Children's Learning Platform

A System that Generates AI-Based Personalized Learning Content for Children

GROUP: 11
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Contents

1 Complex Engineering Problem Statement

Developing a holistic AI-powered learning platform for children in Bangladesh involves intersecting challenges in Educational Technology (EdTech), Real-time AI, and Low-Latency System Design. The core engineering complexities are:

Context-Aware Conversational AI

Building a voice assistant for children under 10 requires understanding "Banglish" and child-specific speech patterns. Crucially, the AI must not be a generic chatbot; it must act as a "Lesson Validator." It needs to read the specific lesson context (e.g., "Math Chapter 1") and generate relevant oral queries to verify understanding without hallucinating facts.

Hybrid Content Delivery & Adaptive Progression

The platform must seamlessly blend static content (video lessons, standard quizzes) with dynamic AI interactions. The challenge lies in creating a unified "Knowledge Graph" that updates based on both static quiz scores and AI conversation analysis. The system must dynamically recommend whether a student should proceed to the next module or retake a lesson based on this hybrid data.

System Latency vs. Resource Constraints

Delivering rich media (lessons) and real-time AI responses on a student-friendly budget requires a highly optimized architecture. We must balance "Storage-Heavy" tasks (serving video lessons) with "Compute-Heavy" tasks (AI inference) while keeping the user experience instant and smooth.

2 Roles and Work Distribution

The project work is divided into clearly defined roles to ensure effective coordination and quality.

Table 1: Team Roles and Responsibilities

Role	Name	Responsibilities
Supervisor	Dr. Anindya Iqbal	Project guidance, technical review, progress monitoring, evaluation
Team Lead	Tanvir Islam (Optimizely) ; Asif Islam (Optimizely)	Project planning, system design, requirement analysis, documentation
Developer (Frontend)	Navin Nawar ; Nujhat Sadia ; Sadia Naushin	User interface design, web integration, voice interaction UI
Developer (Backend)	Shatabdi Chowdhury ; Tasnimzaman Tanmi	AI model integration, backend development, speech processing pipeline
QA Engineer	Shatabdi Chowdhury ; Navin Nawar	Testing voice accuracy, AI responses, child safety constraints, bug fixing

3 Background and Market Study

3.1 Market Context

The global EdTech market has experienced exponential growth, driven by increasing digitalization of education and recognition that traditional one-size-fits-all approaches fail to address individual learning needs. The demand for personalized learning solutions has intensified, particularly in developing markets like Bangladesh.

3.2 Educational Challenges Landscape

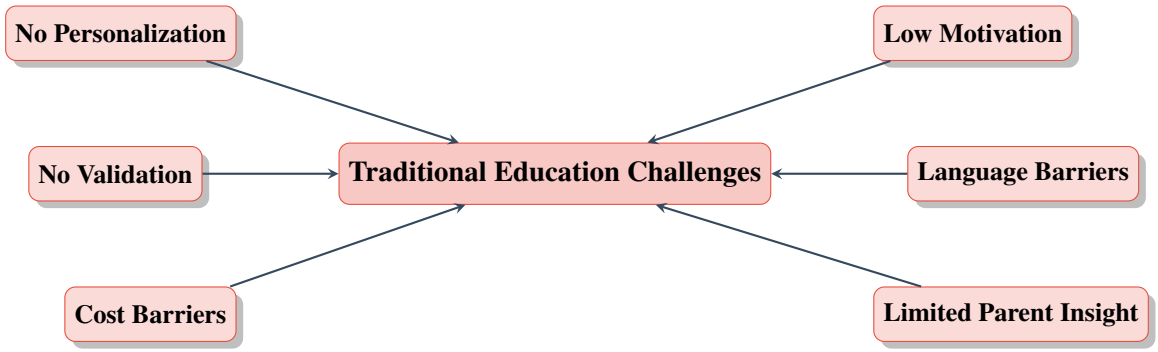


Figure 1: Six Major Educational Challenges in Current Systems

Challenge 1: Lack of Personalization

Teachers managing 30-50 students cannot tailor content to individual learning paces, styles, and comprehension levels. This results in some students being left behind while others remain unchallenged.

Challenge 2: Limited Parent Visibility

Parents lack real-time insights into children's learning progress, specific knowledge gaps, and areas of difficulty, preventing timely intervention.

Challenge 3: Engagement Deficit

Static learning methods and passive content lead to low motivation. Students find learning boring when content doesn't resonate with their abilities.

Challenge 4: Cost Barriers

Quality personalized education through private tutors is expensive and inaccessible to most families, creating educational inequality.

Challenge 5: Language Limitations

Most international platforms lack comprehensive Bangla support, creating barriers for students comfortable in their native language.

Challenge 6: Validation Gap

Existing systems lack mechanisms to validate actual understanding versus superficial engagement.

3.3 Target Market Segmentation

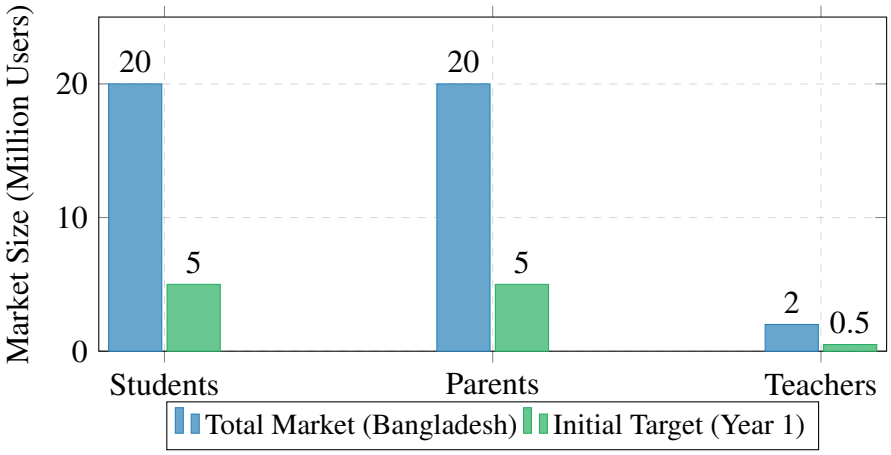


Figure 2: Target Market Size in Bangladesh

Primary Users: Students aged 9-14 years (Class 3 to Class 8) in Bangladesh
Secondary Users: Parents seeking visibility and teachers requiring class insights
Geographic Focus: Bangladesh initially, expanding to South Asian markets

3.4 Market Opportunity Analysis

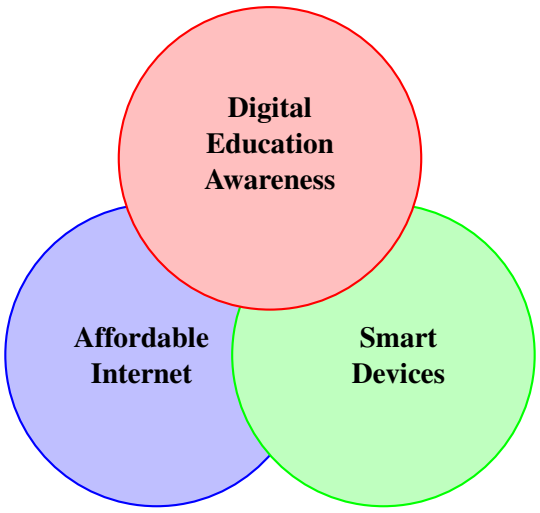


Figure 3: Convergence Creating Market Opportunity

4 Overview of Solution Strategy

To address these challenges, we have adopted a **Hybrid Microservices Architecture** that integrates a robust Learning Management System (LMS) with an AI Intelligence Layer.

- **The Core LMS Engine:** This layer manages the structural foundations: User Authentication, Lesson Content Delivery, Static Quizzes, and Group/Social features. It ensures reliable access to educational materials stored in the cloud.
- **The AI-Tutor Loop:** Sitting on top of the LMS is the AI layer. After a student completes a static lesson, the AI initiates a "Listen-Think-Respond" voice session to test deep understanding. The AI uses the lesson's metadata to frame its questions.
- **Unified Progress Tracking:** Both the Static Quizzes and the AI Oral Sessions feed data into a central "Adaptive Engine." This engine calculates the student's mastery level and dynamically updates their daily goals and recommended content path.

Technical Methods

This section outlines the technologies selected to implement the solution, prioritizing performance, accuracy, and cost-efficiency.

A. The Intelligence Layer (AI & NLP)

Large Language Model (The Brain): Llama 3 (8B)

Role: Acts as the conversational tutor, processing child speech to generate context-aware educational responses.
Justification: Llama 3 via Groq API offers excellent reasoning capabilities and near-instant inference speed, critical for maintaining a child's attention.

Speech-to-Text (The Ear): Whisper Large-v3

Role: Transcribes spoken Bangla into text.
Justification: Hosted via Groq, this model demonstrates superior zero-shot performance in Bangla, effectively handling background noise and indistinct child speech.

B. The Interaction Layer (Voice Output)

Text-to-Speech (The Mouth): Microsoft Edge TTS

Role: Converts AI text responses into natural-sounding Bangla speech.
Justification: Provides high-quality, neural-network-based Bangla voices that sound friendly rather than robotic, essential for engaging young users.

C. Core Application Stack

Frontend: React.js (PWA)

Role: Provides a unified interface for watching video lessons, taking quizzes, and chatting with the AI. PWA ensures the app works on low-end devices.

Backend: FastAPI (Python)

Role: The central orchestrator. It handles API requests for lessons, manages user groups, and routes voice data to the AI services. Python is selected to maintain a single language stack for both App Logic and AI Logic.

