationale. Results will be reported with no fabrication, falsification, and data manipulation.



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Feedback: After finishing general findings will be given to participants who will also be allowed to have questions. This feedback mechanism would result in some level of transparency and may be effective for establishing trust between researchers and many participants.

Such ethical considerations, to be dealt with in addressing validity and reliability, will serve as an adequate conducive to conducting this study on the development of the MathWise e-learning platform for Santo Niño Elementary School.

Data Gathering Procedure

The researchers performed a pre-survey with the teachers of Sañto Niño Elementary School. This session was to figure out what subjects and what grade level needed to be focused on. Follow-up meetings were also conducted to show the clients some of the progress with the system and identify if they are satisfied with the current progress or if there will be changes to be made.

The researchers then performed a post-test survey that adhered to the ISO/IEC 25010 Standard to IT Experts and teachers at Santo Niño Elementary School to assess the quality of the system and the system's usability.

Population, Sample Size and Sampling Technique

The researchers used Purposive Sampling for the selection of the survey respondents. This allowed the researchers to focus on getting the necessary information from the participants who's going to use the system.



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Ten (10) Teachers and ten (10) IT Experts – a total of 20 people were chosen to be the survey's respondents. The respondent's description provided the researchers with an understanding of their perspectives on the proposed system.

Category	Frequency
Teacher	10
IT Expert	10
Total number of Respondents:	20

Table 1: Distribution of the Respondents by Category

In Table 1, the respondent's distribution is shown in 2 categories. Teachers and IT Experts.

Data Analysis Plan

Data analysis is a systematic process that examines, cleans, transforms, and models data in order to extract valuable insights and aid in decision-making. The system



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was developed based on insights obtained throughout the evaluation process to ensure that it fulfilled the needs and expectations of the users. In this section, data from the administration, administrative staff, and instructors were evaluated to discover common patterns, obstacles, and opportunities for improvement.

The data gathered from the survey will be analyzed using the weighted average using a 4-point Likert Scale.

Rating	Scale Range	Interpretation
4	4.00 - 3.00	Strongly Agree
3	2.99 - 2.00	Agree
2	1.99 - 1.00	Disagree
1	1.00 - 0.99	Strongly Disagree

Table 2: 4-point Likert Scale



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System Architecture and Design

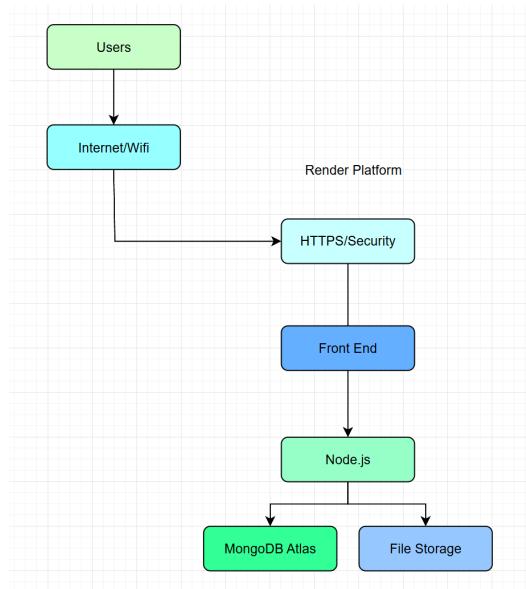


Figure 3: Proposed System Architecture

Figure 3 shows the suggested system architecture showing a website housed on the Render platform. Users interact with a frontend layer created with HTML, CSS, and JavaScript after accessing the system via the Internet/WiFi. SSL certificates and HTTPS techniques guarantee encrypted connection between users and the server, therefore securing the system. The Node.js backend handles user requests and logic, using a MongoDB Atlas database for secure data storage. A file storage system manages static assets and files. This architecture prioritizes security, efficiency, and scalability with clear layer-by-layer responsibility separation.



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1. Use Case Diagram

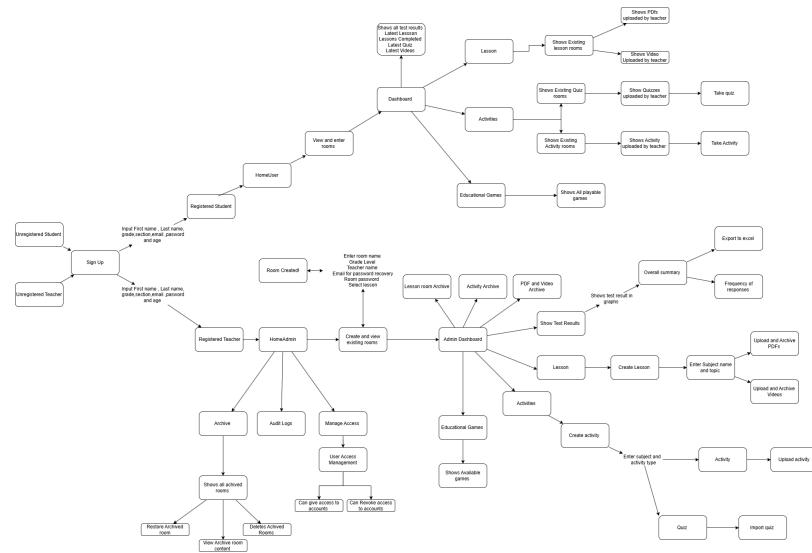


Figure 1.1: Students and Teachers Use Case Diagram

Use Case Description: Teacher (Admin) Use Case Diagram

The use case description below describes the process for teachers (admin) to log in, upload and manage lessons in module or video format and to also upload and manage activities or quizzes. Desk officers can also give admin access to other teachers who just created their own MathWise account.



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Use case Name:	Mathwise Admin Use Case Diagram		
Scenario:	Login and Manage system as Teacher		
Triggering Event:	Teacher needs access to upload Quizzes,Lesson,Activities and videos		
Brief Description:	Teacher logs in to manage lesson and give acces to other teachers		
Actors:	Teachers		
Stakeholders:	Teachers Student		
Preconditions:	One Teacher must be an Admin		
Postconditions:	Lessons are uploaded Quizzes and activities are visible and other teachers are admins		
Flow of Activities:	Actor	System	
	1. Teacher enters login credentials 2.teacher sees other teachers that want access 3. teachers publish draft quizzes or activities 4. teacher see test results 5. teacher exports test results and frequency of answers	1.1 system valitdates login credentials 2.1system shows registerd users 3.1 systems shows all draft quizzes and activities 4.1 systems shows test results of all students 5.1 systems generates excel file	
Exception Conditions:	1.1 if login is incorret login is denied 1.2 if not granted admin privialges actions will be restricted		



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2. Activity Diagram

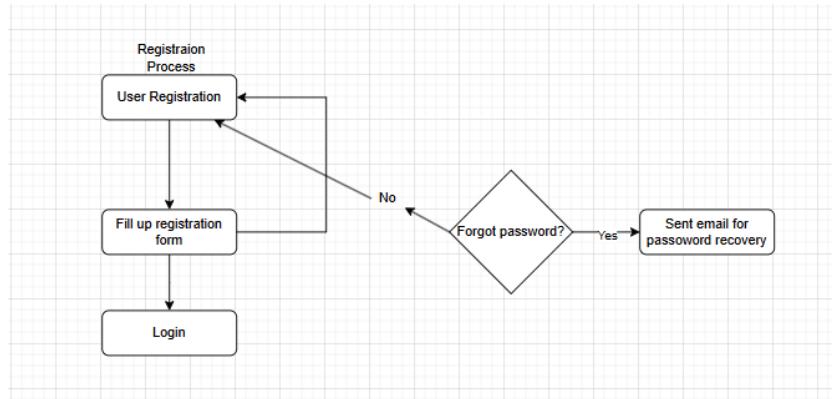


Figure 2.1 Account Registration

The activity diagram titled “Account Registration” illustrates how users can create a personal account by completing a registration form with the required details. Upon finishing the registration, the user will be sent an email to the email address they used during the registration process. The email that contains a link that they can click to get their account validated.

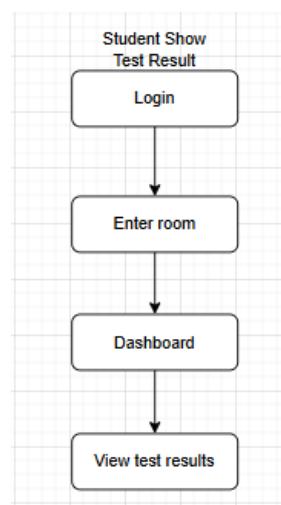


Figure 2.2: Student Dashboard



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The activity diagram titled “Student Dashboard” outlines the process on how the student user can start to access the dashboard to view their latest test results by logging in, entering their room and finally accessing the dashboard.

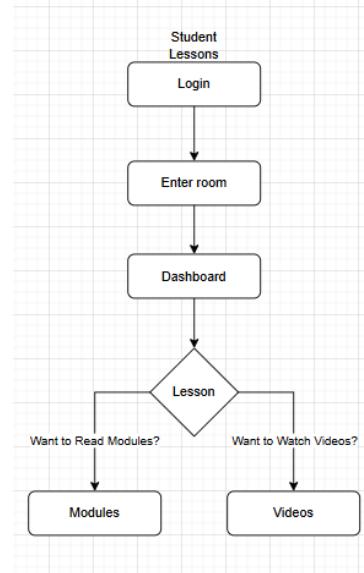


Figure 2.3: Student Lessons

The activity diagram titled “Student Lessons” outlines the process on how the student user can start to access the lessons instance to view their latest available lesson in either Module or Video form by logging in, entering their room and finally accessing the dashboard and clicking the lessons button.



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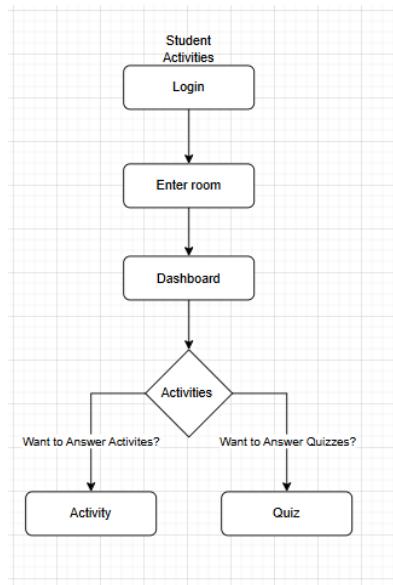


Figure 2.4: Student Activities/Quizzes

The activity diagram titled “Student Activities/Quizzes” outlines the process on how the student user can start to access the lessons instance to view their latest available activities/quizzes by logging in, entering their room and finally accessing the dashboard and clicking the activities button.



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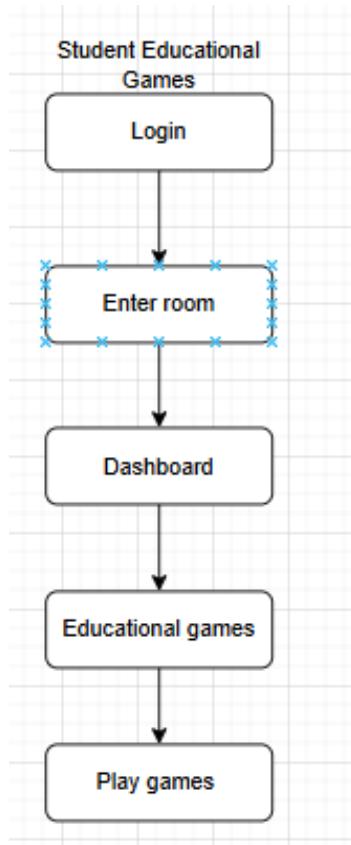


Figure 2.5: Student Educational Games

The activity diagram titled “Student Educational Games” outlines the process on how the student user can start to access the educational games to view/play the latest available educational games by logging in, entering their room and finally accessing the dashboard and clicking the educational games button.



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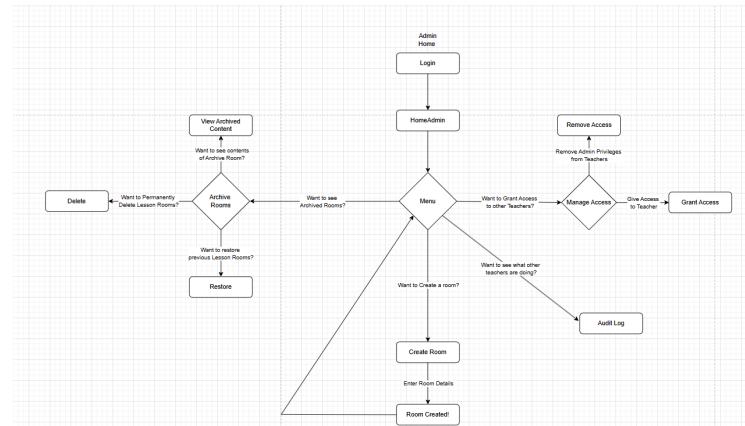


Figure 2.6: Admin Home Screen

The activity diagram titled “Admin Home Screen” outlines the process on how the admin user can start to access their home screen to view the rooms they manage by logging in, entering their room and finally accessing the home screen.

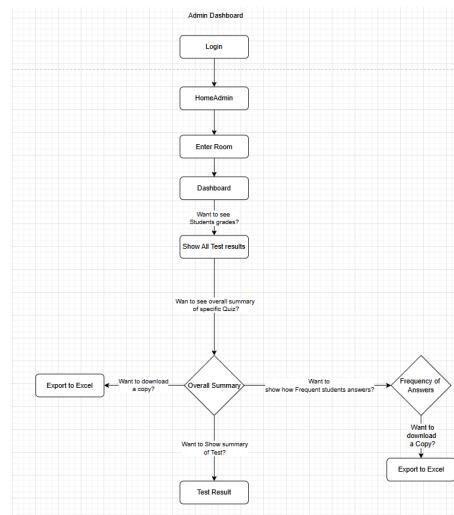


Figure 2.7: Admin Dashboard

The activity diagram titled “Admin Home Screen” outlines the process on how the admin user can start to access their home screen to view the rooms they manage by



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logging in, entering their room and finally accessing the home screen and entering a room that they manage leading them into the dashboard.

