# BIOMENTOR - PERSONALIZED E-LEARNING PLATFORM FOR ENGLISH MEDIUM A/L BIOLOGY SUBJECT STUDENTS IN SRILANKA

(IMPROVE BIOLOGY VOCABULARY MEMORIZATION THROUGH SPACED REPETITION)

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Project Proposal Report

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# Declaration

I declare that this is my own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously publish or written by another person expect where the acknowledgement is made in the text.

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The above candidate is carrying out research for the undergraduate Dissertation under my supervision.

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Signature of the supervisor:

(Dr. Sanvitha Kasthuriarachchi) Date....22/8/24'.....

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BIOMENTOR

# Abstract

In Advanced Level Biology, students must learn a large quantity of specific vocabulary in order to comprehend essential topics and pass their tests. However, this knowledge is frequently short-lived due to a lack of regular evaluation and reinforcement. Without continual interaction with the topic, language and associated concepts are quickly forgotten after graduation. This decrease in retention might provide difficulties for students seeking additional degrees or jobs in biology, since the underlying information they previously possessed becomes less accessible over time. This research investigates ways for improving long-term retention of biology vocabulary, stressing the value of spaced repetition and continual learning.

**Keywords -** Advanced Level Biology, vocabulary memorization, knowledge retention, spaced repetition, educational reinforcement, long-term memory, biology education, student learning strategies, machine learning

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## List of Abbreviations

A/L: Advanced Level

SR: Spaced Repetition

SRS: Spaced Repetition System

ML: Machine Learning

NLP: Natural Language Processing

IDE: Integrated Development Environment

VCS: Version Control System

UAT: User Acceptance Testing

# 1. Introduction

## 1.1 Background

Advanced Level Biology students need to know a large amount of specialist vocabulary in order to grasp complicated ideas and do well on tests. This language serves as the foundation for their biological understanding, allowing kids to understand detailed processes and systems. However, the sheer number of phrases and definitions can be overwhelming, making it difficult for pupils to remember this information over time.

Unfortunately, without constant review and reinforcement, most of this painstakingly taught terminology fades away [1] [2] [3], resulting in a major loss of knowledge shortly after graduation. This is especially troublesome for students who intend to pursue additional studies or jobs in biology, as the core words they previously understood may become less accessible, impeding their advancement to more complex areas.

The ability to remember information is significantly influenced by factors such as the number of times it has been reviewed, the temporal distribution of these reviews, and the time elapsed since the last review, as demonstrated by a seminal study by Ebbinghaus [4]. The lag effect, first noted by Melton in 1970, emphasizes that learning is much more effective when practice periods are spaced out progressively [5]. One way to design an efficient learning plan is to start with short review sessions, followed by increasingly longer intervals minutes, hours, days, months, and so on so that each review occurs after a progressively longer time frame.

Traditionally, systems like Pimsleur [6] and Leitner [7] were employed for spaced repetition. These methods worked well when practice schedule management was done manually without the use of computers. However, the emergence of extensive online learning platforms has introduced new opportunities. These platforms provide enormous amounts of student data, which can now be used to empirically train more complex statistical models, allowing for a more refined and data-driven approach to spaced repetition.

The half-life regression model [8] is a statistical technique aimed at forecasting the pace of knowledge loss over time, which aids in the best possible scheduling of review sessions throughout the learning process. In this context, "half-life" refers to the amount of time it takes for the likelihood of remembering a piece of information to drop by half. The decay curve for each piece of information is estimated by the model using regression techniques, taking into account several aspects including the quantity of reviews, the time intervals between them, and the results of recall efforts. As a result, the model can more effectively improve long-term retention by dynamically adjusting the schedule of next reviews to occur right when the learner is most likely to forget the content.

