



# Rogue-Like Algebra

by the Gold Team

Societal Problem Presentation

*“Gamify algebra—turn problem-solving into an adventure!”*



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# Team Bio



Brennen Gabriel

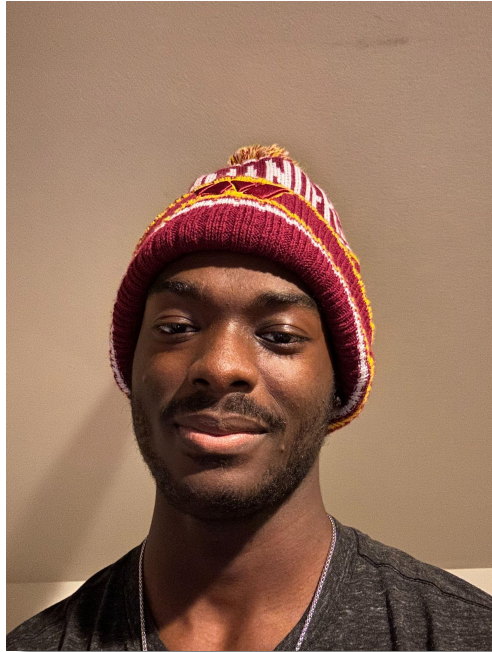


Gabriel Lugo



Jillian Cequeria

# Team Bio



Brandon Thomas



Jacob Thompson



Bryan Baker

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# Pitch

We aim to develop a game to help those who struggle to understand algebra. Our game will be a *turn-based, rogue-like adventure* through algebra. With dungeons, bosses, and power-ups all throughout, you'll be engaged in the world as much as you are with the math.

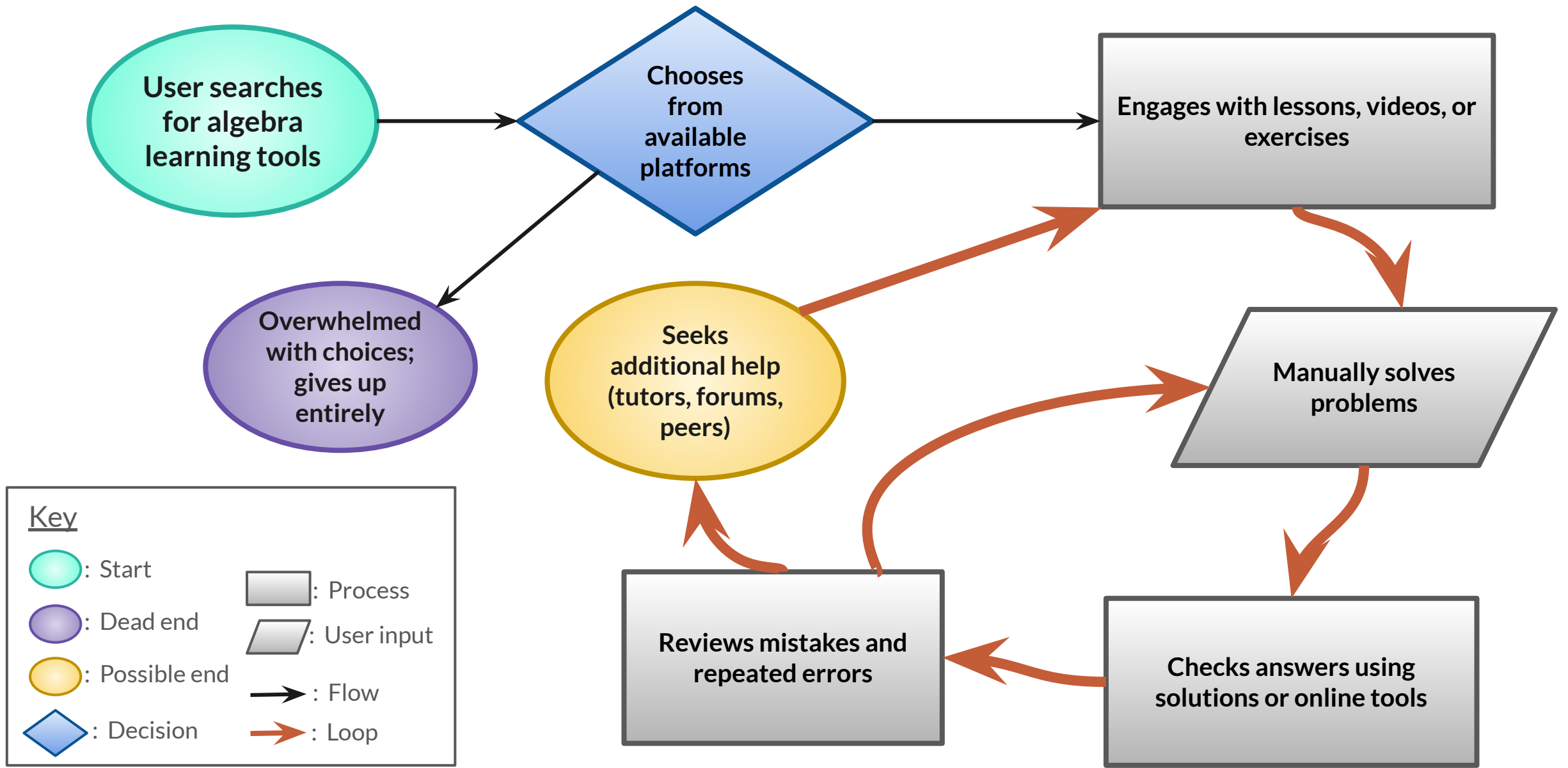
But be sure to calculate your next step carefully. Damage is dealt to the reckless, and penalties will be incurred for wrong answers. Find hints and collect extra lives to survive your mathematical journey.