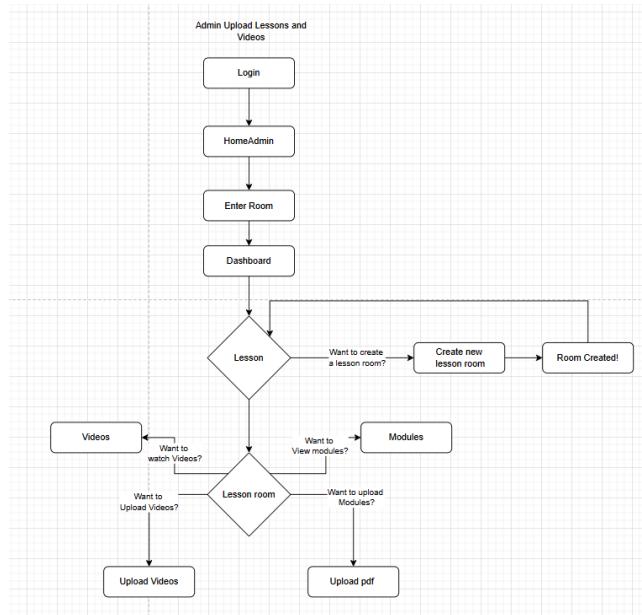


Figure 2.8: Admin Upload Lessons

The activity diagram titled “Admin Upload Lessons” outlines the process on how the admin user can start to access the lessons instance to view and upload their latest available lesson in either Module or Video form by logging in, entering their room and finally accessing the dashboard and clicking the lessons button.



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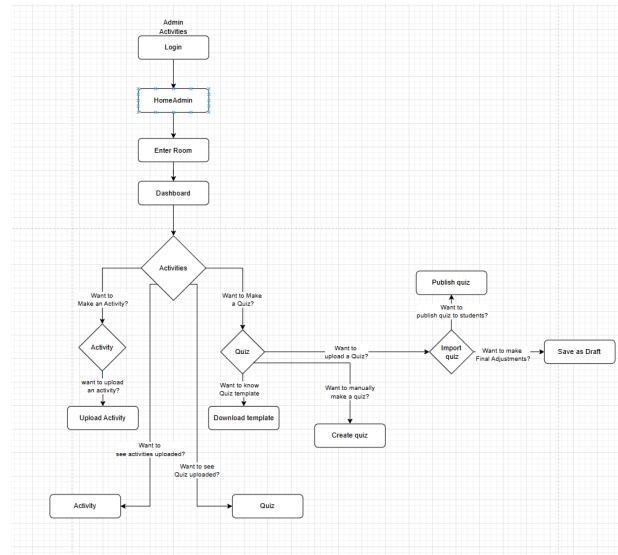


Figure 2.9: Admin Upload Activities/Quizzes

The activity diagram titled “Admin Upload Activities/Quizzes” outlines the process on how the admin user can start to access the activities instance to view and upload their latest available activities/quizzes by logging in, entering their room and finally accessing the dashboard and clicking the activities button.

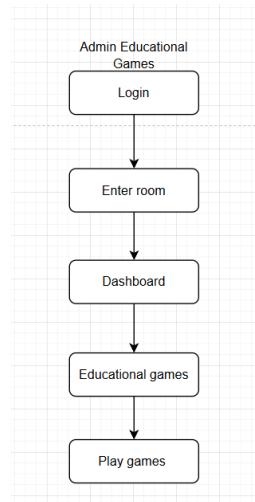


Figure 2.10 Admin Educational Games



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The activity diagram titled “Admin Educational Games” outlines the process on how the admin user can start to access the educational games to view/play the latest available educational games by logging in, entering their room and finally accessing the dashboard and clicking the educational games button.

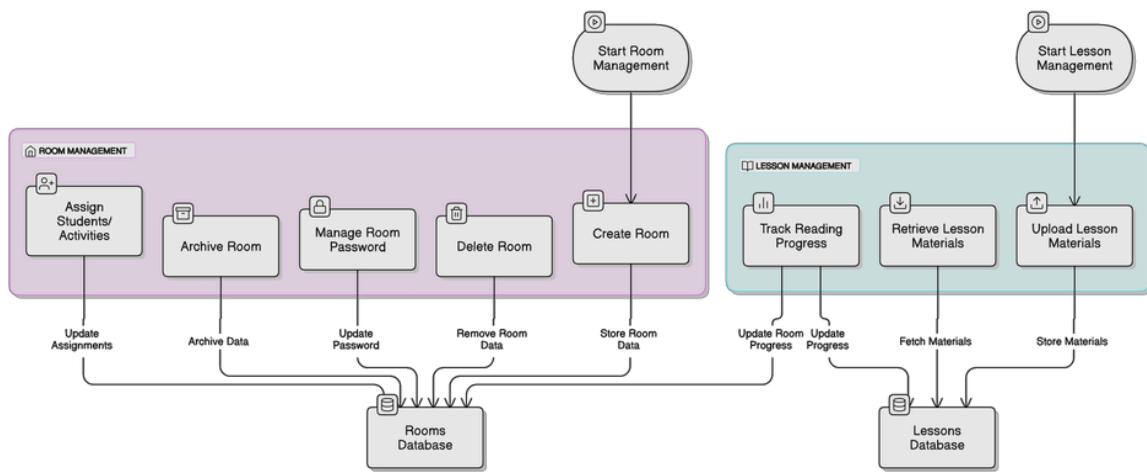


Figure 2.11.1 Level 0 Data Flow Diagram



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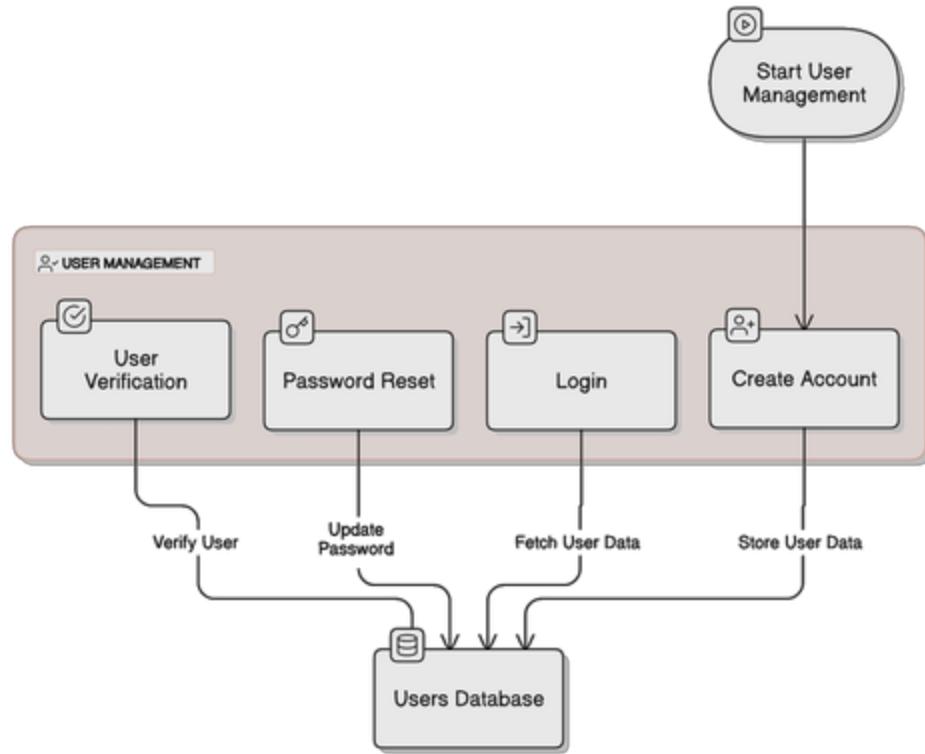


Figure 2.11.2 Level 0 Data Flow Diagram



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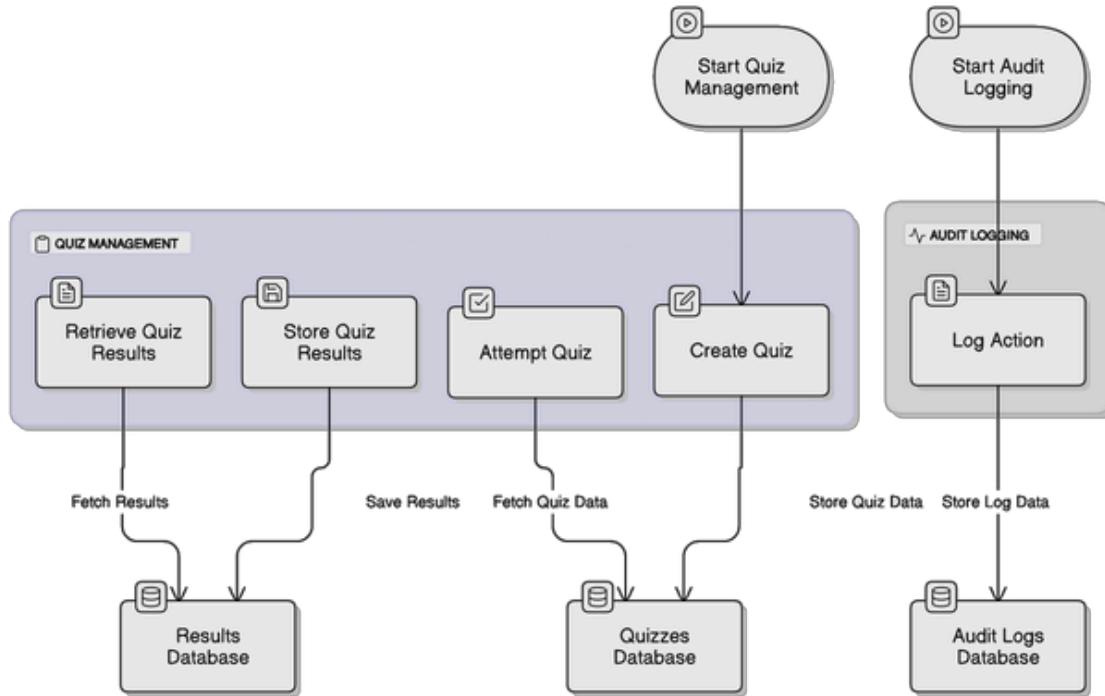


Figure 2.11.3 Level 0 Data Flow Diagram

Figures 2.11.1, 2.11.2 and 2.11.3 show the Level 0 Data Flow Diagram of the Santo Niño MathWise, the flow of data illustrates how information is exchanged between external entities, the system, and where it is stored within the central database. Teachers act as primary data sources by uploading their own lessons in video or module form. The Lesson Management Table is where the lessons in module or video form is stored, the Room Management Table is where multiple room details are stored, the Quiz Management Table stores the quiz details and data, the User Management Table is where user data from registration are stored and the audit log table is where the details of the audit logs are stored. These Inputs are processed and stored in specific tables.



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The Admins (teachers) are accountable for the entire system during the interim, ensuring that access control is effectively managed by administering user accounts in the Users Table and maintaining system security. This centralized database architecture guarantees that data is meticulously organized, thereby enabling the efficient retrieval and storage of all indispensable information and the establishment of a seamless communication platform between users. In this way, the system is ensured to operate securely and efficiently.

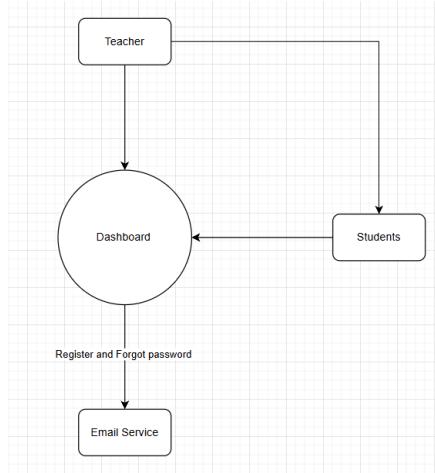


Figure 2.12: Context Flow Diagram

The Context Flow Diagram shows how the Account Registration and Forgot Password System of Santo Niño MathWise links its key elements. Using the MongoDB Node.js driver, it allows the system to connect to the database and function properly. While the Email Service manages account registration and forgot password instances.



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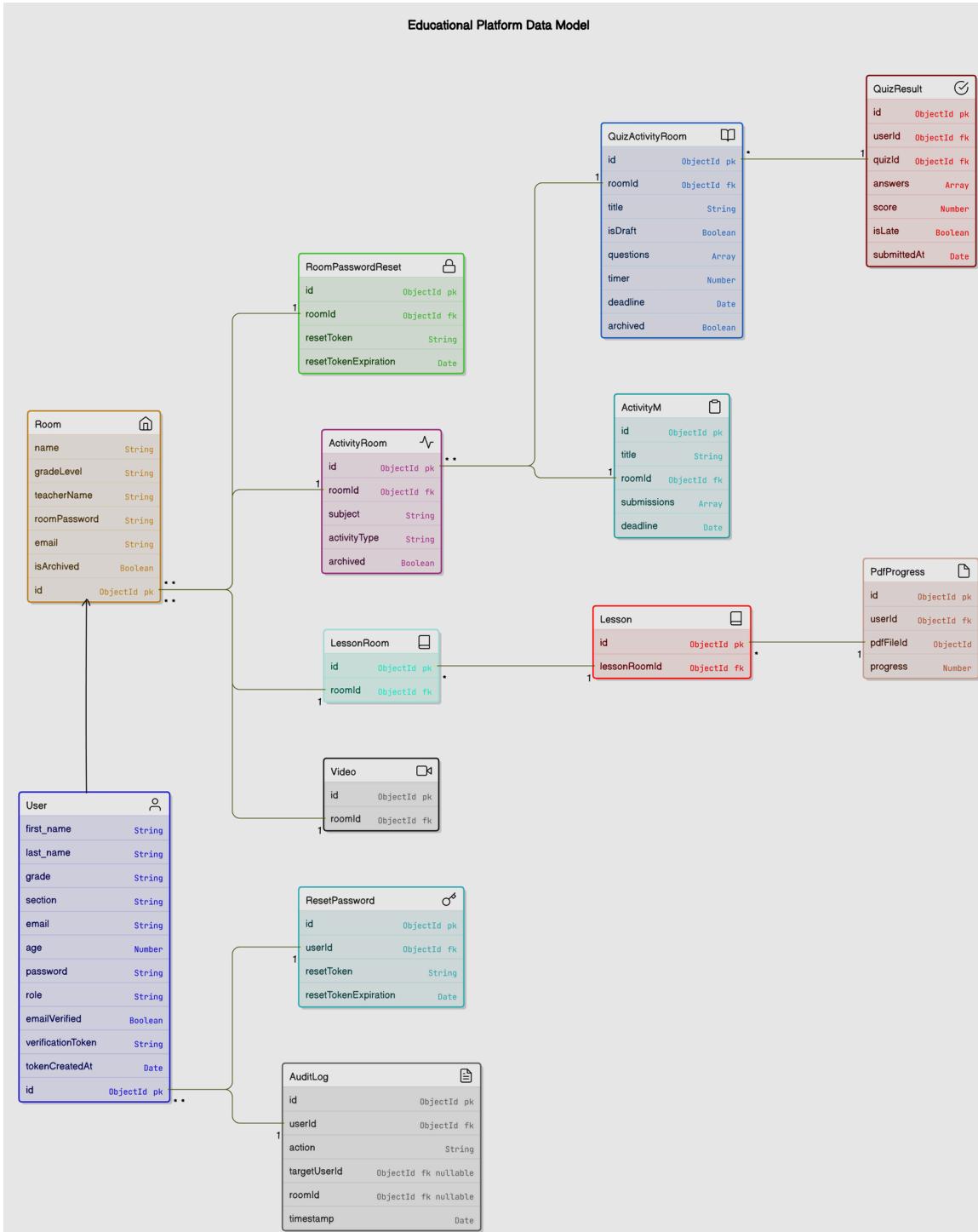


Figure 2.13: Entity Relationship Diagram



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System Software Development Requirements

Components	Specifications
Programming Language	Node.js, java, C#
User Interface Library	HTML, CSS, Bootstrap
Communication/Collaboration tools	Facebook and MsTeams
Development Tool Suite	Node.js Version Manager (For local development)
Database	MongoDB Atlas
Operating System	Windows
IDE/Text Editor	Visual Studio
Package Managers	Node Package Manager
Deployment Platform	Local Host & Render
API Tools	MongoDB Node.js Driver
Design	Figma

Table 1: Software Development Requirements

Table 1 shows the whole software stack and tools needed by developers to build and manage the system. The specifications cover critical development components such as programming languages, frameworks, development environments, and collaboration tools, which developers must have installed on their computers.



