LITERISE: A GAMIFIED APP USING ITEM RESPONSE THEORY FOR AN ENHANCED FLUENCY AND COMPREHENSION AMONG GRADES 4 TO 6 STUDENTS OF TANDANG SORA ELEMENTARY SCHOOL

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BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

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APPROVAL SHEET

In partial fulfillment of the requirements for the degree **BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY,** this Capstone project entitled **"LITERISE: A GAMIFIED APP USING ITEM RESPONSE THEORY FOR AN ENHANCED FLUENCY AND COMPREHENSION AMONG GRADES 4 TO 6 STUDENTS OF TANDANG SORA ELEMENTARY SCHOOL",** has been prepared and submitted by Andalan, Ezer Jan, Cristobal, John Edgardo, Dela Pena, Joshua, Ecawat, Erl Nino, Ignacio, Joshua B., Larios, Patricia C., Lopez, Clarc Anthony, Manicar, Jaimes Aldrich T., Mata, Carl Jhustine D., Merquillo, Jonas, Mullon, Gwyneth, Saligao, Ronaldo, and Trinidad, Andrew L. who are hereby recommended for project presentation.

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SUMMARY OF CHAPTER 1 TO 5

TABLE OF CONTENTS

Title Page	i
Approval Sheet	ii
Table of Contents	vi
List of Tables	vii
List of Figures	viii
List of Appendices	xi
Chapter 1 Capstone Project Background	
Introduction	1
Project Context and Its Background	2
Purpose and Description	
Objective of the Study	
Main Objective	
Specific Objectives	
Scope and Limitation/Delimitations of the Project	
Theoretical Framework and Conceptual Framework of the Study	
Definition of Terms	
Chapter 2 Review of Related Literature, Studies and Systems	
Related Literature	
Local Literature	
Foreign Literature	
Related Studies	
Local Literature	
Foreign Literature	
Technical Background	

Chapter 3 Design and Methodology

Methodology

Requirement Analysis

Sampling Technique

Current Technical Situation

Requirement Documentation

Project In-scope

Project Out-scope

Design of Software, Systems, Product and/or Processes

Development and Testing

Implementation Plan

References

Appendices ….

List of Tables

Table No.	Table Title	Page No.
1	Software Development Requirements	36
1.2	Software Implementation Requirements	38
1.3	**Hardware Development Requirements**	38
1.4	**Hardware Implementation Requirements**	39
2	**Hardware Implementation Requirements**	39

List of Figures

Figure No.	Figure Title	Page No.
1	Conceptual Framework	18
2	Fishbone Diagram	45
2.2	Context Diagram	47
2.3	Data Flow Diagram	47
2.4	Use Case Diagram	48
2.5	Flowchart	49
2.6	Entity-Relationship Diagram/Model	49
2.7	System Architecture	49
2.8	Network Diagram	50
2.9	Block Diagram	50
2.10	Site Map	51

List of Appendices

Appendix	Appendix Title	Page No.
A	Evaluation Tools	55
B	Sample Inputs / Output	57
C	Diagrams / illustrations	59
h.h	hhhhhhhhhhhhhhhhhhhhhhhhhhhhhhh	hh

CHAPTER I
CAPSTONE PROJECT BACKGROUND

Introduction

In today's rapidly evolving educational landscape, it is crucial to explore innovative methods that foster both engagement and effectiveness in learning. The LiteRise project proposes a gamified mobile application designed to enhance fluency and comprehension among Grades 4 to 6 students at Tandang Sora Elementary School, leveraging the powerful framework of Item Response Theory (IRT). The goal of the app is to transform how students interact with reading materials and assessments, offering a personalized learning experience that aligns with their individual capabilities.

The idea behind LiteRise stems from the growing need to cater to diverse learning paces and styles in classrooms. Traditional assessment methods often fail to accurately capture a student's true learning potential, as they rely on static question sets that do not adapt to each learner's proficiency.

Item Response Theory (IRT) offers a solution by analyzing how individual students respond to various items (questions) and adjusting the difficulty level based on their performance. This enables more accurate assessment of a student's reading ability, ensuring that every student is constantly challenged at an appropriate level.

The gamification aspect of the app introduces elements of play, rewards, and progression, making learning an enjoyable experience. This approach aims to not only improve fluency and comprehension but also increase motivation and engagement among students. Through interactive, game-like features, students are encouraged to continually practice and master new reading skills, with immediate feedback and rewards for their efforts.

Project Context and It's Background

Tandang Sora Elementary School is a public educational institution located in Quezon City, Philippines, that serves a diverse community of students. Despite its dedication to providing quality education, the school faces significant challenges that are common across public schools, such as limited resources, overcrowded classrooms, and a diverse range of student learning abilities. Teachers are often stretched thin, trying to cater to the needs of a wide spectrum of learners, making it difficult to provide personalized attention or tailored interventions to students who may be struggling with specific academic skills.

Among the core areas in need of attention is **reading fluency** and **comprehension**, which are essential skills that lay the foundation for overall academic success. Many students, particularly those in the intermediate grades (Grades 4-6), struggle with reading skills, often due to a lack of consistent and

personalized practice. The reliance on traditional teaching methods, which typically involve static, one-size-fits-all assessments and materials, has contributed to a gap in student achievement, particularly for those who require more individualized support.

Project Purpose and Description

LiteRise is a gamified mobile learning app created to help Grade 4 to 6 students improve their reading fluency and comprehension in a fun and personalized way. It uses Item Response Theory (IRT), a psychometric model that allows the system to adjust the difficulty of activities based on each learner's performance. This means that every student gets reading exercises suited to their current skill level, helping them learn more effectively while staying motivated. Reading is one of the most essential skills for students, yet it continues to be a challenge for many.

National assessments and studies show that reading comprehension remains an area where learners often struggle. Traditional classroom teaching, while valuable, sometimes fails to meet individual learning needs, especially when students learn at different paces or have varying levels of motivation. The lack of interactive and adaptive tools also limits how teachers can personalize learning experiences for their students. LiteRise addresses these challenges by introducing

an AI-powered adaptive reading platform that tailors reading tasks to each learner's abilities. To keep students engaged, the app includes gamified elements such as points, badges, and streaks, turning reading practice into a more enjoyable and rewarding experience.

Through IRT-based analytics, the app can automatically adjust the difficulty of reading activities and give meaningful feedback about students' fluency and comprehension progress. The app also features a teacher dashboard, which allows educators to track student progress, identify areas where learners are struggling, and provide targeted support. This helps teachers make informed decisions and strengthens reading programs within schools through data-driven insights. In essence,

LiteRise aims to empower young learners to become more confident, fluent, and motivated readers through technology that is both evidence-based and engaging. It also supports teachers and researchers in developing better literacy interventions by integrating adaptive learning and gamification principles into everyday education.

Objective of the Study

Main Objective

The main purpose of LiteRise is to develop an adaptive, gamified literacy application that improves reading fluency and comprehension while maintaining student engagement through interactive learning experiences.

