Lab 1 – ReasonED Descriptive Paper

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1. Introduction

In this digital era of the information age, the need for strong critical thinking skills is at an all-time high. The ease of viewing and sharing digital information has made us more vulnerable than ever to misinformation and disinformation. While Big Tech companies have started incorporating fact-checking systems into their platforms, flawed information is not the only way we can be misled online. With the growth of opinion content across the web has come a growth in the use of flawed *reasoning*, or *logical fallacies*. People use logical fallacies in their arguments, either accidentally or intentionally, to try to assert their points or to manipulate people who disagree with them. Logical fallacies are not typically claims of fact. Thus, they often slip through the cracks of fact-checking systems and are free to float around online. Making matters worse, social media sites employ algorithms which curate our feeds to only show us what we want to see. This process typically involves filtering out content that is not in support of our own beliefs and interests, exploiting our confirmation bias and creating personal echo chambers we may not even realize. Since logical fallacies are manipulative yet go unchecked on a very opinionated internet, it is almost solely up to *users* to recognize faulty logic in the posts they may encounter. To be able to navigate the internet mindfully and distinguish manipulative reasoning from genuine reasoning, people must have a working knowledge of logical fallacies and adequate skills to identify them.

Figure 1 shows a hasty generalization fallacy in a user's social media post about their experience with an American Airlines flight attendant. A hasty generalization occurs when a person draws a conclusion without having sufficient evidence to support it. In the case of the post below, the user expresses that they had a bad experience with an employee enforcing safety rules and uses this to, perhaps jokingly, conclude that American Airlines' bankruptcy is due to the behavior of its flight attendants. This particular post might not be so serious; it is only a single, non-political example of a logical fallacy. However, similar flawed conclusions are made every day to make claims about social, political, and health-related topics.

Figure 1: Hasty generalization Fallacy

Although American K-12 schools are increasingly advocating for internet literacy, the majority of educators cannot teach the level of critical reasoning necessary for identifying logical fallacies on the internet. While 86% of 4th-grade teachers say they emphasize teaching deductive reasoning skills, only a mere 39% of 8th-grade teachers say the same (Bouygues). Moreover, in a 2019 global survey conducted by Cambridge, 50% of teachers indicated they do not have enough time to effectively teach critical thinking skills, and only 21% of teachers said that they have the resources necessary to teach them.

Existing curriculums do not include adequate resources or requirements for teaching logical fallacies. If educators wish to emphasize these concepts, they must spend time either creating their own materials or searching through the internet to find potential tools. Furthermore, if the resources are not reusable over the year, students will not develop adequate skills, and if there are not similar resources across grade levels, students will forget the material and fail to build on the skills they have acquired. As a result, high school graduates are not prepared with the skills necessary to identify logical fallacies in an increasingly online world.

An optimal solution should account for these common pitfalls by having resources that are both reusable in a way that still builds on fallacy identification skills and curated for multiple grade levels ranging from elementary to high school. As educators lack the time needed to create their own resources, a solution must emphasize ease of use by being quick for educators to set up and easy to guide students through. Team Crystal is proposing a software solution: ReasonED.io.

2. Product Description

ReasonED.io will be a game-based learning website that improves the ability of users to identify logical fallacies through simple, age-appropriate games. ReasonED games will be curated for elementary, middle, and high school respectively to support year-long learning and continuous learning over all grade levels. Thus, it will provide educators with a tool to cultivate their student's critical reasoning skills over the long term and beyond the scope of a single subject. The games will all share the same goal of introducing and improving logical fallacy identification skills, but the difficulties and approaches will vary depending on the age group. While the concepts and scenarios will be simplified for younger ages, these games aim to plant the seeds of critical thinking and encourage kids to recognize flawed reasoning. Many of the games, including all of the prototype games, will involve logical fallacies personified as fun characters. The fallacy characters will serve as memorable guides in students' fallacy education journeys.

2.1. Key Product Features and Capabilities

The educational games hosted on the ReasonED website shall all have the characteristics listed below.

General Game Features:

- Playable directly on the website
- No login or download necessary to play
- In-game tutorials
- Text with text-to-speech options for better accessibility

The ReasonED website (games excluded) shall have the characteristics below.

