I would like to restart a session I am working on the game logic and also this is my first time building a game. so we need to go through and look at everything from a software engineer perspective in order to see this as a game with an educational intent. what can we work on while I'm putting together the game logic?

# The Iron Road to Cognition: A Comprehensive Technical and Mechanical Specification for the "Ask Pete" MMOlitRPG Ecosystem

## Executive Summary

The "Ask Pete" initiative represents a paradigmatic shift in the landscape of educational technology, proposing a transition from the static, repository-based models of current Learning Management Systems (LMS) to a kinetic, Massively Multiplayer Online Literature Role-Playing Game (MMOlitRPG).1 This report provides the definitive architectural and mechanical specification for the platform, synthesizing the project's foundational "Railway Pedagogy" with a rigorous D20-based game system. The objective is to create a "Physical AI" ecosystem where the learner is operationalized as a motive force—a Train—navigating a complex topography of knowledge.1

This document details the complete rule set, character creation mechanics, and authoring tool integration required to build the software. It replaces generic fantasy tropes with a "Railway Ecosystem" metaphor, where Cognitive Load Theory (CLT) governs the physics of the world, and Jungian Psychology defines the driver's persona.1 By adopting a Rust-powered, local-first technical architecture, the platform ensures both high-performance gameplay and absolute psychological safety for the learner.1 The mechanics described herein are designed to be "isomorphic," meaning the rules of the game directly mirror the cognitive processes of learning, transforming abstract pedagogy into concrete, playable systems.

This specification serves as the primary "Game Design Document" (GDD) and "Technical Requirements Document" (TRD) for the engineering team. It addresses the user's requirement for a "full MMOlitRPG game mechanics" set, a detailed "character creation tool," and a "rule book" based on a simplified D20 system, all while integrating the specific "Ask Pete" lore and the authoring constraints of the "Train Yard" tool.

## Part I: The Pedagogical Physics Engine – Theory and Lore Alignment

### 1.1 The Railway Ecosystem Metaphor

The fundamental premise of "Ask Pete" is that education is "Cognitive Logistics"—the physical movement of intellectual cargo (concepts) through a network of schemas.1 The game world is not a dungeon to be cleared but a vast, interconnected rail network to be traversed. This metaphor provides the "Lore" that aligns the game mechanics with the learning intent.

#### 1.1.1 The Kinetic Learner

In traditional education, the learner is a vessel to be filled. In "Ask Pete," the learner is a **Locomotive**. They are a physical entity defined by mass (prior knowledge), momentum (learning velocity), and power (cognitive capacity).1 The learner does not "absorb" content; they "transport" it. This active framing is crucial for the "Physical AI" mandate, as it positions the student as an agent of force within the system.2

#### 1.1.2 The Topological Curriculum

The curriculum is the **Track**. Knowledge is a fixed infrastructure constructed by the Instructional Designer (the Logistician). The track has measurable, physical properties that interact with the Locomotive's stats:

* **Length:** The duration of the lesson.
* **Gradient:** The difficulty or complexity of the concept (mapped to Bloom's Taxonomy).
* **Friction:** The clarity of the instruction or the presence of "Fog of War" (ambiguity).1

#### 1.1.3 The Weight of Knowledge

Content is the **Cargo**. Concepts and vocabulary are physical objects that have "weight" (Intrinsic Cognitive Load). They must be loaded onto the train, transported across the track, and delivered to the destination (application/mastery).1 This allows the game to enforce "Load Limits," preventing the cognitive overload that plagues traditional education by physically stopping the train if it is overloaded.

#### 1.1.4 Motivation as Fuel

Gamification provides the **Fuel** (Coal/Steam). Motivation is the chemical energy that powers the engine. It is finite and must be refined from raw curiosity into high-octane engagement (Flow).1 The economy of the game revolves around the management of this energy resource.

### 1.2 Theoretical Foundations

The mechanics are built upon a deep synthesis of three core theoretical frameworks, which are translated directly into game rules.