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System Costing Table

Item/Service	Description	Cost(USD)	Cost(PHP)
MongoDB	DataBase	9\$	528.24

Table 2.1: Monthly Cost Breakdown

In table 2.1, it shows the monthly cost breakdown that identifies the essential services required for operation. MongoDB Atlas charges \$9 per month for the database access. Render offers free web infrastructure, which includes domain registration, hosting services and file management capabilities.

Item/Service	Description	Cost(USD)	Cost(PHP)
MongoDB	DataBase	108\$	₱6,338.90

Table 2.2: Annual Cost Breakdown

In table 2.2, it shows the monthly cost breakdown that identifies the essential services required for operation. MongoDB Atlas charges \$9 per month which totals to \$108 annually for the database access. Render offers free web infrastructure, which includes domain registration, hosting services and file management capabilities.

Item/Service	Description	Cost(USD)	Cost(PHP)
MongoDB	DataBase	324\$	₱19,016.70

Table 2.3: Three (3) - Year Cost Breakdown

In table 2.3, it shows the monthly cost breakdown that identifies the essential services required for operation. MongoDB Atlas charges \$9 per month which totals to \$324 for



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Three (3) years for the database access. Render offers free web infrastructure, which includes domain registration, hosting services and file management capabilities.

Software Development Methodology

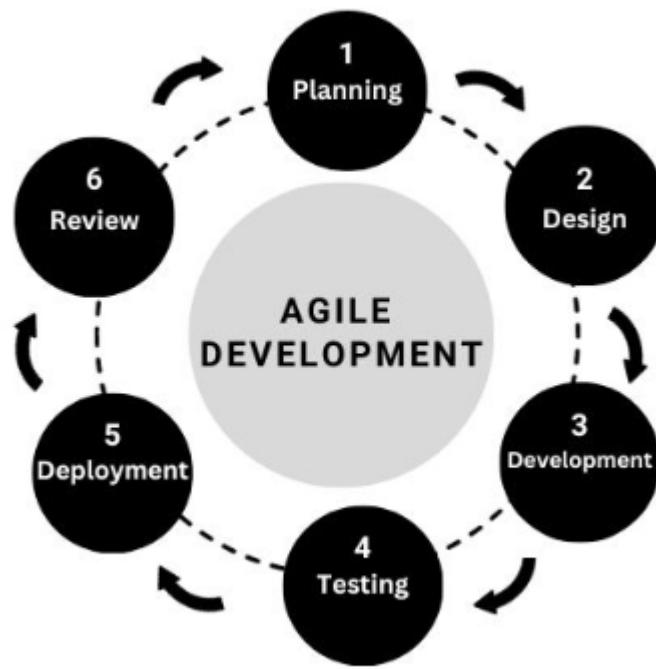


Figure 4: Agile Software Development Project Life Cycle Phases

As the developers developed the system, they applied the agile scrum framework technique in Figure 3, an agile method of numerous practicing developers where they can incrementally and iteratively build the prototype of a system. The framework includes producing the product backlog, sprint planning, project meeting configurations, and sprint reviews at both iteration commencements and closures, among many other



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artifacts of the project. Models of the Scrum technique also encourage teamwork, flexibility, and cooperation for complex projects.

Initial Planning

The researchers aimed to identify the project's goals, requirements and objectives during this phase. Pre-surveys were conducted with the teachers at Santo Niño Elementary School to gather insights into the challenges of their existing methods.

The scope of this project was defined during this phase, the key milestones were also identified during this phase. Software tools and team roles were placed to ensure efficient execution of the project.

Design Stage

During this phase, the architecture of the system and the database schema were developed based on the requirements of the initial planning phase. To ensure the design's usability and accessibility and visualize the user interface, wireframes and prototypes were created.

The client's feedback and suggestions were crucial in refining the prototype's features such as automated frequency of correct response, ability to import quizzes using Microsoft Excel and exporting the results of quizzes/activities into an excel file. The architecture of the system was designed to be scalable, so the researchers used MongoDB for database management.



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Development

This phase involved implementing the system's functions in alignment with the designed architecture. The backend was developed using Node.js and JavaScript. The researchers used MongoDB Atlas for database management because of its scalability and reliability with handling structured data.

The frontend was developed using HTML, CSS and Bootstrap. This ensures responsiveness and accessibility across devices.

GitHub was used as the means for version control. It ensures collaboration and track changes efficiently. Agile Scrum principles guides, this allows iterative updates based on the client's feedback after each sprint cycle.

Testing

To ensure the functionality, reliability and usability of the system, the researchers, teachers and IT experts conducted a comprehensive testing. This phase included integration testing, unit testing and system testing.

User acceptance testing (UAT) was also conducted to verify if the system met the client's requirements. Load testing was also conducted to evaluate the performance of the system under high user demand, resulting in ensured scalability. Bugs and issues were promptly addressed and fixed during the subsequent iterations of testing.

Deployment Stage

During this phase, the researchers turned over the GitHub repository and MongoDB Atlas accounts to the clients. In the case when the clients wanted to use the



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system locally, the researchers also set up a local server that was provided by the clients themselves.

Also, training/seminar on how to use the system was provided to the clients to help them navigate and use the system.

Review Stage

In this phase, the systems performance and user adoption were evaluated through collection of feedback. Stakeholders also provided insights into the strengths and weaknesses of the system and possible areas of improvement that aligns with the iterative feedback in the agile scrum framework.

Data of the system's performance were analyzed to determine. System updates were then made based on this feedback, ensuring constant improvement in usability and functionality.

Implementation Plan

The plan on this phase followed the approach approved by the clients to ensure a smooth transition to using the system. In the beginning, the preparation phase involved briefing the clients on the capabilities of the system and training the clients with the necessary knowledge. Technical resources such as hardware were thoroughly checked and inspected to ensure readiness.

A test-run of the system was also conducted by the researchers. This was done in a controlled environment. This was done to identify potential issues/bugs in the system and provided a chance to refine the system based on real-world usage. The



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feedback of the clients was essential during this phase to ensure that the system met their needs and requirements.

The system was then finally implemented across the school. This phase involved giving access to admin accounts to be used by the teachers at Santo Niño Elementary School, along with technical support to address any post-deployment issues/bugs.



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Chapter 4

RESULTS AND DISCUSSION

This chapter presents a comprehensive summary of the results of the survey conducted.

Design and Development of the Proposed System

PROJECT NAME	Santo Niño MathWise: Revolutionizing Sustainable Education through Interactive E-Learning
PROJECT LEADER	Prof. Erwin E. Acorda
PROJECT MANAGER	Shawn Isaiah A. Ancheta
CLIENT	Santo Niño Elementary School Parañaque (Grade 5 students and Faculty Teachers)
PROJECT SPONSOR	Self Funded
START DATE	July 2024
COMPLETION DATE	
Project Objective	



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To develop and design a Revolutionizing Sustainable Web-based Education through Interactive E-Learning (MathWise) platform that aims to help and improve the Santo Niño elementary grade 5 students' mathematical skills, engagement, and understanding by providing interactive lessons, gamified learning experiences, and accessible resources. Additionally, the platform seeks to make the work of any teacher much more effective and efficient by automating processes like checking tests, creating test results for each student, checking how often they answered the questions correctly and other aspects that can ease the process of making assessments while providing useful insights about students.

Stakeholders and Responsibilities:

Stakeholders	Role	Responsibility	Signature
Ancheta, Shawn Isaiah A.	Project Manager/ Game Developer/ Researcher	Game design, program, Game functionality	
Magbujos, Ronel A.	Back-End Developer/ Quality Assurance/ Researcher	Planning/Resources/S taff Assignment, Monitoring, Website functionality, Development, Executing Project	



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Medina, John Rick D.	Researcher/ UX-UI Designer	UI design	
Tenorio, Alexandra Carmela G.	Front-End Developer/ Researcher	UI Design, Responsive Layout, Code implementation	
Vallejos, Trissa May R.	Front-End Developer/ Researcher	UI Design, Responsive Layout, Code implementation	
Prof. Erwin E. Acorda	Research Adviser	Checking, Monitoring	
Ms. Myril Lausing Ramirez	School Client	Checking, Monitoring	

Gantt Chart

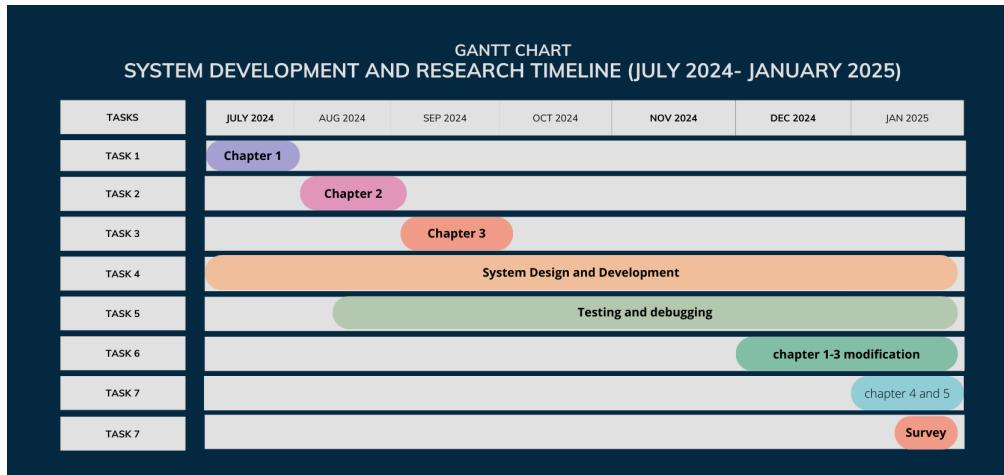


Figure #: Project Timeline



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Figure # provides a detailed system development and research timeline from July 2024 until January 2025. In July 2024: The basic research of this project was reported in Chapter 1, while in August and September Chapters 2 and 3 were reported, respectively. In addition to that chapters gradually incorporated theorized and applied work, a large System Design & Development phase ran concurrently over virtually the entire period of the project. System development continued, and testing and debugging work began in August of 2024. The team began fixing and modifying Chapters 1-3 as the project moved forward into December 2024, probably considering lessons learned throughout the development phase. The completion of Chapters 4 and 5 as well as a final Survey phase were part of the final stages in January 2025.

Results

Evaluation of the Developed System

The researchers employed a purposive sampling technique to select respondents for the study, targeting a diverse group comprising ten (10) IT Experts and ten (10) faculty teachers of Santo Niño Elementary School. Data was collected using both Google Forms and face-to-face surveys, utilizing an ISO 25010 Research Questionnaire. This standardized instrument was divided into eight evaluation categories: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability of the Santo Niño MathWise system. Respondents rated each statement on a 4-point Likert scale, with ratings ranging from 1 (strongly disagree), 2 (disagree), 3 (agree), and 4 (strongly agree).

The weighted mean ratings derived from the data, along with their corresponding verbal interpretations, are presented in the subsequent tables, providing a detailed analysis of the system's performance across the defined quality metrics.



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Survey Results of Teachers of Santo Nino Elementary School

Table_Functional Suitability

A. Functional Suitability							
Indicators		4 Strong ly Agree	3 Agree	2 Disagr ee	1 Strongl y Disagre	Mean	Verbal Interpretation
Completeness	The set of functions covers all the specified tasks and user objectives. <i>Ang buong Sistema ay sumasaklaw sa lahat ng tinutukoy na mga gawain at ang layunin na gumagamit</i>	9	1	0	0	3.9	strongly agree
Correctness	The function provides the correct results with the needed degree of precision. <i>Ang Sistema ay nagbibigay ng tamang resulta sa kinakailangang antas ng katumpakan.</i>	9	1	0	0	3.9	strongly agree
Appropriateness	The functions facilitate the accomplishment of specified tasks and objectives. <i>Ang paggamit sa sistema ay nangangasiwa sa pagtupad ng tiyakang mga gawain at layunin.</i>	10	0	0	0	4	strongly agree
average mean						3.93	strongly agree

The table presents a survey conducted among teachers, evaluating three key indicators: Completeness, Correctness, and Appropriateness, each reflecting user satisfaction with a system's functionality. Completeness assesses whether the system encompasses all necessary functions to meet user objectives, with respondents indicating a strong agreement. Correctness measures the accuracy of results produced by the system, highlighting its precision, while Appropriateness evaluates the system's ability to facilitate specific tasks effectively. The survey yields an average mean score of 3.93, which denotes a general positive agreement with the system's performance across these indicators, indicating very high user satisfaction among the teachers.



