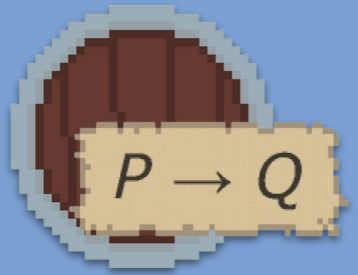


LogicPath

“Level up your thinking”

CS410 – Fall 2025
Team Emerald

Table of Contents

Team Bio

Paul Schacht
Project Lead
He is senior at Old Dominion University, studying Computer Science. His personal interests include software development, music production, gaming, and philosophy.

Caleb Anderson
Programming Lead
Caleb is a senior at Old Dominion University, studying Computer Science with a minor in Cybersecurity. He also recently completed his AWS Cloud Practitioner certification, and is currently working on personal projects involving Java, Python, and Rust.

Krishna Paneru
Design/Programming
Krishna is a senior at Old Dominion University, studying Computer Science. Her personal interests include software development, cooking and social work.

Team Bio cont.

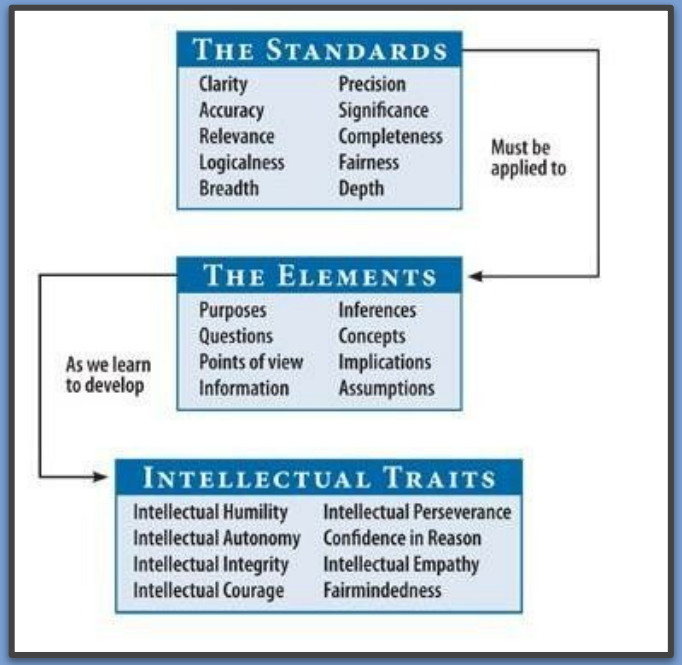
Mia Lai
Webmaster
Mia Lai is a Computer Science Major at Old Dominion University. She is in her fourth year and has some previous experience in web development.

Trent Thorne
Design/Programming
Trent is a Computer Science Major at Old Dominion University. He formally was a member of the US Coast Guard and is looking to start a career in software engineering.

Background

- **Logical thinking** is an essential skill
  - **Logic** is a foundational bedrock of **critical thinking** (Fig 1)
  - Spans across multiple domains like academics, civic engagement, personal decision-making, and more
  - Enables people to evaluate arguments, analyze information, and problem solve more efficiently (Martel et al., 2020).
- *It can be viewed as a fundamental scaling stat where 'leveling it up' improves various aspects of your life*.

Fig 1: Paul-Elder Critical Thinking Framework



Hua, Yanan. (2018)