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# Problem





Current Process Flow



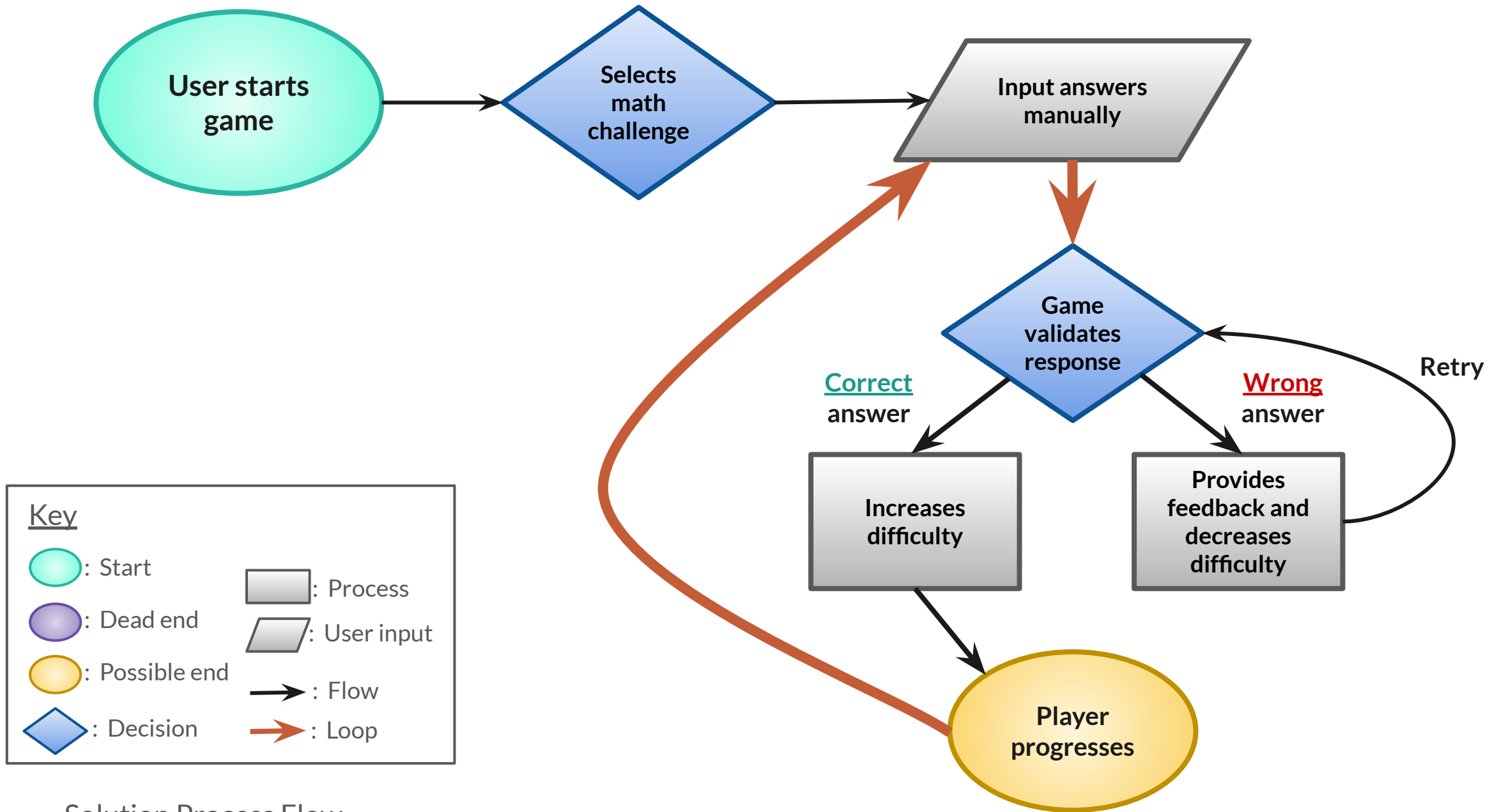
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# Solution



