Hudson's Roadmap: From High School to AI Education Pioneer

Current Status: Sophomore (Age 15), AP Calc BC

Entry Timeline: CMU Fall 2027 (age 17) or Fall 2028 (age 18)

Daily Learning: ~13 hours/day

Core Mission: Build novel AI education platform that fundamentally transforms learning

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IMMEDIATE PRIORITIES (Now - December 2025)

Research Foundation (Current Focus)

Your Research Thesis: Manipulating input-output pairs in AI-assisted programming for pedagogy

November 2025:

- **Finalize ISEF Project** (Due: Regional fairs Jan-Feb 2026)
  - Complete experimental design for input-output pair manipulation study
  - Recruit 20-30 student participants (reach out to local high schools or UCSD students)
  - Build initial prototype of interactive coding platform
  - Begin data collection (need at least 6-8 weeks of data before regional fair)
  - Key metric: Measure requirement fluency improvement vs. traditional scaffolding

Competition Prep:

- **AMC 12** (November): Take for qualification to AIME
- **Congressional App Challenge** (Submission deadline varies by district): Consider submitting your AI education platform prototype

Academic Foundation:

- Continue AP Calc BC excellence (maintain trajectory for BC exam in May)
- **Begin independent study** in discrete math/proof-writing (critical for theoretical CS)
  - Resource: "How to Prove It" by Velleman
  - MIT OCW 6.042J (Mathematics for Computer Science)

SPRING SEMESTER 2026 (January - May)

High-Stakes Opportunities

January:

- **MIT THINK** (Deadline: Jan 1) - Apply for $1,000 research funding for your input-output pair study
- **MathROOTS** application (if interested in pure math community)
- **Complete ISEF Regional** → Advance to State → International (May 2026)
  - This is your PRIMARY goal for demonstrating research capability

February-March:

- **Poster Session Goal:** Submit to education/AI conference
  - Target conferences (with high school tracks or open submissions):
    - **EDM** (Educational Data Mining) - typically June/July
    - **AIED** (AI in Education) - typically July
    - **CHI** (Human-Computer Interaction) - typically April/May
    - **SIGCSE** (CS Education) - typically March (may be too early)
  - Most require submission 6-9 months in advance
  - **Action:** Identify 2-3 conferences NOW, work backward from deadlines
  - Alternative: **Stanford AI4ALL** or similar programs often host student research showcases

Spring Competition Season:

- **AIME** (if qualified from AMC)
- **HMMT** (Harvard-MIT Math Tournament) - February
- **CMIMC** (CMU Math Competition) - March - Excellent CMU visibility

Summer 2026 Program Applications (Due: December 2025 - February 2026)

Tier 1 Targets (Ultra-competitive, apply to all):

- **RSI** (Research Science Institute) - Due December, Junior year (for summer before senior year) - TOO EARLY for you, but flag for next year
- **MIT PRIMES-USA** - If you can frame your work as computational education/data science
- **MITES** - Due January (for summer before senior year) - TOO EARLY
- **Carnegie Mellon AI Scholars** - Due early spring, for rising seniors - TOO EARLY

Tier 2 (Strong research programs, rising juniors eligible):

- **SSP** (Summer Science Program) - Biochemistry or Astrophysics (less relevant to your goals)
- **Clark Scholars** (Texas Tech) - Rising juniors/seniors, research intensive
- **UCSB RMP** (Research Mentorship Program)
- **Stony Brook Garcia** - Rising juniors, computational research
- **BU RISE** - Rising seniors only - TOO EARLY

Tier 3 (Good alternatives, easier admission):

- **Stanford Pre-Collegiate Institutes** - CS/AI tracks
- **CMU Pre-College** - Computer Science Scholars (rising juniors - YOU'RE ELIGIBLE!)
- **LearnLab Summer School** (CMU Human-Computer Interaction Institute)
  - Directly relevant to your education research
  - Small, selective program
  - Work with actual researchers in learning science

Your Optimal Strategy for Summer 2026: Given you're finishing sophomore year, target:

1. **CMU CS Scholars** - Build CMU connection, explore HCI/education research
2. **LearnLab Summer School** - Direct pipeline to your research interests
3. **UCSD Lab Position** - Reach out to Design Lab, CSE department (Piech-affiliated researchers?)
4. If none work out: Independent research + UCSD courses (Math 31H if not already taking)

SUMMER 2026 (June - August)

Research Acceleration

Primary Goal: Develop publication-quality research on input-output pairs in AI-assisted programming

If in formal program:

- Immerse fully, network intensively with mentors
- Identify potential research collaborators for school year
- Aim to produce conference paper or poster by end of summer

If independent:

- **UCSD Summer Courses:**

- Math 31H (Honors Multivariable Calculus) - if not taking during school year
- CSE 151A/B (Machine Learning sequence) - Build technical foundation
- CSE 190 (Topics in CS Education if offered)

- **Research Work (4-6 hours/day):**
  - Expand your participant pool to 50-100 students
  - Build out full web platform for input-output pair study
  - Begin drafting paper for fall conference submission
  - **Target venue:** EDM 2027 (due ~February 2027) or SIGCSE 2027 (due ~August 2026)
- **Skill Building (3-4 hours/day):**
  - Deep learning fundamentals (fast.ai or Stanford CS231n)
  - Educational data mining (EDM techniques, learning analytics)
  - Advanced web development (React, Next.js, databases)
  - Paper reading: 1-2 papers/day from AIED, EDM, CHI, SIGCSE proceedings
- **Networking:**
  - Attend UCSD CS/Education seminars
  - Cold email professors: Chris Piech (Stanford), Ken Koedinger (CMU), local UCSD researchers
  - Template: "I'm a high school student conducting research on [specific topic], currently working on [concrete project]. I read your paper on [specific work] and am exploring [connection to your research]. Would you have 15 minutes to discuss [specific question]?"

Competition Prep:

- **USACO** training (if interested in algorithms)
- **Physics/Chemistry Olympiad** prep if diversifying STEM profile
- **Philosophy Olympiad** (PPE track - interesting for AI ethics)

JUNIOR YEAR (2026-2027)

Fall Semester: Building Toward Top-Tier Applications

Academic Courseload:

- Math 31H (UCSD - Multivariable Calc) or Diff Eq
- AP Physics C (Mechanics + E&M recommended)

- AP Chemistry or AP Computer Science Principles (easy A, good for transcript)
- English/History (maintain humanities strength)
- Consider: UCSD CSE upper-division course (CSE 151A if not taken in summer)

Research Objectives:

- **Primary Goal: First-author conference paper submission**
- Target: SIGCSE 2027 (due ~August 2026) or EDM 2027 (due ~February 2027)
- If already submitted in summer: Revise based on feedback, submit to journal or next conference cycle
- Begin framing as "pioneer in AI education systems" for college apps

Fall Competition Season:

- AMC 12 (aim for AIME qualification again)
- **Apply for Davidson Fellows** (due typically spring, but start materials in fall)
  - Your AI education research qualifies
  - $50,000 scholarship + major recognition

Major Applications Due (November-December 2026):

- **RSI** (Due December for summer 2027) - CRITICAL opportunity
- **TASP/TASS** (Telluride Association) - Due January
- **MIT MITES** (Due January for summer 2027)
- **YYGS** (Yale Young Global Scholars) - Rolling/early deadline
- **LaunchX** (MIT entrepreneurship) - If pivoting toward startup angle
- **Wharton LBW** - If exploring business/startup track

Spring Semester: The Research Sprint

Research Phase 2:

- If paper accepted: Present at conference (HUGE for college apps)
- If paper rejected: Revise, resubmit to next conference cycle
- Begin **second research project**: Expand to different dimension
  - Example: Adaptive difficulty in input-output pair generation
  - Example: Long-term learning retention with AI tutors

- Example: Cross-domain transfer of requirement fluency

Major Milestones:

- **ISEF 2027**: Return with more sophisticated study (if you won in 2026, go bigger)
- **Regeneron STS** (Science Talent Search): Submit by November 2026 for results in March 2027
- **Google Science Fair**: If project is web-based, excellent fit
- **Poster session goal**: Present at EDM/AIED/SIGCSE conference
  - Many conferences have student volunteer/poster sessions
  - **Strategy**: Email program chairs explaining your work and age, ask about presenting

Math Advancement:

- Take Differential Equations (UCSD or AoPS WOOT)
- If ahead: Linear Algebra (Math 18 or 31AH at UCSD)
- Self-study: Probability theory, real analysis foundations (useful for ML theory)

Spring Break (March 2027):

- Visit CMU (if not already committed)
- Meet with professors in:
  - Human-Computer Interaction Institute (LearnLab)
  - Language Technologies Institute
  - Machine Learning Department
  - Psychology Department (learning science researchers)
- Express interest in working in specific labs freshman year

Summer 2027: Pre-Senior Research Push

This is your LAST summer before college apps. Make it count.