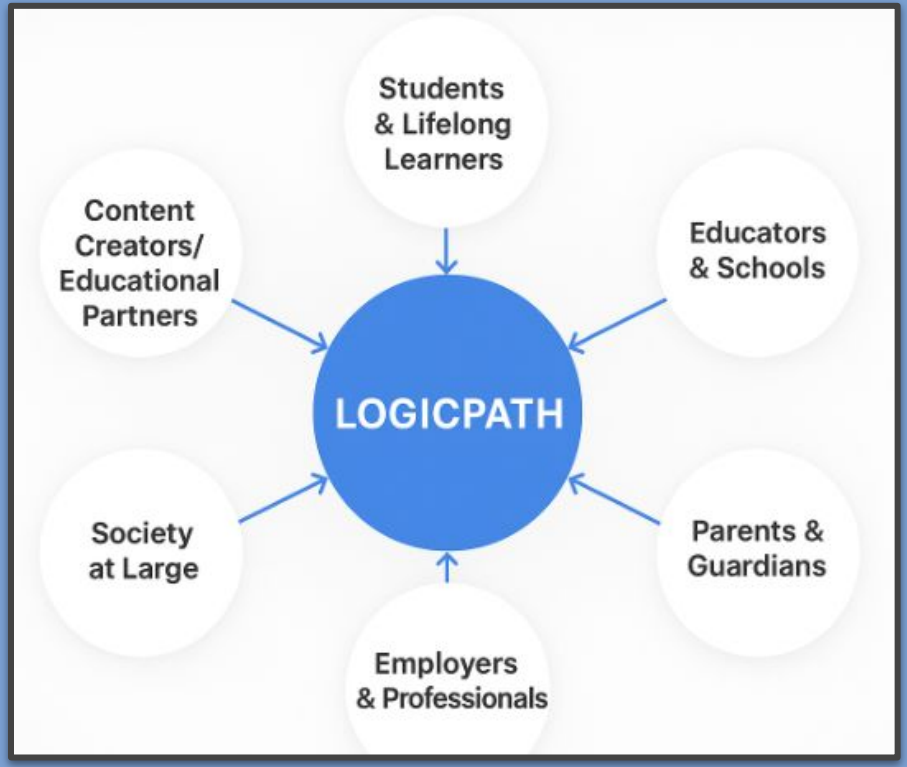
Problem Statement

"Despite logical thinking being an incredibly important skill, there are no comprehensive, yet engaging and accessible resources on logic."

- The currently existing online educational resources on logic may roughly fall in one of these two categories:
  1) Is engaging, yet fails to cover logic with sufficient depth and structure
  2) Sufficiently covers logic, yet is dry and unengaging

Users/Customers/Stakeholders

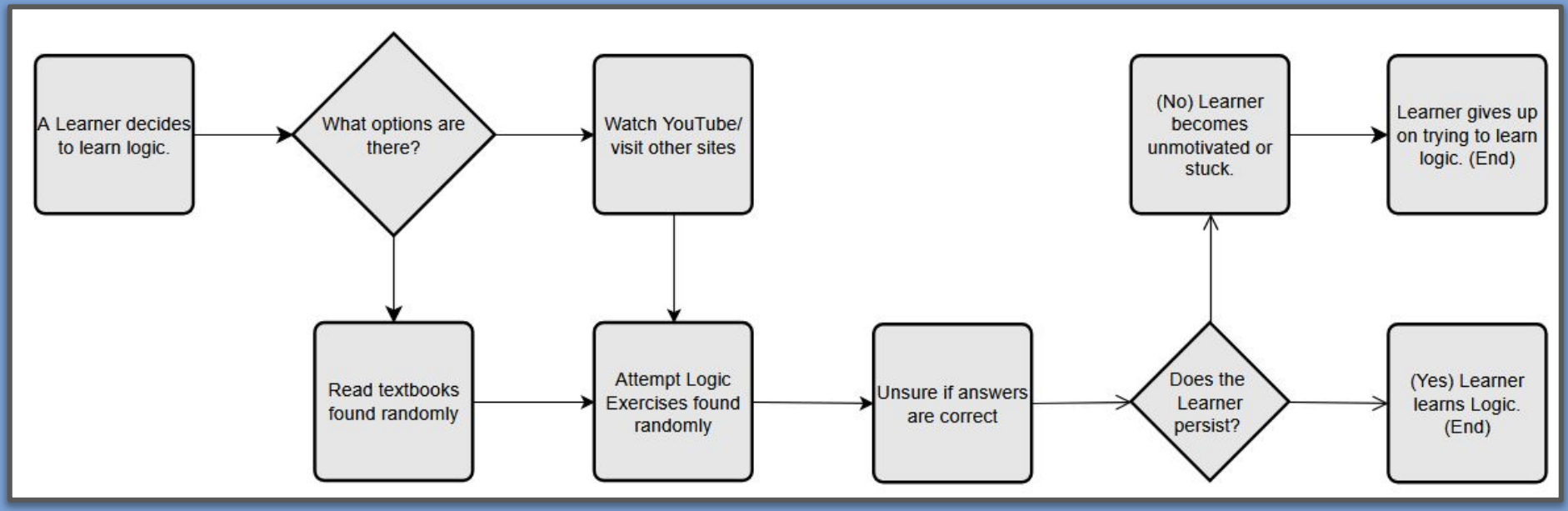
- **Users**
  - High School & College Students
  - Lifelong Learners
  - Educators
- **Customers**
  - Individuals
  - Schools / Educational Institutions
- **Stakeholders**
  - Students & Learners
  - Schools & Educators
  - Parents
  - Employers
  - Society