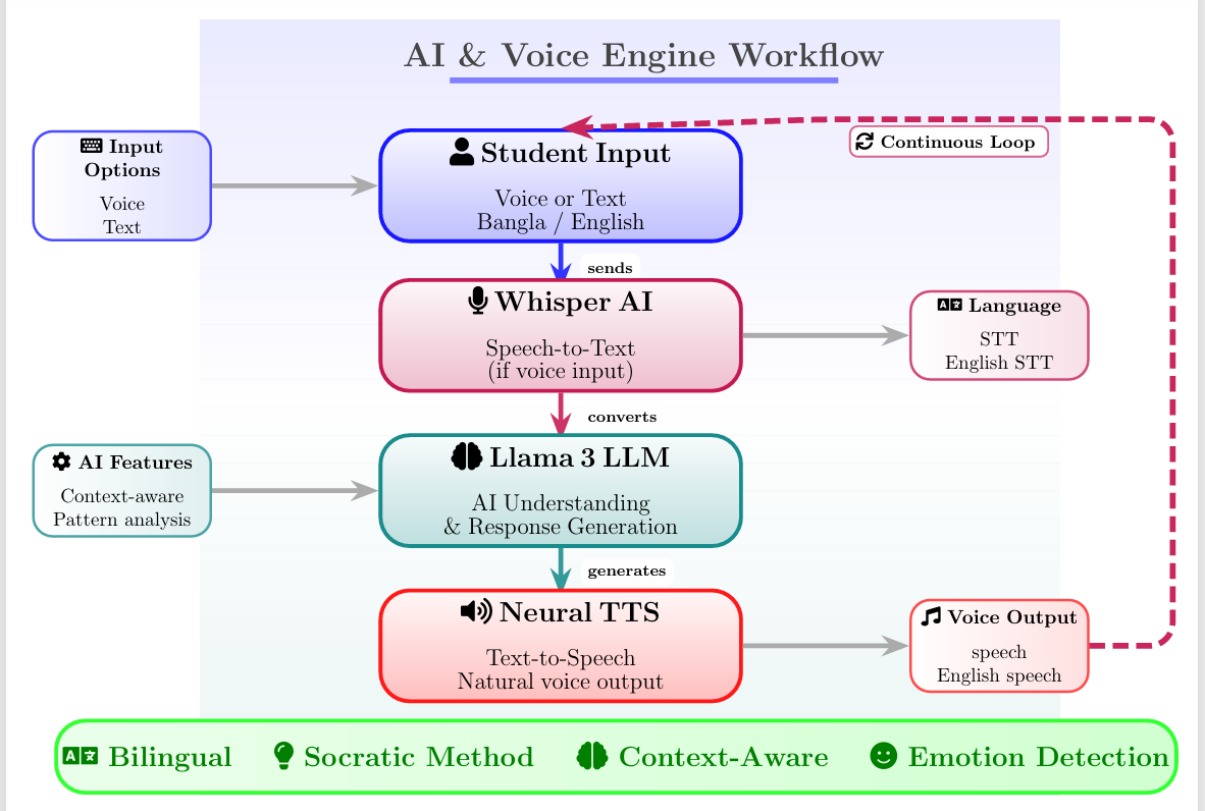
D. Data & Content Management

Database: MongoDB (NoSQL)

Role: Stores User Profiles, Lesson Structures, and Progress Logs.
Justification: Its flexible JSON-like structure allows us to easily store complex, hierarchical educational data (e.g., Courses → Chapters → Quizzes) and AI conversation logs without rigid schema migrations.

Media Storage: Cloud Object Storage

Role: Hosting for heavy static assets (Video Lessons, Images).
Justification: We store large media files in the cloud (e.g., Cloudinary/AWS S3) and store only their access URLs in MongoDB. This keeps the database lightweight and fast while ensuring media is delivered via CDN.



5 Comparison of Existing Solutions vs. Proposed Solution

5.1 Competitive Landscape Overview

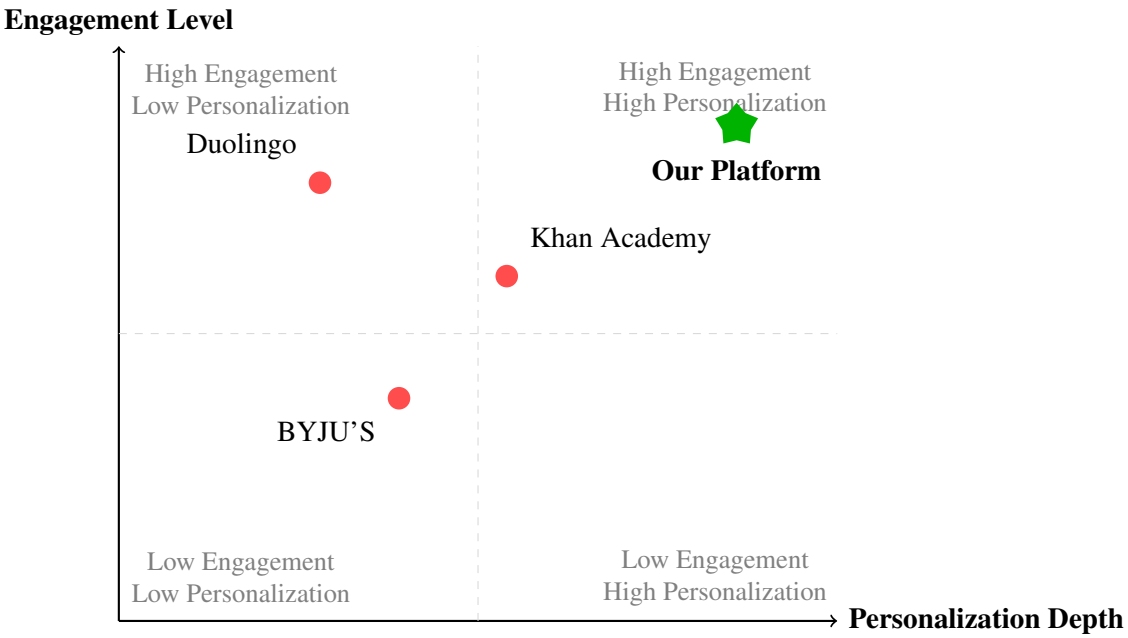


Figure 4: Competitive Positioning Map

5.2 Detailed Competitive Analysis

BYJU'S Analysis

Strengths:

- Video-based learning with animated content
- Adaptive practice questions
- Parent dashboard for progress monitoring

Critical Limitations:

- No emotion/frustration awareness
- High cost (inaccessible to most users)
- Passive learning risk (watching != understanding)
- Limited Bangla support
- No interactive hands-on learning elements

Duolingo Analysis

Strengths:

- Micro-lessons and spaced repetition
- Streak-based motivation
- Highly engaging interface

Critical Limitations:

- Only for language learning (not academic subjects)
- Surface-level personalization
- No academic integration

Khan Academy Analysis

Strengths:

- Comprehensive subject coverage
- Socratic AI tutor (Khanmigo)
- Teacher dashboard with insights
- Free and accessible

Critical Limitations:

- Complex for very young children
- Limited personalization depth
- Minimal gamification
- Limited Bangla content
- Traditional quiz format without interactive manipulation

5.3 Feature Comparison Matrix

Table 2: Comprehensive Feature Comparison

Feature	BYJU'S	Duolingo	Khan	Our Platform
AI Personalization	Partial	Partial	Partial	**Comprehensive**
Emotion Detection	No	No	No	**Yes**
Bangla Support	Limited	No	Limited	**Full**
Social Learning	No	No	No	**Yes**
Gamification	Basic	High	Low	**Comprehensive**
Parent Dashboard	No	No	No	**Enhanced**
Cost	High	Free/Paid	Free	**Affordable**
Content Generation	No	No	No	**AI-Generated**
Real-time Adaptation	Limited	Limited	Limited	**Complete**
Peer Competitions	No	No	No	**Yes**
Voice Interaction	No	Limited	No	**Bilingual**
Interactive Drag-Drop	No	No	No	**Yes**
Hands-on Discovery	No	No	No	**Yes**

5.4 Our Platform's Unique Value Propositions

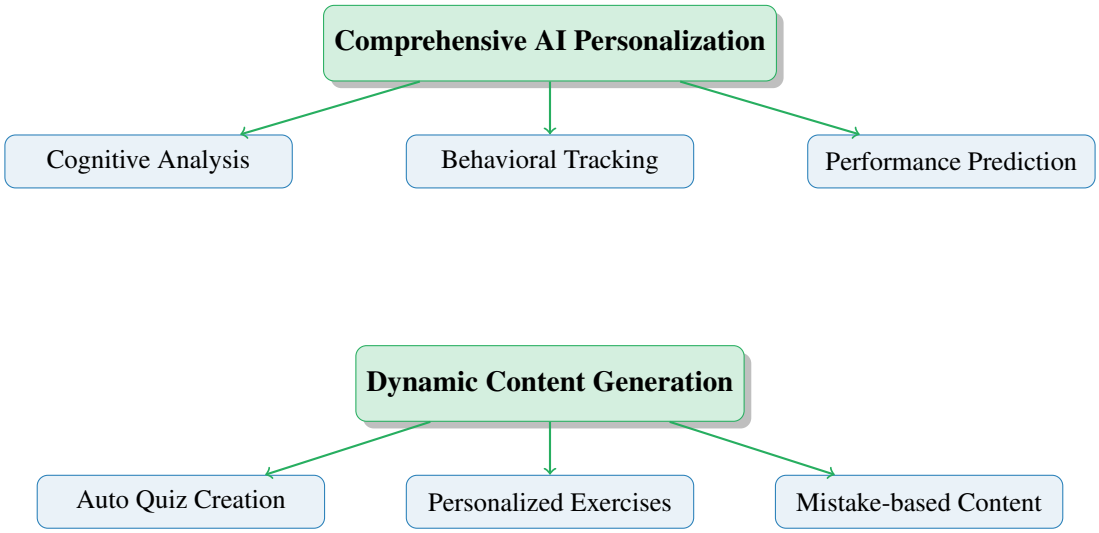


Figure 5: Core Differentiating Features

Comprehensive AI-Driven Personalization

Our platform integrates multiple dimensions unlike partial solutions from competitors:

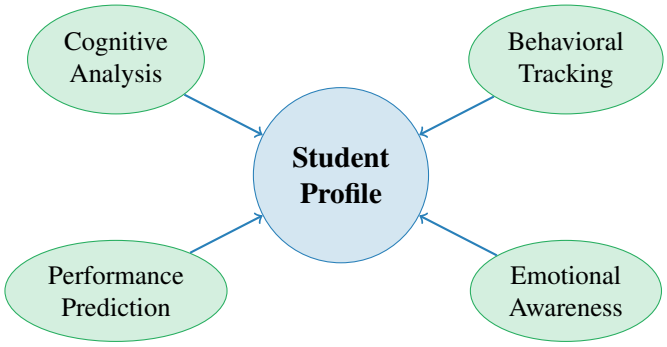
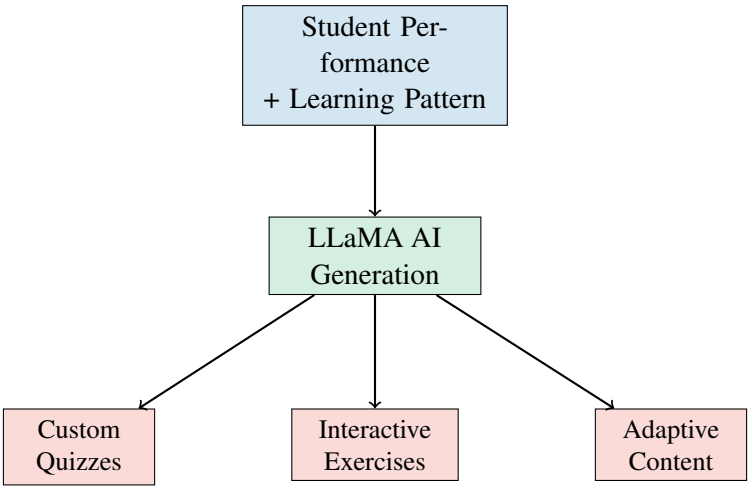


Figure 6: Multi-Dimensional Personalization System

Key Components:

- **Learning Analytics:** Identifies patterns, strong/weak areas through continuous assessment
- **Content Engagement:** Monitors scroll patterns, actual time spent vs. expected
- **AI Tutor Sessions:** Tracks frustration levels to adjust interaction approach
- **Daily Goals:** Creates achievable targets based on capability estimation

Dynamic Content Generation Engine



Beyond recommending existing content, we generate:

- Automatic quiz generation tailored to student level
- Mistake-related content addressing specific errors
- Spaced repetition based on individual retention
- Multi-format delivery (text/voice, English/Bangla)
- Interactive fill-in-the-blank exercises (grammar, math) with drag-and-drop interfaces
- Contextual learning activities that teach concepts through discovery rather than memorization
- Gamified concept exploration (e.g., pronoun hunts, auxiliary verb challenges)

Enhanced Engagement Ecosystem

Feature	Implementation
Socratic AI Tutoring	LLaMA-based AI guides with questions, not direct answers, promoting critical thinking
Gamified Learning	Interactive quests, badges, visual progress indicators
Healthy Competition	Student-created & weekly contests with dual rating system
Peer Engagement	Study groups enabling collaborative learning
Interactive Exercises	Drag-and-drop grammar, fill-in-the-blank math, hands-on concept discovery replacing rote memorization

Stakeholder-Specific Dashboards

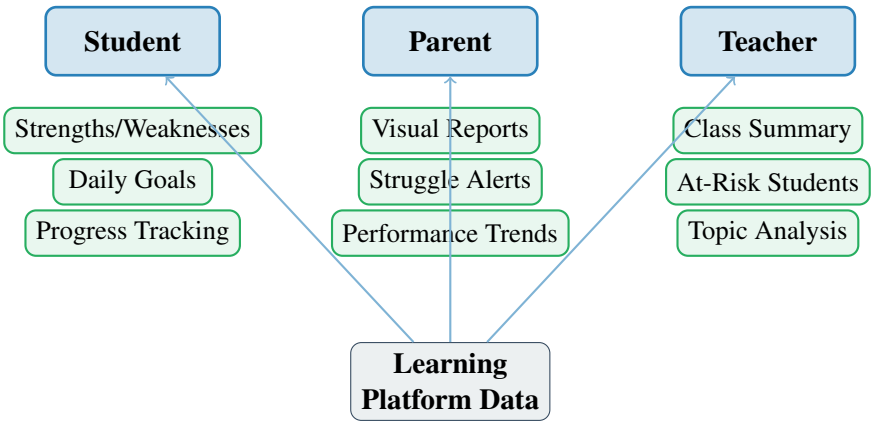


Figure 7: Personalized Insights for Each Stakeholder

Interactive Hands-On Learning Approach

Unlike traditional platforms that rely on rote memorization, our system implements tactile, discovery-based learning:

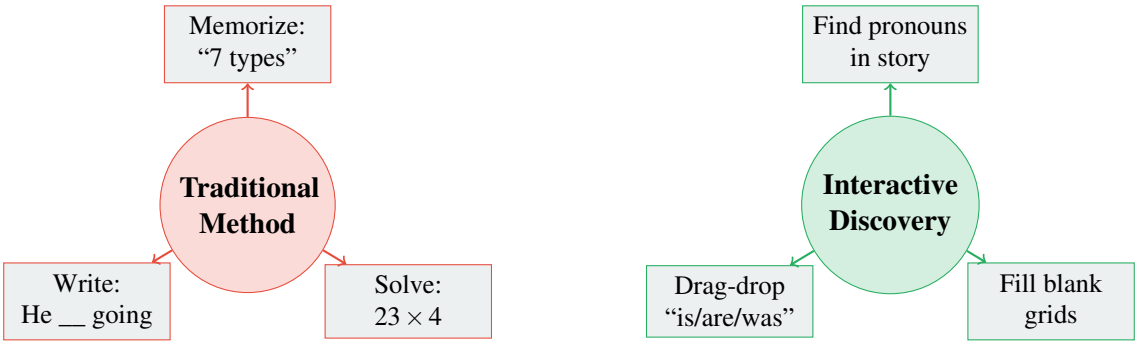
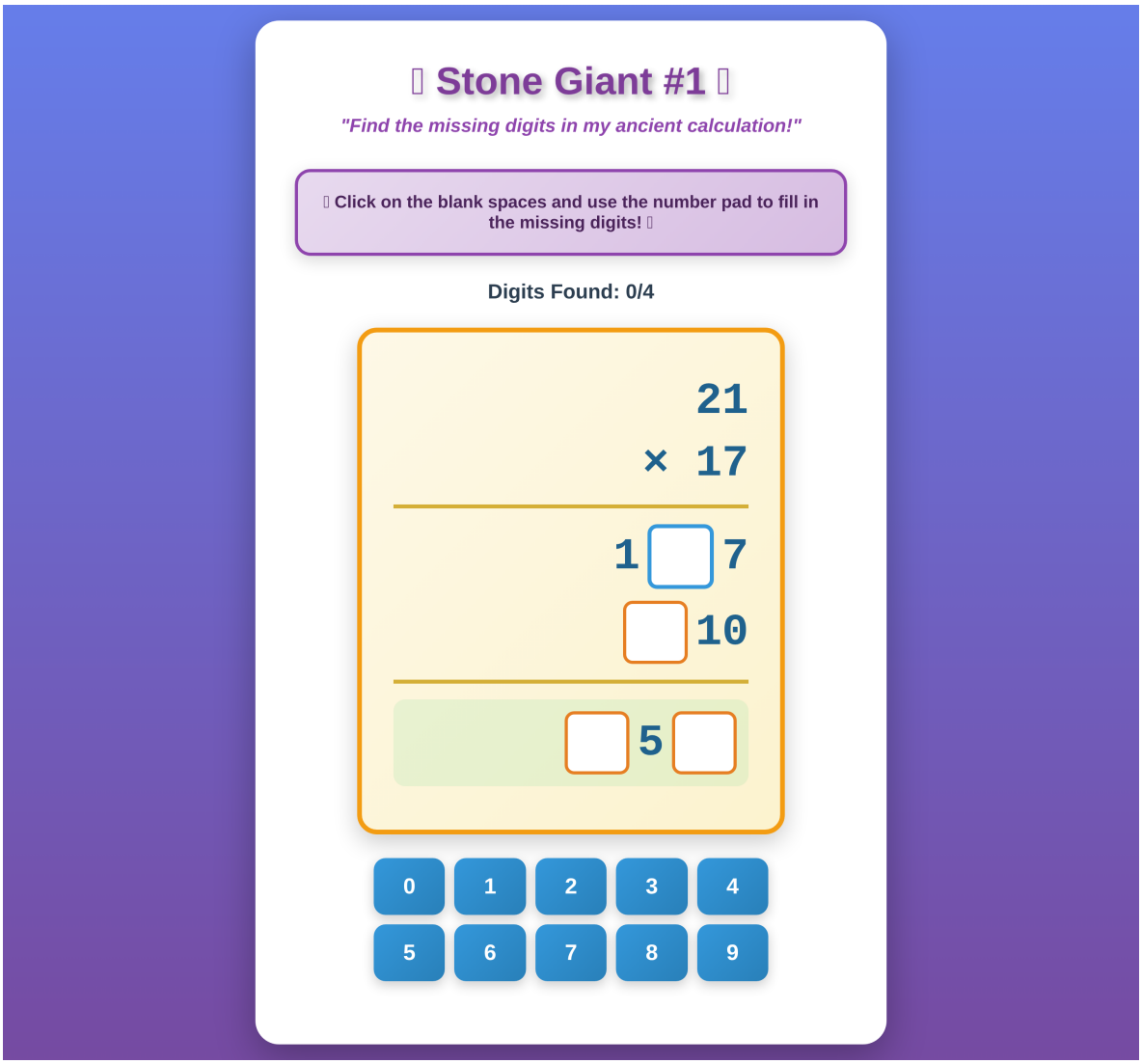