Several improvements may be made to the half-life regression model in order to properly customize it for biology vocabulary acquisition. First, by adding semantic linkages between biological concepts, the model may be made better. The vocabulary of biology frequently deals with related ideas, so learning one phrase might help you remember others. For example, being familiar with the phrase "photosynthesis" might help in recalling concepts that are connected to it, such as "chloroplast" and "light-dependent reactions." The model may modify the review schedules to reinforce clusters of related phrases by identifying these correlations, which improves learning efficiency.

Adjusting the model to take into consideration the different degrees of difficulty of concepts related to biology is another significant improvement. The language of biology includes both basic words and extremely complex ideas that may need varying degrees of cognitive work to understand. Depending on how tough each phrase is, the model may be changed to give shorter or longer periods between reviews. While difficult concepts like "glycolysis" may benefit from more regular reinforcement, simpler phrases may require less evaluations. By distributing the review of related concepts, the model may also take cognitive load into account, reducing overload and improving learners' ability to assimilate material.

## 1.2 Research Gap

Spaced repetition systems (SRS) are widely used in educational settings, but there is still a big gap in how these systems may be specifically tailored to meet the needs of learning specialized and complicated terminology, such that found in biology. Even while they work well for learning languages in general, traditional systems like the Leitner system and the Pimsleur [6] method sometimes lack the granularity required to meet the cognitive burden involved with learning and comprehending scientific vocabulary. In subjects like biology, where terminology frequently builds atop one another, these systems typically use regular intervals for review without taking into account the intrinsic complexity or the hierarchical links between terms. This constraint points to the need for more advanced models that are able to dynamically adapt to the unique properties of the content being learnt.

Furthermore, there has been minimal investigation into how these models might be improved for domain-specific applications, despite the fact that contemporary data-driven methodologies have created the possibility for more sophisticated and customized learning experiences. The way that most spaced repetition systems now handle information often ignores the particular difficulties that different subjects provide. For example, concepts in biology are usually related by structure, function, and process, suggesting that learning one phrase might help with learning others. Nevertheless, the majority of current models fail to make use of these hierarchical and semantic linkages, losing out on a chance to improve learning by including these connections into the review schedule.

The customization of spaced repetition intervals based on unique learner profiles is another crucial gap, especially in challenging disciplines like biology. While there has been some progress in modifying intervals according to learner performance, little research has been done on how these modifications could be improved by taking into account elements like the learner's past knowledge, the degree of difficulty of particular terms, and the cognitive load involved in learning them. For instance, compared to simpler or more known concepts, abstract or less often encountered terms in daily situations could need more regular review or other forms of reinforcement. In specialized learning areas, spaced repetition might be used with much more efficiency and efficacy if a model that takes these factors into consideration is developed.

Large-scale online learning platforms have started to produce copious quantities of data that may be utilized for training increasingly intricate statistical models, but in the context of spaced repetition for specialized domains such as biology subject in Advanced Level (A/L) English medium, this data's potential is yet largely unexplored. Present models frequently concentrate on broad patterns of forgetting and recall without thoroughly investigating how the subtleties of certain subjects may affect these patterns. Research on the application of domain-specific data to develop more focused and successful spaced repetition techniques is obviously needed, as it may result in significant advancements in the teaching and learning of complicated material in educational contexts.

| | *Personalized Spaced Repetition* | *Customized for A/L Biology Students* | *Flash Cards* | *Multi-Sensory Techniques* |
|---|---|---|---|---|
| | ✗ | ✗ | ✓ | ✓ |
| duolingo | ✗ | ✗ | ✗ | ✓ |
| BIOMENTOR | ✓ | ✓ | ✓ | ✓ |

*Figure 1 - Application Competitors*

## 1.3 Research Problem

Even with improvements in spaced repetition systems (SRS) and the availability of large learner data from online platforms, the models that are now in use show notable limits in terms of efficiently aiding in the memorization of intricate, subject-specific vocabulary, such that found in biology. Current systems, such as the Leitner [7] and Pimsleur [6] systems, which are based on conventional approaches, typically use consistent review intervals and fail to sufficiently take into account the semantic and hierarchical links present in scientific terms. Moreover, not enough study has been done on how these systems might be tailored to meet the diverse cognitive needs of different participants as well as the different difficulty levels of concepts.