# Solution Statement

- **Turn-based, rogue-like adventure game** - the player solves math puzzles to progress through procedurally generated dungeons.
- **Efficiency-focused gameplay** - Players are incentivized to solve problems efficiently and mistakes cause damage.
- **Upgrades** - Upgrades, such as hints, energy, or health, can be found or bought.
- **Platforms** - Mobile / Web



Solution Process Flow



## Issues

- **Tedious:**
  - Manually adjusting difficulty
  - Re-entering answers
- **Error-prone:**
  - Mistyped answers
  - Misreading feedback
- **Shortcomings:**
  - No adaptive learning
  - Limited engagement
  - UI inefficiencies

## Opportunities

- **Automate:**
  - Generate math challenges
  - Adjust difficulty automatically
  - Real-time validation
- **Partially Automate:**
  - Hints for incorrect answers
  - Real-time feedback
- **Repetition:**
  - Manual input every time
  - Re-validating similar problems



# What it Will Do

- **Turn-based Combat** - Solve algebra problems to attack, defend, and use abilities.
- **Rogue-like Gameplay** - When you lose, you have to start again from the beginning.
- **Procedural Dungeons** - Unlock skills and items by solving math challenges.
- **Penalties for Mistakes** - Wrong answers lead to in-game consequences.
- **Optimization Puzzles** - Try to find the best solutions, not just any solution.
- **Adaptive Difficulty** - The game adjusts to the player's skill level.
- **Exploration & Rewards** - Solve puzzles to unlock new areas and items.
- **Minimalist UI & Hints** - Clear interface with optional hints for guidance.



# What it Will Not Do

- **Traditional Gamification** - No forced lessons or boring drills.
- **Multiple-Choice Questions** - Players solve open-ended problems, not just pick provided answers.
- **Instant Failure for Mistakes** - Errors have penalties, but players can recover.
- **Overly Complex UI** - The interface stays clean and intuitive.
- **Rote Memorization** - Focus is on problem-solving, not rote learning.
- **Strict Single Solutions** - Multiple valid algebraic approaches are allowed.
- **Pay-to-Win Mechanics** - No microtransactions that impact gameplay.

# Competition Matrix

Feature	Rogue-Like Algebra	IXL	ProdigyGame Math	DragonBox Algebra 12+
Integration with Learning Management Systems	Yes	Yes	Yes	
Web Integration	Yes	Yes	Yes	
Mobile Integration	Maybe	Yes	Yes	Yes
Leaderboard and Challenge System	Yes	**Challenge System Only	Unsure	Unsure
Comprehensive Curriculum Based		Yes	Yes	Unsure
Available Free Subscription	Yes (with Ads)			
Rogue-Like Gameplay	Yes			
Adaptive Difficulty	Yes	Unsure	Yes	Unsure



## Competition Matrix (cont.)

Feature	Rogue-Like Algebra	IXL	ProdigyGame Math	DragonBox Algebra 12+
Turn-based Combat	Yes		Yes	Yes
Procedural Dungeons	Yes			
Optimization Puzzles	Yes			
Exploration & Rewards	Yes		Yes	

**\*For the unsure labels, it is behind a paywall and that is not within our team's budget\***

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# Key Features



# Core Gameplay Concepts

## Turn-Based Combat with Algebra Challenges

- Incorrect answers leads to penalties (e.g., weaker attacks, enemy advantages)
- Players solve algebra problems to attack, defend, or use abilities