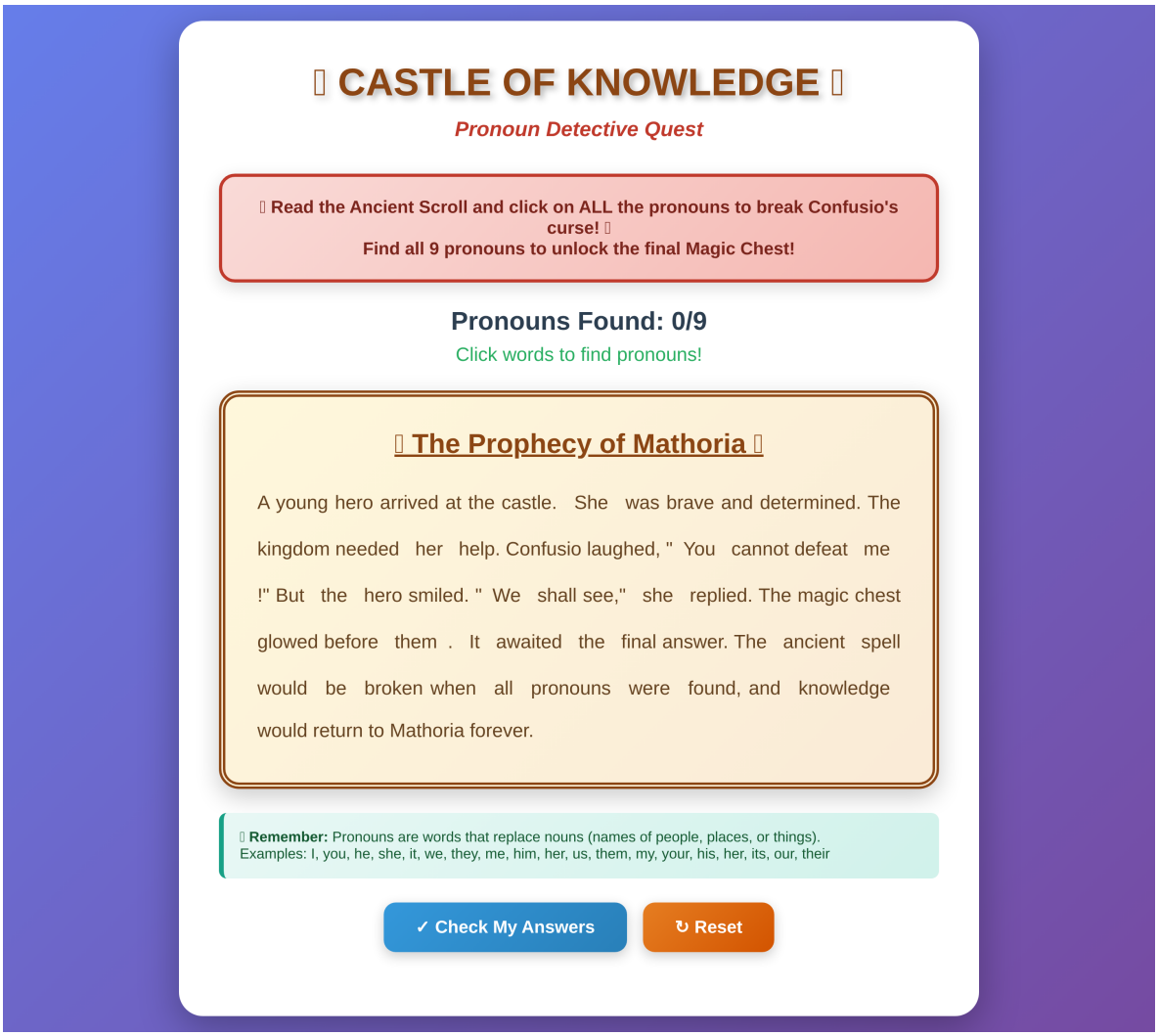
Figure 8: Traditional vs. Interactive Learning Methods

Implementation Examples:

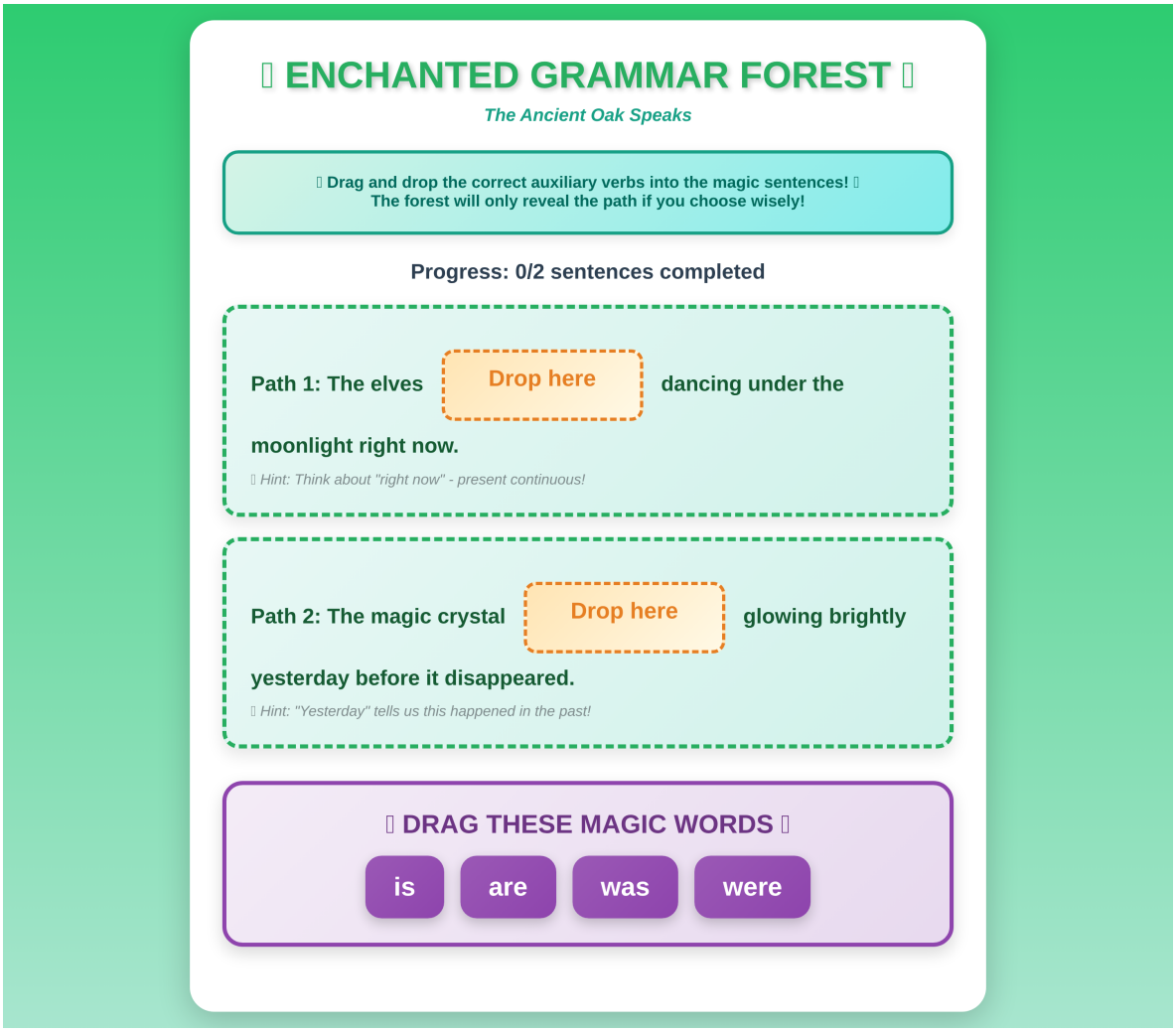
- **Interactive Math Puzzles:** Multiplication problems presented as grids with strategic blank spaces. Students deduce and place correct numbers, understanding the relationship between factors and products through hands-on manipulation.



- **Conceptual Discovery - Pronouns:** Instead of memorizing “Pronoun has 7 types,” students engage in interactive scenarios where they naturally identify and use pronouns in context. For example, students read a short story and tap on words to discover which are pronouns, learning the concept through pattern recognition rather than rote memorization.

