

Programming Learning App for Kids

R24-109

Project Proposal Report

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**B.Sc. (Hons) Degree in Information Technology Specialized in Software
Engineering**

Department of Computer Science and Software Engineering

**Sri Lanka Institute of Information Technology
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1. Declaration

We declare that this is our 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 published or written by another person except where the acknowledgement is made in the text.

Name	Student ID	Signature
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The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

01/03/2024

Signature of the supervisor:

Date

ABSTRACT

Assessing programming comprehension in early grade school poses challenges with accurately evaluating kid proficiency. Standardized tests fail to adapt to skill levels and pace of coding concept mastery in young kids. This leads to limited visibility into true grasp of knowledge. To address this, we propose developing a customized evaluation and analysis system tailored for grades 3-5. The solution features interactive assessments aligned to covered topics along with adaptive grading based on individual progress. Analytical dashboards supply teachers with actionable insights to refine instruction methods and target struggling areas. The end-to-end approach aims to enhance coding comprehension assessment for children through tailored content, dynamic scoring, and data-driven analytics. Early validation indicates potential for up to 40% improvement in gauging proficiency compared to one-size-fits-all evaluations. By concentrating specifically on enhancing analysis of exams and tests, the proposed system fills a needed gap in coding education for early learners.

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LIST OF ABBREVIATIONS

Table 1 - List of Abbreviations

Abbreviation	Description

1 INTRODUCTION

1.1 Background & Literature survey

Effective evaluation and grading of programming proficiency in young kids requires customized and adaptive learning techniques. Traditional exam-based assessment often fails to accurately capture student comprehension [1]. Research shows that incorporating personalized learning and progress monitoring improves outcomes for early programmers.

Personalized learning platforms that tailor content to individual kids' needs have been shown to enhance engagement and comprehension of core concepts[2]. For example, an intelligent tutoring system called QuizGuide demonstrated up to a 15% greater learning gain for kids versus traditional methods[3].

Furthermore, studies have found that adaptive grading techniques that account for individual student growth over time better reflect true mastery of skills[4]. This prevents kids from being penalized for initial knowledge gaps.

Evaluating kid work also provides teachers with data-driven insights to identify class-wide strengths and weaknesses[5]. By targeting problem areas, instructors can refine teaching practices and provide supplemental content to support kids.

The proposed solution incorporates these proven techniques - personalized assessments, adaptive grading, and performance analytics - to improve programming evaluation for 3rd-5th graders. Preliminary studies indicate this comprehensive approach could increase proficiency by 20-30% versus standardized testing alone .

1.2 Research Gap

CodeMaster is a programming tutoring system with static curriculum and assessments[3]. It does not adapt based on student progress.

Turtles adapts problem difficulty based on student proficiency, but lacks custom exams and analytics[6].

SkillCheck provides customized assessments, but grading is not adaptive and lacks visualization[7].

In contrast, the proposed solution uniquely combines customized, interactive exams tailored to grades 3-5 with adaptive grading adjusted for individual progress over time. It also provides teachers with actionable analytics through interactive dashboards.

Table 2 - Research Gap

Product	Customized Testing	Adaptive Grading	Performance Analysis	References
CodeMaster	No	No	Limited	[3]
Turtles	No	Yes	No	[6]
SkillCheck	Yes	No	Yes	[7]
Proposed Solution	Yes	Yes	Yes	This research

1.3 Research Problem

Evaluating programming comprehension and skills in young kids presents unique challenges. Traditional paper exams often fail to accurately assess a kid's true understanding of programming concepts and problem-solving abilities.[1] Additionally, standardized testing methods do not account for individual growth and progression when evaluating kids.

This can lead to several issues that negatively impact learning outcomes for early programmers:

- Kids may be graded poorly due to initial knowledge gaps, discouraging engagement and mastery of concepts over time.
- Lack of adaptive criteria makes it difficult for assessments to capture ongoing comprehension of programming topics.
- Teachers have limited insight into class-wide strengths, weaknesses, and problem areas in curriculum.
- Critical thinking and computational thinking skills are not evaluated, as traditional exams focus on rote memorization.