Option A: Elite Research Program

- **RSI** (if accepted) - Work with MIT mentor on your research area
- **MITES** - MIT immersion
- **Carnegie Mellon AI Scholars** (for rising seniors)
- **Stanford AI4ALL** or similar

Option B: Independent Research + Entrepreneurship

- **Continue UCSD courses:** Upper-division ML, HCI, Education courses
- **Build MVP of your AI education platform:**
  - Full-stack web application
  - User base: 100-500 students
  - Pilot with local high schools or community college
  - Collect rigorous efficacy data
  - Key features based on your research:
    - Input-output pair generation system
    - Adaptive scaffolding based on student performance
    - Requirement fluency assessment
    - Integration with AI coding assistants
- **Pursue funding:**
  - Apply for NSF SBIR (Small Business Innovation Research) if platform is mature
  - Pitch to education VCs or angel investors
  - Enter **MIT Solve** or **Breakthrough Junior Challenge**
- **Skill Deepening:**
  - Advanced ML: Transformers, fine-tuning LLMs, prompt engineering research
  - EdTech stack: Learning Management Systems, xAPI/LTI standards
  - Educational psychology: Cognitive load theory, spaced repetition, metacognition
  - Study papers from: Ken Koedinger, Chris Piech, Philip Guo, researchers in AI+Education

Entrepreneurship Track (If building toward startup):

- **LaunchX** - Build and launch startup over summer
- Incorporate your platform as LLC or nonprofit
- Beta test with 5-10 schools
- Prepare pitch deck for investors or competitions

SENIOR YEAR (2027-2028)

Fall Semester: College Applications + Research Maturation

Academic Load (if still in high school):

- You may be taking mostly college courses at this point
- UCSD: Advanced ML, NLP, Human-Computer Interaction, Education Theory
- Maintain perfect GPA while showing impossible-looking courseload

Research Status:

- By now, you should have: **1-2 published/accepted papers** at CS education or AI conferences
- **Goal:** Submit to **top-tier venue** by October/November
  - CHI (top HCI conference)
  - NeurIPS or ICLR (if ML-heavy)
  - Nature Human Behaviour or Science Advances (if extraordinary results)

College Applications (if not entering early):

- Apply to 10-15 schools including:
  - **CMU** (SCS, HCI, Psychology-CS dual degree)
  - **MIT** (6-3, 6-9, or Course 9 with CS)
  - **Stanford** (CS, HCI, Symbolic Systems)
  - **Harvard** (CS or joint concentration)
  - **UC Berkeley** (EECS or CS+Education)
  - **Princeton** (CS with certificate in Education or Cognitive Science)

Application Strategy:

- **Spike:** AI for Education Research
- **Secondary spike:** Math competition results (if USAMO qualifier)
- **"Why you":** Only high schooler in the world working on input-output pairs for AI-assisted pedagogy
- **Demonstrated impact:** Platform with X users, Y% improvement in learning outcomes
- **Letters of Recommendation:**
  - Research mentor from UCSD or summer program

- Math professor who can speak to exceptional talent
- UCSD CS professor

Major Competitions (Last Chance):

- **Regeneron STS** (submit by November)
- **Davidson Fellows** (if not already won)
- **ISEF 2028** (if you're really attached to this)

Spring Semester: Transition Preparation

Research Wrap-Up:

- Finalize papers, presentations
- Document your platform thoroughly (GitHub, technical documentation)
- If building toward startup: Secure initial users/customers for credibility

Skill Preparation for CMU:

- **Math:** Real Analysis, Abstract Algebra (if not already done)
- **CS Theory:** Algorithms (CLRS), Complexity Theory
- **Advanced ML:** RL, Generative Models, LLM fine-tuning
- **Philosophy of AI/Education:** Read widely in learning science, AI alignment

Pre-CMU Networking:

- Confirm lab position for freshman year
- Reach out to potential faculty advisors:
  - **LearnLab** (Ken Koedinger, John Stamper)
  - **HCI Institute** (Jeffrey Bigham, Nikolas Martelaro)
  - **LTI** (Graham Neubig, Emma Strubell for NLP+Education)
  - **ML Department** (if going theory-heavy)

Summer 2028 (Pre-Freshman):

- **Option 1:** Research internship at FAANG or AI lab
  - Google Brain/DeepMind (Education AI team)
  - OpenAI (Preparatory or Safety team)
  - Anthropic (Education applications)

- Microsoft Research (Learning Science & Education)

- **Option 2:** Continue building your startup
  - Raise pre-seed round ($100K-$500K if traction is strong)
  - Hire small team (2-3 people)
  - Scale to 1,000-5,000 users before starting college
- **Option 3:** Independent research + travel
  - Attend conferences, network heavily
  - Collaborate with professors remotely on papers for fall submission
  - Explore education systems globally (Finland, Singapore, etc.)