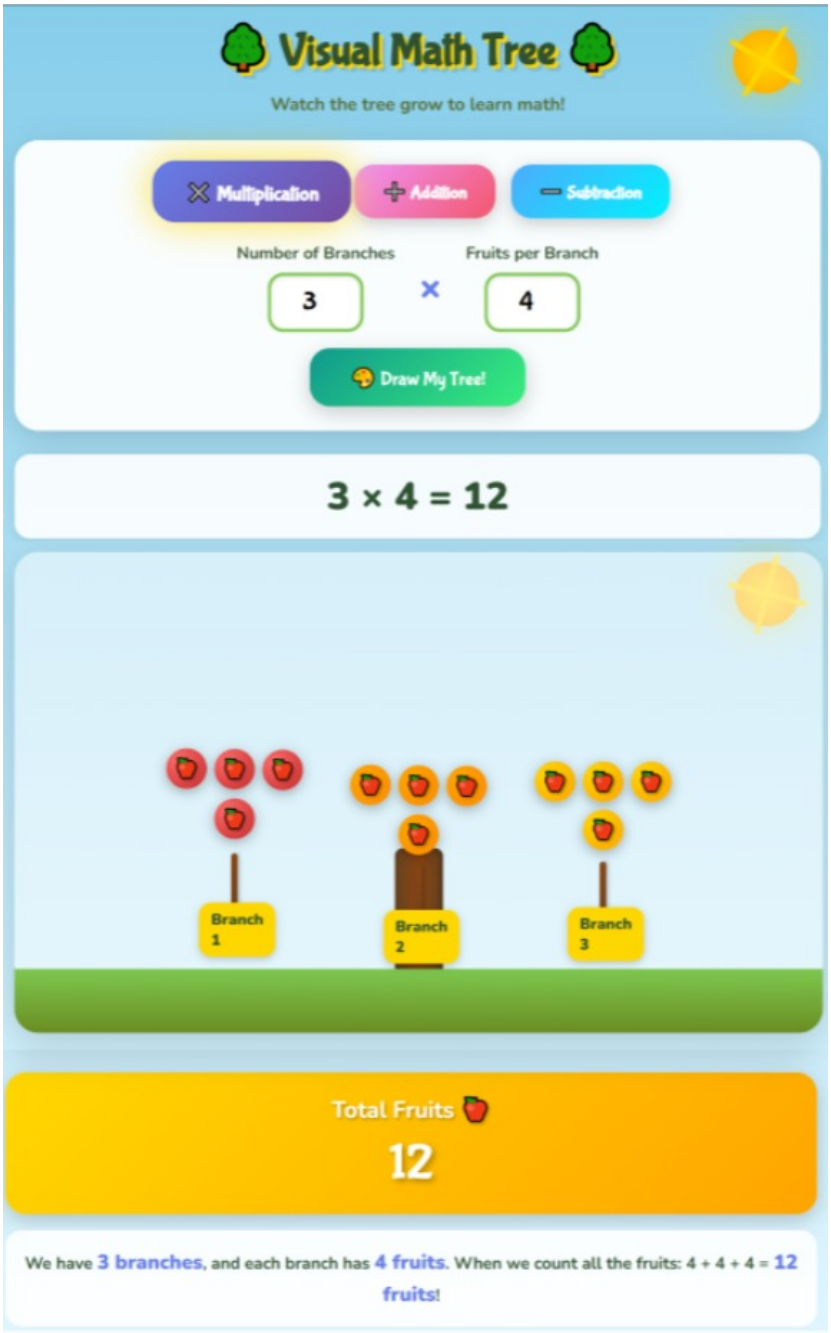


- **Grammar Drag-and-Drop:** English auxiliary verbs teaching uses interactive sentence completion where students drag “is”, “are”, “was”, “were” into appropriate positions.

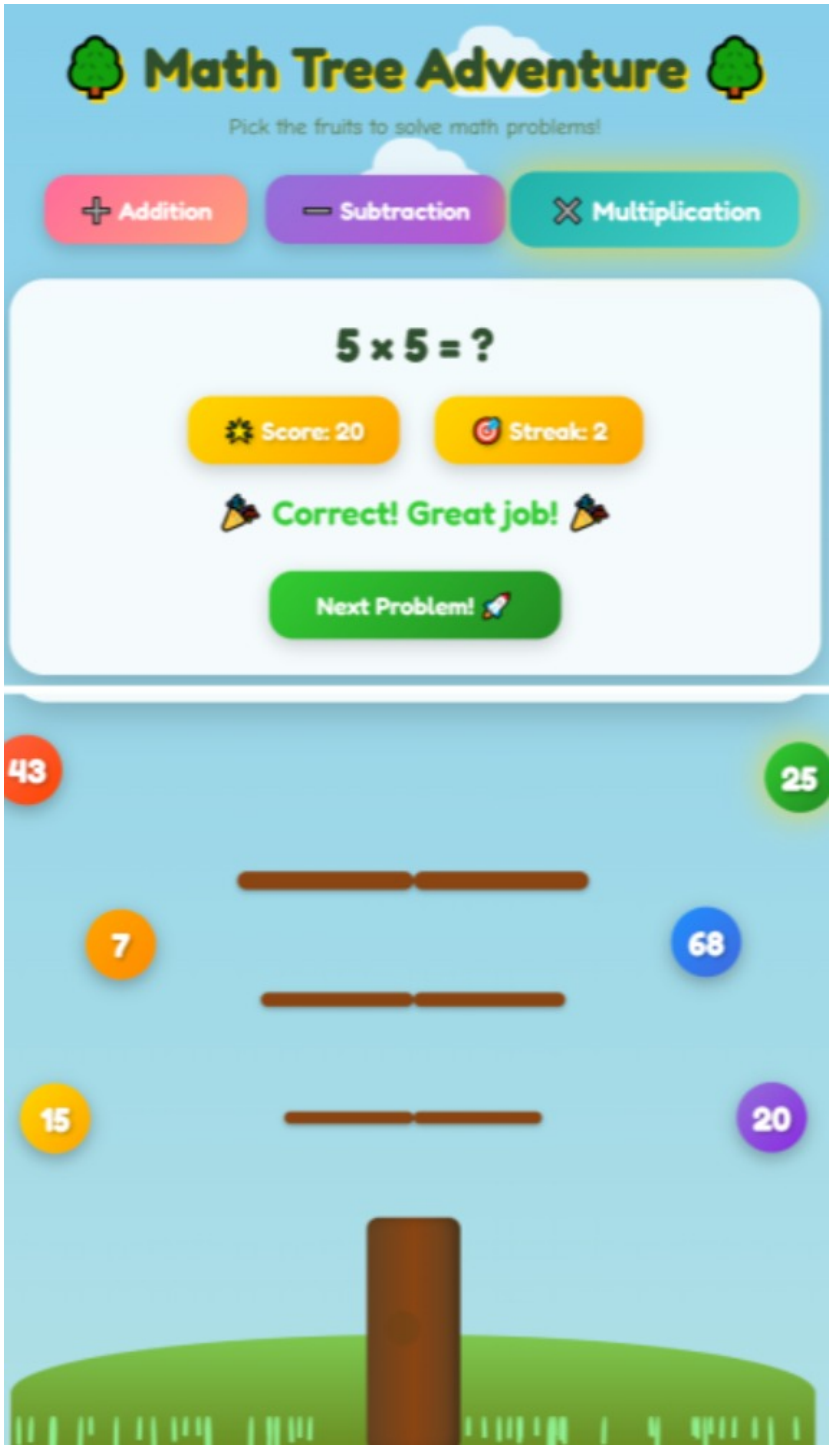


- **Visual Feedback System:** Correct placements trigger encouraging animations and positive reinforcement; incorrect attempts provide gentle hints and alternative approaches without discouragement, maintaining student motivation.

- **Math Tree Adventure:** captures children's attention and reduces monotony



- **Visual Math Tree:** motivates interactive learning.



Cognitive Benefits:

- Transforms passive memorization into active learning through physical interaction
- Builds muscle memory and kinesthetic understanding through drag-and-drop manipulation
- Creates contextual understanding rather than isolated facts
- Increases engagement through gamified manipulation and immediate feedback
- Reduces learning anxiety by making education playful and exploratory
- Promotes discovery learning where students derive rules from patterns rather than memorizing definitions

5.5 Differentiation Summary: Existing vs. Proposed

Table 3: Solution Paradigm Comparison

Existing Solutions	Our Platform
One-size-fits-all paths	AI-driven personalized paths
No emotion awareness	Real-time frustration detection
Limited engagement tracking	Comprehensive behavioral analytics
Weak parent involvement	Enhanced parent dashboard
Content-focused approach	Learner-focused approach
Passive consumption	Active generation & interaction
High cost or limited features	Affordable comprehensive solution
Limited language support	Full bilingual (Bangla/English)
Rote memorization-based	Discovery and hands-on learning
Static quizzes	Interactive drag-and-drop exercises

5.6 Market Positioning Strategy

Strategic Positioning

The Children's Learning Platform positions itself as a **comprehensive, AI-powered personalized learning ecosystem** that:

1. **Combines best-in-class features:** Engagement mechanics of Duolingo + comprehensive coverage of Khan Academy + surpassing BYJU'S personalization
2. **Adds unique innovations:** Emotion detection, peer learning, contest system, full Bangla support, AI content generation, interactive drag-and-drop learning
3. **Targets underserved segment:** Middle-income families in Bangladesh seeking quality personalized education at affordable prices
4. **Replaces expensive tutoring:** Provides AI-powered personalization previously available only through costly private tutors
5. **Revolutionizes learning methodology:** Moves beyond rote memorization to discovery-based, hands-on interactive learning that builds deep conceptual understanding

Competitive Advantage: Modular architecture and scalable AI infrastructure enable continuous improvement while maintaining cost-effectiveness. Interactive learning components create higher engagement and retention compared to traditional passive content delivery.