Problem Characteristics

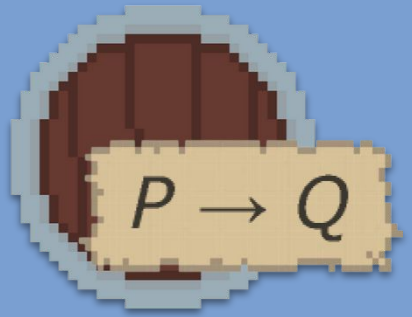
- **Few engaging resources in Logic**
  - Traditional logic resources are text-heavy and dry due to a lack of interactive and engaging content
  - Learners lose their motivation, reducing skill development
- **Lackluster gamification for sustained engagement**
  - Existing resources rarely use game elements like quests or streaks
  - Engagement drops without long term motivation mechanisms
- **Lack of structured progression in logic learning**
  - Most platforms provide scattered or one off exercises
  - Learners lack a guided path from basic reasoning to formal logic learning
- **Poor real-world application**
  - Logic resources often focus on the theory, or at most, applies it to distilled, non-relevant arguments
  - Learners may struggle to apply formal reasoning skills to real-world situation
- **Weak connection between theory and practice**
  - Logic resources present theory without opportunities to apply it
  - Learners fail to make the connection between theory links to real world reasoning
- **Limited focus on informal and formal logic**
  - Few learning tools cover both everyday reasoning and formal logic systems
  - Learners get a loose understanding of logical thinking

