Lab 1 Descriptive Paper

Lee F. Klaus

CS 411W

Thomas J. Kennedy

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Version 1

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1 Introduction

This report covers the project for Team Cystal, for classes CS 410 (Spring 2025) and CS 411W (Fall 2025), both taught at Old Dominion University. Please see the title page of this report for the names of the team members. The proposed project is a web application to be titled “Minnow”, with its purpose consisting of granting “Access to Quality Education”.

Access to quality education remains a pervasive issue, particularly in underserved communities and for individuals with diverse learning needs. Traditional teaching methods often fail to address different learning styles, disabilities, or socio-economic challenges, leaving many students without the necessary resources to thrive. Despite advances in technology, the education system struggles to integrate tools that promote equitable and personalized learning opportunities on an acceptable scale.

Some teachers in poverty zones and less experienced teachers are more likely to report that the materials provided to them are too hard for their students (Doan, 2023). Of the teachers that reported their materials were too challenging for their students, the math teachers reported that they were less likely to use their materials for their class instruction time. In economically challenged cities such as Baltimore, the proficiency rates for students are below average. A study conducted by the NAEP (National Assessment of Educational Progress) showed that 81% of fourth graders that qualified for free or reduced had lower literacy levels and were four times less likely to graduate high school. The USA as a country spends more money on average for student education than most of the other OECD countries. (Organization for Economic Cooperation and Development)

A potential solution to fixing this problem with our country's education problem would be a web application that allows students and teachers to bridge the gap that their materials cannot accomplish. This application would have personalized learning, which can be accomplished via adaptive lesson plans, multimodal accessibility tools, and gamified modules such as those found in other applications such as Duolingo. It would foster collaboration with dashboards for students, teachers and parents while providing a resource library for subjects covered in their schools' curriculum. The application would also leverage modular learning, cloud technologies and real-time communication. This platform would enhance engagement and ensure equitable education for all.

The proposed application, Minnow, would cover every one of the aforementioned fields, providing an educational platform that personalizes learning experiences through adaptive lesson plans and multimodal tools, including text-to-speech and close captioning. It would come with built-in accessibility features, gamified learning and multilingual support. This application could make education more inclusive and engaging.

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2 Minnow Product Description

Minnow is an adaptive learning platform designed to enhance education through personalized lesson plans and interactive engagement. It supports diverse learners with accessibility features and a collaborative dashboard for tracking progress. While Minnow supplements traditional education, it does not replace formal schooling, provide certifications, or guarantee academic improvement. Instead, it offers a flexible, curriculum-based resource accessible anytime with an internet connection. Figure 1 gives an example of the students and teachers situations without the application.