Specific Objectives

The overall goals for the project and these are as follows:

1. To design and to develop a mobile reading application that integrates gamified lessons to enhance reading comprehension and oral fluency.
2. To apply the Item Response Theory (IRT) model throughout the system to enable adaptive assessment, lesson difficulty adjustment, and personalized feedback based on learner performance.
3. To implement interactive reading and pronunciation activities that enhance comprehension, vocabulary retention, and oral fluency through real-time feedback.
4. To integrate gamified elements such as experience points (XP), badges, and streaks to sustain learner motivation and engagement across literacy activities.

5. To develop a teacher dashboard that visualizes learner data, tracks literacy growth, and identifies individual learning challenges for targeted support.
6. To evaluate the system's effectiveness in improving learners' reading comprehension and oral fluency through adaptive analytics and performance comparisons over time.

Scope and Delimitations of the Project

Scope

The scope of this study focuses on the **design, development, and pilot implementation** of **LiteRise**, a **gamified mobile application** aimed at improving **reading comprehension** and **oral fluency** among Grades 4 to 6 students of **Tandang Sora Elementary School**. The system integrates **Item Response Theory (IRT)** to create adaptive reading modules that adjust task difficulty based on each learner's performance, ensuring personalized and effective learning.

LiteRise features a **gamified environment** with points, badges, and rewards to increase motivation and engagement. It also includes **pre-tests and post-tests** to measure literacy progress and evaluate the app's effectiveness. Developed as an **Android-based application**, LiteRise supports both **online and offline modes**, allowing students to access lessons and activities anytime, even without stable internet connectivity.

The study covers the **design, implementation, and pilot testing** of the application within **Tandang Sora Elementary School**, focusing on usability, engagement, and literacy improvement among target learners.

Delimitation

The delimitations of this study define the specific boundaries within which the research was conducted. The study focuses exclusively on enhancing **reading comprehension** and **oral fluency**, deliberately excluding other academic areas such as mathematics or science. It is confined to **young learners in Grades 4 to 6** of **Tandang Sora Elementary School**, and does not extend to senior high school or adult education levels. The evaluation is limited to assessing the **functional performance and educational impact** of the LiteRise application, without examining long-term behavioral or psychological effects. Furthermore, the study does not cover **future enhancements** such as the inclusion of additional subjects, higher grade levels, or expanded language options, as these are beyond the current project's scope and objectives.

Theoretical Framework and Conceptual Framework of the Study

Theoretical Framework

The study is anchored on Item Response Theory (IRT) and the theories of Gamification in Education and Technology Acceptance, which collectively

provide the foundation for the development and implementation of the LiteRise application.

Item Response Theory (IRT), as discussed in various educational measurement studies, is a psychometric model that analyzes the interaction between an individual learner's ability and the difficulty level of test items. It provides a more accurate representation of student performance by adapting question difficulty to each learner's proficiency level. In the context of LiteRise, IRT enables the system to dynamically adjust reading comprehension and fluency activities based on the student's responses. This ensures that learners are consistently challenged at an appropriate level—neither too easy nor too difficult—thus maximizing engagement and progress.

The study is also guided by the concept of Gamification in Learning, which emphasizes the integration of game-like elements such as points, badges, and progress tracking into educational environments to enhance motivation and participation. According to Deterding et al. (2011), gamification transforms routine educational tasks into engaging experiences that promote persistence, competition, and enjoyment. In LiteRise, gamification elements are employed to encourage continuous reading practice, reward progress, and sustain student motivation through immediate feedback and visible achievements.

Furthermore, this research draws upon the Technology Acceptance Model (TAM) proposed by Davis (1989), which explains how users come to accept and use a technology. The model posits that Perceived Ease of Use and Perceived Usefulness significantly affect users' attitudes toward adopting new systems. In this study, TAM provides the basis for understanding how students and teachers at Tandang Sora Elementary School may perceive and adopt LiteRise as an effective learning tool. By ensuring that the application is user-friendly, accessible, and aligned with learners' needs, the system is more likely to be accepted and effectively utilized.

Conceptual Framework

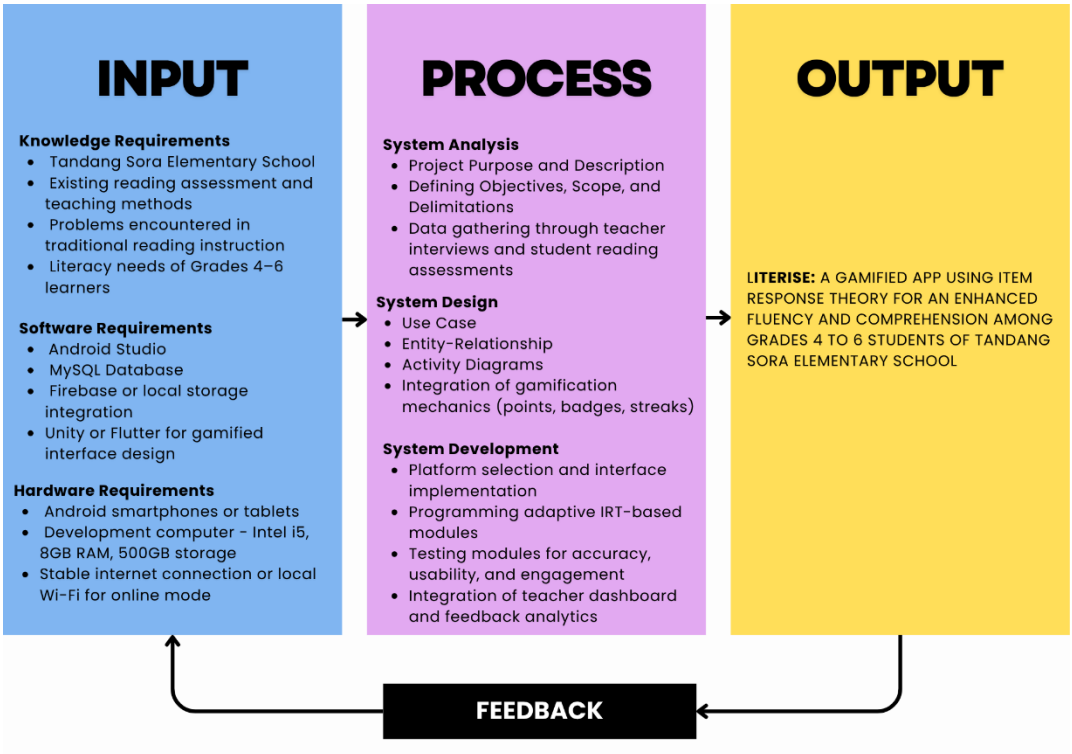

Figure 1.1 **Conceptual Framework**

This illustrates the conceptual framework of the *LiteRise* system. The framework begins with Input, consisting of the knowledge, hardware, and software requirements necessary for system development. The Process section outlines the stages of system analysis, design, and development guided by the Software Development Life Cycle (SDLC) approach. The Output represents the final product—the *LiteRise* mobile application—while the Feedback component ensures continuous improvement of the system based on actual user experiences.