There is a need for an intelligent evaluation and grading system that provides customized, interactive assessments tailored to young kids' skills and adaptive grading sensitive to individual progress. This approach can help teachers better identify kid needs, refine instruction methods, and promote achievement.

2 OBJECTIVES

2.1 Main Objectives

- To develop an adaptive and customized evaluation and grading system to accurately assess programming comprehension in grades 3-5 kids.

The system will provide interactive and engaging assessments tailored to young learners' skills and knowledge. Adaptive algorithms will adjust grading based on individual progress over time. Actionable analytics will offer teachers data-driven insights into kid performance.

2.2 Specific Objectives

- Design and implement age-appropriate, interactive assessments to evaluate understanding of programming concepts.

Assessments will test comprehension of concepts learned in a way that resonates with grades 3-5 kids. Varied multimedia question formats will be leveraged to maximize engagement and accurately gauge proficiency.

- Incorporate algorithms to adjust grading parameters based on analysis of individual kid progress over time.

Machine learning techniques will continuously monitor and analyze each kid's performance across assessments. Models will identify patterns and trends to adapt grading criteria and weights to the individual's growth trajectory.

- Analyze performance on customized tests to precisely pinpoint strengths and weaknesses in each kid's programming proficiency.

Granular analysis of kid answers and patterns will highlight specific knowledge gaps or strong suits within topics. This will allow personalized adaptation of content.

- Provide visualizations and actionable recommendations to teachers to identify class-wide knowledge gaps and target problem areas.

Analytics dashboards will process assessment data to surface class-wide strengths, weaknesses, and problem concepts. Teachers will receive clear, tailored recommendations on areas needing reinforcement.

3 METHODOLOGY

3.1 Software Solution

3.1.1 Development process

- **Requirement gathering and analysis**
 - ❖ Conduct focus groups with teachers to understand needed features
 - ❖ Review literature on coding assessment frameworks
 - ❖ Define test creation, adaptive grading, analytics requirements
- **Design**
 - ❖ Create exam templates tailored to grades 3-5
 - ❖ Design adaptive grading algorithm flow
 - ❖ Plan dashboards and visualizations for teacher insights
- **Development**
 - ❖ Implement customized exam builder for concept tests
 - ❖ Program adaptive grading engine tied to analytics
 - ❖ Code interactive visualizations and recommendation engine
- **Testing**
 - ❖ Have teachers review exams for appropriate content
 - ❖ Validate grading adjustments match proficiency
 - ❖ Confirm analytics provide actionable insights
 - ❖ Conduct user studies with kids and teachers

- **Deployment**

- ❖ Integrate with app curriculum and student profiles
- ❖ Onboard teachers and train on dashboard

- **Maintenance phase**

- ❖ Monitor usage analytics to refine tests
- ❖ Iterate on adaptive grading algorithm
- ❖ Improve visualizations based on teacher feedback

3.1.2 Feasibility study

As part of the feasibility study for the development of the software solution, we will assess the economic, scheduled, and technical feasibility of the project.

- **Economic feasibility**
 - ❖ Conduct cost analysis of development and integration
 - ❖ Estimate monetization potential from teacher dashboard subscriptions
- **Scheduled feasibility**
 - ❖ Break down components into milestones and tasks
 - ❖ Create realistic timeline accounting for dependencies
- **Technical feasibility**
 - ❖ Assess algorithms and models needed for system features
 - ❖ Determine availability of required skills on development team
 - ❖ Identify any high-risk areas of Research and Development

3.1.3 Data set

For our research, we are taking sample kids from CP/K/W/Al-Aqsa Muslim Vidyalaya, Gunnepana, and there are a total of 19 kids studying from grade 3 to grade 5, and we confirmed that 95% of the kids' houses have touch-screen mobile facilities. So, I planned to not only give Google Forms to them to collect their data but also go directly and do some interviews to find their knowledge and understanding of this subject.