UNDERGRADUATE (CMU 2027 or 2028 - 2031)

Philosophy: Build Deep Foundations + Maintain Research Velocity

If entering Fall 2027 (age 17):

- You'll be young but not uniquely so at CMU
- Advantage: Extra year to build before graduate school
- Challenge: Maturity gap with peers (minor, you seem mature)

If entering Fall 2028 (age 18):

- More typical entry age
- Stronger research portfolio going in
- Disadvantage: One year less of undergraduate research

Freshman Year: Foundation + Integration

Academic Strategy:

- **Major:** Likely Computer Science (SCS) or dual with Cognitive Science/Psychology
- **Key courses:**
  - 15-251 (Great Ideas in Theoretical CS) - TAKE IMMEDIATELY
  - 15-213 (Computer Systems) - Critical for systems understanding
  - 10-601/701 (Machine Learning) - PhD-level from day one
  - 15-400/462 (Human-Computer Interaction)

- 85-xxx (Cognitive Psychology, Learning Science)
- Math: Real Analysis, Probability Theory

Research Integration:

- **Join LearnLab or HCI Institute immediately**
  - You already have papers, they'll take you seriously
  - Aim for RA position (paid) by spring semester
- **Continue your platform development:**
  - Use CMU students as user base for studies
  - Collaborate with professors on papers
  - Goal: 1-2 conference papers per year

Competitions/Recognition:

- **Putnam** (if mathematically inclined)
- **ACM ICPC** (if algorithms-focused)
- Focus more on research output than competitions at this point

Skill Acceleration:

- By end of freshman year, you should be operating at junior/senior PhD level in your specific research area
- Read 50-100 papers per year in your domain
- Attend lab meetings, reading groups, conferences

Sophomore Year: Specialization + Publication

Research Maturation:

- **Target:** 1st-author papers at **top-tier venues**
  - CHI, SIGCSE, EDM, AIED (you're already familiar)
  - NeurIPS, ICLR (if incorporating advanced ML)
- **Begin shaping PhD research agenda:** What's the 3-5 year problem you want to solve?

Advanced Courses:

- Graduate-level ML (10-701, 10-703, 10-707, etc.)
- Advanced HCI (05-xxx graduate seminars)

- Education theory (if taking courses at School of Education)
- Research methods, statistics (critical for education research)

Industry Exploration:

- **Summer internship** at top AI lab:
  - Google DeepMind (London or Bay Area)
  - OpenAI (San Francisco)
  - Anthropic (San Francisco)
  - Meta AI (FAIR)
  - Microsoft Research (Redmond - Education Technology)
  - Khan Academy (Engineering or Research)
  - Duolingo (Pittsburgh - RIGHT NEXT DOOR to CMU, they hire heavily from CMU)

Startup Development (If Pursuing):

- If your platform has traction, consider taking semester off to build
- Apply for Thiel Fellowship ($100K, under-23)
- Y Combinator (apply winter or summer)
- Or: Keep it as side project with small team, maintain research focus

Junior Year: Decision Point

Path A: Direct to PhD (Recommended for cutting-edge research)

- Apply to top PhD programs (Fall 2029 for Fall 2030 entry, graduating undergrad in 3 years)
- Or: Complete 4-year undergrad, apply for Fall 2031 entry
- **Target programs:**
  - **CMU** (HCI, ML, LTI, Psychology - you're already embedded)
  - **Stanford** (CS, HCI, Education, Symbolic Systems)
  - **MIT** (CSAIL, Media Lab, Brain & Cognitive Sciences)
  - **UC Berkeley** (EECS, School of Education)
  - **University of Washington** (CS, iSchool, Education - very strong in HCI+Learning)

Path B: Startup Deep Dive

- Take leave of absence, go full-time on your education platform

- Raise seed round ($1M-$3M)
- Spend 1-2 years building, then either:
  - Continue (if traction is exceptional)
  - Return for PhD (having validated ideas in market)

Path C: Industry → Lab

- 1-2 years at top AI lab (OpenAI, DeepMind, Anthropic)
- Build credibility, save money
- Launch independent research lab after

Research Apex:

- By junior year, aim for **papers at top-tier venues** (NeurIPS, ICML, CHI, etc.)
- Establish yourself as emerging expert in AI+Education
- Speaking opportunities: Invited talks, workshops, tutorials
- Potential: **Best paper awards**, media coverage if work is groundbreaking