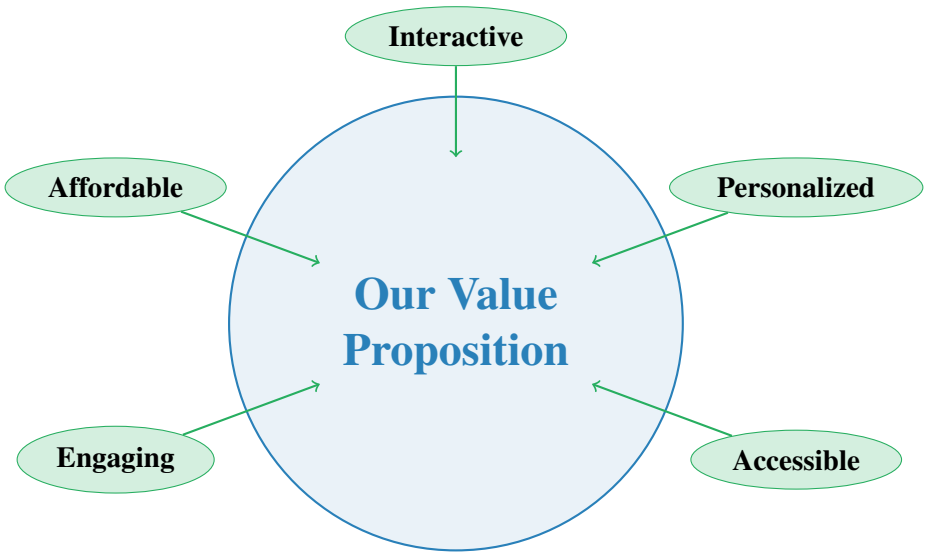


Figure 9: Five Pillars of Our Value Proposition

Impact & Ethics Analysis

This document analyzes the economic, environmental, social, legal, and ethical implications of deploying an AI-based personalized learning platform for children in Bangladesh.

The platform aims to reduce educational inequality by providing affordable, adaptive, and language-accessible learning support. While the system offers strong long-term benefits in cost efficiency, sustainability, and inclusivity, responsible deployment requires strict attention to data privacy, child safety, algorithmic fairness, and regulatory compliance.

This analysis highlights how ethical AI practices, transparency, and legal safeguards are essential to ensure that technological innovation positively contributes to society without compromising children's rights or well-being.

6 Economic Impact Analysis

6.1 Cost-Benefit Framework

The economic impact of the proposed AI-based learning platform extends beyond individual households and directly affects national education accessibility. By leveraging scalable AI infrastructure, the platform significantly reduces the financial burden associated with private tutoring while maintaining consistent learning quality across regions.

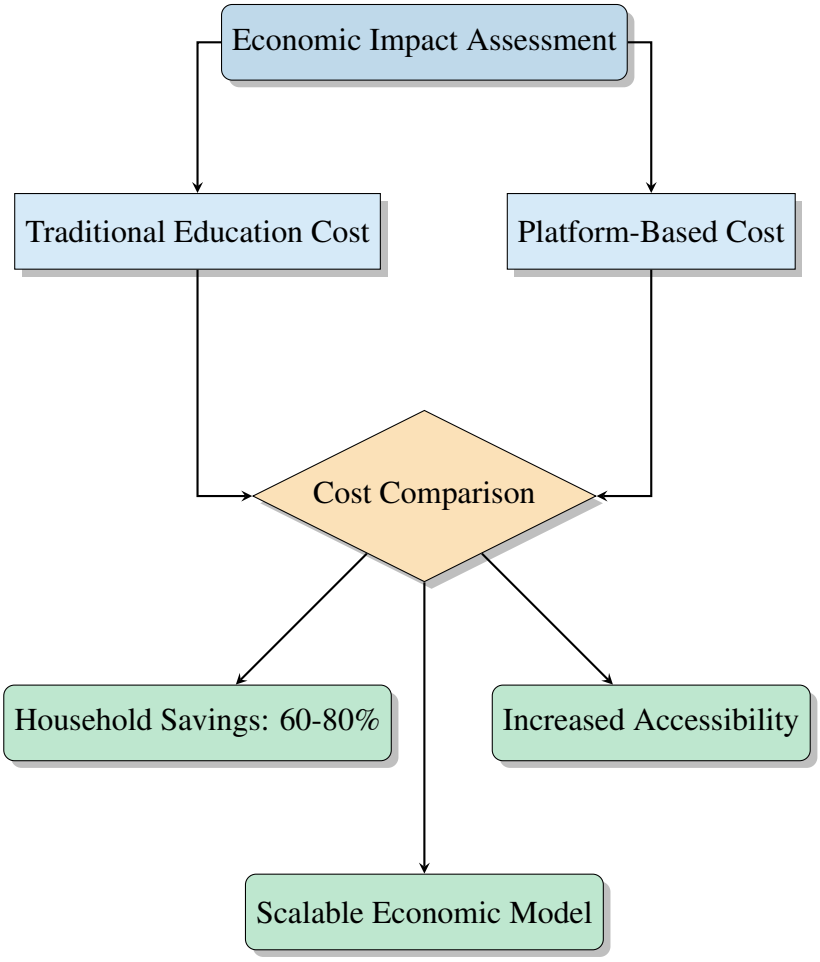


Figure 10: Economic Impact Assessment Framework

6.2 Economic Benefits

Affordable Alternative to Private Tutoring

- **Current Context:** Private tutoring in Bangladesh often costs between BDT 3,000–10,000 per month per subject, creating a financial barrier for many families.
- **Proposed Model:** An AI-based platform that is free of cost , covering multiple subjects.
- **Economic Benefit:** Families can save up to 60–80% compared to traditional tutoring expenses.
- **Social Reach:** This model makes personalized learning accessible to middle and lower-middle-income households.

Scalability Without Proportional Cost Increase

The LLAMA-based AI architecture enables:

- Nationwide deployment without hiring proportional teaching staff
- Marginal cost per additional student approaches zero after initial development
- Economies of scale as user base grows
- Reduced infrastructure requirements compared to traditional education expansion

Reduction in Educational Inequality

- **Minimal Requirements:** Only basic device and internet connection needed
- **Economic Mobility:** Improved educational outcomes lead to better career prospects
- **National Development:** Enhanced human capital contributes to GDP growth

Economic Impact Metrics

Table 4: Comparative Economic Analysis

Metric	Traditional Model	AI Platform Model
Monthly Cost per Student	BDT 5,000-10,000	Free
Scalability	Linear (requires more teachers)	Exponential (AI-driven)
Geographic Coverage	Urban-centric	Nationwide
Accessibility	High-income families	Middle & lower-middle class
Infrastructure Investment	High (buildings, salaries)	Moderate (servers, development)
Long-term Sustainability	Teacher-dependent	Technology-driven

7 Environmental Impact Analysis

7.1 Environmental Benefits Framework

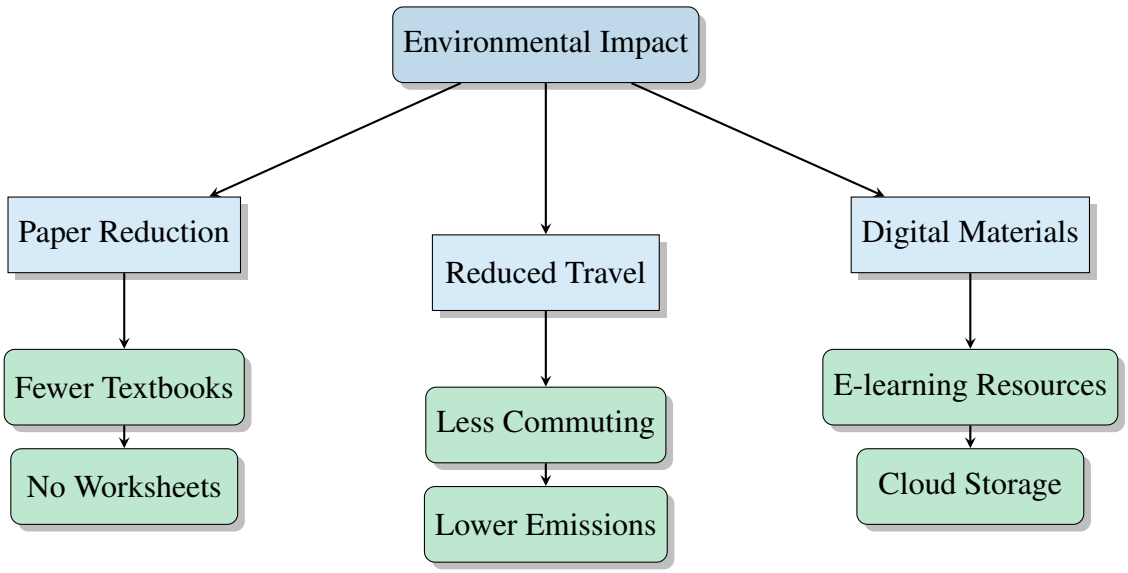


Figure 11: Environmental Impact Pathways

7.2 Quantifiable Environmental Benefits

Paper Consumption Reduction

- **Traditional Education:** Average student uses 5-8 kg of paper annually for textbooks, notebooks, and worksheets
- **Digital Platform:** Reduces paper usage by approximately 90%
- **Forest Conservation:** Approximately 850-1,360 trees saved per 10,000 students annually

Transportation Emission Reduction

- Eliminates need for travel to tutoring centers (average 5-10 km round trip, 3-5 times weekly)
- Estimated CO_2 reduction: 0.5-1.5 tons per student annually

Energy Efficiency Considerations

While digital platforms require server energy:

- Cloud-based AWS infrastructure uses renewable energy sources
- Energy per student significantly lower than traditional brick-and-mortar facilities
- Centralized computing more efficient than distributed physical locations

8 Social Impact Analysis

8.1 Social Impact Framework

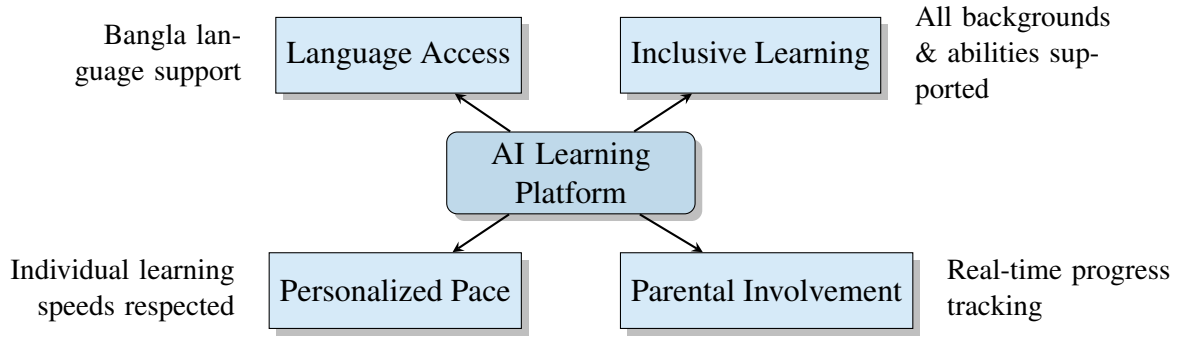


Figure 12: Social Impact Dimensions

8.2 Social Benefits

Inclusive Education for All Backgrounds

- **Socioeconomic Inclusion:** Affordable pricing removes financial barriers
- **Learning Disability Support:** Adaptive AI accommodates different learning needs(basically Bengali and English)
- **Gender Equity:** Equal access regardless of gender, particularly important in conservative areas where girls face educational barriers

Enhanced Parental Involvement

- **Progress Dashboard:** Parents view real-time learning analytics
- **Struggle Alerts:** Notifications when child faces difficulties
- **Informed Engagement:** Data-driven conversations about education

Personalized Learning Pace

- Eliminates peer pressure and comparison stress
- Allows advanced students to progress faster
- Provides struggling students extra time without stigma
- Builds confidence through appropriate challenge levels

Language Accessibility - Bangla Support

- **Cultural Relevance:** Learning in native language improves comprehension
- **Reduced Language Barrier:** English & Bengali speakers access quality education
- **National Identity:** Promotes Bangla language in digital education

8.3 Social Equity Considerations

Table 5: Social Impact Assessment

Social Dimension	Platform Impact
Educational Equity	Reduces gap between privileged and underprivileged students
Family Dynamics	Strengthens parent-child educational partnership
Community Development	Creates peer learning and healthy competition
Cultural Preservation	Bangla language support maintains cultural identity
Social Mobility	Better education outcomes lead to improved career opportunities

9 Ethical Considerations

9.1 Ethical Framework for AI in Education

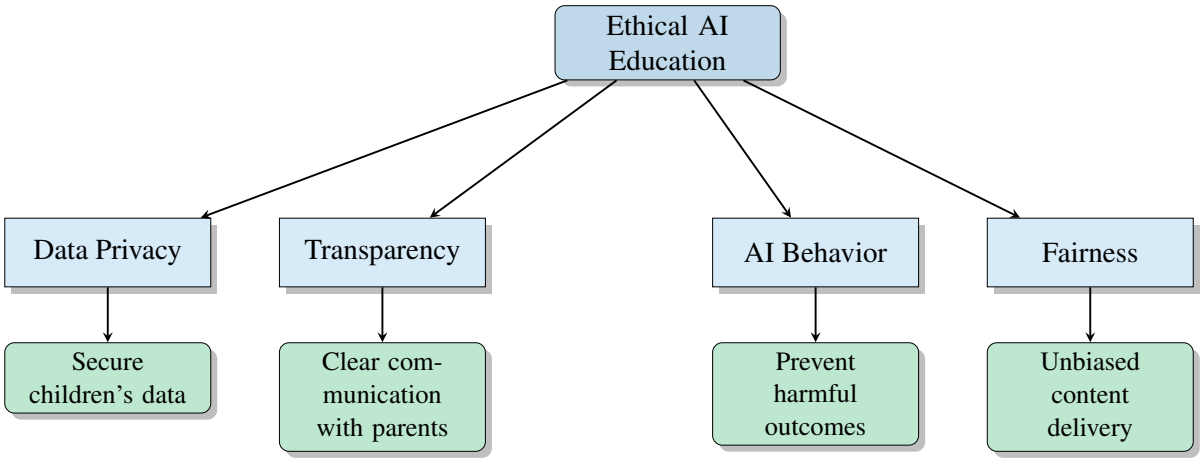


Figure 13: Four Pillars of Ethical AI in Education

9.2 Data Privacy and Security

9.2.1 Children's Data Protection

- **Regulatory Compliance:** Adherence to COPPA (Children's Online Privacy Protection Act) principles
- **Minimal Data Collection:** Only essential educational data collected
- **Encryption:** End-to-end encryption for all student data
- **Access Control:** Strict authentication and authorization protocols
- **Right to Deletion:** Parents can request complete data removal

9.2.2 Privacy-Preserving Architecture

- Student profiles anonymized in analytics
- No sharing of personal data with third parties
- Regular security audits and penetration testing

9.3 Transparency and Informed Consent

9.3.1 Stakeholder Communication

- **Parent Consent:** Clear, comprehensible consent forms before enrollment
- **AI Disclosure:** Explicit explanation that students interact with AI
- **Data Usage:** Transparent policies on how student data improves platform
- **Algorithm Transparency:** General explanation of how personalization works
- **Updates and Changes:** Notification of policy or system changes

9.4 AI Behavior and Safety

9.4.1 Content Safety Measures

- **Age-Appropriate Content:** AI generates content suitable for child's age
- **Content Filtering:** Automated filters prevent inappropriate material
- **Harmful Output Prevention:** Systems to detect and block problematic responses
- **Socratic Approach:** AI guides rather than provides direct answers, promoting critical thinking

9.4.2 Psychological Safety

- AI designed to be encouraging, not discouraging
- Prevents negative reinforcement or shaming language

9.5 Fairness and Bias Mitigation

9.5.1 Algorithmic Fairness

- **Bias Testing:** Regular audits for gender, socioeconomic, and cultural bias
- **Diverse Training Data:** AI trained on diverse student populations
- **Equal Opportunity:** All students receive equally challenging content
- **Cultural Sensitivity:** Content respects Bangladeshi culture and values
- **Language Equity:** Bangla and English content receive equal quality

9.5.2 Preventing Educational Discrimination

- No tracking or labeling that could stigmatize students
- Performance predictions used for support, not limitation
- Adaptive system supports both struggling and advanced learners

9.6 Ethical Decision-Making Framework

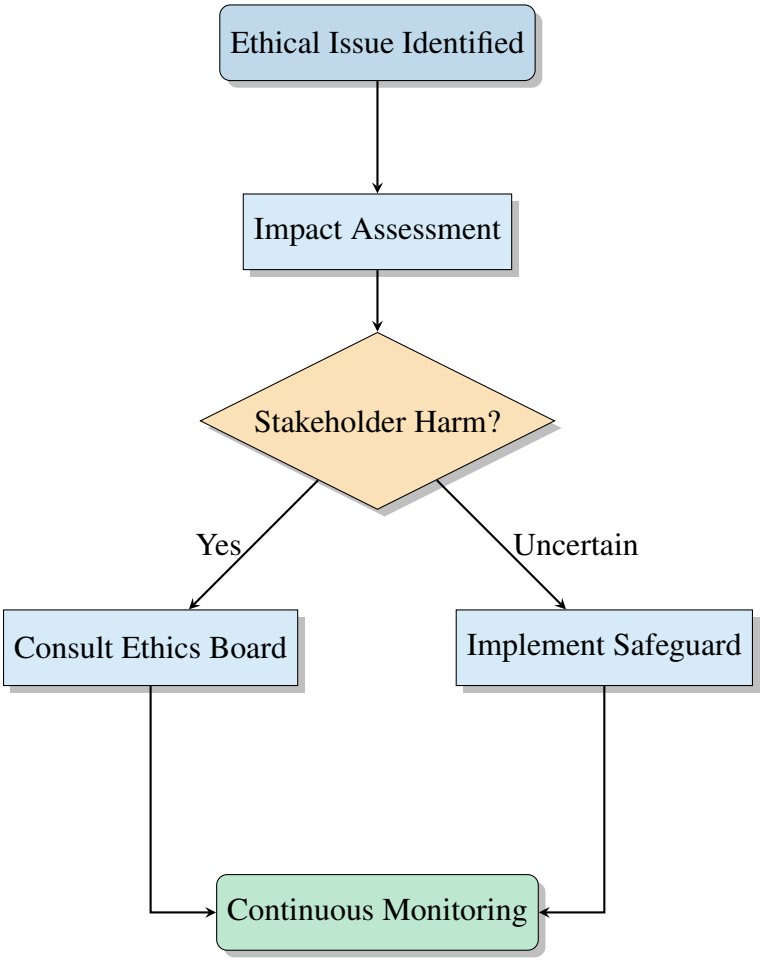


Figure 14: Ethical Issue Resolution Process

10 Legal and Regulatory Compliance

10.1 Safety and Security Compliance

Table 6: Compliance Checklist

Requirement	Status	Implementation
Parental Consent for Minors	Mandatory	Pre-enrollment verification
Privacy Policy Disclosure	Required	Accessible on platform
Content Moderation	Active	AI + Human review
Age Verification	Implemented	Parent-controlled-accounts