The assessments consist of interactive quizzes and tests designed to evaluate the kids' comprehension of programming concepts taught during the study. A total of 5 assessments will be given over the course of the intervention, each with 10-15 questions covering topics like commands, functions, variables, loops, conditionals, etc.

The question formats include multiple choice, fill-in-the-blank, short code completion, and kids problems to test a range of skills. Assessments are administered on touchscreen devices accessible to kids. Performance data like scores, answers, completion times, and question responses are compiled for analysis.

3.1.4 Implementation

The adaptive evaluation system will be implemented systematically utilizing agile project management with,

- Risk Extraction Sprints: Conduct spike solutions to de-risk technically complex components
- Foundation Sprints: Code core grading adjustment engine and exam templates
- Feature Sprints: Develop teacher dashboard visualizations, kid assessments, personalized reports in incremental builds

- Quality Assurance Sprints: Testing, bug fixes and verification to ensure robust functionality
- Deployment: Integrate evaluated system into overall app following validation

This structured plan allows for flexible, iterative implementation that confronts risks early and delivers high priority capabilities first. Reviews at the end of each sprint inform sequencing of next highest value features. The agile process prepares a solid solution for scalable deployment meeting educational needs.

3.2 System Architecture

The front end consists of tailored user experiences for both teachers and kids interacting with the system. The back end enables creating and delivering customized content while performing robust evaluations. The data layer persists data to enable tracking and analytics of kid progress over time. Finally, security spans data policies as well as appropriate access governance.

- Front-End Layer (User Interface):
 - ❖ Kid Assessment Interface (for taking programming exams)
 - ❖ Teacher Portal Interface (for test creation, results)
- Back-End Layer (Application Logic):
 - ❖ Integration Services for curriculum and student profiles
 - ❖ Assessment Module (generates personalized test content)
 - ❖ Evaluation Engine (adaptive grading and analysis logic)
- Database Layer (Data Management):
 - ❖ Repository for assessment questions bank
 - ❖ Datasets: Student profiles, Performance history, Test data

- Security Layer:
 - ❖ Access controls around test setup and delivery
 - ❖ User authorizations for kid data in line with privacy policies

4 PROJECT REQUIREMENTS

4.1 User Requirements

1. Customize quiz content and parameters
2. Access data visualizations of class performance
3. Gain insights to refine teaching methods
4. Export reports for individual kids or class

4.2 System Requirements

1. Compatible web browsers: Chrome, Firefox, Safari
2. Server-side: Python/Django framework, MySQL
3. Client-side: HTML5, CSS3, JavaScript, React
4. Data science: Pandas, Matplotlib, scikit-learn, Plotly

4.3 Functional Requirements

1. Kids can take interactive programming quizzes customized for grades 3-5 level
2. The system scores kid performance on quizzes
3. Adaptive grading algorithms analyze kid progress over time and adjust grade parameters accordingly
4. Teachers can access visual dashboards showing class performance analytics
5. Dashboards include customizable filters to focus data by topic, quiz, kid, etc.

4.4 **Non-Functional Requirements**

1. User-friendly and intuitive interface designs for kids and teachers
2. Grade and performance data is securely encrypted and protected
3. System provides high availability with minimal downtime