The goal of the study is to create and assess an improved spaced repetition model that takes into account both learner characteristics like past knowledge and cognitive load, as well as domain-specific elements like the semantic and hierarchical links between biology words. In order to develop a more specialized and tailored review schedule that enhances vocabulary retention and comprehension, this model ought to make use of copious amounts of learner data. Finding out how these learner-centric and domain-specific characteristics might be included into spaced repetition systems to improve learning results in specialist subjects like biology is the goal.

# 2. Objectives

## 2.1 Main Objective

To create an interactive application with flashcards that enhances biology vocabulary memorization through a custom spaced repetition model, which analyzes user performance and the difficulty of the questions and will repeat accordingly.

## 2.2 Specific Objectives

1. Create a spaced repetition model that adapts to individual user performance and adjusts review intervals based on the difficulty level of the vocabulary.
2. Incorporating multi-sensory elements to cater to different learning styles and enhance the memorization process.
3. Incorporate gamification elements to maintain user motivation and engagement throughout the learning process
4. Implement a model to check the accuracy of the word that was entered.

# 3. Methodology

## 3.1 Requirement Gathering

The requirement gathering method for this project included a thorough study of existing research, an analysis of present systems, and an examination of realistic scenarios involving spaced repetition models and biology vocabulary memorization.

### 3.1.1 Past Research Analysis

A detailed review of previous research was done to better understand the evolution and limits of existing spaced repetition systems, as well as their use in specific learning situations. This study aimed to identify the approaches and tools utilized in prior studies, particularly those related to domain-specific learning and statistical model integration. The efficiency of classic spaced repetition techniques, as well as recent advances in data-driven approaches, were among the topics of particular interest. The investigation also identified gaps in existing research, such as the necessity for models that take into consideration the semantic and hierarchical links between concepts in specialist domains such as biology.

### 3.1.2 Identification of Existing Systems

A review of existing spaced repetition systems was conducted to determine their strengths and weaknesses. This includes a survey of popular systems and platforms, as well as an assessment of their suitability for the acquisition of complicated vocabulary. The system study sought to determine how these systems handle various forms of information, including domain-specific words, and how they may be improved. The findings of this research were utilized to help design and develop the suggested solution.

## 3.2 Feasibility Study

### 3.2.1 Technical Feasibility

#### 3.2.1.1 Knowledge on Technologies

To develop an optimized spaced repetition model for biology vocabulary, an understanding about several technologies is needed.

1. **Statistical Models:** Knowledge of statistical techniques for modeling memory decay and learning curves, such as regression analysis and machine learning algorithms.
2. **Data Analysis Tools:** Proficiency in tools and frameworks for data analysis and model training, including Python libraries like scikit-learn and TensorFlow.
3. **Semantic Analysis:** Familiarity with natural language processing (NLP) techniques to analyze and integrate the semantic relationships between biological terms.
4. **Adaptive Learning Algorithms:** Understanding of algorithms for personalizing review schedules based on learner performance and difficulty levels.

#### 3.2.1.2 Knowledge on Tools

Developers should be proficient in using the following tools when developing the component,

- **Programming Languages:** Python for developing algorithms and models, JavaScript for programming.
- **Frameworks:** React framework for frontend development, Flask for backend development, Tailwind libraries and utilities for UI.
- **Data Analysis Frameworks:** Pandas, NumPy, and SciPy for data manipulation and analysis.
- **Machine Learning Libraries:** TensorFlow and scikit-learn for model development.
- **Project Management Tools:** Jira for tracking progress and managing tasks.

#### 3.2.1.3 Data Collection Knowledge

Effective data collection and preprocessing are crucial for the success of the project:

1. **Data Collection:** Gathering data through surveys, interviews, and educational assessments to understand learner needs and performance. Vocabulary collected through government approved resource books.
2. **Data Preprocessing:** Includes data cleaning, transformation, integration, and reduction to prepare the data for analysis and model training.