#### 1.2.1 Cognitive Load Theory (CLT) as Physics

CLT is the "master design principle".5

* **Intrinsic Load (Cargo Weight):** The inherent difficulty of the material.
* **Extraneous Load (Track Friction):** The difficulty caused by poor design or anxiety. The game engine minimizes this through clean UI ("Glassmorphism") and maximizes it as a penalty for poor instructional design.1
* **Germane Load (Combustion):** The effort required to learn. The engine must burn fuel to generate heat (schema acquisition).

#### 1.2.2 Self-Determination Theory (SDT) as Progression

The game satisfies the three needs of SDT:

* **Autonomy:** Fulfilled through the "Switching" mechanic, allowing learners to choose their path through the "Node Garden".5
* **Competence:** Fulfilled through visible stats (Traction, Velocity) and the leveling of the Locomotive.5
* **Relatedness:** Fulfilled through the "Signal Tower" mentor system and the "Persona" archetypes, which give the learner a narrative identity.3

#### 1.2.3 Jungian Psychology as Character Class

Character creation is an act of "Individuation." The game uses Jungian archetypes (Hero, Sage, Jester, Caregiver) to define the learner's "Locomotive Profile." This connects the mechanical stats to the learner's psychological reality, making the avatar a true "Digital Twin" of the self.3

## Part II: The D20 Logistics System – The Core Rule Book

To facilitate the intent of the app and ensure ease of authoring, the game utilizes a modified D20 system. This system provides a familiar, robust mathematical framework for resolving actions while being simplified to focus on narrative and cognitive tasks rather than tactical combat.

### 2.1 The Core Mechanic: The Logistics Check

In standard D20 systems, the core mechanic is d20 + Modifier vs. Difficulty Class (DC). In "Ask Pete," this is rebranded as the **Logistics Check**. Every time the learner attempts to traverse a difficult track section, apply a vocabulary word, or solve a puzzle, the system performs this check.

The Universal Formula:

$$ \text{Result} = \text{d20} + \text{Locomotive Stat} + \text{Skill Proficiency} + \text{Fuel Bonus} - \text{Friction Penalty} $$

* **Locomotive Stat:** Derived from the Jungian Archetype (e.g., Traction, Analysis).
* **Skill Proficiency:** Derived from mastered vocabulary or completed quests (e.g., +2 to "Eloquence").
* **Fuel Bonus:** The player can choose to burn extra Steam ("Overdrive") to boost the roll.
* **Friction Penalty:** Derived from the environment (e.g., Anxiety, Ambiguity).

**Outcomes:**

* **Critical Success (Nat 20):** "Flow State." The train surges forward, refunding the fuel cost and granting a "Momentum" buff.
* **Success (Result $\ge$ DC):** The action completes. The train moves to the next node.
* **Failure (Result < DC):** "Stall." The train stops. The learner must burn extra fuel to retry or request a "Helper Engine" (Hint).
* **Critical Failure (Nat 1):** "Derailment." The learner is locked out of the node temporarily and must complete a "Maintenance" (Reflection) task to reset.

### 2.2 Difficulty Classes (The Gradient Scale)

The Difficulty Class (DC) of a check represents the "Gradient" of the track. This mapping connects **Bloom's Taxonomy** of learning objectives to D20 mechanical difficulty, creating a standardized "Steepness Scale" for authors.6

**Table 1: The Gradient Scale (Difficulty Classes)**

| **Track Gradient** | **D20 DC** | **Bloom's Taxonomy Level** | **Description of Cognitive Challenge** | **Game Mechanic Equivalent** |
| --- | --- | --- | --- | --- |
| **Flat (0%)** | 5 | Remembering | Simple recall. Retrieving facts. Low friction. | "Coasting." Minimal fuel burn. |
| **Light Grade (1%)** | 10 | Understanding | Constructing meaning. Interpreting concepts. | Basic Logistics Check. |
| **Heavy Grade (2%)** | 15 | Applying | Using a procedure in a new situation (VaaM). | "Standard Encounter." Requires Focus. |
| **Mountain Grade (3%)** | 20 | Analyzing | Breaking material into parts. Detecting patterns. | "Elite Encounter." High fuel cost. |
| **High Mountain (4%)** | 25 | Evaluating | Making judgments based on criteria. Critiquing. | "Boss Fight." High risk of stall. |
| **Vertical Rack (5%+)** | 30 | Creating | Putting elements together to form a new whole. | "Raid Boss." Requires Convoy/Mentor. |

