User Stories and Requirements

Core User Stories

Student Experience

1. **Navigation**
   - As a student, I want to navigate through a virtual school so that I can access different learning areas.
   - As a student, I want to customize my avatar so that I can express my identity in the virtual environment.
   - As a student, I want clear visual cues about where I can go so that navigation feels intuitive.
2. **Learning Resources**
   - As a student, I want to access educational resources like videos and documents so that I can learn at my own pace.
   - As a student, I want to bookmark important resources so that I can find them easily later.
   - As a student, I want to track my progress through resources so that I know what I've completed.
   - As a student, I want to see related resources grouped together so that I can follow a learning path.
3. **Assessment**
   - As a student, I want to take quizzes on the content I've learned so that I can test my knowledge.
   - As a student, I want immediate feedback on quiz answers so that I can learn from mistakes.
   - As a student, I want to see my quiz history so that I can track my improvement over time.
   - As a student, I want to retry quizzes I've failed so that I can improve my scores.
4. **Communication**
   - As a student, I want to chat with classmates so that we can collaborate on assignments.
   - As a student, I want to leave notes on resources so that I can refer to them later.
   - As a student, I want to see which classmates are in the same virtual room so that I can find study partners.
5. **Offline Functionality**
   - As a student, I want the app to work without internet so that I can study anywhere.
   - As a student, I want my progress to sync when I'm online so that nothing is lost.
   - As a student, I want to download resources for offline use so that I can study without connectivity.

Teacher Experience

1. **Content Management**

- As a teacher, I want to organize resources into courses and lessons so that students can follow a structured path.
- As a teacher, I want to create quizzes so that I can assess student understanding.
- As a teacher, I want to set prerequisites for resources so that students follow an appropriate sequence.

2. **Monitoring**
   - As a teacher, I want to see student progress so that I can identify who needs help.
   - As a teacher, I want to view quiz results so that I can understand common misconceptions.
   - As a teacher, I want to see resource popularity metrics so that I can improve my content.
3. **Interaction**
   - As a teacher, I want to leave feedback on student work so that they know where to improve.
   - As a teacher, I want to make announcements to all students so that they stay informed.
   - As a teacher, I want to modify the virtual environment so that it reflects current learning themes.

Functional Requirements

Game Environment

1. **Map System**
   - 2D top-down tile-based map representing a school
   - Multiple distinct areas (classroom, library, hallway, playground, etc.)
   - Collision detection for walls and objects
   - Interactive elements highlighted on approach
   - Smooth transitions between areas
2. **Player System**
   - Customizable avatar with different appearance options
   - Fluid movement controls supporting keyboard/touch input
   - Interaction system for objects within proximity
   - Simple inventory system for collected resources
   - Player progress visualization
3. **Resource System**
   - Support for text documents with formatting
   - Support for embedded video playback (offline cached)
   - Support for interactive elements and simulations
   - Tagging and categorization of resources
   - Search functionality for finding specific content
4. **Quiz System**

- Multiple question types (multiple choice, true/false, matching)
- Rich feedback options for incorrect answers
- Randomization of question order and answer options
- Time limits and scoring mechanisms
- Results visualization and history tracking

5. **Chat System**
   - Text-based messaging between users
   - Local storage of chat history
   - Optional sync when online
   - Room-based chat channels
   - Basic moderation tools

Technical Requirements

1. **Offline Functionality**
   - Complete functionality without internet connection
   - Service Worker caching of all assets and resources
   - IndexedDB storage of user data and progress
   - Offline-first design pattern
   - Minimal storage footprint

2. **Synchronization**
   - Background sync when connection is available
   - Conflict resolution for simultaneous edits
   - Bandwidth-efficient sync protocol
   - Queue management for offline actions
   - Sync status indicators

3. **Performance**
   - Initial load time under 5 seconds on target devices
   - Smooth gameplay at 30+ FPS
   - Memory usage under 200MB
   - Battery efficient operation on mobile devices
   - Progressive asset loading

4. **Compatibility**
   - Support for modern browsers (Chrome, Firefox, Safari, Edge)
   - Responsive design for desktop and tablet screens
   - Touch controls for mobile/tablet use

- Minimum screen size requirements (800x600)
- Accessible for screen readers and keyboard navigation

5. **Security**
   - Secure storage of user data
   - Input sanitization for user-generated content
   - Role-based access control
   - Privacy-focused design
   - Compliance with educational data standards

Non-Functional Requirements

1. **Usability**
   - Intuitive navigation requiring minimal instruction
   - Consistent UI patterns throughout the application
   - Age-appropriate interface based on target audience
   - Clear feedback for all user actions
   - Helpful error messages when issues occur
2. **Scalability**
   - Support for large resource libraries
   - Efficient handling of multiple concurrent users
   - Modular design for adding new features
   - Extensible content model for new resource types
   - API-driven architecture for future integrations
3. **Maintainability**
   - Well-documented codebase
   - Automated testing for core components
   - Modular architecture for easy updates
   - Version-controlled content system
   - Telemetry for identifying issues
4. **Localization**
   - Support for multiple languages
   - Culturally adaptable content
   - Right-to-left language support
   - Date/time formatting for different regions
   - Customizable terminology
5. **Accessibility**
   - WCAG 2.1 AA compliance

- Keyboard navigation support
- Screen reader compatibility
- Colorblind-friendly design
- Adjustable text sizes and contrast