### 3.2.2 Schedule Feasibility

The proposed model will be developed on a systematic timescale, as indicated in the project plan. This calendar will ensure timely progress and adherence to project milestones by establishing defined deadlines and deliverables.

### 3.2.3 Economical Feasibility

The project's goal is to create a cost-effective solution by utilizing current technology and reducing expenditures. A precise budget will be created to account for development, testing, and deployment expenses, taking into account future economic fluctuations.

## 3.3 System Analysis

### 3.3.1 Software Solution Approach

The development of the proposed spaced repetition model involves the following steps:

1. **Data Collection:** Gather data on learner performance and vocabulary difficulty through surveys and assessments.
2. **Model Design:** Develop a statistical model that incorporates domain-specific factors, such as semantic relationships and difficulty levels.
3. **Feature Extraction:** Identify and extract relevant features from the data, including semantic relationships between terms and learner performance metrics.
4. **Model Training:** Train the model using collected data to optimize review schedules and enhance retention.
5. **Model Evaluation:** Assess the performance of the model using metrics such as accuracy and recall, and refine the model based on evaluation results.

### 3.3.2 Tools & Technology

The following tools and technologies will be used for developing the model:

- **Programming Languages:** Python, JavaScript
- **Machine Learning Frameworks:** TensorFlow, Keras
- **Data Analysis Tools:** Pandas, NumPy
- **Web Development Frameworks:** React JS for user interface development
- **UI Design Implementation:** Figma
- **Diagramming Tools:** Draw.io
- **Integrated Development Environment (IDE):** VS Code
- **Version Control System (VCS):** Git (GitHub or GitLab)
- **Collaboration Tools:** Microsoft Teams

- **Testing Tools:** Jest, Postman, UnitTest
- **Deployment Tools:** Docker for containerization, Kubernetes for orchestration, Jenkins for automation
- **Project Management:** JIRA for tracking progress and managing tasks