**Authoring Tool Integration:** When an Instructional Designer (ID) selects a learning objective level in the "Train Yard" authoring tool (e.g., "Analyze the causes of the French Revolution"), the system *automatically* assigns the corresponding DC (20) to the node. This removes the guesswork for non-game-designers.1

### 2.3 The "Coal and Steam" Economy

The economy of the game is based on energy management, not gold accumulation. This models the finite nature of human willpower and attention.

#### 2.3.1 Resource Definitions

* **Coal (Potential Energy):** Represents raw educational content and unrefined motivation. Coal is acquired by completing "Preparation Nodes" (reading text, watching lectures). It is stored in the Tender.
* **Steam (Kinetic Energy):** Represents current Motivation, Focus, and "Flow." Coal is burned to produce Steam. Steam is the currency used to execute actions.
* **Combustion (Action):** The act of learning requires burning Steam.

#### 2.3.2 The Combustion System

The consumption of fuel is governed by the laws of physics simulated in the Bevy ECS engine.

The Combustion Formula:

$$ \text{Steam Cost} = \frac{\text{Cargo Weight (Intrinsic Load)} \times \text{Track Gradient (DC)}}{\text{Locomotive Efficiency}} $$

* **Implication:** Carrying heavy concepts (High Intrinsic Load) up a steep learning curve (High DC) requires massive amounts of motivation (Steam).
* **The Efficiency Stat:** A "Caregiver" or "Sage" archetype with high Efficiency pays a lower Steam cost, allowing them to travel further without resting. A "Hero" with low Efficiency burns fuel rapidly (Burnout risk).1

#### 2.3.3 The Stall Mechanic

If Current Steam < Required Steam Cost, the action cannot be attempted. The train **Stalls**.

* **The User Experience:** The UI greys out the "Attempt" button. "Insufficient Pressure."
* **The Remediation:** The learner must either:
  1. **Rest:** Enter a "Siding" (Reflection Node) to regenerate Steam via metacognition.
  2. **Refuel:** Go back and collect more Coal (review foundation material).
  3. **Signal:** Call for a "Pusher Engine" (Mentor intervention).1

## Part III: Character Creation – The Jungian Locomotive

The character creation system is the learner's first act of self-reflection. It abandons traditional fantasy races and classes in favor of **Jungian Locomotive Profiles**.1 This "Persona Engine" uses a Situation-Based Quiz to diagnose the learner's psychological starting point and assign a corresponding engine type.3

### 3.1 The "Persona" Quiz Mechanics

The quiz is designed as a "Reflection Quest," not a "Class Picker." The learner is presented with 3-5 narrative dilemmas that have no "correct" answer, only behavioral preferences.

The Dilemma Logic:

Each choice maps to a Jungian axis (Ego vs. Soul, Order vs. Chaos).

**Example Scenario:** "You encounter a stalled train blocking the main line. The engineer is panicking."

* **Option A (Action):** "Push the stalled train to the next station yourself." -> *Points to Hero/Interceptor.*
* **Option B (Knowledge):** "Analyze the engine to find the mechanical fault." -> *Points to Sage/Analyzer.*
* **Option C (Community):** "Signal the depot and organize a relief crew." -> *Points to Caregiver/Supply.*
* **Option D (Freedom):** "Find a hidden switch to bypass the blockage entirely." -> *Points to Explorer/Switcher.*

The Reveal:

After the quiz, the system reveals the archetype: "Your answers reveal the heart of a Sage. Your engine is built for precision and insight."

### 3.2 Locomotive Profiles (Archetypes)

The result of the quiz assigns a **Locomotive Profile**. Each profile has distinct base statistics that influence gameplay style.

#### 3.2.1 Core Attributes (The Engine Block)

The standard D20 attributes are re-mapped to Railway Physics to maintain the lore consistency.