Senior Year (If Completing Full Undergrad): Launch Preparation

Academic:

- Finish thesis (likely already have multiple papers)
- Graduate with highest honors
- Potentially master's degree concurrently (CMU allows this)

Career Launch:

- **Option 1: PhD Program** (Fall 2031 entry)
  - 5-6 year program
  - Finish by 2036-2037 (age 24-25)
  - This is YOUNG for PhD completion
- **Option 2: Start Lab/Company Immediately**
  - You're 21-22, have research credibility
  - Can raise seed funding based on papers + CMU credibility
  - Risk: Too early? Industry experience valuable
- **Option 3: Industry → Lab**

- 2-3 years at OpenAI, DeepMind, Anthropic
- Ship real products, understand scaling
- Launch lab at 24-26

GRADUATE SCHOOL / EARLY CAREER (2030-2036)

PhD (5-6 years)

Institution Options:

- **CMU** (HCI/ML/LTI) - You're already integrated, strong choice
- **Stanford** (CS/Education/HCI) - Prestige, incredible network
- **MIT** (CSAIL/Media Lab) - If you want to be at epicenter of AI
- **UC Berkeley** - If focused on education equity, policy

Advisor Selection (Critical Decision):

- Look for advisor who:
  - Has strong publication record in your domain
  - Gives independence to pursue ambitious projects
  - Well-connected in both academia and industry
  - History of students starting companies/labs
- **Potential advisors to follow:**
  - Chris Piech (Stanford)
  - Ken Koedinger (CMU)
  - Emma Brunskill (Stanford - RL for education)
  - Joseph Jay Williams (Toronto - AI+Education)
  - Researchers in your exact subfield (will evolve by 2030)

PhD Research Agenda: Your goal: **Foundational contributions to AI-assisted learning systems**

Possible dissertation topics:

- Adaptive curriculum generation via reinforcement learning
- Causal inference in educational interventions with AI
- Personalized learning paths optimized for long-term retention

- Hybrid human-AI tutoring systems
- [Whatever novel problem emerges in 2030 that doesn't exist yet]

Publication Goals:

- **20-30 peer-reviewed papers** over PhD
- **5-10 first-author papers at top venues** (CHI, NeurIPS, ICML, SIGCSE, etc.)
- **1-2 "home run" papers** that establish new research directions
- These papers are your currency for starting a lab

Teaching:

- TA or co-teach courses (valuable for building education platform later)
- Guest lecture on AI+Education

Networking:

- Attend 3-5 conferences per year
- Build relationships with professors, industry researchers, potential co-founders
- Join program committees, organize workshops

Industry Connection:

- Internships at DeepMind, OpenAI, Anthropic (1-2 over PhD)
- Consulting for EdTech companies
- Maintain awareness of industry needs vs. academic research

Post-PhD Options (Age 24-26)

Path 1: PostDoc (1-2 years)

- Only if you need additional research area expertise
- Or: Strategic positioning at different university/lab
- Generally: If your goal is startup/lab, skip postdoc and move quickly

Path 2: Industry → Lab

- Research Scientist at OpenAI, DeepMind, Anthropic, Google Brain
  - Compensation: $300K-$500K+ (as of 2025, likely higher in 2035)
  - Work on foundational models for education
  - Build reputation, accumulate capital

    - Identify co-founders
- Duration: 2-4 years
- Launch lab at age 26-30

Path 3: Direct to Lab/Company

- Found company immediately after PhD (age 24-25)
- Raise seed round based on PhD research
- This is YOUNG but not unprecedented (OpenAI founders, Ilya Sutskever, etc.)

FOUNDING YOUR LAB (2035-2040, Age ~25-30)

Lab Models

Model A: Research Lab Funded by Non-Profit / Grant

- **Example:** OpenAI (originally), Anthropic (partially)
- **Structure:** Non-profit or PBC (Public Benefit Corporation)
- **Funding:** Philanthropists, foundations, grants (Gates Foundation, Chan-Zuckerberg Initiative, Schmidt Futures, etc.)
- **Advantages:**
    - Research freedom
    - Prestige, academic credibility
    - Can publish openly
- **Challenges:**
    - Harder to raise large capital
    - Slower iteration than for-profit
    - Must balance research with funding

Model B: Research Lab as For-Profit Startup

- **Example:** OpenAI (current), Cohere, Inflection, Adept
- **Structure:** VC-backed startup, likely need $50M-$100M to start in AGI era
- **Funding:** Tier 1 VCs (Sequoia, a16z, Benchmark), strategic investors (Microsoft, Google, Amazon)
- **Advantages:**