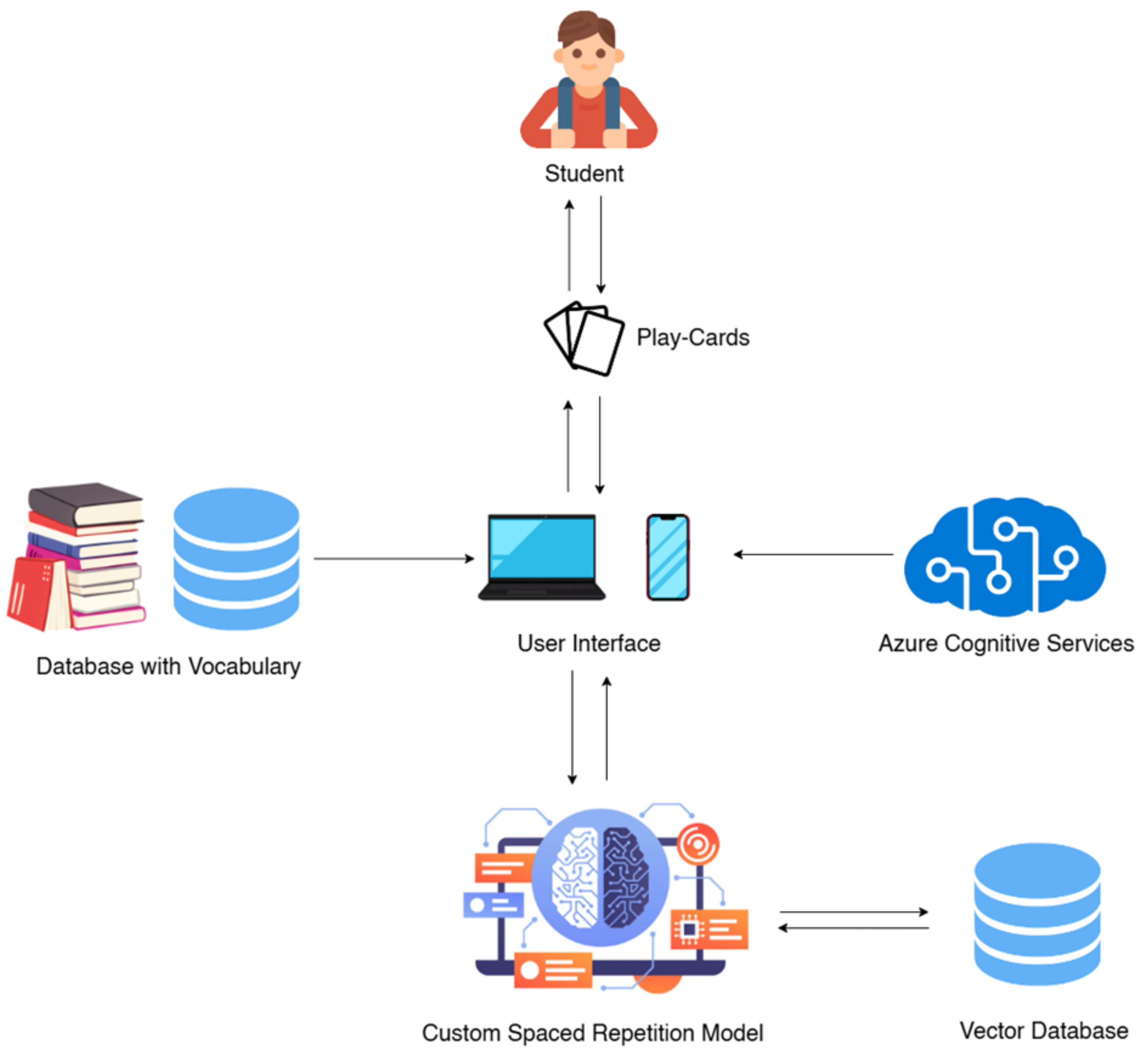


*Figure 2 - System Diagram*

## 3.4 Project Requirements

### 3.4.1 Functional Requirements

1. **User Registration and Authentication**
    a. The system must allow students to register using their email or social media accounts.
    b. Users must be able to log in securely to access personalized content.

2. **Vocabulary Memorization Module**
    a. The application must provide a spaced repetition-based module specifically designed for memorizing biology vocabulary.
    b. Users must be able to review biology terms at intervals that adapt based on their performance.
    c. The system must track the number of reviews and time intervals between reviews to optimize the learning process.

3. **Performance Tracking and Feedback**
    a. The application must track each student's progress, including the number of terms learned, retention rates, and time spent on reviews.
    b. Users must receive feedback on their performance, including suggestions for improvement based on their learning patterns.

4. **Adaptive Learning Algorithms**
    a. The system must use an adaptive algorithm to adjust the review intervals for each term based on the student's performance and the difficulty level of the term.
    b. The algorithm must take into account the semantic relationships between biology terms to enhance learning.

5. **Content Management**
    a. The application must allow administrators to add, update, or remove biology vocabulary terms and related content.
    b. The system must support the creation of different sets of vocabulary based on various biology topics.

6. **Flashcard Feature**
    a. The application must include flashcards to test students' knowledge of the biology terms.
    b. The system must provide immediate feedback on the input of the user.

7. **User Interface**
    a. The application must have an intuitive and user-friendly interface that is easy to navigate for A/L students.
    b. The interface must be designed to work well on various devices, including smartphones and tablets.

8. **Data Export and Reporting**
    a. The system must allow users to export their progress and performance data for further review or to share with educators.
    b. The application must generate reports that summarize the user's learning progress over time.