Current Process Flow



Solution

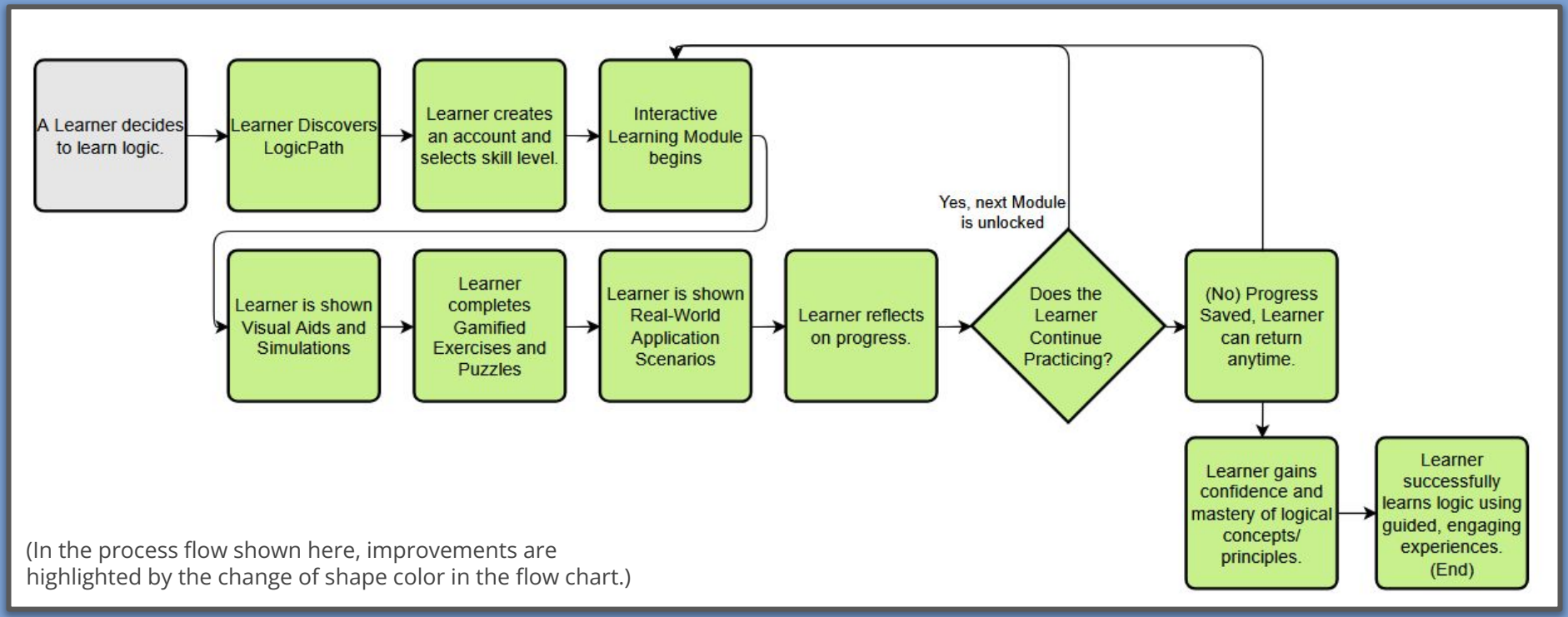
- **LogicPath** is an interactive learning website designed to make learning logic, formal and informal, *engaging, accessible, and fun*.
- **LogicPath** blends education with *interactivity* and *gamification* to create a dynamic learning environment.



Solution Characteristics

- **Interactive Learning Modules**: Step-by-step lessons that gradually introduce concepts from everyday reasoning to formal logic.
- **Gamified Exercises & Puzzles**: Logic quests, challenges, and streak rewards to motivate continued practice.
- **Visual Aids & Simulations**: Diagrams and flowcharts to make abstract concepts easier to understand.
- **Real-World Applications**: Lessons tied to analyzing news, debates, and personal decision-making.