Definition of Terms

Adaptive Learning. A personalized educational approach that modifies the content and difficulty of learning materials according to the learner's individual performance and skill level. In this study, adaptive learning is implemented through the Item Response Theory (IRT) to ensure each student receives tasks suited to their reading proficiency.

Gamification. The process of applying game design elements such as rewards, badges, levels, and leaderboards to non-game contexts to increase motivation and engagement. LiteRise incorporates gamification to make reading activities more interactive and enjoyable for learners.

Item Response Theory. A statistical model used to evaluate both the ability of learners and the difficulty of items in an assessment. Within LiteRise, IRT enables adaptive testing and personalized feedback, ensuring that each learner is challenged appropriately.

Reading Comprehension. The ability to understand, interpret, and extract meaning from written texts. This study focuses on improving learners' comprehension skills through adaptive reading modules that adjust to individual reading levels.

Reading Fluency. The ability to read text accurately, quickly, and with proper expression. LiteRise aims to enhance fluency by integrating oral reading and pronunciation exercises that provide real-time corrective feedback.

Pre-tests and post-tests. Assessment tools used to measure learners' skills before and after using the LiteRise application. These tests help determine the effectiveness of the app in improving reading fluency and comprehension.

Teacher Dashboard. An analytical interface that provides educators with real-time insights into learners' progress, performance, and areas for improvement. In LiteRise, the dashboard supports teachers in tracking literacy growth and planning targeted interventions.

Gamified Elements. The inclusion of motivational features such as experience points (XP), streaks, and achievement badges within the application. These features aim to sustain learners' interest and encourage continuous engagement in reading activities.

Adaptive Assessment. An evaluation process that dynamically adjusts the difficulty of questions based on a learner's previous responses. This ensures that the assessment remains fair, accurate, and reflective of the learner's true ability.

Offline Accessibility. The capability of the system to operate without an active internet connection. LiteRise includes this feature to ensure inclusivity and usability for learners in areas with limited or unstable connectivity.

ISO/IEC 25010:2011. An international standard that defines software quality characteristics such as functionality, reliability, usability, efficiency, maintainability, and portability. This standard serves as a framework for evaluating the overall quality of the LiteRise system.

ISO 9241-210:2019. An international standard that emphasizes human-centered design and user experience. It guides the study in ensuring that the application is user-friendly, accessible, and effective for both learners and educators.

Human–Computer Interaction. The field that studies how people interact with digital technologies and systems. This research applies HCI principles to design an engaging, intuitive, and effective literacy application for young learners.

Literacy. The ability to read, write, and comprehend text effectively. The LiteRise project focuses on strengthening foundational literacy among Grades 4 to 6 students through adaptive and gamified digital learning.

Sustainable Development Goals. Are set of global objectives established by the United Nations to promote inclusive and sustainable development. This study aligns with SDG 4 (Quality Education) and SDG 10 (Reduced Inequalities) by providing an equitable, AI-powered literacy solution accessible to all learners.

CHAPTER II

REVIEW OF RELATED LITERATURE AND SYSTEMS

This chapter discusses the related literature, studies, and existing systems relevant to LiteRise: A Gamified App using Item Response Theory for an Enhanced Fluency and Comprehension among Grades 4 to 6 Students of Tandang Sora Elementary School. Various sources such as research papers, theses, and online articles were reviewed to deepen understanding of gamified learning, reading development, and Item Response Theory. These references provide the foundation for the study and guide the enhancement of the proposed LiteRise system.

Related Literature

Foreign literature

THE MOBILE GAMIFICATION FOR EARLY LITERACY: AN ANALYSIS OF LEARNING OUTCOMES AND ENGAGEMENT

Li, Zhang, Guo, and Wang (2021) examined the effects of a mobile gamified application on early literacy development among young learners. The app included features such as interactive storytelling, progress tracking, and reward systems to motivate consistent learning. Results revealed that students who used the gamified app showed significant improvement in vocabulary, reading fluency, and comprehension compared to those who followed traditional literacy instruction. Additionally, students expressed high engagement and enthusiasm

toward learning, indicating that gamified designs can sustain attention and enjoyment in educational contexts. The study concluded that mobile gamification provides an effective platform for improving early literacy and offers promising potential for older elementary learners as well.

SMARTREAD: A MULTIMODAL EREADING PLATFORM INTEGRATING COMPUTING AND GAMIFICATION TO ENHANCE STUDENT ENGAGEMENT AND KNOWLEDGE RETENTION

Chen and Liu (2023) developed SmartRead, an adaptive eReading platform that integrates gamification and artificial intelligence to improve engagement and comprehension among learners. The system adjusts reading materials to match the learner's proficiency level, offering immediate feedback, progress tracking, and reward mechanisms. Results demonstrated that students using SmartRead exhibited better reading comprehension and knowledge retention compared to traditional eBook users. The study also reported increased motivation, particularly due to the game-based rewards and adaptive content delivery. Overall, the findings indicate that combining adaptive learning systems with gamification can lead to more effective and enjoyable reading experiences.

A PSYCHOMETRIC EVALUATION OF AN ITEM BANK FOR AN ENGLISH READING COMPREHENSION TOOL USING RASCH ANALYSIS

Yim, Lye, and Koh (2020) conducted a psychometric study in Singapore to develop and evaluate a reading comprehension tool for primary students using Rasch analysis, a model under Item Response Theory (IRT). The researchers designed an item bank calibrated for varying difficulty levels, ensuring that assessments matched each learner's ability. Their findings demonstrated that the Rasch model effectively measured students' reading skills with high reliability and precision. The study emphasized the value of using IRT to personalize learning, allowing educators to identify individual strengths and weaknesses. It also provided evidence that adaptive assessments can enhance student engagement and provide fairer, more accurate measures of comprehension.

CHILDREN'S READING COMPREHENSION AND MOTIVATION ON GAMIFIED E-READING EXPERIENCES

Liman Kaban (2021) investigated how gamified e-reading environments affect reading comprehension and motivation among young English as a Foreign Language (EFL) learners. The study involved students using e-books that included game-like features such as points, badges, and instant feedback to sustain attention and engagement. Results revealed that students exposed to the gamified e-reading platform achieved significantly higher comprehension scores than those using

non-gamified reading tools. Moreover, learners reported greater enjoyment and motivation to read in digital settings, suggesting that game elements can foster positive reading habits. This study supports the idea that integrating gamification into reading materials not only enhances comprehension but also encourages more consistent and enthusiastic reading behavior.

MEANINGFUL, GAMIFIED TRAINING OF READING FLUENCY: GAMELET IN SCHOOL SETTINGS

This study by Massler, Stotz, and Koenig (2022) explored the use of GameLet, a gamified learning environment designed to enhance students' reading fluency. The researchers emphasized that meaningful gamification—using game elements that support instructional goals—can improve engagement and learning outcomes. In the program, students recorded, listened to, and repeated reading performances, promoting self-assessment and improvement. Results showed that learners who used GameLet demonstrated higher reading fluency and greater motivation compared to those in traditional reading practice. The study highlights the importance of integrating game elements like feedback, progress levels, and rewards into reading programs to create a more interactive and effective learning experience.