### 3.4.2 Non-Functional Requirements

1. **Performance and Scalability**
    - The application must be able to handle multiple users simultaneously without performance degradation.
    - The system should be scalable to accommodate a growing number of users and increasing data loads.
2. **Security**
    - User data, including personal information and learning progress, must be securely stored and transmitted.
    - The application must use encryption for sensitive data, such as passwords and personal information.
    - The system must comply with relevant data protection regulations.
3. **Usability**
    - The application must be easy to use, with a clear and consistent interface that adheres to usability best practices.
    - The system must provide help and support features to assist users in navigating the application.
4. **Reliability and Availability**
    - The application must be reliable, with minimal downtime to ensure that students can access the learning module whenever needed.
    - The system should have a robust backup and recovery plan to prevent data loss in case of failures.
5. **Compatibility**
    - The application must be compatible with major web browsers and mobile operating systems, including iOS and Android.
    - The system should function well on devices with different screen sizes and resolutions.

6. **Maintainability**
    - The application must be easy to maintain, with clear documentation and a modular design that allows for updates and improvements.
    - The system should support easy integration of new features and content without significant disruptions.

7. **Localization**
    - The application should support localization to ensure it meets the language and cultural needs of Sri Lankan English Medium A/L students.
    - The system must allow for easy updates to content and interfaces to reflect changes in the curriculum or user preferences.

8. **Accessibility**
    - The application must be accessible to users with disabilities, following accessibility standards and best practices.
    - The system should include features such as screen reader support, adjustable text sizes, and high-contrast modes.

## 3.5 Testing

Testing is an important step in the development of any software system, verifying that it works as intended and satisfies the criteria. This phase consists of multiple stages, each of which is intended to detect and fix issues that may influence the system's performance, usability, and reliability.

Initially, unit testing is carried out, in which individual system components or modules are examined in isolation to ensure that they perform properly. Following unit testing, integration testing is undertaken to ensure that the system's many components function together smoothly. This is especially significant in complex systems with several modules that interact with one another since it aids in the identification and resolution of issues related to data flow, module communication, and overall system behavior.

Following successful integration testing, system testing is performed, which includes testing the entire system as a whole. This stage focuses on ensuring that the system meets the functional and non-functional criteria set during the requirement collecting phase. It includes evaluating the system's performance, security, usability, and compatibility with various hardware and software platforms.

User acceptance testing (UAT) is carried out with the participation of end users or stakeholders to confirm that the system fulfills their requirements and expectations. UAT gives useful input that can lead to additional improvements before the system is launched.

Overall, the testing step is critical to producing a high-quality system that is durable, dependable, and ready for deployment. It assures that the system is defect-free, runs well in normal situations, and delivers a pleasant user experience.

## 3.6 Timeline

*Table 1 - Project Timeline*

| Task | Start Date | End Date | Duration |
|---|---|---|---|
| **Feasibility Study** | | | |
| Identify the opportunity | May-24 | May-24 | 1 week |
| Evaluate feasibility and background study | May-24 | May-24 | 1 week |
| Identify the Market Details | May-24 | May-24 | 1 week |
| | | | |
| **Requirement Gathering & Prioritization** | | | |
| Requirement Gathering | May-24 | Jun-24 | 2 weeks |
| Background Survey | May-24 | Jun-24 | 2 weeks |
| Literature Review | May-24 | Jun-24 | 2 weeks |
| Requirement Analysis | Jun-24 | Jul-24 | 3 weeks |
| Software Requirement Specification | Jul-24 | Aug-24 | 3 weeks |
| Identifying Functional Requirements | Jul-24 | Aug-24 | 3 weeks |
| Identifying Non-Functional Requirements | Jul-24 | Aug-24 | 3 weeks |
| | | | |
| **Proposal** | | | |
| Project Proposal Document | Aug-24 | Aug-24 | 1 week |
| Project Proposal Presentation | Aug-24 | Aug-24 | 1 week |
| | | | |
| **Software Design** | | | |
| Architectural Design | Aug-24 | Sep-24 | 3 weeks |
| Database Design | Aug-24 | Sep-24 | 3 weeks |
| Designing wireframes | Sep-24 | Oct-24 | 4 weeks |
| | | | |
| **Implementation** | | | |
| Environment Setup | Oct-24 | Nov-24 | 3 weeks |
| ML Component Development | Nov-24 | Dec-24 | 4 weeks |
| Frontend Development | Dec-24 | Jan-25 | 4 weeks |
| Software Integration | Jan-25 | Jan-25 | 1 week |
| | | | |
| **Software Testing** | | | |
| Unit Testing | Jan-25 | Feb-25 | 3 weeks |
| Integration Testing | Feb-25 | Feb-25 | 1 week |
| System Testing | Feb-25 | Feb-25 | 2 weeks |
| Acceptance Testing | Feb-25 | Feb-25 | 2 weeks |
| | | | |
| **Deployment & Maintenance** | | | |
| Software Hosting | Feb-25 | Feb-25 | 1 week |