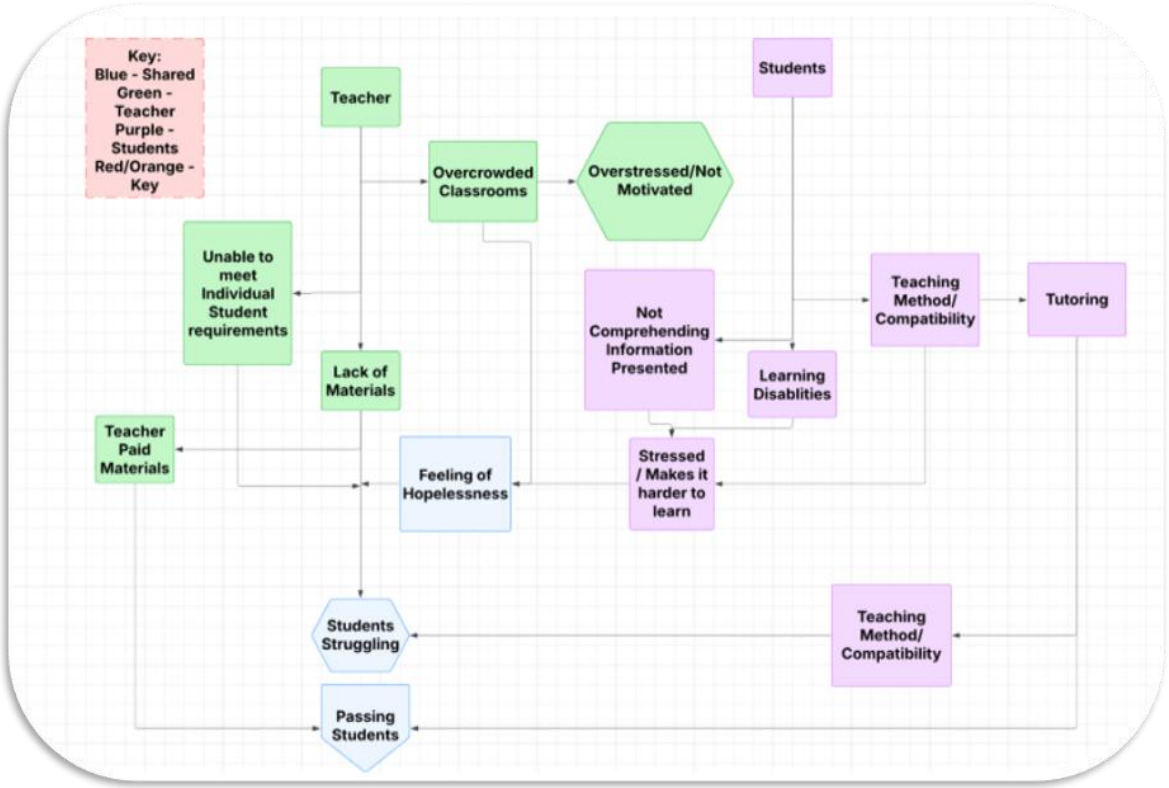

Figure 1: Current Process Flow

Figure 2 gives a demonstration of the students and teachers situations with the proposed application.