Local Literature

USING GAMIFICATION TO ENHANCE READING COMPREHENSION OF GRADE 4 LEARNERS. COGNIZANCE JOURNAL OF MULTIDISCIPLINARY STUDIES

The study aimed to determine gamification's effectiveness in enhancing reading comprehension in grade 4 learners at Aguinaldo Elementary School. The respondents of the study were 49 grade 4 learners. The researchers used qualitative research design through the Phil-IRI pretest and post-test as the main data-gathering tool. Before using gamification, the level of performance was satisfactory as assumed in hypothesis. Gamification has been proven to have significance in improving reading comprehension. Despite the struggles encountered, the research was successfully conducted. The result of the study demonstrated that the reading comprehension of grade 4 learners improved using gamification. It is therefore recommended as a tool to enhance the teaching-learning process in the classroom.

EFFECTIVENESS OF EDUCATIONAL GAMES IN TEACHING READING COMPREHENSION AND LEVEL OF ENGAGEMENT AMONG LEARNERS

This study explored the effectiveness of educational games in teaching reading comprehension and their influence on the engagement levels of Grade 6 learners in public elementary schools within District III, Division of Valencia City,

for the school year 2024–2025. Utilizing a descriptive-correlational research design, the study involved 445 Grade 6 learners as respondents. A validated survey questionnaire was used to measure the effectiveness of educational games based on four indicators: general perception, impact on reading comprehension, game design and features, and motivation. Additionally, the level of learner engagement was evaluated. Results revealed that educational games were perceived as "very highly educational" across all indicators. Learners strongly agreed that games enhanced their reading comprehension, made learning more enjoyable, improved critical thinking, and increased their motivation to read. The data also indicated a very high level of engagement among learners who participated in game-based activities.

A GAMIFIED APPROACH FOR IMPROVING THE LEARNING PERFORMANCE OF K-6 STUDENTS USING EASTER EGGS

Gamification is mainly used to increase user engagement and motivation, hence increasing the user base and user activity. Defined by applying game elements to non-gaming contexts, gamification is mostly integrated with software applications in order to provide a gameful experience for users. Education has been one of the areas where gamification studies have focused a lot during the last decade. Young students with the age range of 7–12 years old (K-6) require different teaching methods to use their full potential. However, the methods and principles

presented in studies on gamification and its application in education are not dedicated to K-6 students. Furthermore, the evolution of video games has brought new opportunities to develop new gamification elements and principles. In this research, the easter egg element has been implemented as a gamification element.

INTEGRATION OF GAMIFIED INSTRUCTION ON STUDENTS' ACADEMIC PERFORMANCE

Several factors can significantly impact students' academic performance, among these is disengagement during lessons and this stands out as a prominent concern. This lack of engagement can have a far-reaching effect on students' academic achievement, primarily manifesting lower scores and reduced learning outcomes. The primary objective of this study is to investigate the impact of incorporating gamified instructions into traditional classroom lessons. By introducing game elements and mechanics into the learning environment, the study aims to evaluate how this approach influences motivation, engagement and academic performance. The researcher utilized a quasi-experimental design, which involves establishing a cause-and-effect relationship between the variables in a controlled setting. This type of design allows the investigation of the impact of a certain variable on outcomes.

ENHANCING READING INSTRUCTION THROUGH GAMIFICATION: A SYSTEMATIC REVIEW OF THEORETICAL MODELS, IMPLEMENTATION STRATEGIES, AND MEASURABLE OUTCOMES

Reading instruction faces persistent challenges, including declining student engagement, varied reading comprehension levels, and a lack of motivation among Learners. Traditional methods often fail to captivate students, resulting in suboptimal literacy outcomes. In response to these challenges, educators and researchers are increasingly turning gamification as a promising approach to reinvigorate reading instruction. Gamification, which incorporates game design elements into non-game contexts, has the potential to enhance student motivation, engagement, and comprehension.

Related Studies

Foreign Studies

ENHANCING READING INSTRUCTION THROUGH GAMIFICATION: A SYSTEMATIC REVIEW OF THEORETICAL MODELS, IMPLEMENTATION STRATEGIES, AND MEASURABLE OUTCOMES (2020–2024)

Wang et al. (2024) conducted a systematic review of gamified reading instruction across multiple countries. Their findings revealed that integrating game mechanics such as badges, points, and interactive feedback significantly improved reading fluency and learner motivation. This supports LiteRise's

approach to using gamification and adaptive learning to enhance literacy outcomes among Grades 4–6 students.

DIFFICULTY-CONTROLLABLE READING COMPREHENSION QUESTION GENERATION USING ITEM RESPONSE THEORY.

Liu and Zhang (2023) explored the use of Item Response Theory (IRT) in generating reading comprehension questions with controllable difficulty levels. Their study introduced an adaptive framework that tailors question complexity based on learner ability, ensuring personalized assessment and instructional alignment. This directly supports LiteRise's goal of integrating IRT to adjust lesson difficulty and provide individualized feedback, enhancing both fluency and comprehension among Grades 4–6 learners.

EXAMINING THE EFFECTIVENESS OF GAMIFICATION ON LEARNING OUTCOMES: A META-ANALYTIC REVIEW. FRONTIERS IN PSYCHOLOGY

Examining the Effectiveness of Gamification on Learning Outcomes is the title of a meta-analytic review by Hamari, Koivisto, and Sarsa (2023) that was published in Frontiers in Psychology. After combining data from several educational settings, the study came to the conclusion that gamified learning environments greatly improve student engagement, motivation, and academic achievement. These results lend credence to the inclusion of gamified components

in LiteRise, such experience points, badges, and streaks, which are intended to maintain student attention and enhance literacy results. The adaptive framework of LiteRise, which is driven by Item Response Theory (IRT), reflects the study's emphasis on the significance of matching game mechanics with educational objectives.

FROM READERS TO PLAYERS: EXPLORING STUDENT ENGAGEMENT IN A GAMIFIED METAVERSE AND ITS EFFECT ON READING INTEREST

Liu et al. (2025) examined how gamified metaverse environments affect reading engagement among elementary students. Their study found that learners exposed to interactive story elements and virtual NPCs showed greater reading interest and motivation than those in traditional settings. These findings support LiteRise's use of gamified features to boost engagement and personalize literacy experiences.

EFFECTS OF ADAPTIVE FEEDBACK THROUGH A DIGITAL TOOL ON READING COMPREHENSION IN PRIMARY LEARNERS.

Mejeh (2024) investigated how adaptive feedback delivered through a digital reading tool impacts comprehension among primary learners. The study found that personalized feedback based on learner responses significantly improved reading accuracy and retention. These results align with LiteRise's use

of adaptive analytics and IRT-based feedback to support individualized literacy growth.