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Table_Reliability

Indicators		4 Strongl y Agree	3 Agree	2 Disagr ee	1 Strongl y Disagr ee	Mean	Verbal Interpretation
Maturity	A system, product, or component meets needs for reliability under normal operation. <i>Ang sistema, produkto o bahagi nito ay nakatutugon at maasahan sa ilalim ng normal na operasyon.</i>	7	3	0	0	3.7	strongly agree
Availability	A product, or system is operational and accessible when required for use. <i>Ang produkto o sistema ay gumagana at maaring makita kapag kinakailangan sa paggamit.</i>	9	1	0	0	3.9	strongly agree
Fault Tolerance	A system, product or component operates as intended despite the presence of hardware or software faults. <i>Ang sistema, produkto o bahagi nito ay inaasahang mapatakbó sa kabilang pagkakaroon ng hardware o software.</i>	9	1	0	0	3.9	strongly agree
Recoverability	In the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the system's desired state. <i>Sa kaganapan ng pagkakambala o kabiguan magamit ang sistema, maaring mabawi ng produkto o sistema and data na tuwirang apektado at muling mabalik ang nais na estado ng sistema.</i>	9	1	0	0	3.9	strongly agree
average mean						3.85	strongly agree

The table_ summarizes a survey conducted among teachers assessing three critical indicators of a system's reliability: Maturity, Availability, Fault Tolerance, and Recoverability, with responses indicating strong user satisfaction. Maturity refers to whether the system or component is up to standard for reliable operation. Availability addresses how accessible the system is when needed, and Fault Tolerance measures the capability of the system to withstand and manage potential failures. Finally, Recoverability assesses the system's ability to recover functionality after an interruption. The average mean score of 3.85 reflects strong agreement among respondents regarding the system's effectiveness across these indicators, indicating a high level of satisfaction with its reliability among the teachers.



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Table_Portability

C. Portability		Indicator	4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Adaptability	A product or system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments. <i>Ang produkto o sistema ay maaaring sukdib at mahusay na malaakma para sa iba't ibang hardware, software o iba pang mga uri ng pagpapatakbo o paggamit.</i>	9	1	0	0	3.9	strongly agree	
Durability	A product or system can withstand technology evolution and changes without costly redesign, reconfiguration or recoding. <i>Ang produkto o sistema ay maaaring tumagal sa ebolusyon ng teknolohiya at pagbabago ng hindi mahal na muling idisenyo, pagsasaayos o pakukudigo.</i>	9	1	0	0	3.9	strongly agree	
Installability	A product or system can be successfully installed and/or uninstalled in a specified environment. <i>Ang produkto o sistema ay maaaring matagumpay na maikabit at matanggal ng naayon sa pangangailangan.</i>	8	2	0	0	3.8	strongly agree	
Replaceability	A product can replace another specified software product for the same purpose in the same environment. <i>Ang produkto ay maaaring palitan ng isa pang tiyak na produkto na software para sa parehong layunin sa parehong kapaligiran.</i>	8	2	0	0	3.8	strongly agree	
Affordability	A product or system can increase efficiency and productivity by reducing the time and costs involved in delivering instruction. <i>Ang produkto o sistema ay maaaring tumaas ang kakayahang at pagiging produktibo sa pamamagitan ng pabawas ng oras at paggugel sa katulad na kapaligiran.</i>	9	1	0	0	3.9	strongly agree	
average mean						3.86	strongly agree	

The table_ reports a survey conducted among teachers evaluating four key indicators of a product's adaptability: Adaptability, Durability, Installability, Replaceability, and Affordability, with responses that show high levels of user satisfaction. Adaptability refers to how well the product can be changed to meet varied hardware or software needs that evolve over time. Durability represents the product's resistance to technological changes, while Installability indicates how easily a product can be installed or integrated. Replaceability assesses the ease with which one product can be substituted for another to serve the same purpose. Finally, the Affordability factor



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considers cost-effectiveness. The average mean score of 3.86 reflects a strong agreement among respondents regarding the product's effectiveness across these indicators, indicating a high level of satisfaction among the teachers.

Table_Usability

Indicators		4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Appropriateness Recognizability	Users can recognize whether a product or system is appropriate for their needs. <i>Makikilala ng mga gumagamit kung ang produkto o sistema ay angkop para sa kanilang mga pangangailangan.</i>	8	2	0	0	3.8	strongly agree
Learnability	A product or system enables the user to learn how to use it with effectiveness, efficiency in emergency situations. <i>Ang produkto o sistema ay nagbibigay daan upang malaman ng gumagamit kung paano ito gamitin nang epektibo, at mabisa sa mga panahon ng pangangailangan.</i>	9	1	0	0	3.9	strongly agree
Operability	A product or system is easy to operate, control and appropriate to use. <i>Ang produkto o sistema ay madaling gamitin, kontrolin at angkop na gamitin.</i>	8	2	0	0	3.8	strongly agree
User Error Protection	A product or system protects users against making errors. <i>Ginagabayang ng produkto o sistema ang mga gumagamit nito upang maiwasan ang mga pagkakamali.</i>	7	3	0	0	3.7	strongly agree
User interface aesthetics	A user interface enables pleasing and satisfying interactions for the user. <i>Ang user interface ay nagbibigay kasiyahan at kaluguran para sa mga gumagamit nito.</i>	9	1	0	0	3.9	strongly agree
Accessibility	A product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use. <i>Ang produkto o sistema ay maaaring gamitin ng mga lao na may pinakamalawak na hanay ng mga katangian at kakayahang upang makamit ang tiyak na layunin sa isang tinukoy na konteksto ng paggamit.</i>	9	1	0	0	3.9	strongly agree
average mean						3.85	strongly agree

The survey table_ conducted among teachers evaluates usability across five indicators: Appropriateness/Recognizability, Learnability, Operability, User Error Protection, User Interface Aesthetics, and Accessibility. Each indicator is rated on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting user perceptions.



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The overall average score of 3.85 indicates strong user agreement that the product is highly usable and meets their needs effectively.

Table_Performance Efficiency

E. Performance Efficiency

Indicators		4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Time-behavior	The response and processing times and throughput rates of a product or system, when performing its functions, meet requirements. <i>Nakatutugon ang sistema sa mga kinakailangan oras ng pagtugon at pagproseso at mga antas ng throughput ng isang produkto o sistema, kapag nakapag-sasagawa ng tungkulin nito.</i>	8	2	0	0	3.8	strongly agree
Resource utilization	The amounts and types of resources used by a product or system, when performing its functions, meet requirements. <i>Ang halaga at uri ng mga mapagkukunan na ginamit ng sistema, kapag gumaganap ng tungkulin nito ay nakatutugon sa mga pangangailangan.</i>	8	2	0	0	3.8	strongly agree
Capacity	The maximum limits of the product or system parameters meet requirements. <i>Nagtutuguran ng pinakamataas ng limitasyon o parametro ng sistema ang mga pangangailangan.</i>	9	1	0	0	3.9	strongly agree
average mean					3.83	strongly agree	

The survey table_ conducted among teachers, assesses performance efficiency through three indicators: Time-behavior, Resource Utilization, and Capacity. Respondents rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting user experiences. The overall average score of 3.83 suggests strong user agreement that the product performs efficiently, effectively meeting requirements in terms of response times, resource usage, and capacity.



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Table_Security

Indicators		4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Confidentiality	The prototype ensures that data are accessible only to those authorized to have access. <i>Tinitiyak ng sistema na ang mga datos ay nakuha lamang ng mga awtorisadong magkaroong ng access nito.</i>	9	1	0	0	3.9	strongly agree
Integrity	A system, product or component prevents unauthorized access to, or modification of, computer programs or data. <i>Pinipigilan ng sistema, ang di awtorisadong pag-access o pagbabago ng, mga programa sa computer o data.</i>	10	0	0	0	4	strongly agree
Non-repudiation	Actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later. <i>Ang mga pagkilos o mga kaganapan ay maaaring mapatunayan na naganap, upang ang mga pangyayari o mga pagkilos ay hindi na maiwaki/malimutan pa kalaunan.</i>	10	0	0	0	4	strongly agree
Accountability	The actions of an entity can be traced uniquely to the entity. <i>Ang mga pagkilos ng isang entity ay maaaring matukoy ang kataangi-tangi sa entidad.</i>	10	0	0	0	4	strongly agree
Authenticity	The identity of a subject or resources can be proved to be the one claimed. <i>Ang pagkakilalan ng tinutukoy/paksa o mapagkukunan ay mapatunayan na siyang inaangkin.</i>	10	0	0	0	4	strongly agree
average mean						3.98	strongly agree

The survey table_ conducted among teachers, evaluates security through four indicators: Confidentiality, Non-repudiation, Accountability, and Authenticity. Participants rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores indicating user perceptions. The overall average score of 3.98 reflects strong user agreement that the product effectively ensures security, safeguarding data access, maintaining accountability, and verifying user authenticity.



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Table_Compatibility

Indicators		4 Strongl y Agree	3 Agree	2 Disagre e	1 Strongl y Disagr ee	Mean	Verbal Interpretati on
Co-existence	A product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product. <i>Ang sistema ay maaaring magsagawa ng mga kinakailangang tungkulin nito nang mabisa habang nagbabahagi sa magkatulad na kapaligiran at mga mapagkukunan sa iba pang mga produkto, nang walang masamang epekto sa iba pang produkto.</i>	8	2	0	0	3.8	strongly agree
Interoperability	Two or more systems, products or components can exchange information and use the information that has been exchanged. <i>Ang dalawa o higit pang bahagi ng sistema, produkto nito ay maaaring makapagpalitan ng impormasyon at magamit ang mga impormasyon na pinagpalitan.</i>	9	1	0	0	3.9	strongly agree
average mean						3.85	strongly agree

The survey table_, conducted among teachers, evaluates compatibility through two indicators: Co-existence and Interoperability. Respondents rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting user perceptions. The overall average score of 3.85 indicates strong user agreement that the product effectively shares functions and information with other systems, demonstrating high compatibility with existing resources.



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Table_Maintainability

H. Maintainability

Indicators		4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Modularity	A system or computer program is composed of discrete components such that a change to one component has minimal impact on other components. <i>Ang sistema o programa ng computer ay binubuo ng mga hiwalay na mga bahagi na ang anumang pagbabago sa isang bahagi nito ay may kaunting epekto sa iba pang mga sangkap.</i>	9	1	0	0	3.9	strongly agree
Reusability	An asset can be used in more than one system, or in building other assets. <i>Ang kalidad ng kakayahan ng sistema ay maaaring gamitin nang higit sa isang isang sistema, o sa pagbuo ng iba pang mga sistema.</i>	10	0	0	0	4	strongly agree
Analyzability	It is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified. <i>May posibilidad ang epekto sa produkto o sistema ng isang tinangkang pagbabago sa isa o higit pa sa mga bahagi nito, o upang masuri ang isang produkto para sa mga kakulangan o mga sanhi ng pagkabigo, o upang tukuyin ang mga bahagi na babaguhin.</i>	10	0	0	0	4	strongly agree
Modifiability	A product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality. <i>Ang produkto o sistema ay maaaring baguhin ang epektibo at mabisang ang hindi nagbabalik sa mga depekto o nakakapag-pababa sa kalidad ng produkto.</i>	10	0	0	0	4	strongly agree
Testability	Test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met. <i>Ang pamantayan ng pagsusulit ay maaaring mabuo/magawa para sa isang sistema, produkto o bahagi at maaaring isagawa ang mga pagsubok upang matukoy kung natugunan ang pamantayan.</i>	10	0	0	0	4	strongly agree
average mean						3.85	strongly agree

The survey table, conducted among teachers, assesses software modularity through four indicators: Modularity, Reusability, Analyzability, and Testability. Participants rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting their experiences. The overall average score of 3.85 indicates



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strong user agreement that the product exhibits effective modular design, facilitating reuse, analysis, and testing while minimizing impact on other components.

The overall mean score of survey results 3.9, derived from the functional sustainability, reliability, portability, usability, performance efficiency, security, compatibility, and maintainability tables, reflects strong user agreement among teachers. This high score indicates that the platform is perceived as highly effective and reliable across various aspects, meeting the teachers' expectations and needs effectively.



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SURVEY RESULTS OF IT EXPERT

Table_ Functional Suitability

A. Functional Suitability		Indicators	4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Completeness	Correctness							
Completeness	The set of functions covers all the specified tasks and user objectives. <i>Ang buong Sistema ay sumasaklaw sa lahat ng tinutukoy na mga gawain at mg layunin na gumagamit</i>	9	1	0	0	0	3.9	strongly agree
Correctness	The function provides the correct results with the needed degree of precision. <i>Ang Sistema ay nagbibigay ng tamang resulta sa kinakailangang antas ng katumpakan.</i>	8	2	0	0	0	3.8	strongly agree
Appropriateness	The functions facilitate the accomplishment of specified tasks and objectives. <i>Ang paggamit sa sistema ay nangangasiwa sa pagtupad ng tiyakang mga gawain at layunin.</i>	9	1	0	0	0	3.9	strongly agree
						average mean	3.87	strongly agree

The table_ presents a survey conducted among IT experts, evaluating three key indicators: Completeness, Correctness, and Appropriateness, each reflecting user satisfaction with a system's functionality. Completeness assesses whether the system encompasses all necessary functions to meet user objectives, with respondents indicating a strong agreement. Correctness measures the accuracy of results produced by the system, highlighting its precision, while Appropriateness evaluates the system's ability to facilitate specific tasks effectively. The survey yields an average mean score of 3.87, which denotes a general positive agreement with the system's performance across these indicators, indicating very high user satisfaction among the IT experts.



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Table_ Reliability

B. Reliability		Indicators	4 Strongl y Agree	3 Agree	2 Disagr ee	1 Strongl y Disagr ee	Mean	Verbal Interpretation
Maturity	A system, product, or component meets needs for reliability under normal operation. <i>Ang sistema, produkto o bahagi nito ay pakatutugon at maaasahan sa ilalim ng normal na operasyon.</i>	8	2	0	0	3.8	strongly agree	
Availability	A product, or system is operational and accessible when required for use. <i>Ang produkto o sistema ay gumagana at maaaring makuha kapag kinakailangan sa paggamit.</i>	6	4	0	0	3.6	strongly agree	
Fault Tolerance	A system, product or component operates as intended despite the presence of hardware or software faults. <i>Ang sistema, produkto o bahagi nito ay inaasahang mapatatakop sa kabilang pagkakaroon ng hardware o software.</i>	6	4	0	0	3.6	strongly agree	
Recoverability	In the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the system's desired state. <i>Sa kaganapan ng pagkagambla o kabiqiang magamit ang sistema, maaaring mabawi ng produkto o sistema and data na tuwirang apektado at muling mabalik ang nais na estado ng sistema.</i>	5	4	1	0	3.4	strongly agree	
						average mean	3.60	strongly agree

The table_ summarizes a survey conducted among IT Expert assessing three critical indicators of a system's reliability: Maturity, Availability, Fault Tolerance, and Recoverability, with responses indicating strong user satisfaction. Maturity refers to whether the system or component is up to standard for reliable operation. Availability addresses how accessible the system is when needed, and Fault Tolerance measures the capability of the system to withstand and manage potential failures. Finally, Recoverability assesses the system's ability to recover functionality after an interruption. The average mean score of 3.60 reflects strong agreement among respondents regarding the system's effectiveness across these indicators, indicating a high level of satisfaction with its reliability among the IT Experts.