## Inventory & Equipments System

- Weapons, armour, and consumables provide tactical advantages

## Difficulty Scaling

- Problems given to the player will increase in difficulty as the player progresses

## Minigames

- Different areas of algebra will be split up into different events throughout the game, such as potion crafting and item enchanting



# Algebra-Based Puzzles & Problem-Solving

## Contextual Algebra Challenges

- Solving for unknowns, simplifying expressions, or graphing functions in an immersive way

## Dynamic Difficulty Scaling

- Difficulty adapts based on the player's performance to maintain engagement

## Multi-Step Problems for Special Moves

- More complex algebra unlocks powerful attacks



# Narrative & Worldbuilding

## A Mysterious Lore-Driven Dungeon

- Players explore an ancient world where algebraic knowledge holds power.

## NPC Mentor

- Players may receive help from a mentor to get hints if they are stuck.



# Progression & Reward Systems

## XP and Leveling Up via Problem Solving

- Solving harder problems earns better XP


## Achievements & Streaks for Engagements

- Rewards for continuous answers, no hints used, etc.

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# Background & Statistics





**“Hierarchical linear modeling analyses of the final analytic sample (N = 1,850) showed significantly higher posttest scores for students who used From Here to There and DragonBox 12+ compared to the Active Control condition.”**







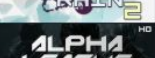


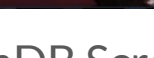
- Quote from “The Impacts of Three Educational Technologies on Algebraic Understanding in the Context of COVID-19”

SteamDB Search...

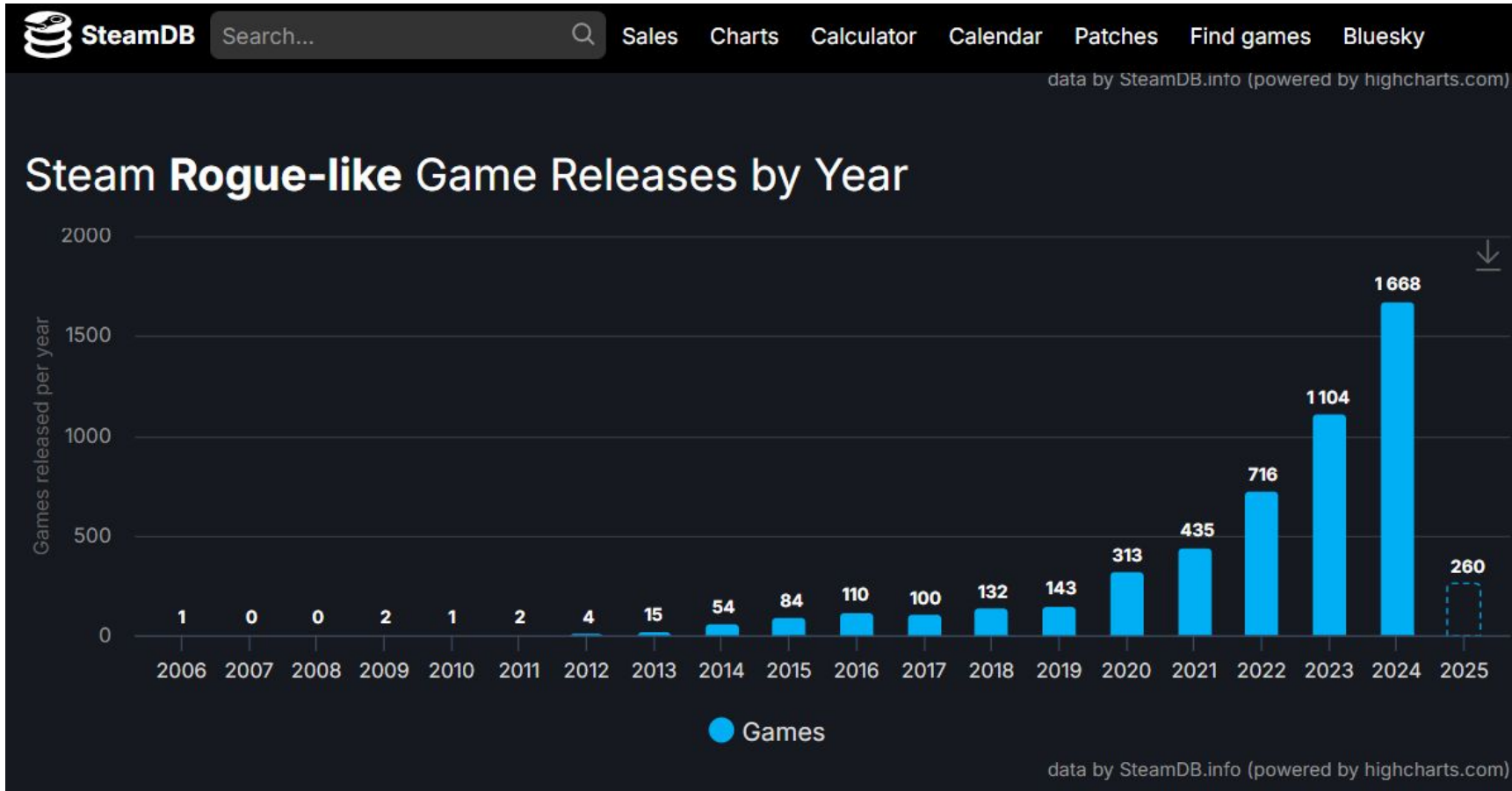
Sales Charts Calculator Calendar Patches Find games Bluesky