Local Studies

EFFECTS OF GAMIFIED LEARNING ACTIVITIES ON ENGLISH VOCABULARY RETENTION

Experimental study examined how gamified word games influenced vocabulary retention of junior high students in a private Filipino school. It found that structured gamified activities significantly improved post-test vocabulary scores compared to traditional instruction, supporting the use of game elements to increase engagement and language gains. Samortin, M. (2020)

THE EFFECTIVENESS OF A GAME-BASED TEACHING APPROACH IN IMPROVING READING FLUENCY

A quasi-experimental study that investigated a game-based teaching approach with Grade 2 learners and reported measurable improvements in reading fluency after the intervention. The paper includes methodology, instruments, and pre/post results that you can cite for evidence that game-based instruction helps early readers. Joaquin, S. R. (2024)

A GAMIFIED EDUCATIONAL LEARNING MODULE FOR CORE SUBJECTS

A full paper describing design, implementation, and testing of a gamified learning module for core subjects (including reading/language tasks) developed by Filipino university students. The study documents how gamified modules can be integrated into lessons and reports on usability and learning outcomes from pilot testing. Useful when citing locally developed gamified learning systems. Blancaflor, E. B., Camaongay, K. D. G., Chua, J. A. S., & Echanes, G. A. (2020).

IMPACT OF TRADITIONAL GAMIFICATION ON READING PERFORMANCE OF STRUGGLING LEARNERS

This research explored whether traditional gamification (badges, points, game activities) improved reading performance among Grade 3 learners in selected Philippine schools. Their quasi-experimental results show positive effects on reading scores and recommend gamified strategies for remediation programs. Candillada, K. I. T. (2025)

EFFECTIVENESS OF EDUCATIONAL GAMES IN TEACHING READING COMPREHENSION (GRADE 6)

A descriptive-correlational study that assessed the influence of educational games on reading comprehension and engagement among Grade 6 learners in public elementary schools; it reports increased engagement and improved

comprehension measures after sustained use of game-based activities. This is directly relevant to fluency and comprehension outcomes for upper elementary grades. Bebanco, M. B. (2025)

Related Systems

DUOLINGO

A highly gamified platform that uses game-like features such as levels, streaks, points, and leaderboards, along with an adaptive content review schedule, to boost user engagement and retention in language and literacy practice.

READWORKS

A platform offering free reading passages, comprehension questions, and lesson plans for K-12. It focuses on improving reading comprehension and vocabulary, which are core skills targeted by LiteRise.

SCIENCE ISLAND

A web application research project that demonstrated how implementing gamification elements like "easter eggs," points, and badges can increase engagement and motivation, leading to significant improvement in the learning performance of elementary students.

ITEM RESPONSE THEORY-BASED COMPUTERIZED ADAPTIVE TESTING (IRT-CAT)

A fundamental framework that utilizes Item Response Theory (like the 3PL model) to build assessments that automatically adjust the level of question difficulty to a learner's estimated ability in real-time, providing targeted learning interventions.

READTHEORY

Uses AI-driven software to continuously note student performance and adjust the reading difficulty of exercises, ensuring a personalized learning path tailored to each student's specific reading level (K-12).

Technical Background

The hardware and software specifications used by the developers to complete the project are presented in this section. The project provides software specifications such as the software's name, description, and specification. The computer and other devices used to run the system are included in the hardware specification. These are necessary for completing, running, and implementing the project.

Software

Software is used to instruct a computer system to perform specific tasks and process required data. The developers utilized various software tools and platforms in the development of Literise, a gamified reading development application designed to assess and enhance learners' comprehension and oral fluency. The software listed below was used during the design, coding, testing, and implementation of the system.

Software Development Requirements

Table 1.1 Software Development Requirements

Software	Specification	Descriptions
Operating System	Windows 10	Windows 10 is a Microsoft operating system for PCs, tablets, and embedded devices. It provides a stable environment for development and testing.
Programming Languages	Java, PHP, C#	Java was used for developing the mobile application in Android Studio. PHP was used to build the RESTful API for backend communication, while C# was used for developing the web dashboard and management system.
Framework	ASP.NET MVC	ASP.NET MVC was used for building the teacher management system and web dashboard to handle analytics and monitoring.
Mobile IDE	Android Studio	Android Studio is the official integrated development environment (IDE) for Android,

		used for building the mobile application using Java.
Database	Microsoft SQL Server	SQL Server was used as a centralized database for secure data storage and management.
Cloud Hosting	Microsoft Azure	Azure was used for hosting the database, web dashboard, and API server to ensure scalability, reliability, and cloud backups.
API Server	PHP (with RESTful API)	The PHP-based RESTful API provides the bridge between the mobile app, web dashboard, and cloud database.
Version Control	GitHub	GitHub was used for version control and team collaboration throughout the project development.
Speech Processing	Azure Cognitive Services Speech SDK	This SDK was used to analyze oral fluency, perform speech recognition, and generate transcriptions.
Testing Tools	JUnit, PHPUnit, Selenium	These tools were used for unit testing, API testing, and automation testing to ensure system accuracy and reliability.

Table 1.1 presents the list of software used in the development phase of the proposed project. It shows the software names, versions or specifications, and their respective descriptions. Each tool was essential to ensure a smooth development workflow and reliable system integration.

Software Implementation Requirements

Table 1.2 Software Implementation Requirements

Software	Specification	Descriptions
Operating System	Windows 10, Android OS, iOS	The system is compatible with Windows 10 for the web and teacher dashboard, and Android/iOS for the mobile application.
Browser	Any Browser (Google Chrome, Microsoft Edge, Mozilla Firefox, Opera)	A browser is required to access the web-based teacher dashboard hosted on Microsoft Azure.

Table 1.2 lists the software used in the implementation phase of the project. It presents the software name, specification, and description. The system can be accessed through any compatible device and browser, ensuring accessibility and ease of use.

Hardware Development Requirements

Table 1.3 Hardware Development Requirements

Hardware	Specification	Descriptions
Laptop/PC	Intel Core i5 Processor, 8GB RAM, 512GB SSD, Windows 10	The developers used laptops with sufficient processing power and storage for coding, simulation, and testing.
Smartphone (for testing)	Android 10 or higher, 4GB RAM	The mobile device was used for running and testing the LITERISE Android application during development.

Internet Connection	Minimum 10 Mbps	A stable internet connection was required for accessing cloud services and API testing.

Table 1.3 lists the hardware used during the development of the proposed system. It displays the name, specification, and description of each hardware used to perform programming, testing, and deployment activities.

Hardware Implementation Requirements

Table 1.4 Hardware Implementation Requirements

Hardware	Specification	Descriptions
Device	Laptop, Computer, Smartphone, Tablet	Devices used to access the system, either through the web dashboard or mobile app.
Wi-Fi / Mobile Data	Minimum 5 Mbps	Internet connectivity is essential for system access, synchronization, and cloud database communication.

Table 1.4 presents the hardware used in the implementation phase of the proposed system. Since the system operates through the internet, users can utilize any device with an active internet connection to access the mobile app or teacher dashboard seamlessly.

CHAPTER III

DESIGN AND METHODOLOGY

This chapter presents the design and methodology used in conducting the study. It highlights the methodology, requirement analysis, sampling techniques, current technical situation, requirement documentation—both in-scope and out-of-scope—the design of the software, implementation plan, and the development and testing needed in conducting this research.