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Table_Portability

C. Portability

Indicators		4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Adaptability	A product or system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments. <i>Ang produkto o sistema ay maaaring adaptibyo at mahusay na malaakma para sa ibat ibang hardware, software o iba pang mga uri ng pagpapatalko o paggamit.</i>	7	3	0	0	3.7	strongly agree
Durability	A product or system can withstand technology evolution and changes without costly redesign, reconfiguration or recoding. <i>Ang produkto o sistema ay maaaring tumagal sa ebolusyon ng teknolohiya at pagbagong disenyo, pagasaasayos o pakukudigo.</i>	8	2	0	0	3.8	strongly agree
Installability	A product or system can be successfully installed and/or uninstalled in a specified environment. <i>Ang produkto o sistema ay maaaring matagumpay na maikabit at matanggal ng naisayon sa pangangailangan.</i>	5	5	0	0	3.5	strongly agree
Replaceability	A product can replace another specified software product for the same purpose in the same environment. <i>Ang produkto ay maaaring palitan ng isa pang tiyak na produkto na software para sa parehong layunin sa parehong kapaligiran.</i>	8	2	0	0	3.8	strongly agree
Affordability	A product or system can increase efficiency and productivity by reducing the time and costs involved in delivering instruction. <i>Ang produkto o sistema ay maaaring tumaas ang kakayahan at pagiging produktibo sa pamamagitan ng pabawas ng oras at paggugtal sa katulad na kapaligiran.</i>	9	1	0	0	3.9	strongly agree
average mean						3.74	strongly agree

The table_ reports a survey conducted among IT Experts evaluating four key indicators of a product's adaptability: Adaptability, Durability, Installability, Replaceability, and Affordability, with responses that show high levels of user satisfaction. Adaptability refers to how well the product can be changed to meet varied hardware or software needs that evolve over time. Durability represents the product's resistance to technological changes, while Installability indicates how easily a product can be installed or integrated. Replaceability assesses the ease with which one product can be



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substituted for another to serve the same purpose. Finally, the Affordability factor considers cost-effectiveness. The average mean score of 3.74 reflects a strong agreement among respondents regarding the product's effectiveness across these indicators, indicating a high level of satisfaction among the IT Experts..

Table_Usability

D. Usability

Indicators		4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Appropriateness Recognizability	Users can recognize whether a product or system is appropriate for their needs. <i>Makikilala ng mga gumagamit kung ang produkto o sistema ay angkop para sa kanilang mga pangangailangan.</i>	9	1	0	0	3.9	strongly agree
Learnability	A product or system enables the user to learn how to use it with effectiveness, efficiency in emergency situations. <i>Ang produkto o sistema ay nagbibigay dean upang malaman ng gumagamit kung paano ito gamitin nang epektibo, at mabisa sa mga panahon ng pangangailangan.</i>	5	5	0	0	3.5	strongly agree
Operability	A product or system is easy to operate, control and appropriate to use. <i>Ang produkto o sistema ay madaling gamitin, kontrolin at angkop na gamitin.</i>	7	3	0	0	3.7	strongly agree
User Error Protection	A product or system protects users against making errors. <i>Ginagabayang ng produkto o sistema ang mga gumagamit nito upang maiwasan ang mga pagkakamali.</i>	4	5	1	0	3.3	strongly agree
User interface aesthetics	A user interface enables pleasing and satisfying interactions for the user. <i>Ang user interface ay nagbibigay kasiyahan at kaluguran para sa mga gumagamit nito.</i>	3	7	0	0	3.3	strongly agree
Accessibility	A product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use. <i>Ang produkto o sistema ay maaaring gamitin ng mga tao na may pinakamalawak na hanay ng mga katangian at kakayahan upang makamit ang tiyak na layunin sa isang inukoy na konteksto ng paggamit.</i>	10	0	0	0	4	strongly agree
average mean						3.6	strongly agree



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The survey table_ conducted among teachers evaluates usability across five indicators: Appropriateness/Recognizability, Learnability, Operability, User Error Protection, User Interface Aesthetics, and Accessibility. Each indicator is rated on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting user perceptions. The overall average score of 3.6 indicates strong user agreement that the product is highly usable and meets their needs effectively.

Table_Performance Efficiency

Indicators		4 Strongl y Agree	3 Agree	2 Disagr ee	1 Strongl y Disagr ee	Mean	Verbal Interpre tation
Time-behavior	The response and processing times and throughput rates of a product or system, when performing its functions, meet requirements. <i>Nakatutugon ang sistema sa mga kinakailangan oras ng pagtugon at pagproseso at mga antas ng throughput ng isang produkto o sistema, kapag nakapagpasagawa ng tungkulin nito.</i>	8	2	0	0	3.8	strongly agree
Resource utilization	The amounts and types of resources used by a product or system, when performing its functions, meet requirements. <i>Ang halaga at uri ng mga mapagkukunan na ginamit ng sistema, kapag gumaganap ng tungkulin nito ay nakatutugon sa mga pangangailangan.</i>	5	5	00	0	3.5	strongly agree
Capacity	The maximum limits of the product or system parameters meet requirements. <i>Nagtutuguran ng pinakamatass ng limitasyon o parametro ng sistema ang mga pangangailangan.</i>	5	4	1	0	3.4	strongly agree
average mean						3.57	strongl y agree



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The survey table_ conducted among IT Experts, assesses performance efficiency through three indicators: Time-behavior, Resource Utilization, and Capacity. Respondents rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting user experiences. The overall average score of 3.57 suggests strong user agreement that the product performs efficiently, effectively meeting requirements in terms of response times, resource usage, and capacity.

Table_Security

F. Security

Indicators		4 Strongl y Agree	3 Agree	2 Disagr ee	1 Strongl y Disagr ee	Mean	Verbal Interpretation
Confidentiality	The prototype ensures that data are accessible only to those authorized to have access. <i>Tinitiyak ng sistema na ang mga datos ay nakukuha lamang ng mga autorisadong magkaroon ng access nito.</i>	8	2	0	0	3.8	strongly agree
Integrity	A system, product or component prevents unauthorized access to, or modification of, computer programs or data. <i>Pinipigilan ng sistema, ang di autorisadong pag-access o pagbabago ng, mga programa sa computer o data.</i>	8	2	0	0	3.8	strongly agree
Non-repudiation	Actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later. <i>Ang mga pagkilos o mga kaganapan ay maaaring mapatunayan na naganap, upang ang mga pangayari o mga pagkilos ay hindi na maliwaks/malimutan pa kalaunan.</i>	7	3	0	0	3.7	strongly agree
Accountability	The actions of an entity can be traced uniquely to the entity. <i>Ang mga pagkilos ng isang entity ay maaaring matukoy nang katangi-tangi sa entidad.</i>	10	0	0	0	4	strongly agree
Authenticity	The identity of a subject or resources can be proved to be the one claimed. <i>Ang pagkakilalan ng tinutukoy/paksa o mapagkukunan ay mapatunayan na siyang inaangkin.</i>	8	2	0	0	3.8	strongly agree
average mean						3.82	strongly agree



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The survey table_ conducted among IT Experts, evaluates security through four indicators: Confidentiality, Non-repudiation, Accountability, and Authenticity. Participants rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores indicating user perceptions. The overall average score of 3.82 reflects strong user agreement that the product effectively ensures security, safeguarding data access, maintaining accountability, and verifying user authenticity.

Table_Compatibility

Indicators		4 Strongl y Agree	3 Agree	2 Disagre e	1 Strongl y Disagr ee	Mean	Verbal Interpretati on
Co-existence	A product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product. <i>Ang sistema ay maaaring magsagawa ng mga kinakailangang tungkulin nito nang mabisa habang nagbabahagi sa magkatulad na kapaligiran at mga mapagkukunan sa iba pang mga produkto, nang walang masamang epekto sa iba pang produkto.</i>	6	4	0	0	3.6	strongly agree
Interoperability	Two or more systems, products or components can exchange information and use the information that has been exchanged. <i>Ang dalawa o higit pang bahagi ng sistema, produkto nito ay maaaring makapagpalitan ng impormasyon at magamit ang mga impormasyon na ipinagpalitan.</i>	6	3	1	0	3.5	strongly agree
average mean						3.55	strongly agree

The survey table_, conducted among IT Experts, evaluates compatibility through two indicators: Co-existence and Interoperability. Respondents rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting user perceptions. The overall average score of 3.55 indicates strong user agreement that the



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product effectively shares functions and information with other systems, demonstrating high compatibility with existing resources.

Table_Maintainability

H. Maintainability		Indicator	4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	Mean	Verbal Interpretation
Modularity	A system or computer program is composed of discrete components such that a change to one component has minimal impact on other components. <i>Ang sistema o programa ng computer ay binubuo ng mga hivalay na mga bahagi na ang anumang pagbabago sa isang bahagi nito ay may kaunting epekto sa iba pang mga sangkap.</i>	6	4	0	0	0	3.6	strongly agree
Reusability	An asset can be used in more than one system, or in building other assets. <i>Ang kalidad ng kakayahan ng sistema ay maaaring gamitin nang higit sa isang isang sistema, o sa pagbuo ng iba pang mga sistema.</i>	5	6	0	0	0	3.5	strongly agree
Analyzability	It is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified. <i>May posibilidad ang epekto sa produkto o sistema ng isang tiangkang pagbabago sa isa o higit pa sa mga bahagi nito, o upang masuri ang isang produkto para sa mga kakulangan o mga sanhi ng pagkabigo, o upang tukuyin ang mga bahagi na babaguhin.</i>	6	4	0	0	0	3.6	strongly agree
Modifiability	A product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality. <i>Ang produkto o sistema ay maaaring baguhin pang epektibo at mabisa pang hindi nagoapakilala sa mga depekto o nakakapag-pababa sa kalidad ng produkto.</i>	7	3	0	0	0	3.7	strongly agree
Testability	Test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met. <i>Ang pamantayan ng pagsusulit ay maaaring mabuo/magawa para sa isang sistema, produkto o bahagi at maaaring isagawa ang mga pagsubok upang matukoy kung natuwaan ang pamantayan.</i>	8	2	0	0	0	3.8	strongly agree
average mean						3.64	strongly agree	

The survey table, conducted among IT Experts, assesses software modularity through four indicators: Modularity, Reusability, Analyzability, and Testability. Participants



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rated each indicator on a scale from 1 (Strongly Disagree) to 4 (Strongly Agree), with mean scores reflecting their experiences. The overall average score of 3.64 indicates strong user agreement that the product exhibits effective modular design, facilitating reuse, analysis, and testing while minimizing impact on other components.

The overall mean score of the survey results is 3.6, derived from the functional sustainability, reliability, portability, usability, performance efficiency, security, compatibility, and maintainability tables, reflects strong user agreement among IT Experts. This high score indicates that the platform is perceived as highly effective and reliable across various aspects, meeting the IT Experts expectations and needs effectively.

After analyzing the general average of the functionality table, sustainability, reliability, portability, usability, performance efficiency, security, compatibility, and maintainability, it can be construed that the software quality considered by the respondents is based on the mean score of 3.75 which indicates that the Santo Nino Elementary Faculty's teachers and IT experts have strong agreement in terms of usability. The high rating implies that the platform is viewed as being very dependable and effective in several areas, thus satisfying the teachers' demands and expectations.



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User Interface Design

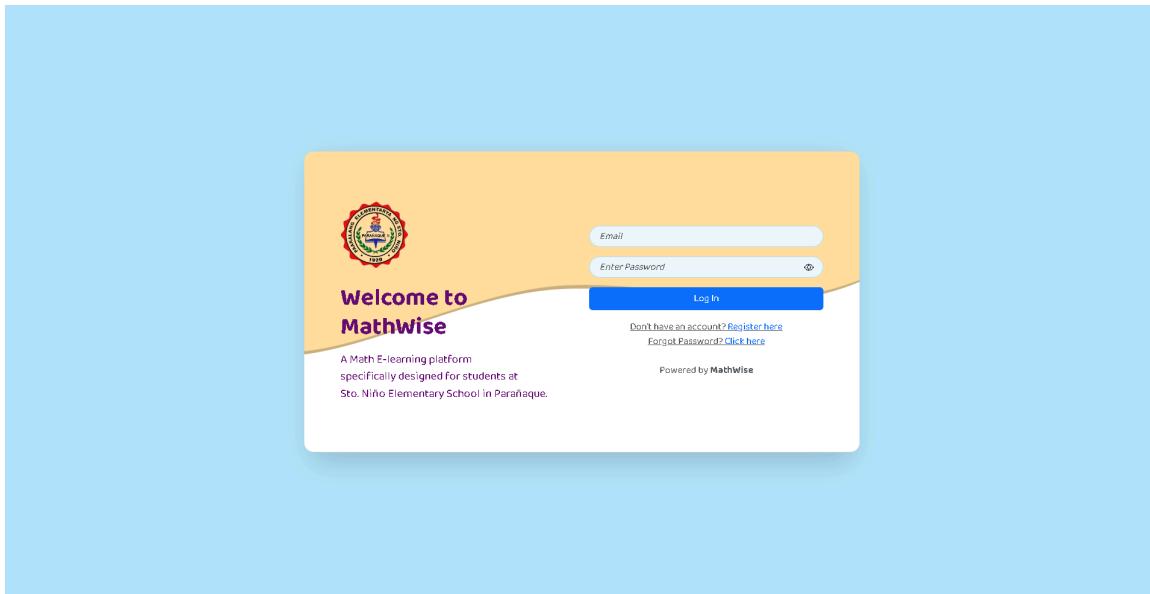


Figure 1 Mathwise Log-in page

This interface features a clean and inviting login page for “MathWise”. Its layout is well-structured, with a light blue background that enhances the user experience. Fields for email and password are included to ensure seamless access for users. The prominent "Login" button is easy to locate, and additional links for "Register here" and "Forgot Password?" are provided for easy navigation.