### Most played Rogue-like games

100 entries per page. Hold Shift to sort by multiple columns. Search...

SteamDB.info	Name ↓↑	Current ↓↑	24h Peak ↓↑	All-Time Peak ↓↑	
	The Binding of Isaac: Rebirth	25,044	28,907	70,701	+
	Balatro	21,741	23,438	43,905	+
	Don't Starve Together	16,649	55,703	115,925	+
	Slay the Spire	10,629	19,596	33,086	+
	Hades II	7,215	8,015	103,567	+
	Brotato	6,185	10,712	38,905	+
	Risk of Rain 2	5,898	7,295	75,406	+
	Alpha League HD	4,535	5,253	10,252	+
	Hades	3,356	3,755	54,240	+
	Vampire Survivors	3,334	3,508	77,061	+

SteamDB Screenshot from 3/5/2025 with the filter set to “Rogue-like” games
















SteamDB Screenshot from 3/5/2025

## Results

Found **8523** games. It's 6.5% of all Steam games

Export to Excel  **Pro**

#	Title	Release	Price	Tags	Followers	Reviews	Score	Net Revenue 
1	 <b>Hades</b> <a href="#">Steam</a>  Publisher: Supergiant Games Developer: Supergiant Games	Sep 17, 2020 4 years, 5 months ago	\$24.99	Action Action RPG Action Roguelike Atmospheric Difficult Dungeon Crawler Great Soundtrack Hack and Slash Hand-drawn	291,414	255,246	10/10	~\$120 million
2	 <b>Risk of Rain 2</b> <a href="#">Steam</a>  Publisher: Gearbox Publishing Developer: Hopoo Games	Aug 11, 2020 4 years, 6 months ago	\$24.99	Action Action Roguelike Bullet Hell Co-op Difficult Early Access Great Soundtrack Indie Loot Looter Shooter Multiplayer Online Co-Op	320,685	207,277	9/10	~\$99 million
3	 <b>Don't Starve Together</b> <a href="#">Steam</a>  Publisher: Klei Entertainment Developer: Klei Entertainment	Apr 21, 2016 8 years, 10 months ago	\$14.99	2D Action Adventure Atmospheric Co-op Crafting Difficult Funny Horror Indie Multiplayer Online Co-Op Open World	701,060	334,900	10/10	~\$96 million
4	 <b>The Binding of Isaac: Rebirth</b> <a href="#">Steam</a>  Publisher: Nicalis, Inc. Developers: Edmund McMillen, Nicalis, Inc.	Nov 4, 2014 10 years, 4 months ago	\$14.99	2D Action Action Roguelike Atmospheric Co-op Dark Difficult Dungeon Crawler Gore Great Soundtrack Horror Indie Local Co-Op	341,273	300,613	10/10	~\$86 million
5	 <b>Slay the Spire</b> <a href="#">Steam</a>  Publisher: Mega Crit Developer: Mega Crit	Jan 23, 2019 6 years, 1 month ago	<del>\$24.99</del> <b>\$8.49</b> <b>-66%</b>	2D Card Battler Card Game Casual Deckbuilding Difficult Dungeon Crawler Fantasy Great Soundtrack Indie Mouse only	221,514	152,244	10/10	~\$73 million
6	 <b>Dead Cells</b> <a href="#">Steam</a>  Publisher: Motion Twin Developer: Motion Twin	Aug 6, 2018 6 years, 7 months ago	\$24.99	2D Action Action Roguelike Adventure Atmospheric Dark Fantasy Difficult Funny Hack and Slash Indie Metroidvania	382,701	140,502	10/10	~\$67 million