    - Can scale quickly
    - Attract top talent with equity
    - Potential for massive impact and returns
- **Challenges:**
    - Investor pressure for commercialization
    - Less research freedom
    - Must balance science with business

Model C: Lab Within University

- **Example:** Berkeley AI Research (BAIR), Stanford HAI
- **Structure:** Academic research group within university
- **Funding:** NSF, DARPA, industry partnerships, university support
- **Advantages:**
    - Academic freedom
    - Talent pipeline from students
    - Lower overhead
- **Challenges:**
    - Harder to retain top researchers (can't compete on compensation)
    - Bureaucracy
    - Difficult to commercialize

Model D: Hybrid Academic-Industry

- **Example:** Some professors maintain companies while teaching (e.g., Andrew Ng with Coursera)
- **Structure:** Faculty position + startup/lab on side
- **Advantages:** Best of both worlds
- **Challenges:** Conflict of interest issues, time management

Your Likely Path (Speculative)

Given your goals, I predict: **Model B (For-Profit) or Model A (Non-Profit) Research Lab**

Why:

- Your research is inherently applied (education platform)

- For-profit allows faster iteration, user growth
- But non-profit provides mission alignment with education equity

Possible trajectory:

1. **Initial product/research** (PhD + early career): Publish foundational papers, build initial user base
2. **Seed funding** ($5M-$15M, age 25-27): Raise from education-focused VCs or philanthropists
    - Investors: GSV Ventures, Reach Capital, Learn Capital, Emerson Collective, Gates Foundation
3. **Build team** (years 1-3): 10-30 employees
    - Research scientists (PhD-level)
    - Engineers (ML, full-stack)
    - Education specialists
    - Product, Design
4. **Research + Product** (years 2-5): Ship initial products while publishing research
    - Platform that embodies your research
    - Target: 100K-1M students using your system
    - Publish papers demonstrating efficacy at scale
5. **Scale or pivot** (years 5-8): Either
    - Scale to dominant education platform (10M+ students)
    - Pivot to foundational model research (if education is a small part of broader AGI mission)
    - Acquired by larger company (Microsoft, Google, Meta)

Key Success Factors:

- **Technical moat:** Novel AI techniques others can't replicate
- **Research credibility:** Continuous publication at top venues
- **Product-market fit:** Students/teachers actually want to use it
- **Team:** World-class researchers + engineers + educators
- **Funding:** Sufficient capital to compete in AI arms race
- **Timing:** Right moment in AI adoption curve

CRITICAL SKILLS TO DEVELOP (Continuously)

Technical Skills

Mathematics (Priority: Very High)

- **Now-Undergrad:** Real analysis, probability, linear algebra, optimization
- **Undergrad-PhD:** Measure theory, functional analysis, information theory
- **Specific to ML:** Convex optimization, PAC learning theory, statistical learning theory
- **Specific to Education:** Bayesian inference, causal inference, experimental design

Computer Science (Priority: Very High)

- **Now-Undergrad:** Data structures, algorithms, systems programming
- **Undergrad-PhD:** Advanced algorithms, complexity theory, distributed systems
- **ML Engineering:** PyTorch, JAX, distributed training, MLOps
- **Full-Stack Development:** React, databases, cloud infrastructure (for shipping products)

Machine Learning (Priority: Very High)

- **Foundations:** Supervised, unsupervised, reinforcement learning
- **Advanced:** Transformers, diffusion models, multi-modal learning
- **Specific to Education:** Meta-learning, few-shot learning, knowledge tracing, intelligent tutoring systems
- **LLM Fine-tuning:** LoRA, RLHF, prompt engineering at scale

Education & Cognitive Science (Priority: High)

- **Learning Science:** Cognitive load theory, spaced repetition, desirable difficulties
- **Assessment:** Psychometrics, item response theory, knowledge graphs
- **Instructional Design:** Backward design, mastery learning, differentiation
- **EdTech Standards:** xAPI, LTI, SCORM

Non-Technical Skills

Research Skills (Priority: Very High)

- **Experimental Design:** A/B testing, randomized controlled trials, quasi-experiments
- **Statistics:** Regression, causal inference (DiD, RDD, IV), Bayesian methods
- **Writing:** Scientific papers, grants, blog posts

- **Presenting:** Conference talks, poster sessions, media interviews

Product Skills (Priority: High)