Methodology

This study develops and evaluates **LiteRise**, a gamified mobile app that enhances reading fluency and comprehension among Grades 4–6 students at **Tandang Sora Elementary School**. Using **Item Response Theory (IRT)**, the app adapts reading tasks to each learner's ability for personalized learning. An **exploratory sequential design** guides the research. The **qualitative phase** gathers insights from interviews to identify reading challenges and inform app design, while the **quantitative phase** tests LiteRise's effectiveness through pilot implementation. An **IRT-based pre-assessment** establishes reading baselines, followed by **gamified modules** aligned with **MELCs**, integrating rewards, streaks, and badges to sustain motivation. A **teacher dashboard** supports lesson uploads and progress tracking. **Progress is measured** through app-recorded reading

performance, while **success is defined** by improved fluency, positive feedback, and demonstrated usability during the pilot test.

Requirement Analysis

The requirement analysis initiated the development of LiteRise, where proponents brainstormed to define objectives based on challenges faced by students and teachers in reading comprehension and oral fluency. Through discussions and interviews, the proponents confirmed the need for a mobile application with adaptive learning, interactive gamification, and teacher monitoring tools. LiteRise was designed for Android devices to ensure accessibility, with online and offline functionality to accommodate limited internet access. Technical requirements, including software frameworks and hardware (Android phones/tablets for students, basic computers for teachers), were outlined. The project focused solely on reading comprehension and oral fluency, deferring other subjects to future iterations, ensuring alignment with educational goals and technical feasibility.

Sampling Technique

The sampling technique used in this study is purposive sampling. This method was chosen because it allows the researchers to intentionally select respondents who meet specific criteria that are directly relevant to the objectives

of the research. Purposive sampling, also known as judgmental or selective sampling, is a type of non-probability sampling where participants are chosen based on their suitability and ability to provide valuable insights related to the study.

In this research, the respondents will consist of Grades 4 to 6 students of Tandang Sora Elementary School who will serve as the test group for evaluating the LiteRise application. These students were selected because they belong to the age group where reading fluency and comprehension skills are actively developing, making them the most appropriate participants to assess the system's effectiveness. The selection also ensures that the participants can meaningfully engage with the app's adaptive reading modules and provide feedback on its usability and learning impact.

The purposive sampling technique enables the researchers to focus on a specific group of learners that aligns with the study's purpose of improving literacy through adaptive gamified learning. Data gathering will be conducted within the selected classes under the supervision of their teachers to ensure proper coordination and ethical implementation of the evaluation process.

Current Technical Situation

Tandang Sora Elementary School currently follows the traditional method of teaching reading and comprehension. Teachers conduct face-to-face classes

using printed materials, textbooks, and oral reading activities. Each school year, administrators assign teachers to handle specific grade levels, where they plan lessons, lead reading sessions, and assess students' understanding through quizzes and performance tasks. Students are expected to participate actively during reading exercises, while teachers evaluate their progress and submit results to the school's academic coordinator or principal for record keeping.

Requirement Documentation

In – Scope

Login and Authentication Module – This module enables users, including students and professors, to safely log into the system. User credentials are validated to guarantee suitable access levels, with students and teachers having their own dashboards and permissions.

Student Module – In This module, Students can use adaptive reading tasks, track their progress, and take part in interactive, gamified classes to increase comprehension and spoken fluency. Using the Item Response Theory (IRT) methodology, the system automatically modifies the difficulty of reading materials in response to the learner's performance.

Teacher Dashboard – Teachers are given an analytics dashboard to track student progress, identify reading issues, and generate performance reports. The dashboard promotes evidence-based instructional approaches for literacy development.

Gamification Features – Gamified components such as experience points (XP), badges, streaks, and level development are used in the program to motivate learners and keep them engaged while reading.

Pre-Test and Post-Test Evaluation – The method includes pre- and post-assessment exams to track progress in reading fluency and comprehension, ensuring that literacy grows over time.

Offline Mode Support – LiteRise has limited offline functionality, allowing learners to access preloaded reading materials and activities even without an online connection. Once connectivity is restored, any offline progress will be synced.

Out – Scope

Subjects Beyond Literacy – LiteRise only concentrates on vocal fluency and reading comprehension. This study does not cover other academic fields like science, math, or writing development.

Higher Grade Levels and Adult Learners – The application is just for pupils in grades 4 through 6, and it does not cover senior high school or adult education.

Integration with External Learning Management System (LMS) – LiteRise will not integrate or synchronize data with third-party LSM platforms like Google Classroom or Moodle during its present phase

Design of Software, Systems, Product and/or Processes

This section presents the overall design of the proposed system. It includes diagrams that show how the system was analyzed, structured, and developed based on the identified problems and user requirements. Each figure illustrates a specific part of the system, from problem analysis to data flow, architecture, and interface design.

Figure 3.1 Fishbone Diagram

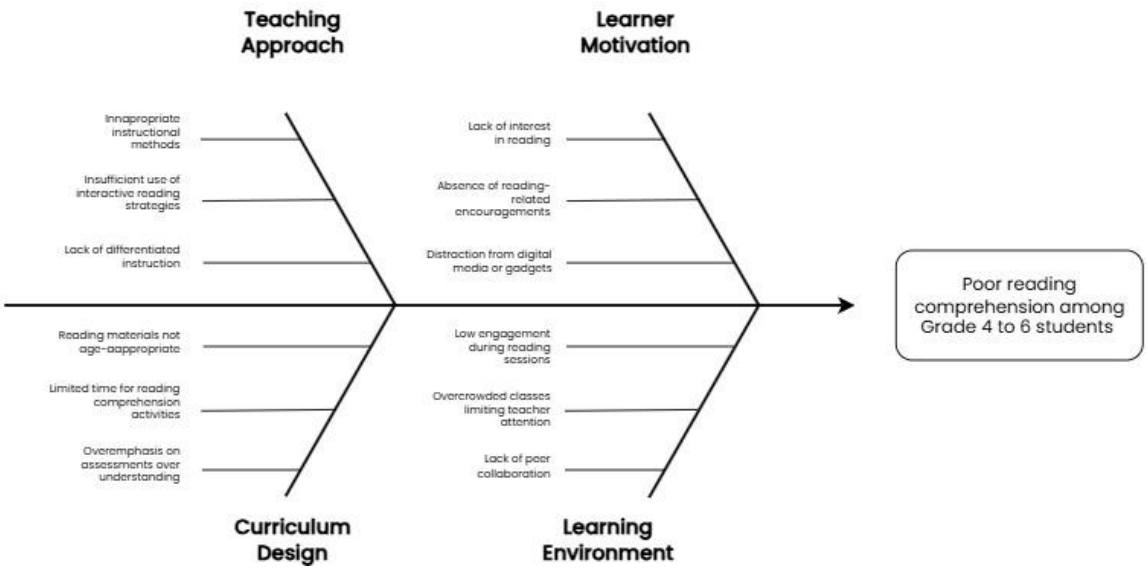

Figure 2 Fishbone Diagram

The Fishbone Diagram (Ishikawa Diagram) presents the root causes of poor reading fluency and comprehension among Grades 4–6 students. It identifies major contributing factors such as **Teaching Approach**, **Learner Motivation**, **Curriculum Design**, **Learning Environment,** and **Cu**. These causes guided the development of LiteRise, emphasizing adaptive digital learning, gamification, and accessibility.