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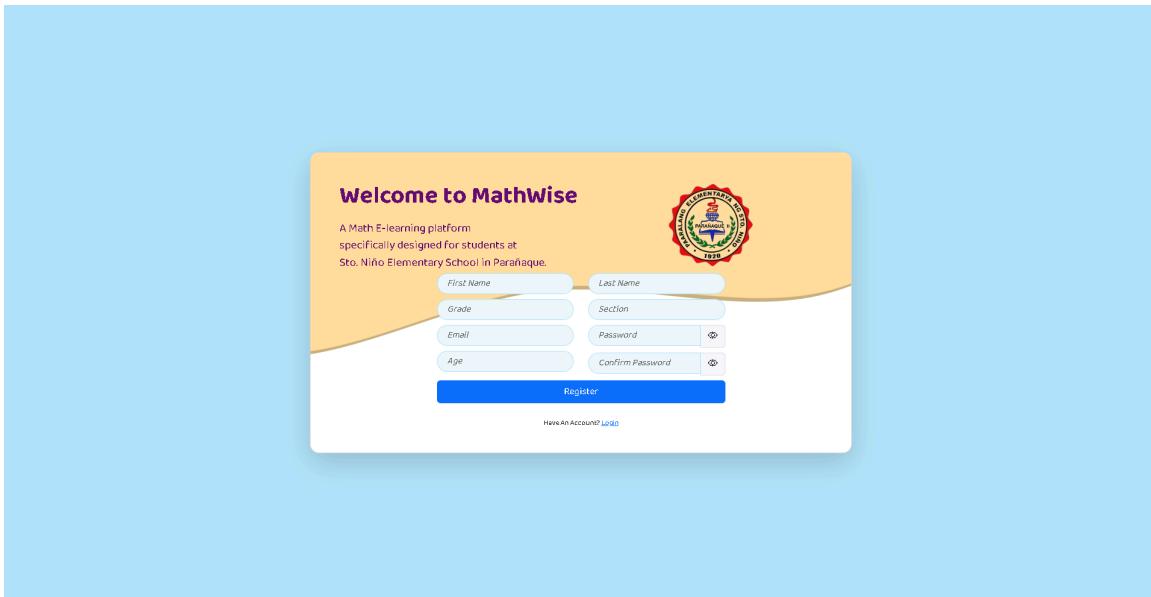
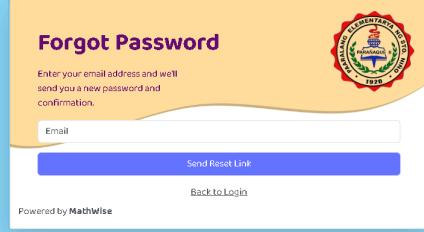


Figure 2 Mathwise Signup Page

This interface features a welcoming registration page for "MathWise", designed with a friendly light blue background. It displays a warm welcome message. The registration form includes clearly labeled fields for first name, last name, grade, section, email, age, and password. A prominently placed "Register" button encourages easy submission of information.



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A screenshot of the "Forgot Password" page. The background is light blue. At the top center is the university's name and logo. Below that is a yellow header bar with the title "Forgot Password" in purple. The main form area has a white background. It contains a text input field labeled "Email" and a blue button labeled "Send Reset Link". At the bottom left is a link "Back to Login" and at the bottom right is the text "Powered by MathWise".

The page is titled "Forgot Password" in a purple font. It instructs the user to enter their email address to receive a password reset link. A large input field is provided for the email, and a blue button labeled "Send Reset Link" is centered below it. At the bottom, there is a "Back to Login" link and the text "Powered by MathWise".

Figure 3 Forgot Password Page

The "MathWise" has an easily readable "Forgot Password" page designed to make this feature user-friendly. The simple request for an email address against a light blue background to generate a new password provides clarity on how to continue from here. One input field clearly labeled as "Email" assures the user what is needed. helps in the easy recovery. A link takes the user back to the login page for added convenience.



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Admin UI Design

A screenshot of a web-based administrative interface titled "Rooms". At the top left is a "Menu" button. Below it is a search bar with the placeholder "Search Rooms" and a "Search" button. A prominent "Create Room" button is located just below the search bar. The main area displays three room cards in a grid. The first card is for "Rizal", Grade 5, Teacher: Serano. The second card is for "Bonifacio", Grade 5, Teacher: Dela Cruz. The third card is for "Mabini", Grade 5, Teacher: Santos. Each card has a three-dot menu icon on its right side.

Figure 4 Mathwise Admin Room Page

This interface will display a friendly "Rooms" page for "MathWise", designed to navigate and interact with ease. It features a search bar at the top, so users can find specific rooms easily by entering the name of the teacher. Below the search function, there is a prominent "Create Room" button, which encourages users to start new learning spaces. This page demonstrates a grid of existing rooms and presents information concerning each room within clearly defined cards, showing information such as room number, grade, and the name of the teacher.



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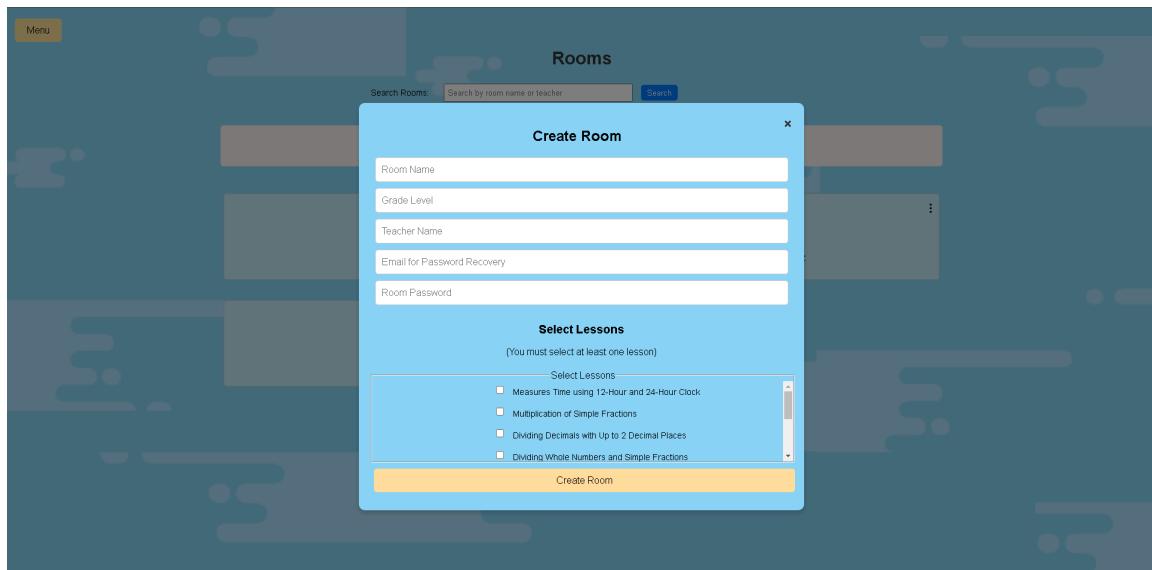
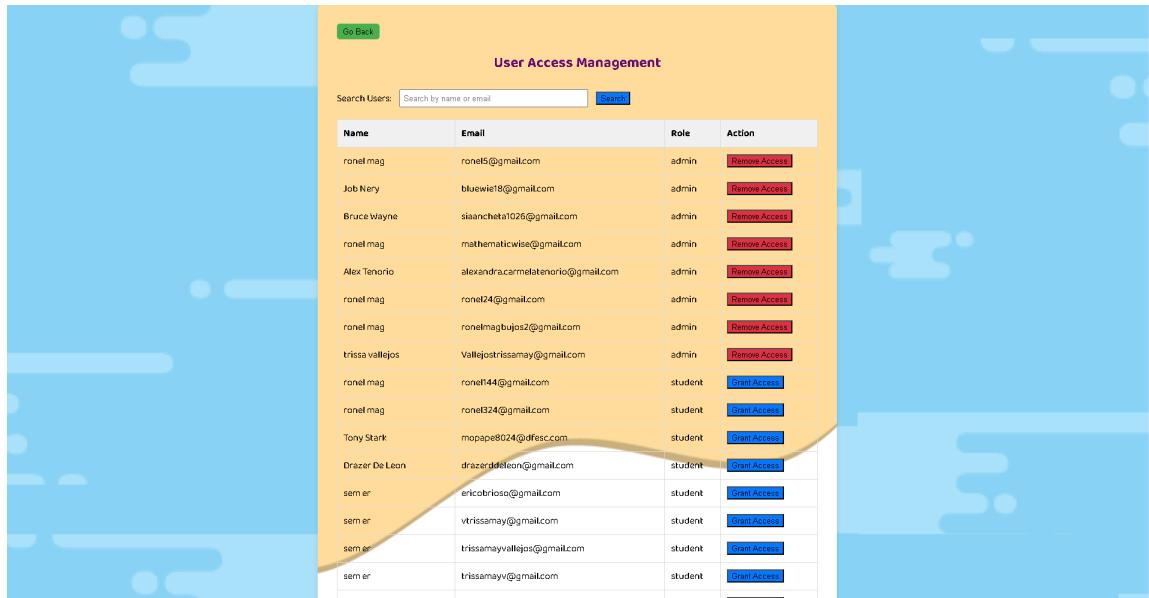


Figure 5 Mathwise Admin Create Room

This interface contains a modal to create a new room on the "MathWise," intended to be intuitive for user input. The modal contains well-defined fields that provide necessary information such as the name of the room, grade level, teacher's name, email for recovery of password, and room password. Below this field, there is a section where users can select lessons by picking from the available options.



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A screenshot of a web-based user access management system. At the top, there is a header bar with a "Go Back" button and a search bar labeled "Search Users: Search by name or email". Below the header is a title "User Access Management". A table follows, displaying user information in four columns: Name, Email, Role, and Action. The "Action" column contains two buttons: "Remove Access" (in red) and "Grant Access" (in blue). The table lists 15 users, mostly named "ronel mag" with various email addresses and roles (admin or student).

Name	Email	Role	Action
ronel mag	ronel5@gmail.com	admin	<button>Remove Access</button>
Job Nery	bluewies18@gmail.com	admin	<button>Remove Access</button>
Bruce Wayne	siancheta1026@gmail.com	admin	<button>Remove Access</button>
ronel mag	mathematicwise@gmail.com	admin	<button>Remove Access</button>
Alex Tenorio	alexandracarmelatenorio@gmail.com	admin	<button>Remove Access</button>
ronel mag	ronel24@gmail.com	admin	<button>Remove Access</button>
ronel mag	ronelmagbuja2@gmail.com	admin	<button>Remove Access</button>
trissa vallejos	Vallejotrissamay@gmail.com	admin	<button>Remove Access</button>
ronel mag	ronel144@gmail.com	student	<button>Grant Access</button>
ronel mag	ronel324@gmail.com	student	<button>Grant Access</button>
Tony Stark	mopape8624@fresc.com	student	<button>Grant Access</button>
Drazer De Leon	drazerdileon@gmail.com	student	<button>Grant Access</button>
sem er	ericobrillo@gmail.com	student	<button>Grant Access</button>
sem er	vtrissamay@gmail.com	student	<button>Grant Access</button>
sem er	trissamayvallejos@gmail.com	student	<button>Grant Access</button>
sem er	trissamayv@gmail.com	student	<button>Grant Access</button>

Figure 6 Mathwise Admin User Acess Management

This interface offers a "User Access Management" page for the "MathWise", which is meant to be user-friendly for efficient user administration. At the top, there is a search bar to allow administrators to quickly find users by entering their email addresses. Below this, a well-organized table displays user information, including names, emails, and roles, such as admin or student. Each entry includes action buttons that enable easy modifications to user access, enhancing management efficiency.



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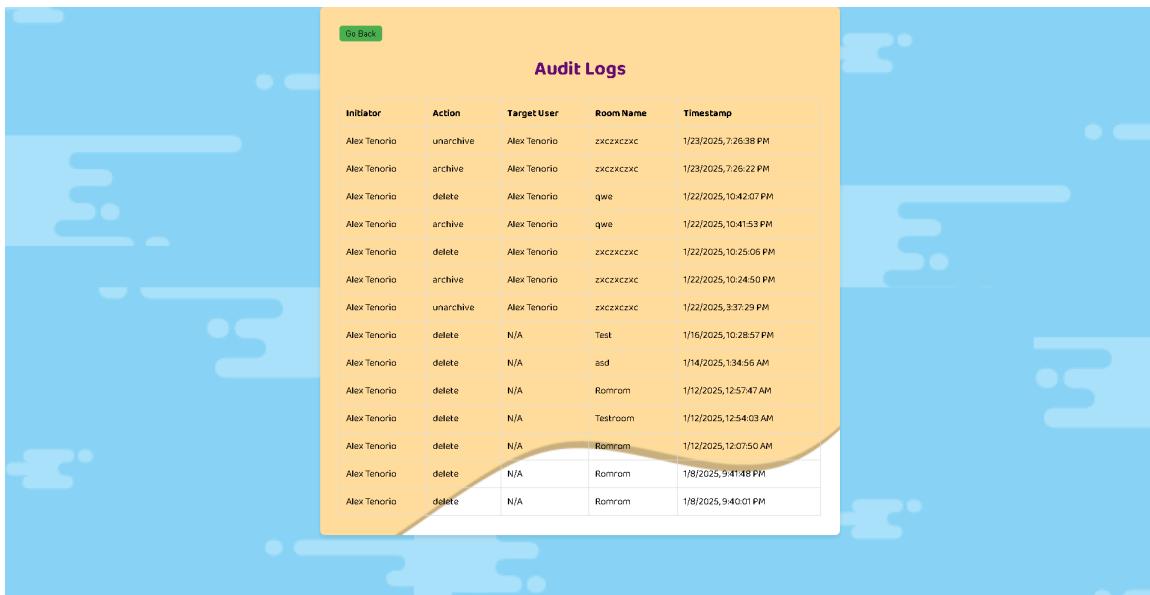


Figure 7 Mathwise Admin Archived Rooms

This interface shows the "Archived Rooms" page for "MathWise", to make it more visible of previously used classrooms. Archived rooms are listed in a card format with a clear display of room number, grade, and teacher.



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A screenshot of a web application titled "Audit Logs". At the top left is a green "Go Back" button. The main title "Audit Logs" is centered above a table. The table has columns: Initiator, Action, Target User, Room Name, and Timestamp. The data in the table is as follows:

Initiator	Action	Target User	Room Name	Timestamp
Alex Tenorio	unarchive	Alex Tenorio	zxczxczxc	1/23/2025, 7:26:38 PM
Alex Tenorio	archive	Alex Tenorio	zxczxczxc	1/23/2025, 7:26:22 PM
Alex Tenorio	delete	Alex Tenorio	qwe	1/22/2025, 10:42:07 PM
Alex Tenorio	archive	Alex Tenorio	qwe	1/22/2025, 10:41:53 PM
Alex Tenorio	delete	Alex Tenorio	zxczxczxc	1/22/2025, 10:25:05 PM
Alex Tenorio	archive	Alex Tenorio	zxczxczxc	1/22/2025, 10:24:50 PM
Alex Tenorio	unarchive	Alex Tenorio	zxczxczxc	1/22/2025, 3:37:29 PM
Alex Tenorio	delete	N/A	Test	1/16/2025, 10:28:57 PM
Alex Tenorio	delete	N/A	asd	1/14/2025, 1:34:56 AM
Alex Tenorio	delete	N/A	Rommrom	1/12/2025, 12:57:47 AM
Alex Tenorio	delete	N/A	Testroom	1/12/2025, 12:54:03 AM
Alex Tenorio	delete	N/A	Rommrom	1/12/2025, 12:07:50 AM
Alex Tenorio	delete	N/A	Rommrom	1/8/2025, 5:41:48 PM
Alex Tenorio	delete	N/A	Rommrom	1/8/2025, 5:40:01 PM

Figure 8 Mathwise Admin Audit Logs

This interface shows an "Audit Logs" page for the "MathWise", whose purpose is auditing user activities as well as all system changes. The logs can be viewed on a structured table format, noting down the very important information; that is who initiated the activity, the involved user, name of the room, the nature of the performed action, and the timestamp respectively.