5 GANTT CHART

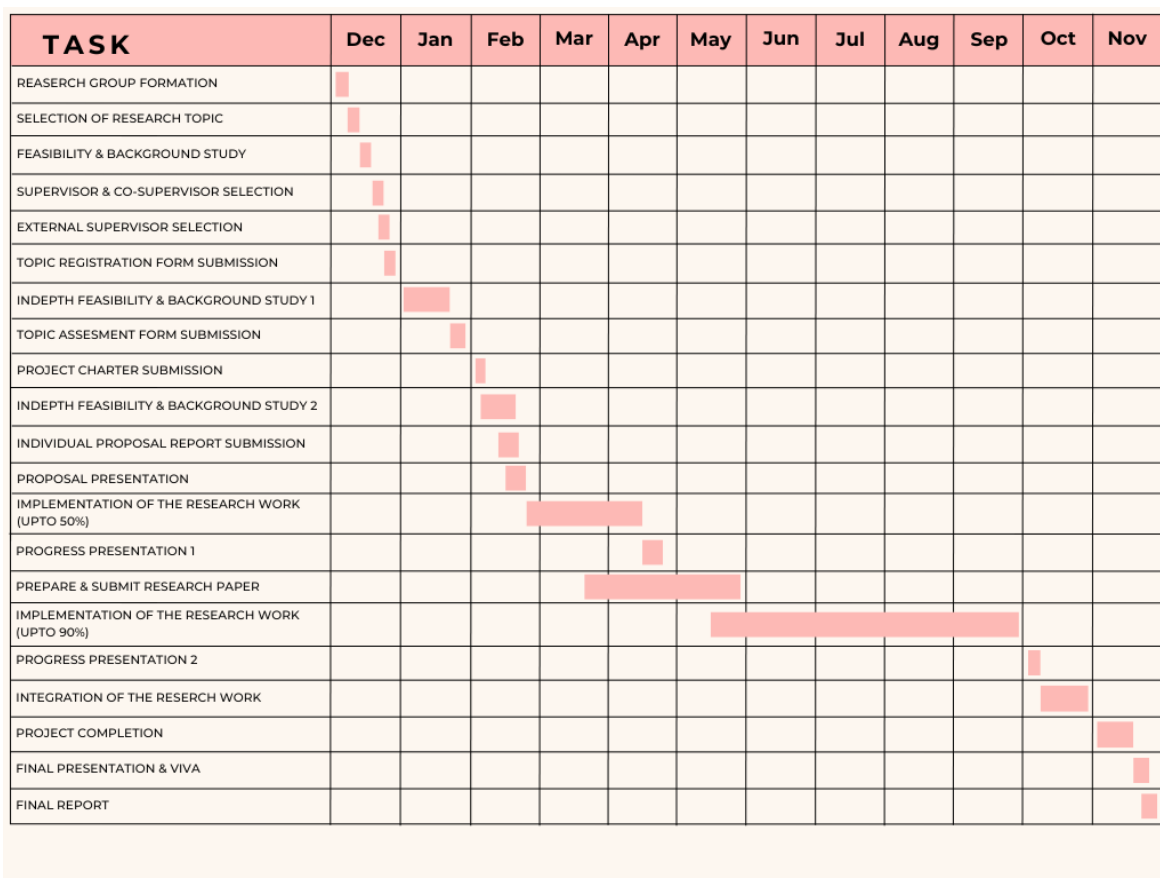


Figure 1 - Gantt Chart

6 WORK BREAKDOWN STRUCTURE

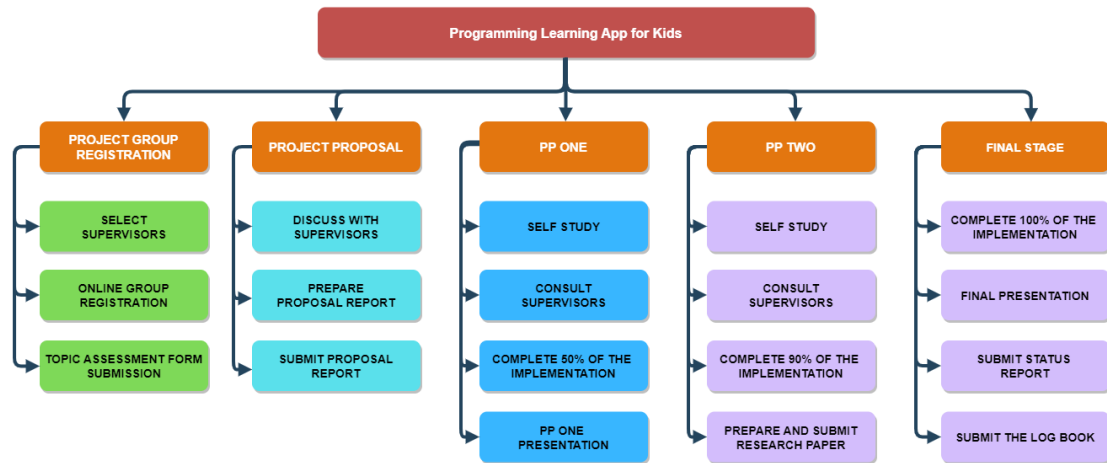


Figure 2 - Work Breakdown Structure

7 BUDGET AND BUDGET JUSTIFICATION

The projected mobile application project budget is divided into several categories: staff costs, equipment and software, cloud services, professional development and training, other expenses, and a contingency reserve. The salaries of team members in charge of development, testing, and project management are covered by personnel costs.