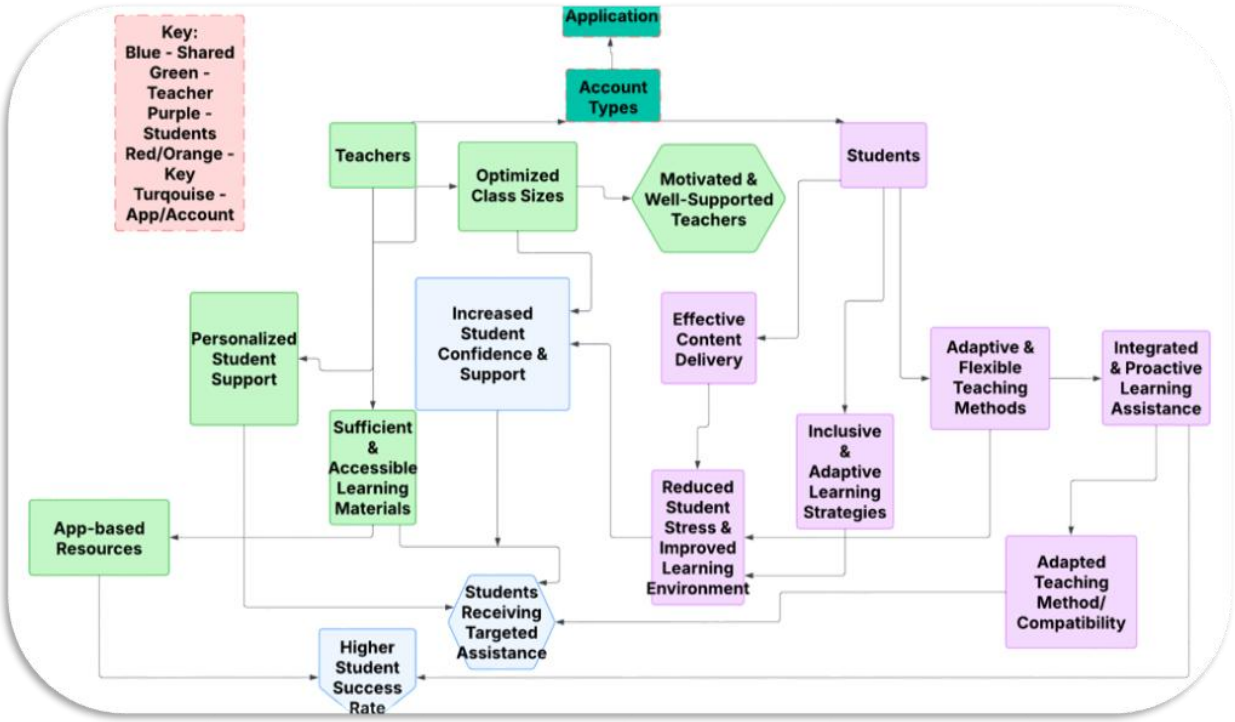

Figure 2: Solution Process Flow

2.1 Key Product Features and Capabilities

Minnow tailors lesson plans to individual student needs, adapting to strengths and weaknesses for a personalized learning experience. It incorporates accessibility tools such as text-to-speech, closed captioning, and visual aids to support diverse learners. Gamified modules enhance engagement through interactive lessons and quizzes, while a collaborative dashboard connects students, teachers, and parents for real-time progress tracking. The platform also includes a

resource library with videos, exercises, and virtual tutoring options, ensuring a comprehensive and flexible learning experience. Figure 3 gives a brief diagram of the process.

2.2 Major Components (Hardware/Software)

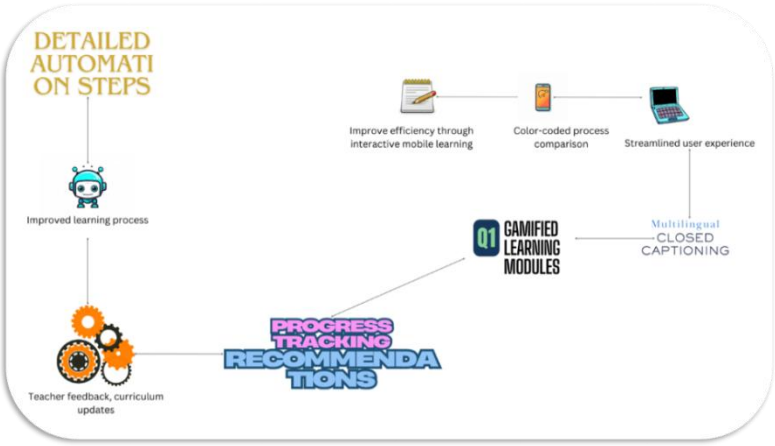

Figure 3: Major Functional Components Diagram

The software will require something like a LAMP stack, using Docker, Django, PostgreSQL, and Python. The software being developed will be an online based mobile application that provides dynamically updated and gamified quiz activities for a wide range of educational purposes. As such, it will require a hosting provider to ensure online functionality.

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3 Identification of Case Study

The web application will be for students, teachers and schools. For students who struggle with conventional means of learning, this new means of learning will be an impactful, beneficial, and even enjoyable means of learning. The teachers will have access to the resources needed to educate the students. Schools and institutions will have better and highly positive results.

The application may have a small number of risks accompanied by impacts, as shown in Figure 4. C1 indicates the possibility of not finding benefits, T1 & T2 represent downtime and network issues. Data leaks are represented by S1, while L1 and L2 represent copyright and lawsuits.