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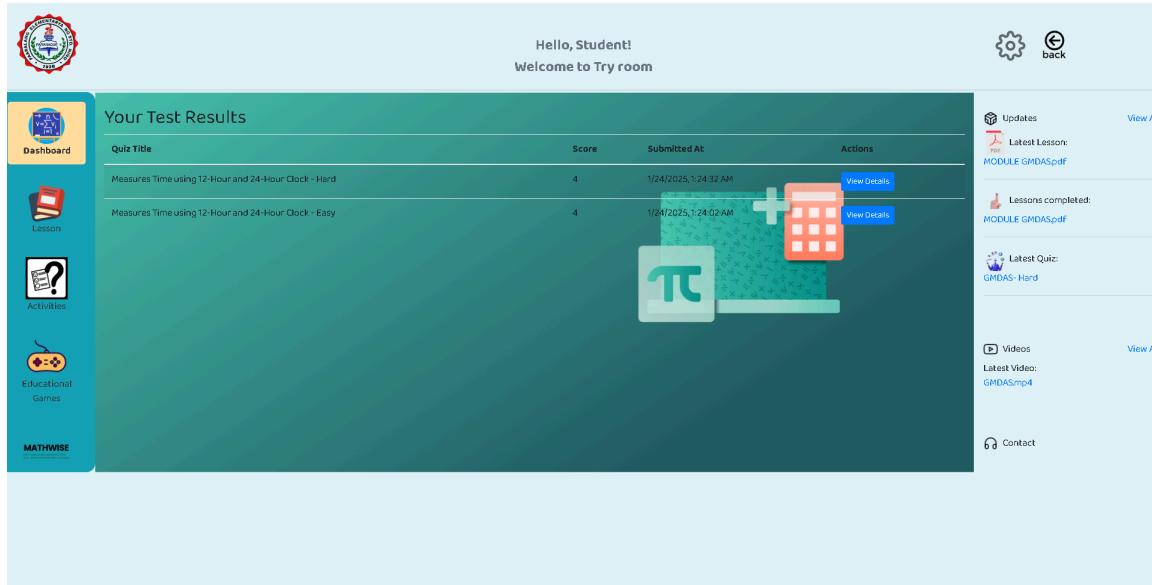
A screenshot of the Mathwise Admin Dashboard. The top navigation bar includes the university logo, a search bar, and links for "Dashboard", "Lessons", "Activities", "Educational Games", and "MATHWISE". The main content area shows test statistics for "GMDAS- Hard": Average 7 points, Median 7 points, and Range 7 points. A "Show All Test Results" button is present. To the right is a decorative graphic of mathematical symbols like a pi symbol, a plus sign, and a calculator. The right-hand sidebar contains sections for "Updates" (Latest Lesson: MODULE GMDAS.pdf), "Lessons completed" (No completed lessons yet), "Latest Quiz" (GMDAS-Hard), "Videos" (Latest Video: GMDAS.mp4), and "Contact".

Figure 9 Mathwise Admin Dashboard

This interface features the admin dashboard for "MathWise." The dashboard displays test statistics such as average, median, and range. The right-hand panel offers streamlined updates, including the latest lesson, quizzes, videos uploaded.



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The screenshot shows the Mathwise Student Dashboard. At the top, there's a header with the university logo, the text "Hello, Student! Welcome to Try room", and navigation icons for "back" and "View All". On the left, a sidebar menu includes "Dashboard" (selected), "Lesson", "Activities", "Educational Games", and "MATHWISE". The main content area is titled "Your Test Results" and displays two rows of quiz results:

Quiz Title	Score	Submitted At	Actions
Measures Time using 12-Hour and 24-Hour Clock - Hard	4	1/24/2025, 1:24:32 AM	View Details
Measures Time using 12-Hour and 24-Hour Clock - Easy	4	1/24/2025, 1:24:02 AM	View Details

Below the results is a decorative graphic featuring a green gradient background with mathematical symbols like a pi symbol, a plus sign, and a calculator icon.

On the right side, there are sections for "Updates", "Lessons completed", "Latest Quiz", "Videos", and "Contact".

Figure 10 Mathwise Student Dashboard

This interface features the user dashboard for the "MathWise" platform, it displays the student's test results featuring a clear table format that includes quiz titles, scores, submission timestamps, and an "Actions" column with "View Details" buttons for detailed review.



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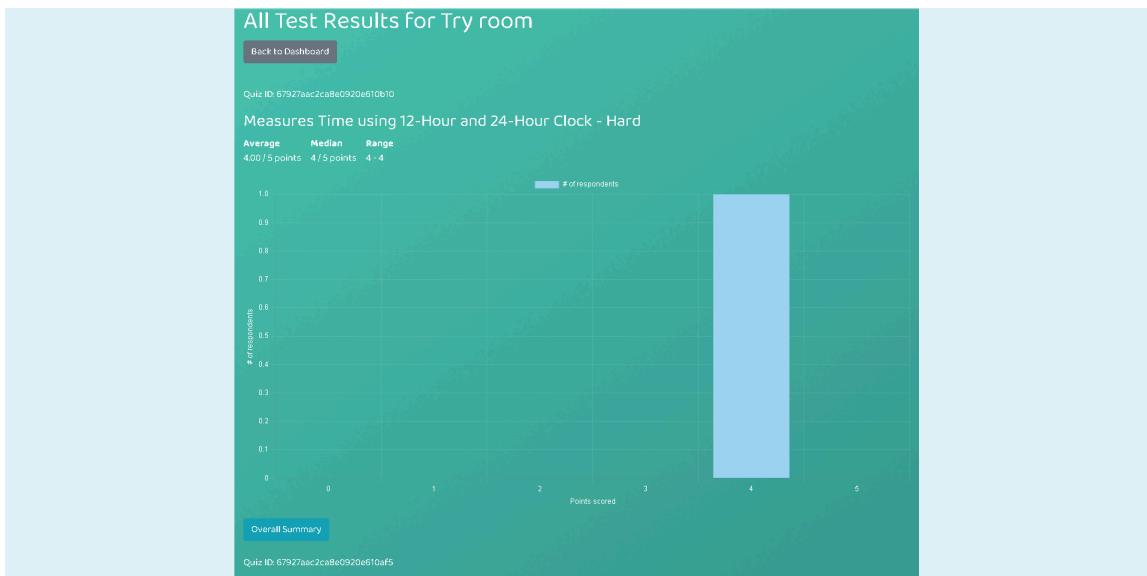


Figure 11 Mathwise Admin All Test Results

This interface presents a detailed summary of test results for a specific quiz. Key quiz statistics such as average, median, and range scores are highlighted, ensuring a quick overview of participant performance. The "Overall Summary" button at the bottom allows teachers to view additional details.

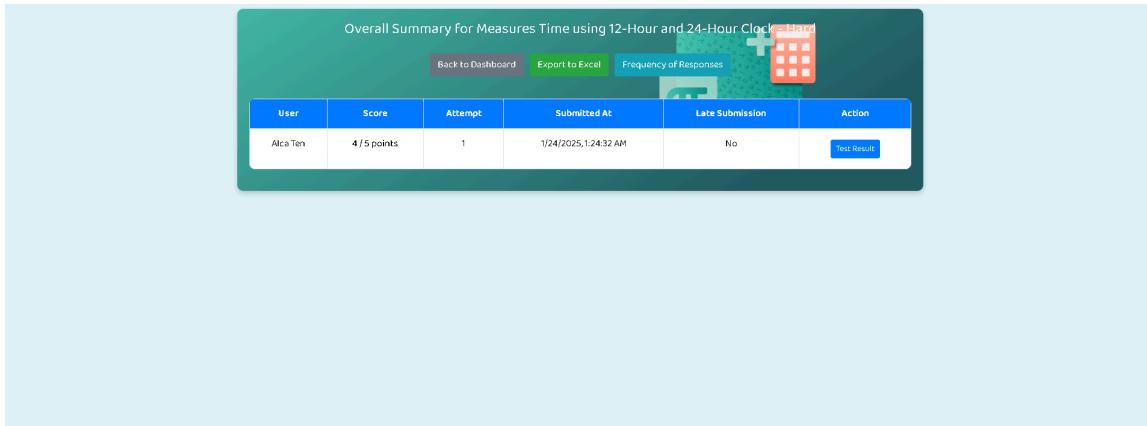


Figure 12 Mathwise Admin Overall Summary



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This interface provides a comprehensive summary of quiz performance. The main content includes a well-organized table that presents user performance details, including score, attempt count, submission time, and late submission status.

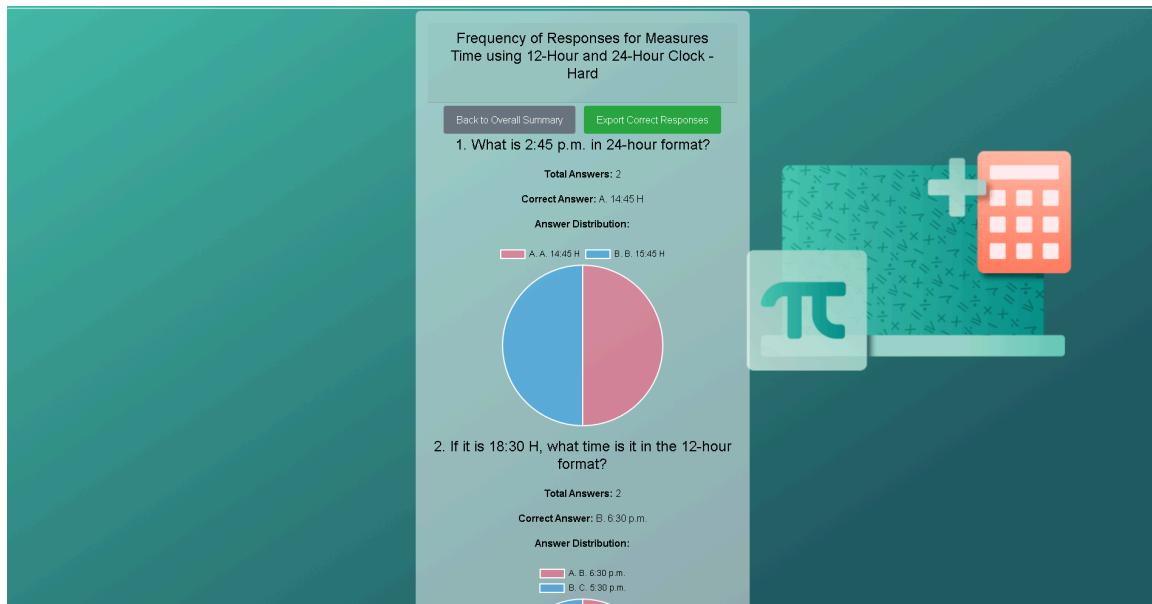


Figure 13 Mathwise Admin Frequency of Responses

This interface features a detailed breakdown of responses, including correct answers and answer distributions, displayed through intuitive pie charts. The interface provides clear navigation options with buttons for returning to the overall summary and exporting correct responses.



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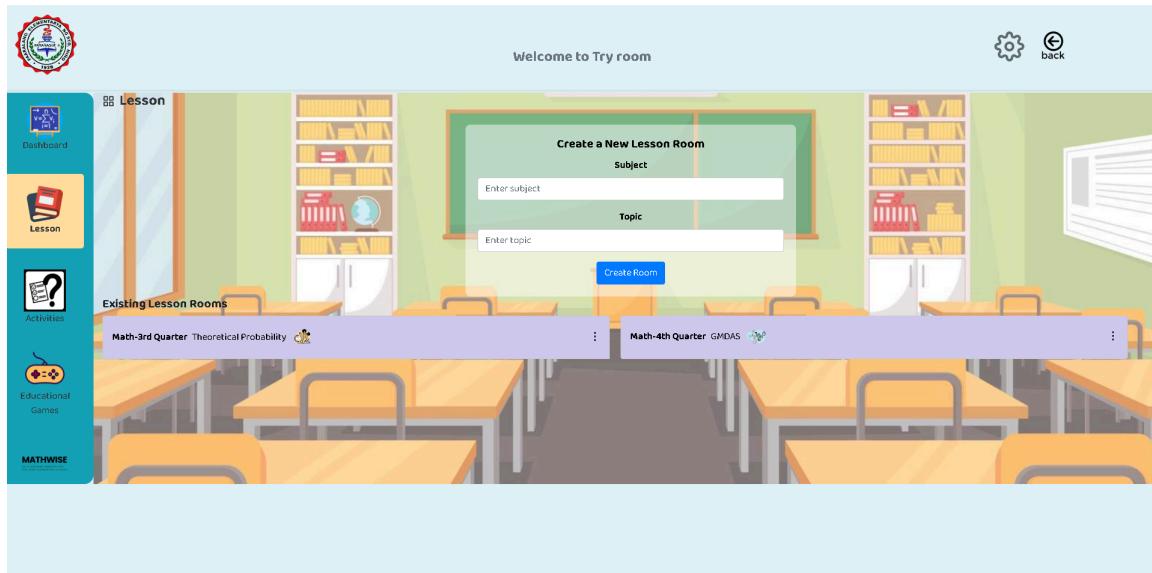


Figure 14 Mathwise Admin Create Lesson Room

This interface presents an intuitive lesson creation page for "MathWise". It features a simple, user-friendly form with clearly labeled fields for entering the subject and topic. A prominently displayed "Create Room" button ensures easy submission. Below the form, existing lesson rooms are neatly showcased in interactive cards,



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providing teachers with a quick overview and management options.