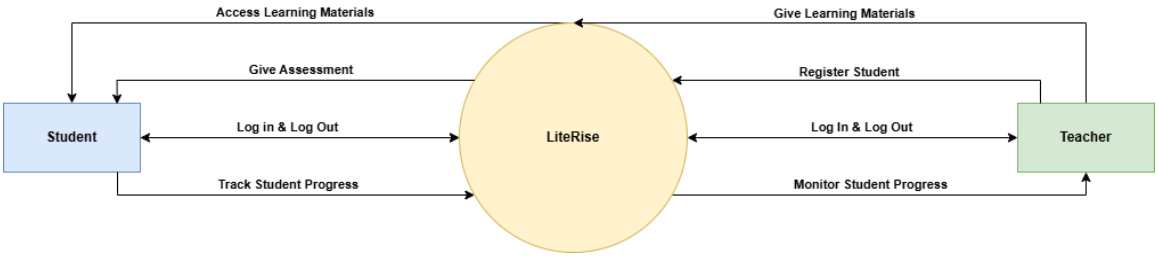

Figure 2.2 Context Diagram

The Context Diagram shows the overall boundary of the LiteRise system. It depicts the main entities interacting with the system — Students, Teachers, and the Database Server. Students use the mobile app to access reading modules and submit responses, while teachers access the dashboard to monitor progress. The database stores results, profiles, and activity logs.

Figure 2.3 Data Flow Diagram

The Data Flow Diagram (DFD) illustrates the flow of data within LiteRise.

- **Level 1** and **Level 2** break down detailed processes such as:
    1. Account Registration and Login
    2. Adaptive Reading Test (IRT-Based)
    3. Lesson Access and Gamified Activities
    4. Progress Tracking and Report Generation

These diagrams demonstrate how information moves between the user interface, system logic, and database.

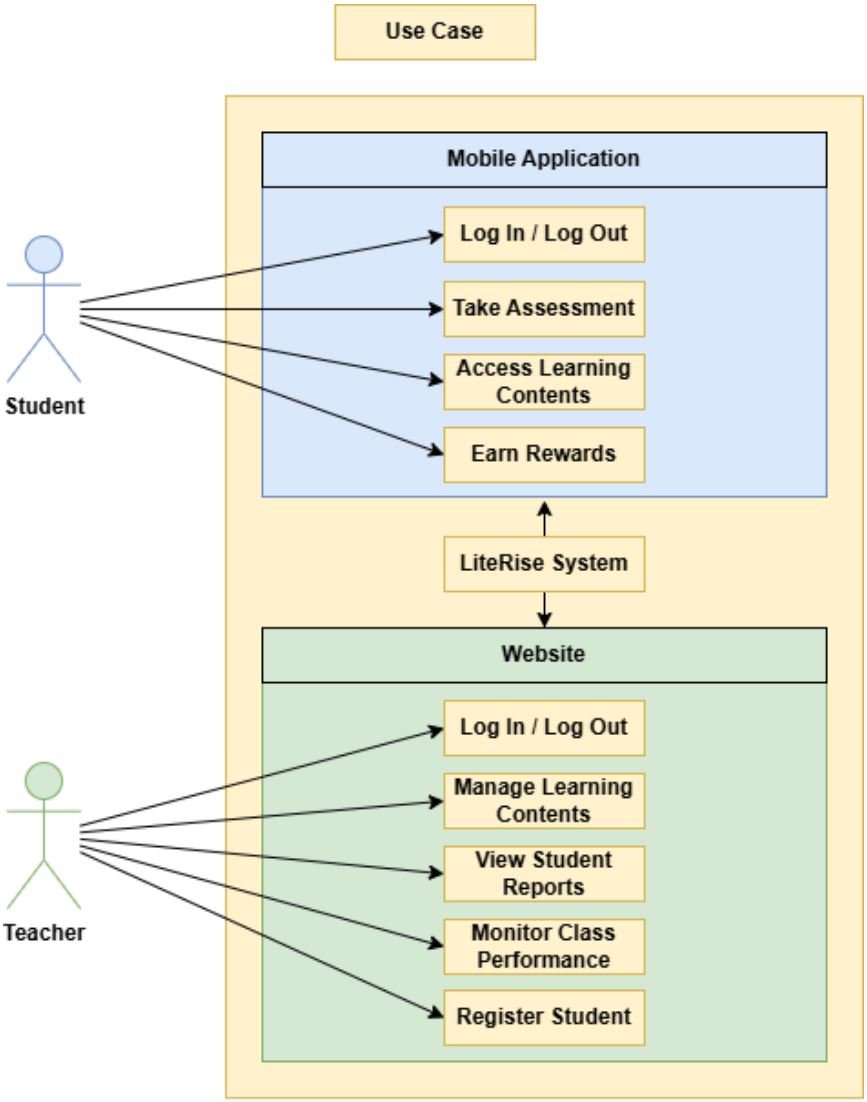

Figure 2.4 Use Case Diagram

The Use Case Diagram illustrates the interactions between **actors** (Students and Teachers) and the **system**. Students can register, take reading assessments, access lessons, earn rewards, and view progress. Teachers can log in, view student reports, and monitor class performance through the dashboard.

Figure 2.5 Flowchart

The System Flowchart depicts the step-by-step process of user interaction. It shows how the user begins at login, proceeds to adaptive reading tests, engages with gamified lessons, and receives feedback and progress updates. For teachers, it shows the data retrieval process for generating class performance reports.

Figure 2.6 Entity-Relationship Diagram / Entity-Relationship Model

The ERD or Entity–Relationship Model defines the structure of the database used in LiteRise. It includes main entities such as **User**, **Assessment**, **Reading Module**, **Progress**, **Rewards**, and **Teacher**. Relationships between these entities ensure proper data management for tracking student learning and performance analytics.

Figure 2.7 System Architecture

The System Architecture Diagram illustrates how different components of LiteRise communicate. It follows a **client–server architecture** where the **Android mobile app** serves as the client, connecting to a **cloud-hosted database and API**. The teacher dashboard, developed using ASP.NET MVC or a web interface, interacts with the same backend to display student performance.