**Table 2: Attribute Mapping**

| **D20 Stat** | **Ask Pete Stat** | **Abbr.** | **Description** | **Gameplay Function** |
| --- | --- | --- | --- | --- |
| **Strength** | **Traction** | TRC | Raw power to pull weight. | Overcoming Intrinsic Load; Brute force puzzles. |
| **Dexterity** | **Velocity** | VEL | Speed and agility. | Navigating fast tracks; Quick-time events; Avoiding Friction. |
| **Constitution** | **Efficiency** | EFF | Fuel conservation/Stamina. | Max Steam capacity; Resistance to Burnout. |
| **Intelligence** | **Analysis** | ANA | Logic and reasoning. | Solving VaaM puzzles; Decoding complex schemas. |
| **Wisdom** | **Signaling** | SIG | Perception and Intuition. | Detecting "Fog of War"; Connection to Indra's Net. |
| **Charisma** | **Coupling** | CPL | Social connection. | Influence in the Signal Tower; "Convoy" bonuses. |

#### 3.2.2 The Archetype Roster

**I. The Interceptor Express (The Hero)**

* **Jungian Core:** The Hero. Desires to prove worth through action.1
* **Stat Focus:** High **Traction**, High **Velocity**. Low **Efficiency**.
* **Playstyle:** "High Risk / High Reward." Capable of tackling "Boss Nodes" (Exams) head-on but prone to "Burnout" (running out of Steam) due to poor efficiency.
* **Unique Ability:** *Overdrive.* Can burn Fuel at 2x rate to gain advantage on Logistics Checks for 1 minute.
* **Authoring Hook:** The ID can tag content as "Heroic Challenges," which grant bonus XP to this archetype.
* **Dialogue Unlock:** [Hero] "I must pass. Stand aside!".3

**II. The Analyzer Class (The Sage)**

* **Jungian Core:** The Sage. Desires truth and understanding.3
* **Stat Focus:** High **Analysis**, High **Signaling**. Average **Traction**.
* **Playstyle:** "Slow and Steady." Excels at VaaM tasks and decoding complex schemas.
* **Unique Ability:** *Diagnostic.* Can lower the DC of a "Mystery Node" by analyzing the metadata before attempting it.
* **Dialogue Unlock:** "I seek the knowledge within.".3

**III. The All-Terrain Switcher (The Explorer/Jester)**

* **Jungian Core:** The Explorer/Trickster. Desires freedom and lateral thinking.1
* **Stat Focus:** High **Velocity**, High **Coupling**. Low **Traction**.
* **Playstyle:** "Lateral Thinker." Prefers "Branch Lines" (electives) and finding shortcuts. Avoids the main linear track.
* **Unique Ability:** *Off-Roading.* Can traverse "Under Construction" or beta content without friction penalties.
* **Dialogue Unlock:** [Jester] "Find a clever way to bypass the obstacle.".3

**IV. The Armored Supply Train (The Caregiver)**

* **Jungian Core:** The Caregiver. Desires to protect and support.1
* **Stat Focus:** High **Efficiency**, High **Coupling**. High **Traction**.
* **Playstyle:** "Social Logistics." Thrives in "Convoy Mode" (group projects). Gains bonuses when helping other learners.
* **Unique Ability:** *Payload Sharing.* Can offload Friction (Anxiety) from other players in a convoy.
* **Dialogue Unlock:** [Caregiver] "Comfort the stranded passenger.".3

### 3.3 The "Shadow" Mechanic (Tier 3 Progression)

To facilitate true psychological growth, the game implements Jung's concept of the "Shadow".3 At higher levels (Tier 3), the learner must face their "Shadow Engine"—the archetype opposite to their own.

* **The Sage's Shadow:** The Hero. The Sage must face a node requiring decisive action without full information.
* **The Hero's Shadow:** The Caregiver. The Hero must face a node requiring patience and support, not action.
* **Mechanic:** The "Weigh Station" AI detects over-reliance on primary stats and generates "Shadow Nodes" that specifically target the learner's lowest stat (Dump Stat), forcing them to round out their personality.3

## Part IV: The "Node Garden" Gameplay Loop

The actual gameplay occurs in "Node Gardens"—3D environments where the train stops to interact with content. These interactions are governed by the D20 Logistics system and the VaaM model.