A screenshot of the Mathwise Admin interface. On the left is a sidebar with icons for Dashboard, Lesson, Activities, Educational Games, and MATHWISE. The main area shows a "Lesson" section with "Existing Lesson Rooms" for "Math-3rd Quarter Theoretical Probability" and "Math-4th Quarter GMIDAS". Below this is a form to "Upload PDF" with a placeholder "Choose PDF File: Choose file | No file chosen" and a "Upload PDF" button. Under "Uploaded PDFs", there are two cards: "MODULE Theoretical Probability.pdf" (Progress: 0%) and "PPT Theoretical Probability.pdf" (Progress: 0%). A "Go back to Lesson" button is at the bottom. The top right has a gear icon and a "back" button. The top center says "Welcome to Try room".

Figure 15 Mathwise Admin Uploaded Modules

This interface showcases the "Uploaded Modules" section of the "MathWise" platform. Teachers can seamlessly upload PDF files using a straightforward form and view their uploaded materials below. The uploaded files are displayed as interactive cards, complete with preview thumbnails, file names, and progress indicators, allowing



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educators to manage their resources with ease and efficiency.

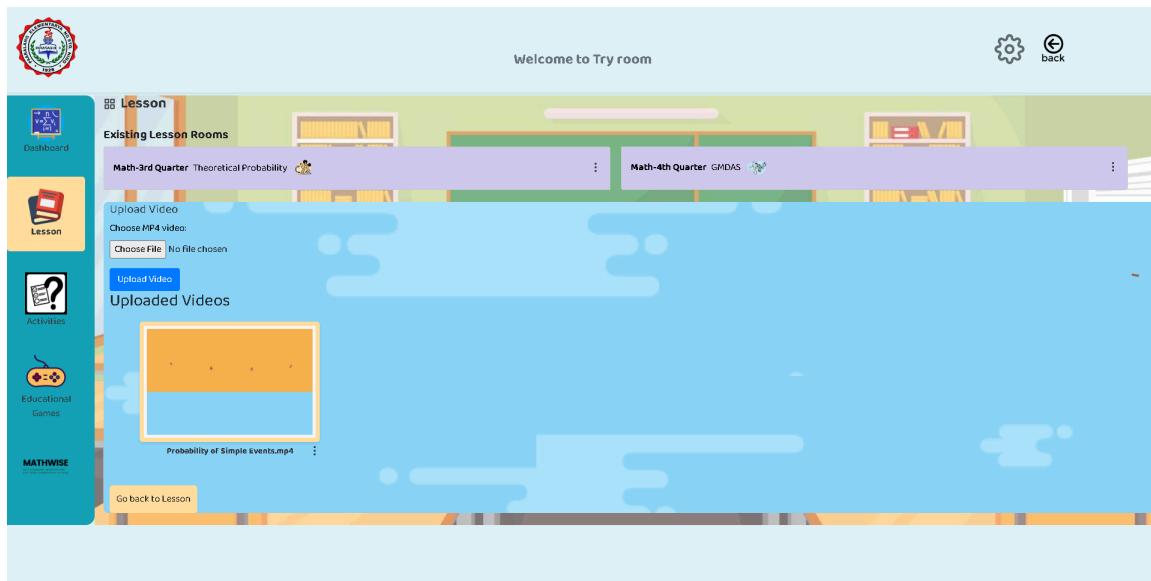


Figure 16 Mathwise Admin Uploaded Videos

This interface highlights the "Uploaded Videos" section of the "MathWise" platform. Teachers can effortlessly upload MP4 videos through an intuitive form and view their uploaded content below. The uploaded videos are presented as interactive cards, featuring file names, preview thumbnails, and management options, enabling educators



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to organize and utilize video resources efficiently in their lessons.

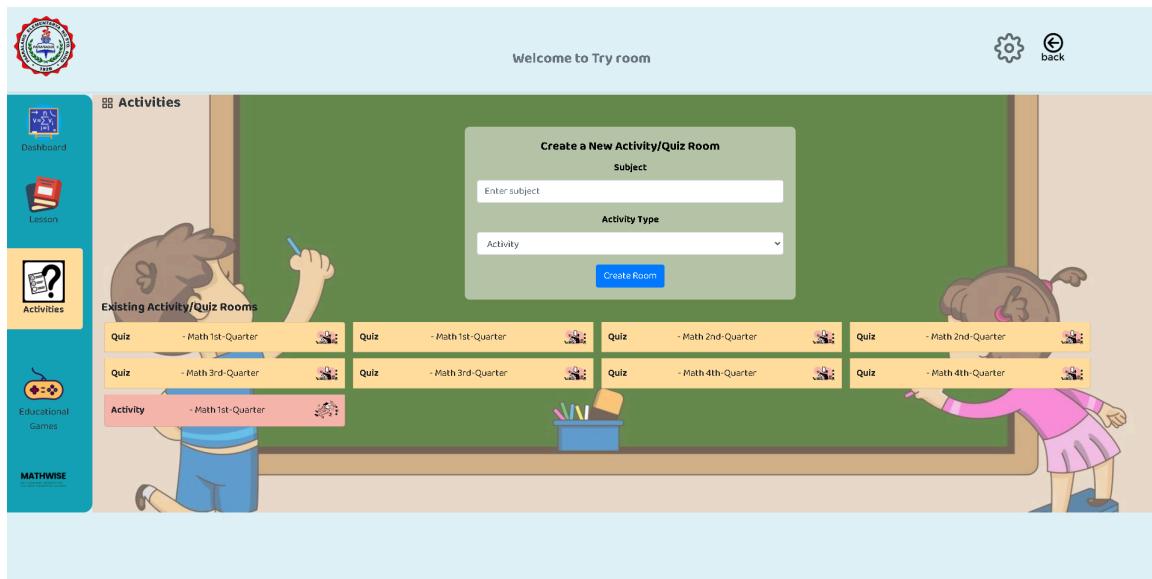


Figure 17 Mathwise Admin Create New Activity / Quiz Room

This interface highlights the "Activities and Quizzes" management page of the "MathWise" platform. It includes a clear form for creating new activity or quiz rooms, with fields to specify the subject and activity type. Below, existing activity and quiz rooms are displayed in a grid format.



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A screenshot of the Mathwise Admin Create Quiz interface. The top navigation bar shows tabs for "Quiz", "Lesson", "Activity", and "Available Quizzes". The main area is titled "Create a Quiz" with sub-sections for "Upload Quiz File (Excel)", "Quiz Title", "Set Timer", "Maximum Attempts", and "Set Deadline". Below these are fields for "Question1" and "Question Type". Buttons for "Remove Question", "Add Question", and "Submit Quiz" are visible. On the right, a sidebar titled "Available Quizzes" lists two quizzes with details like creation date, deadline, and attempts. A gear icon and a back button are in the top right corner.

Figure 18 Mathwise Admin Create Quiz

This interface showcases the "Create a Quiz" page of the "MathWise" platform. It provides educators with a structured form for quiz creation, featuring options to upload a quiz via an Excel file, set a title, configure timers, and define deadlines. Teachers can also customize quizzes with multiple question types and manage quiz visibility by saving drafts. On the right, the "Available Quizzes" section displays a list of existing quizzes with relevant details, such as creation time, deadline, and maximum attempts. The vibrant, interactive design enhances usability, making it easy for teachers to manage and create engaging assessments.



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A screenshot of the Mathwise Admin Create Activity interface. The top navigation bar includes the university logo, the title "POLYTECHNIC UNIVERSITY OF THE PHILIPPINES", and a "Welcome to Try room" message. On the right, there are settings and back buttons. The left sidebar has icons for Dashboard, Lesson, Activities (which is selected and highlighted in orange), and Educational Games. The main content area shows existing activity/quiz rooms organized by subject and quarter: Math 1st-Quarter, Math 1st-Quarter, Math 2nd-Quarter, Math 2nd-Quarter, Math 3rd-Quarter, Math 3rd-Quarter, Math 4th-Quarter, and Math 4th-Quarter. Below this is a "Create an Activity" form with fields for Activity Title, Description, Attachment (optional), Points, Deadline, and Save as Draft? (with options Publish or Draft). To the right of the form is a "Available Activities" section which currently displays "No activities available.".

Figure 19 Mathwise Admin Create Activity

This interface features a form for creating new activities, allowing educators to input an activity title, description, optional attachments, points allocation, and deadlines. Teachers can choose to save activities as drafts or publish them directly. At the top, the page displays existing activity and quiz rooms organized by subject and quarter, making it easy to navigate and manage. The "Available Activities" section provides a space to list upcoming or published activities.



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A screenshot of a web-based educational platform. At the top, there's a header with the university's logo and name. Below it, a navigation bar on the left includes links for "Dashboard", "Lesson", "Activities", and "EDUCATIONAL GAMES". The main content area is titled "Educational Games" and lists three games: "Operation Odessy", "Tens!", and "Cal & Bomba". A large section for "Operation Odessy" is displayed, showing a screenshot of the game where a character runs through pipes, a description of the game's objective, and control instructions. To the right of the game description is another screenshot of the game and a button labeled "Click to play the game!".

Welcome to Try room

Educational Games

Operation Odessy

Dodge the obstacles and navigate your way to the correct pipe to input the right answer and advance to the next level.

Rack-up points to climb the class leaderboards

1. Use arrow keys to control the character.
-Left Arrow Key: Move left
-Right Arrow Key: Move up
-Up Arrow Key: Move up
2. Avoid the obstacles by maneuvering your character through the gaps.
3. Locate the correct pipe corresponding to the answer.
4. Fly into the correct pipe to input the answer and proceed to the next level.
5. Earn points by successfully navigating through the obstacles and providing the right answers.

Click to play the game!

Figure 20 Mathwise Admin Educational Games

This interface offers an "Educational Room" section for the "MathWise," which refers to educational games meant to reinforce learning through gameplay. The design of the educational games tab allows for a description of the kind of gameplay along with objectives provided for each title, such as "Operation Odyssey.",



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Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The results, conclusions, and suggestions of the study are summarized in this chapter. drawn from Santo Niño MathWise: Revolutionizing Sustainable Education through Interactive E-Learning, the chapter that came before it. The information presented here is based on the conclusions drawn from the capstone project.

Summary of Findings

Santo Niño MathWise: Revolutionizing Sustainable Education through Interactive E-Learning is a system that was developed specifically to address the study's goal and improve the efficiency of tasks and duties that are currently completed manually by the Sto Nino Elementary School, where they encounter difficulties and conflicts. The system was assessed by the users through a survey questionnaire. In compliance with ISO standards 25010, the assessment covered a wide range of topics, such as functional sustainability, performance efficiency, compatibility, usability, dependability, security, maintainability, and portability. The study findings that emerged from this analysis are summarized below.



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The summation of the respondents' feedback in the table evaluating Completeness, Correctness, and Appropriateness is ranked as 'strongly agree' on the assessment of the system. The considerable degree of agreement among respondents about the system's ability to encompass necessary functions, produce accurate results, and effectively facilitate tasks demonstrates in-depth and efficient functionality. This alignment highlights the system's capability to meet user needs seamlessly, resulting in very high satisfaction and overall positive performance among the teachers.

The summation of the respondents' feedback in the table assessing Maturity, Availability, Fault Tolerance, and Recoverability is ranked as 'strongly agree' on the assessment of the system. Positive evaluations of the system's reliability, accessibility, failure management, and recovery capability highlight its robust and dependable performance. This alignment underscores the system's ability to maintain consistent operation and recover effectively, resulting in enhanced productivity and high user satisfaction among the teachers.

The summation of the respondents' feedback in the table assessing Adaptability, Durability, Installability, Replaceability, and Affordability is ranked as 'strongly agree' on the evaluation of the product. Positive feedback on the product's flexibility to meet evolving needs, resistance to technological changes, ease of installation, substitutability, and cost-effectiveness highlights its comprehensive and efficient functionality. This alignment demonstrates the product's ability to meet user requirements effectively, resulting in high levels of satisfaction among the teachers.



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The summation of respondents' feedback in the table evaluating Appropriateness/Recognizability, Learnability, Operability, User Error Protection, User Interface Aesthetics, and Accessibility is rated as 'strongly agree.' High scores across these usability indicators reflect the product's ease of use, intuitive design, and accessibility, effectively meeting user needs and ensuring strong satisfaction among the teachers.

The summation of respondents' feedback in the table evaluating Time-Behavior, Resource Utilization, and Capacity is rated as 'strongly agree.' High scores across these performance efficiency indicators highlight the product's ability to deliver quick response times, optimize resource usage, and handle capacity effectively, resulting in strong user satisfaction among the teachers.

The summation of respondents' feedback in the table assessing Confidentiality, Non-repudiation, Accountability, and Authenticity is rated as 'strongly agree.' High scores across these security indicators demonstrate the product's effectiveness in protecting data, ensuring accountability, and verifying authenticity, resulting in strong user satisfaction among the teachers.



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The summation of respondents' feedback in the table assessing Co-existence and Interoperability is rated as 'strongly agree.' High scores in these compatibility indicators highlight the product's ability to share functions and information seamlessly with other systems, showcasing strong alignment with existing resources and high user satisfaction.

The summation of respondents' feedback in the table assessing Modularity, Reusability, Analyzability, and Testability is rated as 'strongly agree.' High scores across these software modularity indicators highlight the product's effective design, enabling easy reuse, analysis, and testing while minimizing disruptions to other components.

Conclusion

Notably, the study on Santo Niño MathWise: Revolutionizing Sustainable Education through Interactive E-Learning proved the effectiveness of the system in overcoming constraints in Sto. The manual processes at Niño Elementary School. It was evaluated through user feedback and designed in compliance with ISO 25010 standards, which ensure the system encompasses comprehensive quality requirements.

The results show that the system performed exceptionally at various levels, with respondents consistently rating "strongly agree" across evaluation criteria. The system scored high because of its functionality, reliability, adaptability, usability, efficiency, security, compatibility, and maintainability. All these features together, exemplify the system's ability to offer valuable educational assistance, improve efficiency, and promptly satisfy user needs. Features such as reliability, availability, and recoverability enable it to



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remain up, enhancing the user trust factor. The affordability, pluggability, and compatibility of the product with existing systems also reinforce its pragmatic relevance to the educational setting.

The positive feedback confirms that Santo Niño MathWise serves as a highly effective tool for revolutionizing sustainable education and addressing the specific needs of Sto. Niño Elementary School. This study establishes the system as a valuable and sustainable solution for modern educational challenges, promoting enhanced efficiency, accessibility, and adaptability for its users.

Recommendations

- The researchers recommends that this E-Learning platform be offered not only in Santo Niño Elementary School, but also to all other elementary schools
- The researchers recommends to continue to investigate and evaluate for further system improvement, and the researchers suggest that additional studies involving more respondents and more areas be conducted to further strengthen the results of this research



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