- **User Research:** Interviews, surveys, usability testing
- **Product Management:** Roadmapping, prioritization, MVP scoping
- **Design Thinking:** Prototyping, iteration, design systems

Entrepreneurship (Priority: Medium-High)

- **Pitching:** Investors, customers, press
- **Fundraising:** VC meetings, term sheets, cap tables
- **Leadership:** Hiring, management, culture-building
- **Business:** Unit economics, growth models, go-to-market strategy

Communication (Priority: High)

- **Public Speaking:** Practice extensively, TED-style talks
- **Writing:** Blog, Twitter/X, newsletter (build audience NOW)
- **Networking:** Conferences, cold emails, maintaining relationships
- **Media:** Interviews, podcasts, press

TIMELINE TO "NOVEL CONTRIBUTION" (Realistic Estimates)

Question: How long to build something novel like OpenAI/ChatGPT for education?

Learning the Math & Theory

Realistic Timeline:

- **High School (Now-2028):** Multivariable calc, diff eq, linear algebra, discrete math, probability
  - **Status by graduation:** Strong undergraduate math foundation
- **Undergrad (2028-2031/32):** Real analysis, abstract algebra, optimization, statistical learning theory
  - **Status by graduation:** Graduate-level mathematical maturity
- **PhD (2032-2037):** Measure theory, functional analysis, information theory, causal inference
  - **Status by completion:** Research-level mathematical sophistication

Time to "sufficient math for novel research": 4-6 years (by end of undergrad or early PhD)

You don't need to master ALL of mathematics to contribute. You need depth in your specific area (learning theory, optimization, probabilistic inference) and breadth to read papers.

Building Novel Systems

Realistic Timeline for "ChatGPT-level" Education Platform:

Phase 1: Proof of Concept (Age 15-18, Now-2028)

- Small-scale studies with 20-500 students
- Initial papers at education conferences
- Validated core hypothesis (input-output pairs matter)
- **Status:** "Promising research direction"

Phase 2: Research Maturity (Age 18-22, Undergrad 2028-2031)

- Scaled studies with 1K-10K students
- Multiple papers at top CS/Education venues
- Demonstrated effect sizes, replicated results
- Built functional platform with real user base
- **Status:** "Established researcher in niche area"

Phase 3: System Development (Age 22-26, PhD/Industry 2031-2035)

- Foundational contributions to AI+Education
- Novel architectures, algorithms, insights
- Papers at top ML conferences (NeurIPS, ICML)
- Integrated into real educational systems
- **Status:** "Leading expert, novel contributions"

Phase 4: Lab/Company (Age 26-30, 2035-2039)

- Raised funding, assembled team
- Shipping product to 100K+ users
- Research → product feedback loop
- **Status:** "Pioneer with deployed system"

Conservative estimate: 10-12 years from now (age 25-27) to have a novel, deployed, research-backed system that's actually used and making an impact

Aggressive estimate: 6-8 years from now (age 21-23) if you:

- Skip traditional educational path (leave undergrad early)
- Raise significant funding quickly
- Assemble exceptional team
- Have breakthrough insight/timing

Becoming a "Pioneer" (Reality Check)

What it takes:

1. **Novel insight** that advances the field (not incremental)
2. **Empirical validation** (papers, replicated results)
3. **Deployed system** (real users, measurable impact)
4. **Recognition** (awards, citations, media coverage)
5. **Sustained impact** (system still used 5-10 years later)

Examples of "pioneers" in your domain:

- **Sal Khan** (Khan Academy) - Popularized online learning, age 30 when started
- **Andrew Ng** (Coursera) - Pioneered MOOCs, age 36 when founded
- **Luis von Ahn** (Duolingo) - Gamified language learning, age 33 when founded
- **Daphne Koller** (Coursera, Insitro) - ML for education, age 45 when founded Coursera

Pattern: Most "pioneers" were in late 20s to mid-30s when they built their platforms, after 5-15 years of research/industry experience.

You're aiming to do this at age 25-28. This is VERY aggressive but not impossible:

- You're starting research at 15 (most start at 22-23)
- AI is accelerating rapidly (advantages compound)
- Education is ripe for disruption

Reality: You'll likely have "novel contributions" by age 22-24 (end of undergrad/early PhD), but "ChatGPT-level deployed system" more likely age 27-30.

CONTINGENCIES & ADVICE

If You Don't Get Into CMU or Top School Early

Alternatives:

- **UC Berkeley, Stanford, MIT** (if admitted)
- **Continue at UCSD** for 1-2 years, then transfer
- **Gap year** to build platform, publish papers, then reapply

Remember: Institution matters less than research output. Some of the best AI researchers didn't go to top schools. Focus on papers, projects, impact.

