Mastery-Based Adaptive Learning Platform

K-12 Education System — Homeschool Market Entry

Core Problem

Current education systems conflate time spent with mastery achieved. Students advance based on calendar progression rather than demonstrated understanding, creating knowledge gaps that compound over time. Homeschool families seeking mastery-based progression face fragmented curricula, inconsistent quality standards, and no empirical validation of retention.

Solution Architecture

An adaptive learning platform that validates mastery through empirical retention testing at spaced intervals before permitting progression. Students cannot advance until they demonstrate genuine understanding, measured not by immediate recall but by retention over time.

Key Mechanisms

- Subject-level mastery progression — students advance independently in math, reading, science based on demonstrated competency
- Empirical retention validation — spaced-repetition testing confirms knowledge durability, not just short-term recall
- Multiple pedagogical pathways — same concept taught through different methods; students route to what works for them
- Curated content sourcing — Eureka Math/Science (K-5), CK-12/OpenStax (6-12), LLM-generated ELA/social studies (3-5)
- Video analysis pipeline — ffmpeg + Whisper + Claude API processes instructional video into structured lesson units

Market Entry: Homeschool Wedge

The homeschool market represents 6% of K-12 students (~3.7M students, $2.5B annual spend) and is ideally positioned for early adoption. Homeschool families already seek mastery-based, self-paced curricula; have faster purchasing cycles than districts; and congregate in accessible communities (co-ops, online forums, conferences).

Unlike institutional sales requiring multi-year procurement cycles, homeschool families buy directly when a product solves their problem. The platform's empirical validation of mastery addresses their core anxiety: 'Is my child actually learning?' Success in homeschool creates organic demand from traditional schools seeking proven mastery-based solutions.

Technical Foundation

- Video processing pipeline extracts structure, generates transcripts, identifies concept boundaries, creates assessment items
- Student data architecture complies with FERPA; household-level trust model appropriate for homeschool deployment
- Adaptive routing algorithm selects next lesson/assessment based on mastery state, not rigid scope-and-sequence
- Offline-capable mobile/desktop apps (Flutter) enable learning independent of internet availability

Revenue Model

Subscription-based: $30-50/month per student (competitive with existing homeschool curricula). Multi-student household discounts. Revenue scales with student count, not content development — same curriculum serves infinite students once created.

Competitive Differentiation

Existing homeschool platforms (Khan Academy, Time4Learning, Acellus) provide content and immediate feedback but do not validate retention or enforce mastery gates. The platform's spaced-repetition validation ensures students cannot progress with false confidence. This is not adaptive pacing — it is empirical mastery validation.

Exit Pathways

Build and sell to established education company (Pearson, McGraw-Hill, Houghton Mifflin Harcourt) seeking proven mastery-based technology, or scale independently targeting institutional markets (charter networks, supplemental intervention programs) after homeschool validation. The platform's architecture — content-agnostic, assessment-driven — integrates into existing curricula without replacement.

Current Status

Conceptual architecture complete. Video analysis pipeline operational. Student data privacy architecture designed for FERPA compliance. Next: MVP development targeting single-subject pilot (mathematics) with 10-20 homeschool families.