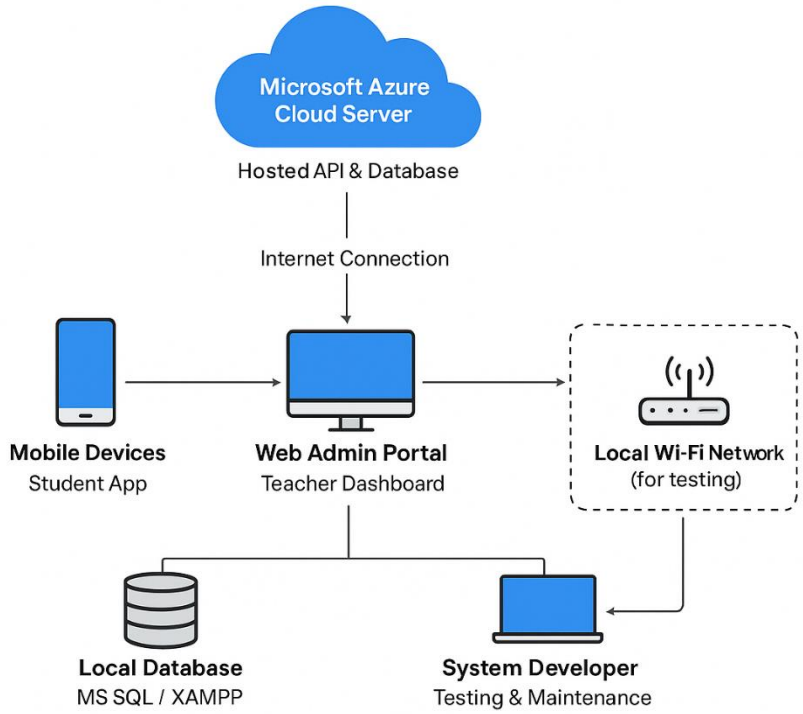

Figure 2.8 Network Diagram

The Network Diagram presents the connectivity of all system components. Mobile devices communicate with the central server through the internet (or local Wi-Fi during testing). The server is hosted on **Microsoft Azure**, ensuring secure data access, cloud backup, and scalability.

Figure 2.9 Block Diagram (Storyboard)

The Block Diagram (Storyboard) demonstrates the sequence of app screens and user experience. It shows the flow from **Login → Dashboard → Pre-Test → Lessons → Games → Rewards → Progress Report**. This storyboard visualizes the learner's journey and how engagement is maintained through adaptive and gamified design.

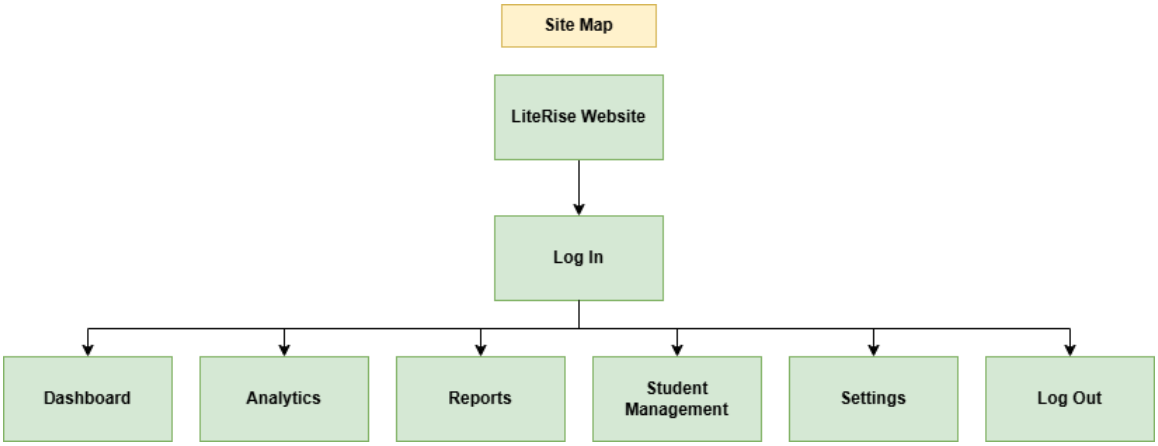

Figure 2.10 Site Map (For Web Site)

The Site Map illustrates the web-based teacher dashboard structure. It includes main pages such as:

- **Dashboard Overview**
- **Student Management**
- **Performance Analytics**
- **Reports**
- **Settings**
- **Logout**

This hierarchical design ensures intuitive navigation and efficient monitoring for educators.

Development and Testing

In the development of the proposed system, the researchers utilized a web hosting service and employed PHP as the main programming language for the

system's source code. The evaluation of the system will be based on the ISO/IEC 25010:2011 Software Quality Model, which provides standardized criteria for assessing software quality. The following quality characteristics will serve as the basis for evaluation:

1. Functionality
2. Reliability
3. Usability
4. Efficiency
5. Maintainability
6. Portability

In addition, ISO 9241-210:2019 will be applied to evaluate the system's user experience, ensuring that the system is both effective and user-friendly.

Data Analysis Plan.

The primary instrument used in this study was a survey questionnaire. The researchers utilized the weighted mean as the statistical method to evaluate the developed system according to the criteria adapted from ISO/IEC 25010:2011. The proposed system was assessed in terms of the following quality characteristics: functionality, reliability, usability, efficiency, maintainability, and portability.

The responses gathered from the evaluation were analyzed by computing the mean scores of the respondents based on the set criteria. The weighted mean was obtained using the formula below:

Formula: $\bar{X}\frac{\Sigma^{x}}{N}$

Weighted Mean: $\bar{X}$

Summation of Responses: Σ^{x}

Total Number of Respondents: N

A Likert scale was used to interpret the evaluation results, and the corresponding interpretation is presented below:

Scale	Range	Verbal Interpretation
1	4.51 – 5.00	Very Good
2	3.51 – 4.50	Good
3	2.51 – 3.50	Fair
4	1.51 – 2.50	Poor
5	1.00 – 1.50	Very Poor

Implementation Plan

To ensure the successful implementation of the **LiteRise Reading and Comprehension Monitoring System** at **Tandang Sora Elementary School**, the

proponents must follow a structured deployment process. The approval and support of the school administration are essential, as well as the active participation of teachers, students, and IT personnel throughout each phase. The following table outlines the series of strategies, activities, personnel involved, and duration required to accomplish the full deployment and evaluation of the proposed system:

Table 2: Implementation Plan

STRATEGY	ACTIVITIES	PERSON INVOLVED	DURATION
Approval from School Administrator	Submission of formal proposal and approval request for system deployment	Proponents and School Administrator	1 Day
System Installation	Installation and configuration of the LiteRise mobile app, teacher dashboard, and server API on Microsoft Azure	Proponents and IT Personnel	5 Hours
Hardware and Software Setup	Setting up required devices (Android phones, laptops) and configuring network access and MS SQL connections	Proponents and Administrator	1 Day
Information Dissemination	Distribution of flyers and orientation materials to introduce LiteRise to teachers and students	Administrator and Students	1 Day

System Orientation	Conducting short demos for teachers and students on how to use the app and teacher dashboard	Proponents and Teachers	1 Day
3-Day Training	Hands-on training and lectures on how to navigate the LiteRise app, manage student data, and interpret results	Administrator, Teachers, and Students	3 Days
Pilot Testing	Testing the system in real classroom conditions to identify bugs, gather feedback, and record performance data	Proponents, Teachers, and Selected Students	1 Week
System Evaluation and Feedback	Collecting user feedback, analyzing system performance, and implementing improvements	Proponents and Administrator	2 Days
Full Implementation	Deployment of final version to all target users and monitoring of post-deployment issues	Proponents and School Administrator	Ongoing (1 Month Monitoring)

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(follow APA style/APA format, hanging indent)

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