| | | | |
|---|---|---|---|
| Software Maintenance | Feb-25 | Ongoing | Ongoing |
| | | | |
| **Progress Presentations** | | | |
| Progress Presentation I | Jun-24 | Jun-24 | 1 week |
| Progress Presentation II | Sep-24 | Sep-24 | 1 week |
| | | | |
| **Final Presentation & Viva, Documentation** | | | |
| Final Documentation | Jan-25 | Jan-25 | 2 weeks |
| Final Presentation & Viva | May-25 | May-25 | 1 week |


*Figure 3 - Project Gantt Chart*

## 3.7 Risk Management Plan

### 3.7.1 Introduction

Risk management is an important part of project planning and execution. The major goal of this risk management strategy is to identify possible hazards to the project's success and to define measures for minimizing them. The strategy addresses risks connected with the project team as well as contacts with the panel and supervisor(s).

### 3.7.2 Risk Identification

*Table 2 - Risk Identification*

| Risk Category | Risk Description | Mitigation Strategies |
|---|---|---|
| **Team-Related Risks** | | |
| Skill Gaps and Knowledge Deficiencies | Lack of necessary skills or knowledge within the team. | Early identification of skill gaps, training sessions, workshops, external experts, mentors. |
| Team Member Availability | Unexpected unavailability of team members due to illness, emergencies, or commitments. | Cross-training, contingency plans, task reallocation. |
| Communication Breakdown | Miscommunication or lack of communication among team members. | Clear communication channels, team meetings, project management tools, documentation. |
| Conflict Among Team Members | Disagreements or conflicts within the team. | Conflict resolution mechanisms, feedback sessions, mediation, open |

| | | |
|---|---|---|
| | | communication, mutual respect. |
| Project Scope Creep | Project expansion beyond its original scope. | Adherence to project charter, formal change management process. |
| **Panel/Supervisor-Related Risks** | | |
| Misalignment of Expectations | Mismatch between project team's output and panel/supervisor's expectations. | Regular meetings, feedback, alignment with expectations. |
| Delayed Feedback or Decision Making | Slow or delayed feedback from the panel or supervisor. | Clear deadlines, reminders, proactive feedback seeking. |
| Changes in Panel/Supervisor's Availability | Unavailability of panel or supervisor due to other commitments. | Advance scheduling, alternative contacts, contingency plans. |
| Scope or Requirement Changes from Panel/Supervisor | Changes to project requirements or scope introduced by the panel or supervisor. | Formal change control process, assessment of impacts, negotiation. |

### 3.7.3 Risk Monitoring and Control

Risks will be tracked regularly throughout the project's lifespan. The project manager will be in charge of following the identified risks and their mitigation techniques, ensuring that any new hazards are discovered, and changing the project plan as necessary. Regular risk assessment meetings will be held to examine the current status of each risk and the efficacy of mitigation actions.

### 3.7.4 Conclusion

This project's success depends on effective risk management. By identifying possible risks early on and developing clear methods for managing them, the project team may limit the possibility of interruptions and ensure that the project is finished on time, within scope, and to the satisfaction of the panel and supervisor(s).