If Research Direction Changes

Your topic (AI+Education) may evolve significantly by 2030:

- New architectures, paradigms, tools will emerge
- Education itself may transform radically
- Your interests may shift

Stay flexible:

- Develop strong fundamentals (math, CS, ML)
- Follow your curiosity
- Pivot based on what's most impactful in the moment

If You Burn Out

This is the biggest risk with 13-hour/day schedule:

- You're 15. Neuroplasticity is high but so is risk of burnout
- Pace yourself for 10-15 year marathon, not 2-year sprint

Strategies:

- Take 1 day/week completely off
- Pursue hobbies unrelated to research (music, sports, art)
- Maintain friendships (you'll need collaborators and co-founders)
- Sleep 8 hours (non-negotiable for cognitive performance)
- Exercise daily (30 min minimum)

Remember: Sustainable intensity > unsustainable intensity. You're in this for decades.

On Being "Ambitious and Aggressive"

Good:

- Dreaming big (ChatGPT-level impact)
- Working hard (13 hours/day if sustainable)
- Planning strategically (you're doing this now)

Risks:

- Overcommitting (burnout)
- Tunnel vision (missing opportunities outside plan)
- Losing joy in learning (means → end confusion)

Advice from the greats:

- **Richard Hamming:** "Work on important problems" + "Keep multiple lines of attack"
- **Feynman:** "Physics is for fun. If it's not fun, find what is."
- **Turing:** "We can only see a short distance ahead, but we can see plenty there that needs to be done."

FINAL THOUGHTS: The Long Game

You're 15 with a 10-15 year horizon to build something that fundamentally changes education. Here's what that really means:

Years 1-4 (Age 15-19, High School + Early Undergrad):

- Build foundations (math, CS, research skills)
- Establish credibility (papers, competitions)
- Develop taste (read widely, explore)
- **Goal:** Become credible researcher

Years 5-8 (Age 20-23, Late Undergrad + Early PhD):

- Novel contributions (papers at top venues)
- Deployed systems (real users)
- Network building (collaborators, mentors, potential co-founders)
- **Goal:** Recognized expert in niche

Years 9-12 (Age 24-27, Late PhD + Post-PhD):

- Foundational research (dissertation-level contributions)
- Industry experience or continued research
- Fundraising / lab formation
- **Goal:** Launch lab/company with credibility & resources

Years 13-15+ (Age 28-30+):

- Scale deployed system
- Continuous research → product feedback loop
- Hire world-class team
- **Goal:** Transform education at scale

The honest truth:

- You WILL NOT do this alone. You'll need collaborators, mentors, co-founders, funders, early adopters.
- Your specific research direction WILL change as you learn more and AI evolves.
- The world of 2030-2040 WILL be radically different from today. Stay adaptable.

But you have real advantages:

- Starting research at 15 (7-8 years ahead of typical PhD student)
- AI is accelerating (more opportunities)
- Education is broken (desperate for solutions)
- You're intrinsically motivated (not chasing prestige/money)

The meta-skill: Learning how to identify important problems, acquire necessary skills, and execute. You're developing this NOW by creating this plan.

Godspeed, Hudson. The world needs you to succeed.

APPENDIX: IMMEDIATE ACTION ITEMS (November 2025)

- [ ] Finalize ISEF project experimental design (this week)
- [ ] Identify 2-3 target conferences for poster session (due dates, requirements)
- [ ] Begin MIT THINK application (due Jan 1, 2026)
- [ ] Research CMU professors in HCI/Education/ML (LearnLab, HCI Institute)
- [ ] Email 3-5 UCSD professors about potential research collaboration

- [ ] Register for AMC 12 (November)
- [ ] Set up bibliography management system (Zotero/Mendeley) for paper reading
- [ ] Create GitHub account and begin documenting your platform code
- [ ] Start personal website/blog (share research updates, build audience)
- [ ] Read 5 papers from SIGCSE 2025 and EDM 2025 proceedings
- [ ] Outline summer 2026 applications (due dates, requirements)
- [ ] Schedule informational interviews with researchers in your domain
- [ ] Create structured learning plan for discrete math / proof-writing
- [ ] Set up spaced repetition system (Anki) for math/CS concepts
- [ ] Block time for exercise, sleep, friends (sustainability)

Most Critical This Week:

1. ISEF experimental design
2. MIT THINK application (funding for your research!)
3. Email potential research mentors at UCSD

Ship fast. Learn faster. Stay focused on impact.