### 4.1 Vocabulary-as-a-Mechanic (VaaM)

VaaM is the primary content delivery system. It transforms vocabulary words from abstract text definitions into **inventory items** (tools/weapons) with game stats.7

#### 4.1.1 VaaM Itemization (The "Item Block")

Every vocabulary word in the database is an object.

**VaaM Item Structure (JSON):**

JSON

{  
 "item\_id": "vocab\_ephemeral",  
 "word": "Ephemeral",  
 "definition": "Lasting for a very short time.",  
 "type": "Adjective",  
 "rarity": "Uncommon",  
 "intrinsic\_load\_weight": 2,  
 "effects": {  
 "analysis\_bonus": +2,  
 "duration": "instant"  
 },  
 "puzzle\_tags": ["time", "fleeting", "decay"],  
 "assets": {  
 "visual": "img\_clock\_fading.png",  
 "audio": "tts\_ephemeral.mp3"  
 }  
}

#### 4.1.2 The Three-Phase VaaM Loop

**Phase 1: Acquisition (Looting)**

* **Trigger:** The learner reads a text containing the target word.
* **Mechanic:** The word glows. The learner clicks to "Loot."
* **Dual Coding:** The acquisition triggers a GenAI image (Visual Channel) and a TTS pronunciation (Verbal Channel) simultaneously to maximize retention.7
* **Inventory:** The word is added to the "Cargo Hold." The Hold has limited slots (7 +/- 2), simulating working memory.

**Phase 2: Application (Situated Usage)**

* **Scenario:** The learner encounters a "Locked Node" (Puzzle). Example: A bridge that disappears and reappears rapidly. A guardian asks for a "Key of Time."
* **Action:** The learner must drag the correct word (*Ephemeral*) from their inventory into the "Socket."
* **The Check:** d20 + Analysis (INT) + Item Bonus vs. DC 15.
* **Result:** Success opens the bridge. Failure consumes Steam.

**Phase 3: Reinforcement (Mastery)**

* **The Mastery Bar:** Each word has a progress bar (0/3 uses).
* **Leveling:**
  + Use 1: Familiar (Bronze).
  + Use 2: Practiced (Silver).
  + Use 3 (in a new context): Mastered (Gold).
* **Reward:** Mastering a "Set" of words (e.g., 10 Philosophy words) grants a permanent **+1 to Analysis** stat.7 This creates a virtuous cycle where learning content makes the player stronger.

### 4.2 The Friction System (Extraneous Load)

Friction is a dynamic penalty applied to movement and checks. It models the difficulty caused by environmental or psychological factors.1

**Sources of Friction:**

1. **Fog of War (Ambiguity):** If the "Weigh Station" AI detects unclear writing in the content, it applies "Fog." *Effect:* -2 to Signaling Checks.
2. **Rust (Technical Debt):** High latency or poor UI connection. *Effect:* Increased Fuel Burn Rate (+50%).
3. **Anxiety (Psychological):** If the learner's reflection logs indicate stress. *Effect:* -2 to Traction Checks (Paralysis).

**Remediation:** The "Caregiver" archetype can apply "Grease" (Support) to reduce Friction for themselves or allies.

### 4.3 Navigation and GPS Integration (Physical AI)

To support the "Physical AI" mandate, the game integrates real-world GPS coordinates into the D20 movement system.2

* **Node Gardens as Geofences:** Major campus landmarks (e.g., The Bell Tower, The Engineering Fountain) are defined as "Node Gardens."
* **The "Proximity Check":**
  + *Requirement:* The learner must be within 50 meters of the GPS coordinate to "Dock" at the station.
  + *Mechanic:* Docking unlocks the local VaaM puzzles. For example, the "Resonance" vocabulary word can only be equipped/used when physically standing near the Bell Tower.8
* **The "Digital Twin" Telemetry:** The system tracks the "Train's" velocity between physical nodes. A learner moving quickly between nodes indicates "Flow"; stalling at a location indicates "Derailment." This data creates the Digital Twin used for research.2

## Part V: The "Train Yard" Authoring Tool Integration

The authoring tool is not a separate entity but the "Level Editor" for the game. It is designed to be accessible to IDs with no coding experience, synthesizing the best features of Twine, Storyline, and Genially.5

### 5.1 The Topological Graph Editor

The "Train Yard" uses a visual, node-based interface.