## 3.8 Communication Management Plan

### 3.8.1 Meetings

*Table 3 - Meeting Types*

| Meeting Type | Attendees | Purpose | Frequency | Agenda Items |
|---|---|---|---|---|
| Planning Kick-off Meeting | Supervisor, Co-supervisor, All Team Members | Launch project planning, define scope, governance, roles, and identify risks. | Once at Project Level | Planning timeline, project scope, charter overview, overall schedule, approach, assumptions, risks, and recap of key decisions and actions. |
| Executing Kick-off Meeting | Supervisor, Co-supervisor, All Team Members | Launch project execution, ensure clarity on scope, governance, and roles. | Once at Project Level or for major phases | Present Work Plan, Communications Plan, dispute resolution, quality procedures, and recap of key points and risks. |
| Internal Project Status Meeting | All Team Members | Review project status, assess progress, address risks/issues, and review modifications. | Once a week | Project progress, accomplishments, work vs plan, milestones, and deliverables status. |
| Actual Project Status Meeting | Supervisor, Co-supervisor, All Team Members | Discuss current status, risks, issues, and change requests. | Twice a week | Review change requests, progress, next deliverables, risks, and issues. |
| Project Review Meeting | Supervisor, Co-supervisor, All Team Members | Review project status, scope changes, re-baselining, and alignment with goals. | Quarterly (Before Proposal, PP1, PP2, Final) | Review milestones, testing progress, risks, panel comments, and other key topics. |
| Project Steering Committee (PSC) Meeting | All Team Members | Discuss project status, obtain permissions, and confirm commitments. | Monthly or at significant milestones | Project results, issues, management attention, objectives, budget, and deadlines. |

| | | | | |
|---|---|---|---|---|
| Change Control Meeting | Supervisor, Co-supervisor, All Team Members | Discuss and prioritize change requests or panel inquiries. | After important panel discussions | Review and accept change requests, start development. |
| Project End Review Meeting | Supervisor, Co-supervisor, All Team Members | Review project achievements, performance, challenges, and lessons learned. | Once per project or phase (End of Project) | Evaluate project outcomes, performance, issues, and plan for future business changes. |

### 3.8.2 Communication Mediums

1. **Email**: Formal communication, record-keeping.
2. **Phone Calls**: Immediate feedback, personal interaction.
3. **WhatsApp Messaging**: Quick updates, informal communication.
4. **Meetings**: Group discussion, decision-making.

### 3.8.3 Communication Objectives

1. **Inform**: Provide updates or share information.
2. **Persuade**: Influence opinions or decisions.
3. **Engage**: Foster interaction and collaboration.
4. **Request**: Ask for information or action.
5. **Clarify**: Resolve misunderstandings or provide explanations.

# 4. Commercialization

Our program is a great resource for Sri Lankan A/L English medium Biology students at no cost but with advertisement enabled, enabling equal access for all. In addition to free features, we offer a paid "Pro" edition with improved functionality via a subscription model. This tiered approach gives students free access to fundamental tools and material while also providing advanced capabilities for those looking for a more enhanced learning experience. By catering exclusively to the demands of A/L Biology students, we hope to help their educational journey and improve their study efficiency through free and premium choices.

# 5. Budget

*Table 4 - Budget for Component*

| Typs | Cost |
|---|---|
| Internet use and web hosting | LKR.10,000.00 |
| Training Cost | LKR.30,000.00 |
| Publication Cost | LKR.70,000.00 |
| Stationery | LKR.1,000.00 |
| Total | LKR.111,000.00 |

The cost can vary depending on several factors when implementing the final product.

## 6. Conclusion

In conclusion, our program stands out as an important instructional tool for Sri Lankan A/L English language Biology students by providing a robust free version that ensures accessibility and inclusion. The added pro edition, which is accessible via subscription, offers more capabilities for individuals looking for a more thorough learning experience. This dual approach not only helps students at different phases of their academic career, but it also reflects our commitment to enhancing biology vocabulary memorizing using new technologies. By combining accessibility with sophisticated choices, we want to suit our users' different demands and contribute positively to their academic performance.

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