Solution Process Flow

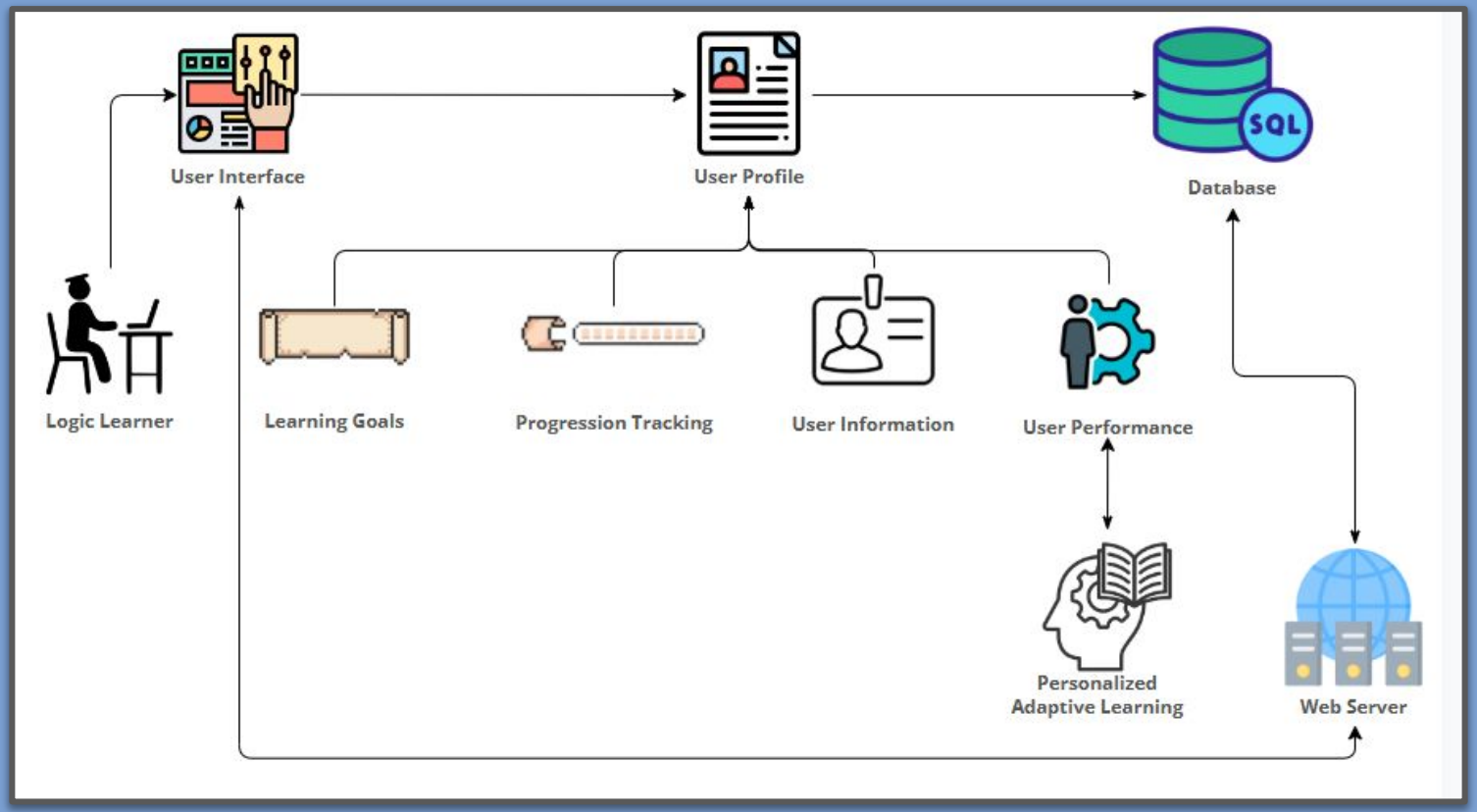


(In the process flow shown here, improvements are highlighted by the change of shape color in the flow chart.)

Major Functional Components

- **Presentation Layer**
  - User Interface
    - Web Application
  - Student/Learner Profile
    - Registration/login
  - Social/Engagement Features
    - Sharing progress
- **Application Layer**
  - Learning Module Engine
  - Gamification & Motivation Engine
  - Adaptive Learning Engine
  - Assessment & Feedback Manager
  - Content Management System
- **Data Layer**
  - User Date
    - Profiles, preferences, learning history
  - Store data
    - Name, Course ID
  - Container Data

Major Functional Component Diagram



What LogicPath Will Do

- **Provide Core Learning Goals**
  - Provide a clear learning modules on the logic
  - Allow learners to apply theoretical concepts to practical contexts
- **Contain Gamified Engagement**
  - RPG Quest-style learning path with skills
  - Levels, points, and achievement tracking to motivate continued engagement
- **Adaptive Learning Features**
  - Personalized difficult adjustments based on user performance
  - Immediate feedback for failed attempts
  - Progress tracking menu for self-assessment
- **Supporting Tools**
  - Glossary/wiki on additional information
  - Tutorials the integrate theory with practice