11 Risk Assessment and Mitigation

11.1 Identified Risks and Mitigation Strategies

Table 7: Risk Matrix and Mitigation

Risk	Severity	Mitigation Strategy
Data Breach	High	Encryption, access controls, regular audits, incident response plan
AI Bias	Medium	Bias testing, diverse datasets, regular algorithm audits
Over-reliance on Technology	Medium	Encourage balanced learning, promote parental involvement
Digital Divide	High	Affordable pricing, offline mode features, partnership with NGOs
Inappropriate Content	High	Multi-layer content filtering, human oversight, reporting system
Privacy Violations	High	Strict data policies, minimal collection, transparency
Screen Time Concerns	Medium	Built-in time limits, breaks reminders, parent controls

12 Long-Term Sustainability and Impact

12.1 Sustainability Framework

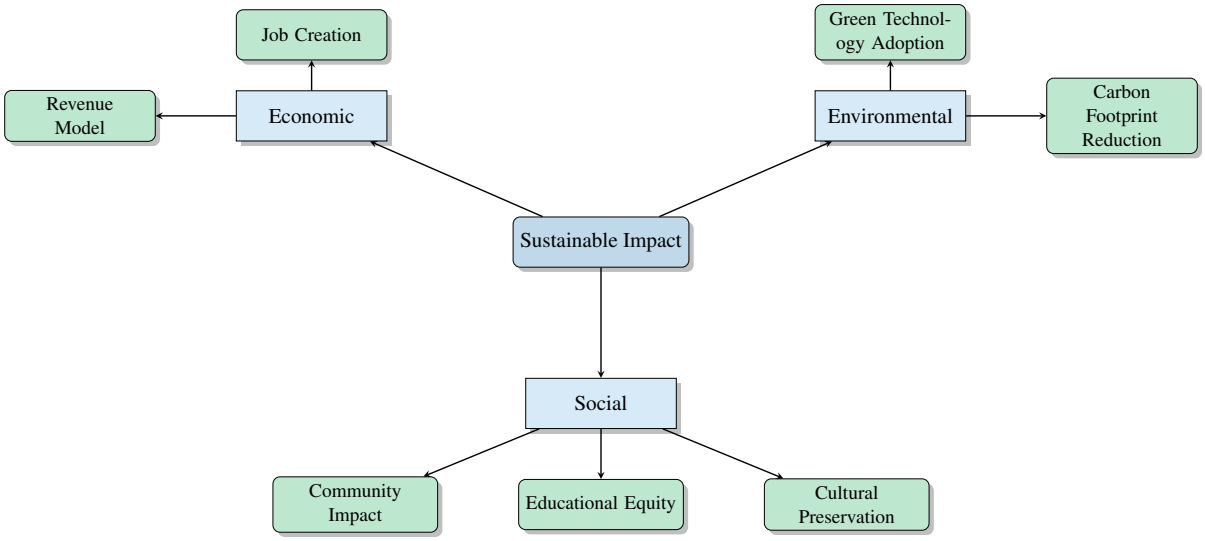


Figure 15: Triple Bottom Line Sustainability Model

12.2 Future Development and Ethical Expansion

12.2.1 Multilingual Support Expansion

- **Planned Languages:** Hindi, Arabic, Spanish, indigenous languages
- **Ethical Consideration:** Preserving linguistic diversity and cultural identity
- **Implementation:** Culturally appropriate content for each language

12.2.2 Adaptive Curriculum Engine

- **Capability:** Custom learning paths aligned with school curriculum
- **Ethical Alignment:** Supports formal education, doesn't replace it
- **Collaboration:** Partnership with educational authorities

12.2.3 Subject Expansion

- **Additional Subjects:** Science, arts, life skills
- **Holistic Development:** Beyond academic subjects to life competencies
- **Ethical Integration:** Values education and digital citizenship

13 Stakeholder Impact Summary

Table 8: Multi-Stakeholder Impact Analysis

Stakeholder	Impact
Students	Personalized learning, improved outcomes, accessible education
Parents	Cost savings, real-time insights, informed involvement, peace of mind
Teachers	Reduced workload on repetitive tasks, data-driven insights for intervention
Educational Institutions	Complementary tool, performance analytics, scalable support
Society	Reduced inequality, improved human capital, economic development
Environment	Lower carbon footprint, reduced paper consumption, sustainable model

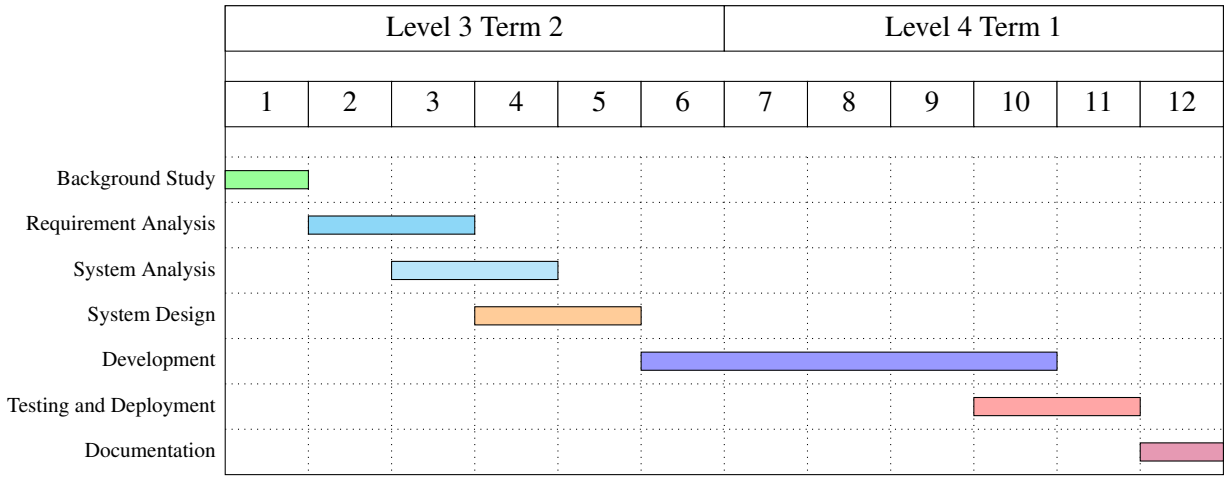
14 Ethical Reflection and Closing Note

This project demonstrates how artificial intelligence can be responsibly integrated into educational systems to create long-term social value. While technological innovation offers powerful solutions to challenges such as educational inequality and accessibility, its impact depends heavily on ethical design, transparency, and accountability.

By prioritizing children's data privacy, psychological safety, and fairness, the proposed AI-based learning platform ensures that innovation remains human-centered. With continuous ethical oversight and regulatory compliance, the system has the potential to support sustainable development goals while maintaining public trust and social responsibility.

15 Project Timeline and Gantt Chart

The Gantt chart illustrates the project schedule distributed across two academic terms, divided into twelve time slots. Initial phases focus on background study and requirement analysis, followed by system analysis and design with partial overlaps to reflect realistic development practices. The core development phase spans multiple time slots, ensuring adequate time for implementation. Testing and deployment are conducted toward the later stages, and the project concludes with documentation.



Project milestones mark important checkpoints where major phases are completed and reviewed. They help track progress, ensure timely delivery, and allow feedback and adjustments throughout the project lifecycle.

16 Budget Plan and Cost Estimation

16.1 Budget Assumptions

The budget estimation is based on the following assumptions:

- Target user base: 5,000 registered children
- Average daily active users: 30% (1,500 users/day)
- Average AI interactions per user per day: 5
- Each interaction uses one LLaMA 4 API inference
- Cloud infrastructure hosted on Microsoft Azure
- Project duration: 1 year for development and deployment, followed by 1 year of maintenance

16.2 Year 1: Development and Deployment Cost

Item	Cost Basis	Yearly Cost (USD)
LLaMA 4 API Usage (2.7M requests/year)	$0.0006 per request	$1,620
Azure Application Server (2–4 vCPU, 16GB RAM VM)	$60/month	$720
Azure Database (Managed PostgreSQL / Cosmos DB)	$30/month	$360
Azure Storage (User data, logs, backups)	$8/month	$96
Speech-to-Text (Open-source Whisper, CPU-based)	Self-hosted	$0
Text-to-Speech (Open-source TTS engine)	Self-hosted	$0
Monitoring, Security, Logging (Azure Monitor)	$12/month	$144
Development Tools and Frameworks	Open-source	$0
Total Year 1 Cost		**$2,940**

16.3 Year 2: Maintenance and Operational Cost

Item	Cost Basis	Yearly Cost (USD)
LLaMA 4 API Usage (Optimized usage)	$0.0005 per request	$1,350
Azure Server Hosting	$55/month	$660
Database and Storage	$30/month	$360
System Monitoring and Updates	$15/month	$180
Security, Backups and Compliance	$12/month	$144
Total Year 2 Cost		**$2,694**

16.4 Overall Budget Summary

Phase	Estimated Cost (USD)
Year 1: Development and Deployment	$2,940
Year 2: Maintenance and Operation	$2,694
Total Estimated Cost (2 Years)	**$5,634**

17 Conclusion

This project proposes a feasible, ethical, and impactful AI-based educational assistant for children using LLaMA-4. By combining voice interaction, Bangla language support, and strict safety measures, the system aims to democratize education and improve learning outcomes for children.