Games-Stats.com Screenshot from 3/5/2025 with the filter “Rogue-like” games



# Target Audience

## Primary Audience

- Middle School and High School Students (Ages 12-18)
- STEM-Oriented Gamers & Puzzle Enthusiasts

## Secondary Audience

- Parents and Educators
- Casual & Indie Game Players
- Games with an Interest in Logic & Strategy

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# Engagement Strategies



# Gamification of Learning

## Time-Based Combos and Multipliers

- Solving within a time limit increases attack damage

## Boss Battles with Complex Algebra Challenges

- Require multiple algebraic steps to defeat





# Adaptive Learning

## Hints and Adaptive Challenges

- Struggling players get guided help without “hand-holding”

## Procedurally Generated Problems for Replayability

- Problems change dynamically, ensuring fresh experiences



# Social & Competitive Elements

## Leaderboards & Speedruns


- Track best problems-solving times and dungeons cleared

## PVP & Co-Op Modes

- Battle friends or solve cooperative algebraic puzzles

## Guilds & Team Challenges

- Players work together to solve harder problems



# Rewarding Risk & Creativity

## Risk-Rewarding System


- Players can attempt harder problems for greater loot

## Multiple Solution Paths

- Creativity encouraged in problem-solving approaches
- Encourage avoiding rote memorization

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# Development Tools



# Integrated Development Environment (IDE)

## Visual Studio Code

We will use VS Code because it is **powerful**, **extensible**, and, most importantly, **free**.



# Version Control

## Git / GitHub

We will use Git through GitHub because it is an **industry-standard** tool for version control.



## **Continuous Integration (CI) & Continuous Deployment (CD)**

### **GitHub Actions & Workflows**

We will use GitHub Actions because it is directly integrated with GitHub.



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# Major Functional Components



# Operating System

## Windows / Linux

Windows is the most widespread end-user platform, while Linux is what powers Android and the Steam Deck.



# Engine

## Godot

Godot is free and open source software, which gives us a lot of flexibility.

It is easy to use due to the intuitive interface and prevalence of tutorials and documentation.



# Language

## Rust / GDScript

We will primarily use the Rust programming language as it is **fast**, **modern**, and **safe**.

We may also be using GDScript for features that aren't covered by Rust in Godot.

# Required Components

Technology	Must be built
Godot	
Audio Subsystem	
Networking Subsystem	
Character Controller	Yes
Leaderboard System	Yes
Procedural Dungeon Generator	Yes
Enemy AI and Pathfinding	Yes
Procedural Problem Generator	Yes

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# Risks



# Technical

**Players “Sandbagging.”** When done poorly, players can easily circumnavigate the adaptive difficulty by sandbagging their progress.

To mitigate this, we can slowly raise the difficulty when stagnation is detected. To prevent falling behind, review practice can be offered.

- Probability: 5
- Impact: 4

**Cheating.** If we want leaderboards, we would need to prevent players from uploading scores that are impossible to attain fairly.

To mitigate this, an anti-cheat system will need to be implemented.

- Probability: 5
- Impact: 5



# Security

**Data Leakage.** Privacy is important, so we must ensure that anything collected (names, passwords, emails, phone numbers, etc.) are properly stored and protected from leaks.

This can be done by using secure, encrypted methods of storage and communication via clients, databases, and servers.

- Probability: 3
- Impact: 5






# Legal

**Data Leakage.** As mentioned before, data privacy is extremely important and legally protected. In certain regions, such as the US and EU, there are specific data protection laws that must be followed.

To prevent legal action, we would need to review data handling laws in any regions we plan to release in.

- Probability: 3
- Impact: 5



# Customer & End User

**Boredom.** If math problems aren't balanced, players may get frustrated or bored.

To mitigate this, problems should be varied and gameplay engaging.

- Probability: 4
- Impact: 4

**Poor Motivation.** Weak rewards or progress systems could make players quit (motivation to keep playing).

As a solution, rewards should be designed to directly assist the player and keep them engaged.