What LogicPath Will Not Do

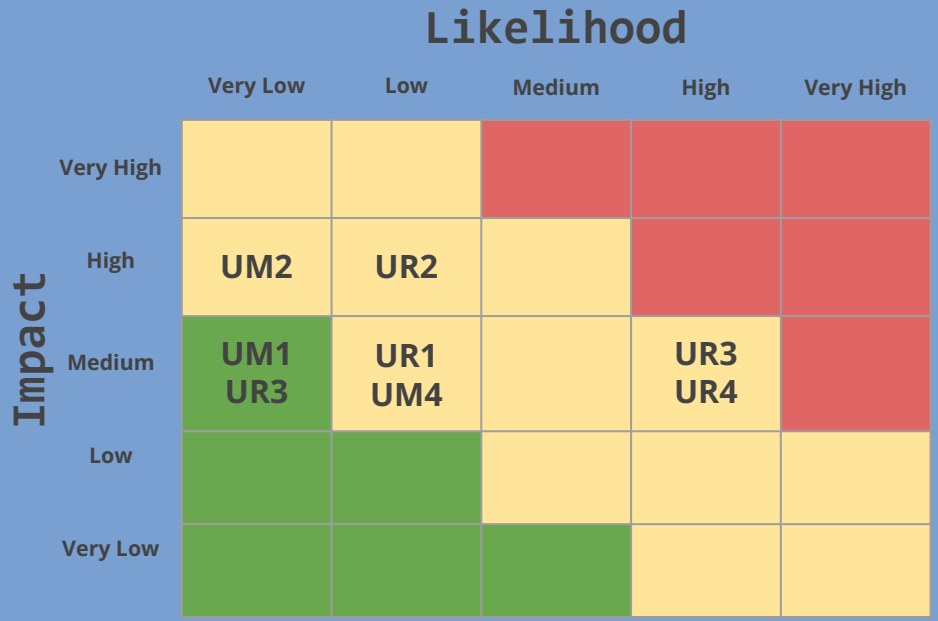
- **Replace formal classroom instruction**
  - This is a supplemental, engaging tool, not a full curriculum replacement.
- **Provide “brain training” without context**
  - Unlike Lumosity, exercises won’t be abstract games with no connection to real-world logic.
- **Act as a debate forum or social media platform**
  - There will not be debate between users. The focus is on building debate skills by analysing examples not through an active forum.

Competition Matrix

	Brilliant.org	Khan Academy	Lumosity	LogicPath
Reasoning	✓ Covers reasoning indirectly through math and problem-solving challenges	✓ Offers some content on critical thinking (mostly in test prep, reading, and argument analysis)	✓ Offers some content on critical thinking (mostly in test prep, reading, and argument analysis)	✓ Dedicated lessons on reasoning, from everyday logic to formal logic
Informal/Formal Logic	✗ Not a focus. Touches on reasoning in math only	✗ Minimal exposure (Basics on arguments in some humanities courses)	✗ None. Only focuses on brain games not structured logic	✓ Core feature is progressive modules on informal and formal logic
Engagement	✗ Limited gamification, mostly traditional problem sets	✗ Engagement relies on video format and quizzes	✓ Strong gamified elements using streaks, leaderboards & mini-games	✓ Gamified quests, challenges, and streaks tied to logic learning
Skill Development	✗ Builds math, CS, and puzzle-solving skills but not transferable logic skills	✗ Academic skills in specific subjects, but weak in general reasoning	✗ Improves short-term memory and focus, not reasoning skills	✓ Structured path to build long-term logic and critical thinking abilities
Theory Development	✗ Some exposure to STEM theories, but no logic theory foundation	✗ Mostly focused on applied content, theory limited	✗ No theory, only experimental games	✓ Lessons explicitly develop both logic theory and application