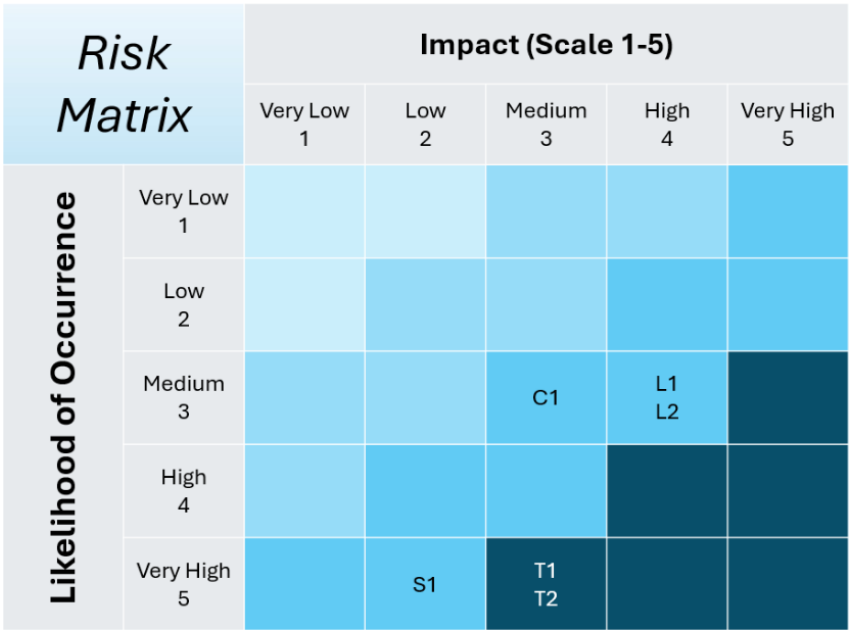

Figure 4: Risk Matrix

However, these risks can be multiple mitigations. Figure 5 shows the impacts of these mitigations. Feedback can counter the inability to find benefits and is represented by MC1.

Offline copies (MT1) help with the technical problems, while a split data center (MS1) mitigates the data leaks. ML1 is for Citations and End User agreement, solving the copyright and lawsuits.

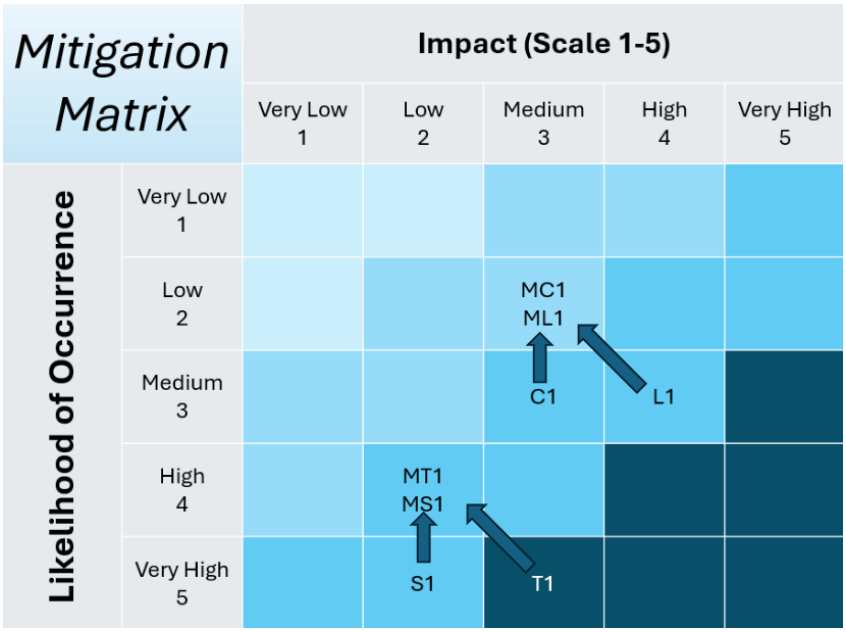

Figure 5: Mitigation Matrix

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4 Glossary

Accessibility Tools – Features such as text-to-speech, closed captioning, and visual aids that support diverse learners.

Gamification – The use of interactive lessons, quizzes, and rewards to enhance student engagement.

Multimodal Learning – An approach that integrates various forms of content delivery, including visual, auditory, and interactive methods.

Personalized Learning – Adaptive lesson plans that adjust based on a student's strengths and weaknesses.

Role-Based Access – A security feature that ensures users (students, teachers, parents) have appropriate permissions based on their role.

Secure Authentication – Measures to protect user privacy and maintain data security.

Virtual Tutoring – Online support resources designed to assist students outside of traditional classroom settings.

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