* **Tracks:** Arrows connecting nodes. The ID defines the "Gradient" (DC) of the track by selecting the Bloom's Taxonomy level from a dropdown.
* **Stations:** Nodes representing content. The ID drags and drops media assets (video, text) into the station.
* **Switches:** Logic gates. The ID can create branching paths based on Locomotive type.
  + *Example:* "If Locomotive = 'Hero', offer 'Challenge Track' (DC 20). If Locomotive = 'Sage', offer 'Research Track' (DC 15)."

### 5.2 The "Weigh Station" (Real-Time AI Analytics)

The "Weigh Station" is a real-time AI analytics tool embedded in the authoring environment.1

* **Function:** It analyzes the text written by the ID using NLP.
* **Metric:** It calculates the **Intrinsic Load** (Cargo Weight) based on lexical density and sentence complexity.
* **The Safety Lockout:** If the calculated load exceeds the safe limit for a standard "Train Car" (Lesson Module), the "Pressure Gauge" turns Red.
* **Constraint:** The system **locks the "Publish" button**. The ID *cannot* dispatch the train until they reduce the complexity or split the content into multiple cars. This enforces pedagogical rigor through software constraints.1

### 5.3 Prefabricated Scaffolding

To assist IDs, the tool includes "Scaffolding Prefabs" that align with the game mechanics:

* **The Bridge Kit:** A template for connecting two difficult concepts.
* **The Tunnel Borer:** A template for dense text that automatically highlights VaaM words.
* **The Pusher Engine:** A configuration for the "Pete" AI companion to provide hints if a learner stalls.1

## Part VI: Technical Architecture – The "Rust" Ecosystem

To support these complex mechanics with high performance and privacy, the platform uses a "Bleeding Edge" technical stack.4

### 6.1 The "Systems Isomorphism" Architecture

The choice of the Rust programming language is strategic. The **memory safety** of Rust parallels the **psychological safety** of the learner.1

* **Backend:** Rust (Axum) for high-concurrency handling of thousands of "Trains."
* **Game Engine:** Bevy ECS (Entity Component System). This data-driven architecture is perfect for managing the complex state of the Railway Ecosystem (Fuel, Cargo, Velocity components).
* **Frontend:** Leptos (Rust -> WebAssembly) for a "Local-First" reactive UI that runs on the student's device.
* **Database:** LanceDB (Embedded Vector DB) for local storage of reflection logs and AI embeddings, ensuring the "Privacy Moat".8

### 6.2 The "Web-to-ECS" Bridge

A key engineering challenge is connecting the web-based UI (Leptos) with the game engine (Bevy). The solution is the **bevy\_defer** pattern.4

1. **User Action:** Student clicks "Equip Word" in the web UI.
2. **Async Request:** Sent to the Axum backend.
3. **The Bridge:** The backend queues a task in bevy\_defer::AsyncWorld.
4. **Sync Execution:** On the next game tick, Bevy processes the task, updating the ECS state (e.g., moving the item from Inventory to Socket).
5. **Reactive Update:** Bevy fires an event, which updates the Leptos UI via WebSocket.

### 6.3 The "Glass Box" AI Strategy

To avoid the "Black Box" problem, the AI components (The Weigh Station, The Conductor) use open-source models (Llama 3, Gemma) running locally or on controlled infrastructure.8

* **Local Inference:** Grammar checking and reflection prompting happen on the "Edge" (student's device), ensuring no PII is sent to third-party APIs.
* **Transparency:** The algorithms governing the "Coal Economy" are open and auditable, allowing researchers to study the "mechanism design" of the learning environment.8

## Part VII: Social Mechanics and the "Signal Tower"

The social layer of the game is governed by the "Signal Tower," a secure implementation of Vygotsky's Zone of Proximal Development.1

### 7.1 The "Opt-In" Privacy Hinge

Social interaction is *never* automatic. It respects the "Maintenance Shed" (Private Reflection) vs. "Main Line" (Public Performance) distinction.