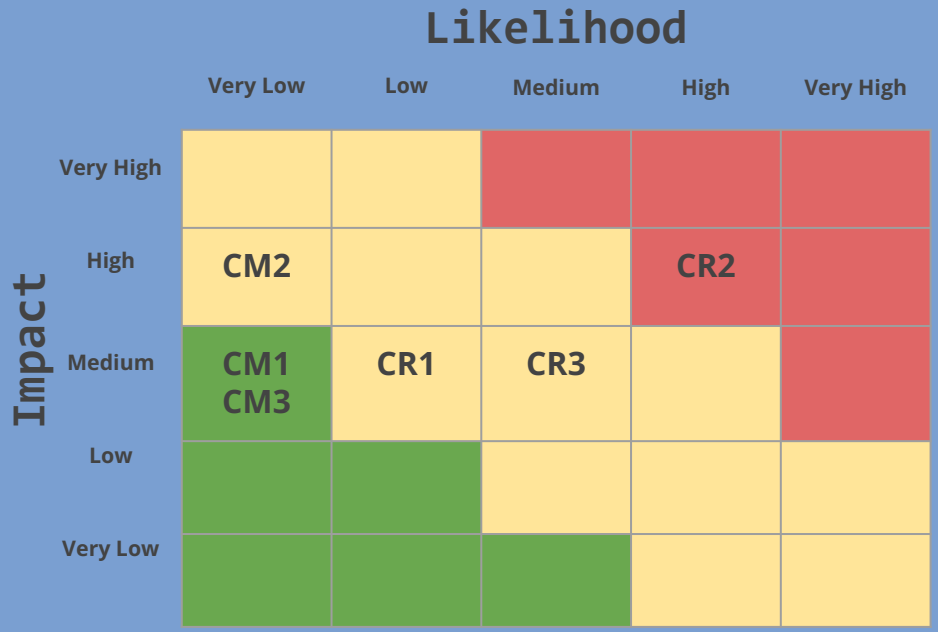
User Risk Matrix

- **Risks**
  - **UR1**: Limited personalization risk
  - **UR2**: Insufficient feedback risk
  - **UR3**: Limited progress tracking risk
  - **UR4**: User may find progression to be too difficult
- **Mitigation**
  - **UM1**: Adaptive learning features that adjust difficulty based on user performance.
  - **UM2**: Immediate feedback on failed attempts with detailed explanations of why answers are wrong.
  - **UM3**: Achievement history displaying badges, streaks and milestones.
  - **UM4**: Break complex topics into smaller lessons