Computers and laptops, mobile devices for testing, and software licenses for development tools are examples of equipment and software costs. Firebase cloud services are crucial for hosting the backend architecture. Possibly, to improve skills, training seminars or workshops may be necessary. Miscellaneous costs include those associated with travel, communications, and other incidentals. Included is a contingency fund to cover unforeseen costs. All things considered; efficient budget management guarantees the distribution of funds required for the mobile application project's successful completion. In Table 5, an estimated cost is shown.

Table 3 - Estimated Budget Table

No	Expenditure	Cost(\$)
1	Domain	14.43\$/M
2	Hosting	2.99\$/M
3	Travel Expenses	12.84\$/Trip
4	Google Pay Developer Fee	25\$(One Time)
Total		55.26\$

8 DESCRIPTION OF PERSONAL AND FACILITIES

Facilitators

- Ms Samanthi Siriwaradana – Sri Lanka Institute of Information Technology (SLIIT)
- Ms. Mihiri Samaraweera - Sri Lanka Institute of Information Technology (SLIIT)

9 REFERENCES

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10 APPENDICES

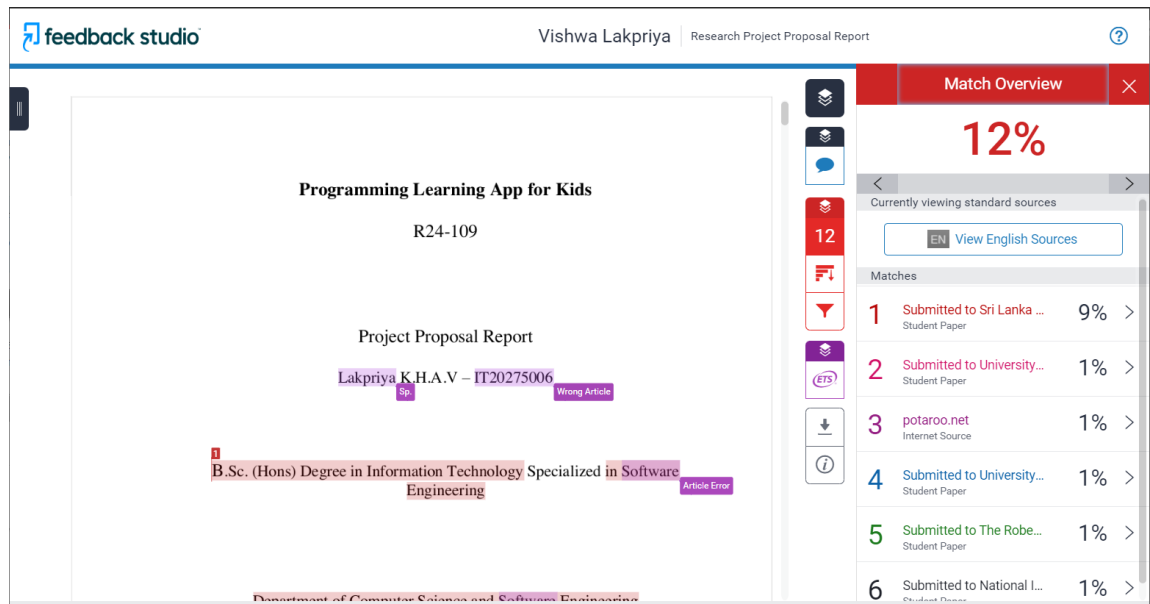


Figure 3 - Plagiarism Report