General Website Features:

- Free Sign-up and Username creation (Usernames regulated)
- Readings that introduce the concept of logical fallacies for each age group
- Printable graphics for Educators
- Links to External Resources for Educators

2.2. Major Components (Hardware/Software)

Users will interact with ReasonED.io through Desktop and Tablet browsers. The components being developed are the website interface, its collection of games, and its educator resources. The following software tools will be utilized to build those components.

Back-End:

ReasonED will use a Node.js web server, which offers scalability and flexibility. It will also utilize Next.js API Routes for serverless functions as the framework has WebSocket built into it. ReasonED games will be built using Godot 3 engine, with C# and GDScript as their programming languages. Godot is a powerful open-source engine for two-dimensional games and provides export functionality to HTML5 for use in browsers. ReasonED will be hosted via Vercel for Next.js and will use a Vercel PostgreSQL database.

Front-End:

ReasonED will use a Next.js React framework with Typescript and Tailwind CSS, enabling a responsive and interactive user interface.

Development Tools:

Git and GitHub will be used for version control as they are a reliable way to track changes in the codebase. Trello will be used to keep track of story and issue progress. JavaScript libraries such as Mocha and Chai will ensure the reliability of the code through testing. The IDE of choice is Visual Studio Code, which provides a smooth and efficient coding experience for the team. Discord and Zoom will serve as the primary means of communication and coordination among team members.

3. Identification of Case Study

3.1. Intended Users

ReasonED will be a dynamic educational platform that caters to a diverse set of users. The primary beneficiaries are categorized into two groups: Customers and End Users.

Customers:

1. K-12 Schools: ReasonED aims to play a pivotal role in K-12 education, supporting educators in enhancing critical thinking skills among students.
2. Colleges and Universities: In higher education, ReasonED serves as a valuable supplement to classroom learning, offering an interactive and gamified approach to logical fallacy education.
3. Educational Publishers: ReasonED becomes a sought-after resource for educational publishers seeking innovative tools to elevate their offerings.

End Users:

1. K-12 Students (including Homeschoolers): ReasonED transforms logical fallacy education, providing a dynamic and accessible learning experience.
2. College Students: College students find ReasonED a complementary tool to reinforce their understanding of logical fallacies, with a gamified environment adding an interactive layer to traditional coursework.

3. Educators: Educators at all levels discover a valuable ally in ReasonED, providing an interactive and engaging resource to enhance logical fallacy education.
4. General Public: While designed primarily for educational institutions, ReasonED is intentionally crafted to be accessible to the general public.

3.2. Intended Use

The intended use of ReasonED revolves around providing engaging and effective logical fallacy education to different educational stakeholders. It can serve as a supplement to traditional classroom learning, offering an interactive and gamified approach to enhance critical reasoning skills, or as a standalone resource to introduce logical fallacies in places where such curriculum may be lacking. Because ReasonED is a website, once it is whitelisted on school networks, students can access it in their free time during school. Given how schools are pushing to incorporate more technology into lessons, ReasonED has the potential to gain a lot of exposure even outside of language arts classes.

3.3. Case Study Group

To further enhance the utility and accessibility of ReasonED, we envision a collaboration with local schools to gain approval for the platform's usage in their educational environments. By working closely with school administrators and educators, we aim to integrate ReasonED into their curriculum as a valuable tool for logical fallacy education.

3.4. Future Use

As ReasonED evolves, the user base will extend beyond traditional educational stakeholders. Lifelong learners, language arts enthusiasts, and anyone interested in fostering a more informed society are all welcomed onto the platform. Our goal is to create a widely accessible and adaptable tool for logical fallacy education.

4. Product Prototype Description

The ReasonED prototype will consist of a visually appealing website with pages dedicated to games, readings, and educator resources respectively. Three two-dimensional games will be developed and embedded on the website, each in which a logical fallacy is personified as a fun character with some flawed tendency that corresponds to the fallacy. The games will be:

- **Straw Manny:** Straw Manny is a hopeful knight who needs better training. He only practices combat on fake straw men because they are easier to hit. As a result, he isn't a very skilled fighter. Players need to help Manny build his combat skills by attacking real opponents rather than fake ones, teaching the concept of the "straw man" fallacy.
- **Hasty Harry:** Harry is an astronaut who makes flawed generalizations about the new creatures and plants he discovers on planets he visits. Players will collect enough information about each planet and help Harry avoid making generalizations in his planet report, teaching the "hasty generalization" fallacy. This will be a top-view game.
- **Slope Sadie:** Sadie is a snowboarder who tends to jump to extreme conclusions. In this game, players need to guide Sadie safely down a snowy path without letting her slip into a pitfall, introducing the "slippery slope" fallacy. This will be a platformer game.