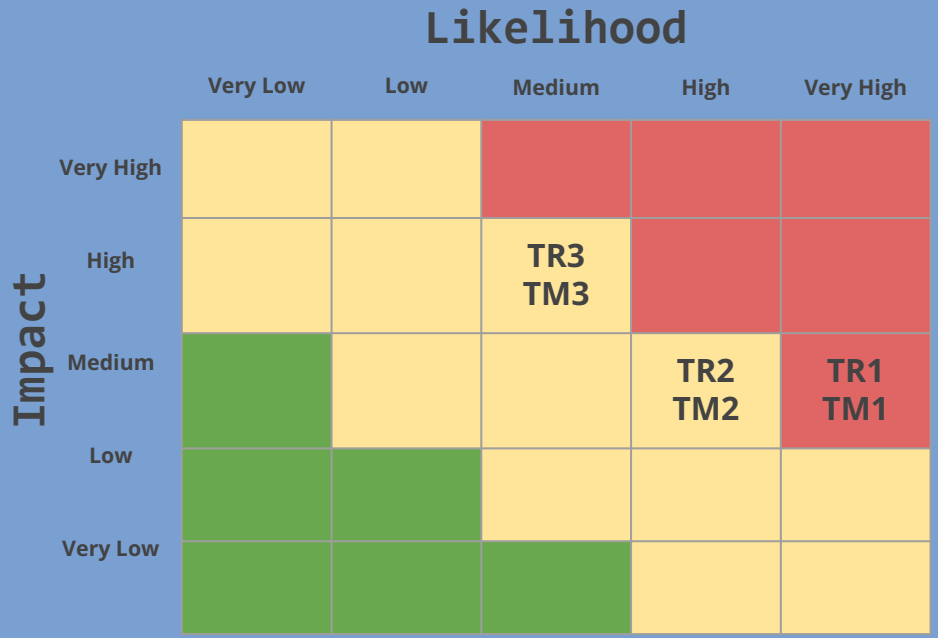
Customer Risk Matrix

- **Risks**
  - **CR1**: Teachers may not think the app is credible.
  - **CR2**: People may not want to pay for premium services.
  - **CR3**: People make find the topic too intimidating still.
- **Mitigation**
  - **CM1**: Partner with logic professors for content validation
  - **CM2**: Tiered pricing for individuals vs institutions
  - **CM3**: Extensive beta testing with target users.



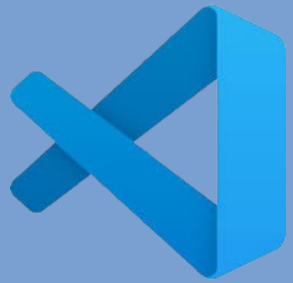
Technical Risk Matrix

- **Risks**
  - **TR1**: Creating high quality content that is engaging may be more time consuming.
  - **TR2**: Creating both web and mobile platforms at the same time may delay development time.
  - **TR3**: Interactive simulations and gamification of the content may be challenging for a college team.
- **Mitigation**
  - **TM1**: Modular content architecture
  - **TM2**: Build web platform first, use proven frameworks (React, Node.js)
  - **TM3**: Prototype complex features before implementation



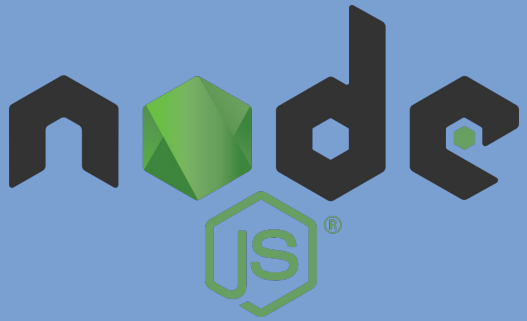
Development Tools

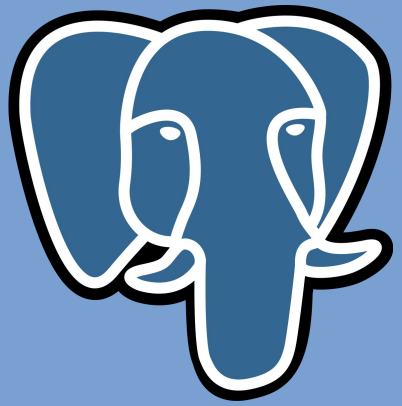
- **IDE**: VSCode
- **Version Control**: Git & GitHub
- **CI/CD**: GitHub Actions & Workflows



Tech Stack

- **Front-end Languages**: HTML, CSS, Javascript, React
- **Back-end Languages**: Node.js
- **Database**: PostgreSQL





Glossary

- **Logic:** the systematic use of symbolic and mathematical techniques to determine the forms of valid deductive argument.
- **Formal/Informal Logic:** Formal logic is based off deductively valid reasoning. Informal logic is based off natural languages.
- **IDE**: Integrated Development Environment
- **CI**: Continuous Integration
- **CD**: Continuous Deployment

References

Martel, Cameron, et al. “Reliance on Emotion Promotes Belief in Fake News.” Cognitive Research: Principles and Implications, vol. 5, no. 1, 7 Oct. 2020, pp.1–20, cognitiveresearchjournal.springeropen.com/articles/10.1186/s41235-020-00252-3, https://doi.org/10.1186/s41235-020-00252-3.

Hua, Yanan. (2018). The Influence of Debate on Chinese College Students Critical Thinking Disposition: A Multiple Case Study Based on Paul-Elder Model of Critical Thinking. 10.2991/icesem-18.2018.5.