* **The Maintenance Shed:** A local-first, encrypted database where the learner writes reflections. This data is sovereign and invisible to the Mentor.1
* **The Switch:** To share data, the learner must manually "Throw the Switch" (Opt-In). Only then is the specific artifact transmitted to the Signal Tower.

### 7.2 The Mentor-in-the-Loop (MITL)

The Signal Tower replaces email with a secure, in-game dashboard for Mentors (Conductors).

* **Telemetry Dashboard:** Mentors see a "Track Map" of their students.
  + *Green Signal:* Student is moving at optimal Velocity.
  + *Amber Signal:* Student is stalling on a gradient (High Load).
  + *Red Signal:* Student has derailed (stopped engagement).
* **Intervention Mechanics:**
  + *Throwing a Switch:* The Mentor can remotely unlock a "Remedial Siding" (easier content) for a stalled student.
  + *Dispatching a Helper Engine:* The Mentor can send a direct message (Scaffolding) to the student's comms system.

## Part VIII: Operational Framework and Recommendations

### 8.1 The "Internal Recharge Center" Model

To ensure sustainability and bypass procurement hurdles, "Ask Pete" should be established as an **Internal Recharge Center** within the university.2

* **Mechanism:** Departments "buy" access via Journal Vouchers.
* **Benefit:** Keeps data sovereign within the university legal umbrella (FERPA compliance) and creates a "Privacy Moat."

### 8.2 The "License-Back" Strategy

To incentivize development, the IP can be spun out into a Public Benefit Corporation (PBC), which then grants a perpetual, royalty-free license back to the university.2 This allows the university to act as the "Anchor Customer" while the startup commercializes the tool externally.

### 8.3 Implementation Roadmap (The "Phoenix Project")

1. **Phase 1 (The Clarity Update):** Build the "Train Yard" with the AI Weigh Station to solve the "Blank Page" problem for IDs.
2. **Phase 2 (The Physical AI Prototype):** Deploy a single Node Garden at a campus landmark (e.g., Bell Tower) to test the GPS and VaaM mechanics.
3. **Phase 3 (The Signal Tower):** Launch the Mentor Portal to enable the social scaffolding loop.

## Appendix A: Character Creation Data Structures

### A.1 Archetype JSON Schema

JSON

{  
 "archetype\_id": "loco\_hero",  
 "name": "The Interceptor Express",  
 "description": "High velocity, high power, low efficiency.",  
 "jungian\_core": "Hero",  
 "base\_stats": {  
 "traction": 16,  
 "velocity": 14,  
 "efficiency": 8,  
 "analysis": 10,  
 "signaling": 10,  
 "coupling": 12  
 },  
 "abilities": [  
 {  
 "name": "Overdrive",  
 "cost": 5,  
 "effect": "advantage\_on\_check"  
 }  
 ],  
 "dialogue\_tags": ["heroic", "direct", "impatient"]  
}

### A.2 Experience Point (Steam) Table

| **Level** | **Total Steam Required** | **Rank Title** |
| --- | --- | --- |
| 1 | 0 | Shunter |
| 2 | 300 | Local Freight |
| 3 | 900 | Regional Express |
| 4 | 2,700 | Mainline Heavy |
| 5 | 6,500 | Transcontinental |

## Appendix B: System Limitations and Rules

1. **Inventory Cap:** Hard limit of 9 items in the "Active Cargo Hold" (Working Memory Limit). Excess items must be stored in the "Depot" (Long Term Memory) and cannot be used in puzzles.
2. **Fuel Cap:** Maximum Steam is determined by Efficiency \* 10. If Steam hits 0, the Train enters "Emergency Braking" and cannot move until a Reflection Quest is completed.
3. **AI Constraints:** The "Weigh Station" AI is *read-only*. It cannot rewrite content for the ID, only suggest changes. This preserves the ID's authorship.
4. **Privacy Lock:** Data cannot leave the "Maintenance Shed" without an explicit, cryptographically signed "Opt-In" token from the user.

**End of Specification**

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