The games will be curated for three general age groups; the first group being grades 2 and 3, the second being all middle schoolers, and the third being all high schoolers. Curation will be achieved by adjusting the simplicity of the examples, reading levels, and feedback, and by adjusting the penalties for wrong answers. Each game will follow a similar pattern of providing an age-appropriate explanation about the specific logical fallacy in focus, and feedback after each answer to help players understand why the character's thinking is incorrect so that they can identify similar patterns in real-life scenarios.

A breakdown of the prototype in contrast to the real-world product (RWP) can be seen in Table 1.

RWP vs. Prototype

Features & Functionality	RWP Features	Planned Prototype	Actual Prototype
PC & Tablet compatibility	✓	✓	
Characters+ Animations	✓	✓	
Accessibility Features	✓	Text-to-Speech	
Educator Tools	✓	Printable Graphics, Progress Tracking	
Paid Features	✓		
Games for k-12+	✓	1 Game Elementary, 1 Middle, 1 High School	

Table 1: Real World vs. Prototype

4.1. Prototype Architecture (Hardware/Software)

The ReasonED prototype will use the following front-end and back-end architecture:

Front-End
- Frameworks: Next.js React, Tailwind CSS
- Languages: TypeScript

Back-End
- Web Server: Node.js
- Languages: Javascript, C#, GDScript
- Engine: Godot 3
- Database: Vercel PostgreSQL
- Hosting: Vercel

Figure 2 demonstrates how each of these components relate to the product prototype.