- Probability: 5
- Impact: 3

# Risk Matrix (Pre-Mitigation)

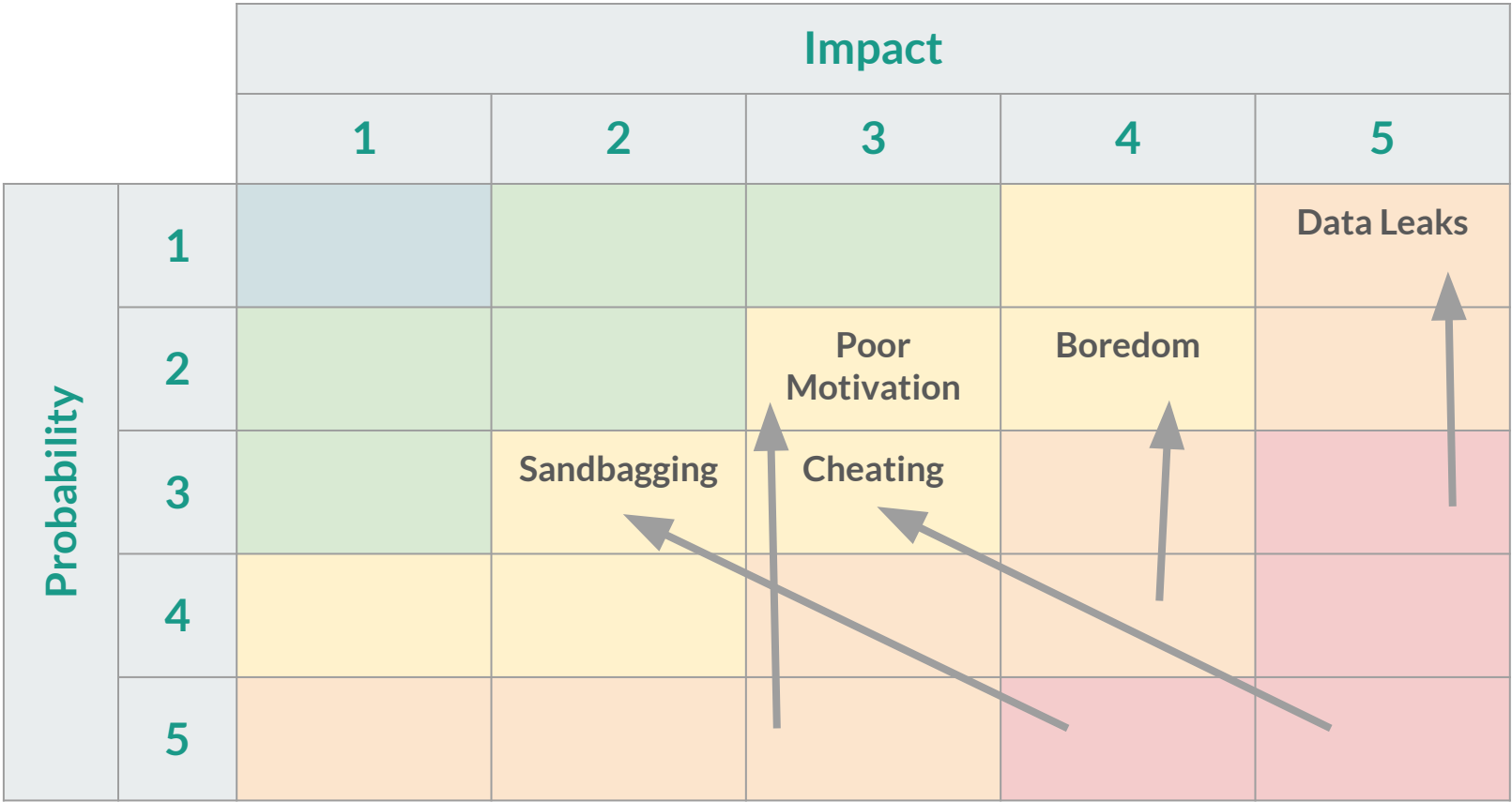
Blue: Low severity

Red: High severity

		Impact				
		1	2	3	4	5
Probability	1					
	2					
	3					Data Leaks
	4				Boredom	
	5			Poor Motivation	Sandbagging	Cheating

# Risk Matrix (Post-Mitigation)

Blue: Low severity  
Red: High severity



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# Conclusion

**While algebra may a difficult  
subject for some to learn,  
through the fun of gaming,  
anyone can defeat this math  
monster.**

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# Appendix



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