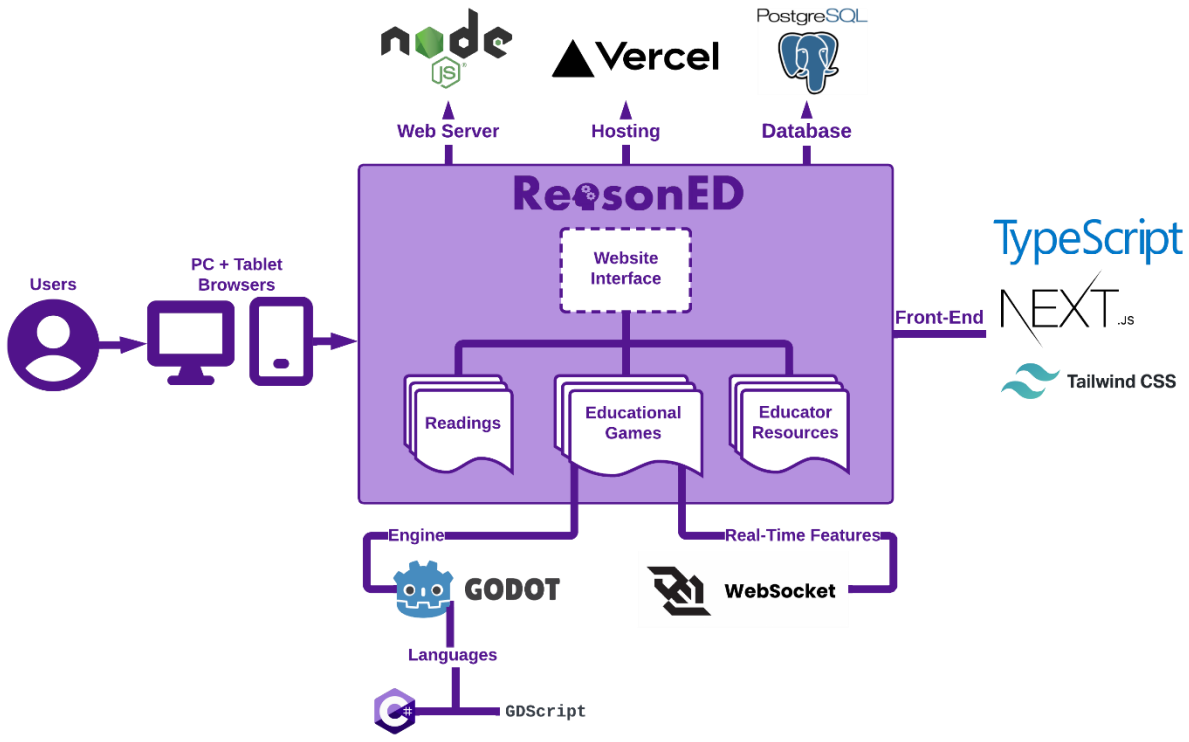

Figure 2: Multi-Functional Component Diagram

4.2. Prototype Features and Capabilities

While the prototype will not include all the features that would be present in the real-world product, it will include the following:

- **User Sign-Up and Log-In:** Users will be able to create a ReasonED account using their email address. Users will be able to pick an appropriate username to be displayed on leaderboards which they may place on.
- **In-game tutorials:** Each game will have a tutorial level to introduce players to the gameplay mechanics.
- **Leaderboards:** Each game will have a connected leaderboard displaying the usernames of account-holding users with the highest scores for the respective game.
- **User Progress Tracking:** Account holders' high scores and level progress data will be stored in the database to enable the addition of achievements and badges in the future.
- **Adaptive Learning:** The games must build logical fallacy identification skills as users play. The challenges that occur in the games must increase in difficulty if players select the correct answers or decrease in difficulty if players answer incorrectly. Each challenge will have a difficulty score that algorithms will use to determine the next challenge that a player will encounter.
- **PC & Tablet Compatibility:** The ReasonED website and all its games will be compatible with personal computers, tablets, and various browsers. The Next.js and Tailwind CSS framework offers automatic sizing of the webpage elements to fit common screen sizes.
- **Text-to-Speech:** Each game will have text-to-speech functionality provided by Godot.
- **Printable Graphics:** Downloadable/printable images of each game's characters will be available in the teacher resources section of the website.

4.3. Prototype Development Challenges

While developing the ReasonED prototype, a variety of challenges will appear:

1. Technical Compatibility: Ensuring a consistent and optimized user experience across various PCs and tablets, each with different specifications and screen sizes will require testing and adaptation.
2. Game Development: Navigating Godot 3 Engine to develop the games will be a learning curve for the team. Translating algorithm diagrams to scripts, integrating animations, and addressing bugs will be particularly difficult.
3. Server-Database Communication: Establishing communication between the server and the database for more custom functionalities like user progress tracking and leaderboards will be difficult as the team does not have extensive experience with database development.
4. Educational Value & Adaptive Learning: Developing educational games for different K-12 levels presents the challenge of maintaining both educational value and user engagement. Each game should be tailored to the specific educational abilities of its target audience while ensuring a fun playthrough via adaptive learning.

Addressing these challenges will require individual research and close collaboration between developers, designers, educators, and potential users. Continuous testing, user feedback loops, and an iterative development approach will be instrumental in refining the prototype.

5. Glossary

Confirmation Bias - A cognitive bias that involves seeking, interpreting, and remembering information that confirms one's preconceptions (American Psychological Association n.d.).
Critical Thinking - The ability to think clearly and rationally, understanding the logical connection between ideas and the ability to make reasoned judgements (American Psychological Association n.d.).
Fact-Checking - The process of verifying the accuracy of claims made in public discourse and journalism (Cambridge English Dictionary n.d.).
False Dilemma - A fallacy that presents a limited set of options as the only possible choices when there may be other alternatives (Excelsior OWL n.d.).
Logical Fallacy - An error in reasoning or a flawed argument that can make an argument appear valid when it is not (Nikolopoulou, 2023).
Misinformation - False or inaccurate information shared, often unintentionally, without the intent to deceive (Dictionary.com n.d.).
Disinformation - False information deliberately spread to deceive or mislead others (Dictionary.com n.d.).
Slippery Slope - A fallacy that suggests one small step will inevitably lead to a chain of related events, often with exaggerated consequences (Excelsior OWL n.d.).
Straw Man Argument - A fallacy that involves misrepresenting an opponent's argument to make it easier to attack and refute (Excelsior OWL n.d.).

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