Shortcut or Stepping-Stone? AI-Assisted Coursework and STEM Graduate Aspirations among U.S. STEM Undergraduates

EDUC RAC, UCLA,
2026/06/04

Shuhan “Alice” Ai

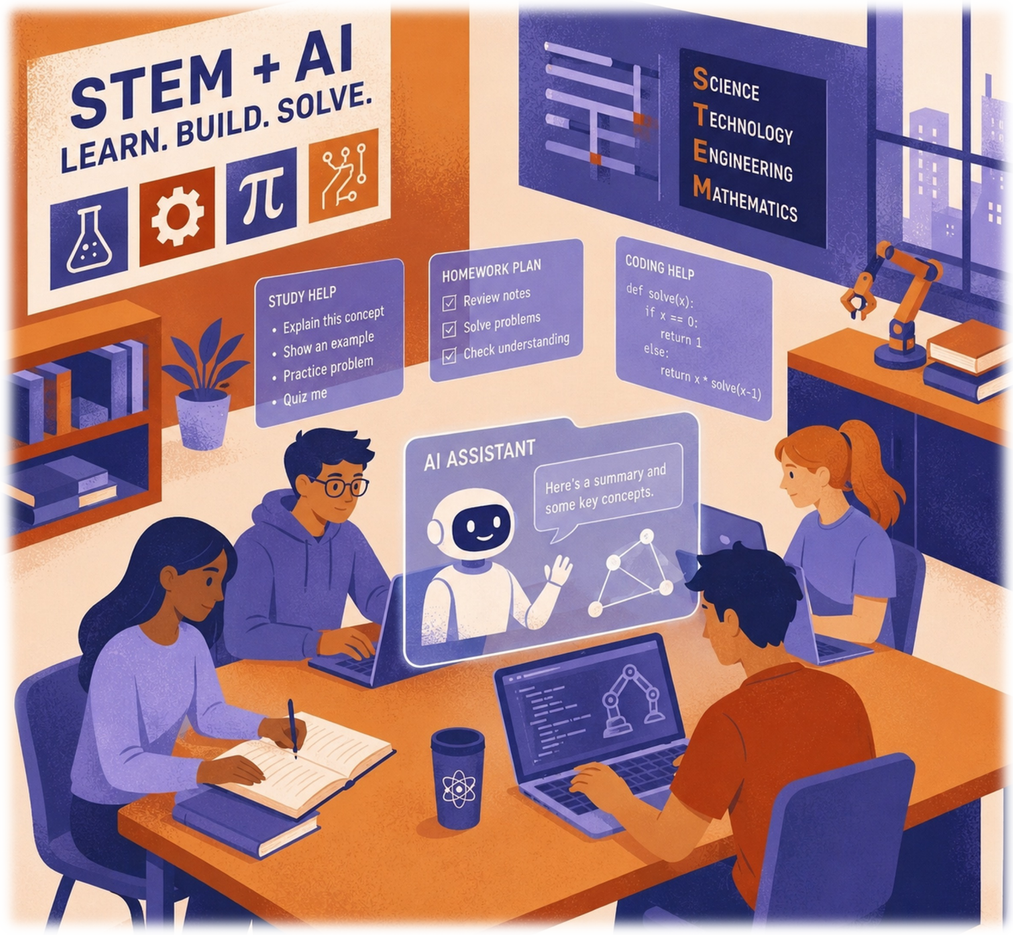
School of Education and Information Studies
University of California, Los Angeles

Introduction

- **Expanding STEM Participation**
  - STEM occupations projected to grow 10.4% by 2033, nearly 3 times the rate of non-STEM jobs (BLS, 2025).
  - Only 20% of U.S. STEM workers hold an advanced degree; strengthening the undergrad-to-graduate transition is critical (NSB, 2024).
- **Informal AI Tools in Undergraduate Coursework**
  - Grammar assistants, code helpers, and intelligent tutors (Bond et al., 2024).
  - A "double-edged sword": short-term productivity and motivation, but long-term risks of metacognitive laziness, skill erosion, and reduced self-monitoring (Chen et al., 2023; Fan et al., 2024; Abbas et al., 2024).
  - STEM students earliest and most active AI adopters (Arum et al., 2025).
- **Research Gap**
  - Focus on within-course outcomes, attitude, perceptions; none link AI use to long-term STEM graduate degree aspirations.
  - Financial access to AI tools is largely ignored (Strzelecki, 2024).
  - Evidence base skews toward single-institution, non-U.S. samples or relies on binary AI-use indicators (Liang et al., 2023; Arum et al., 2025).
  - Narrows AI to GenAI only, overlooking the broader AI-tool.

Research Questions

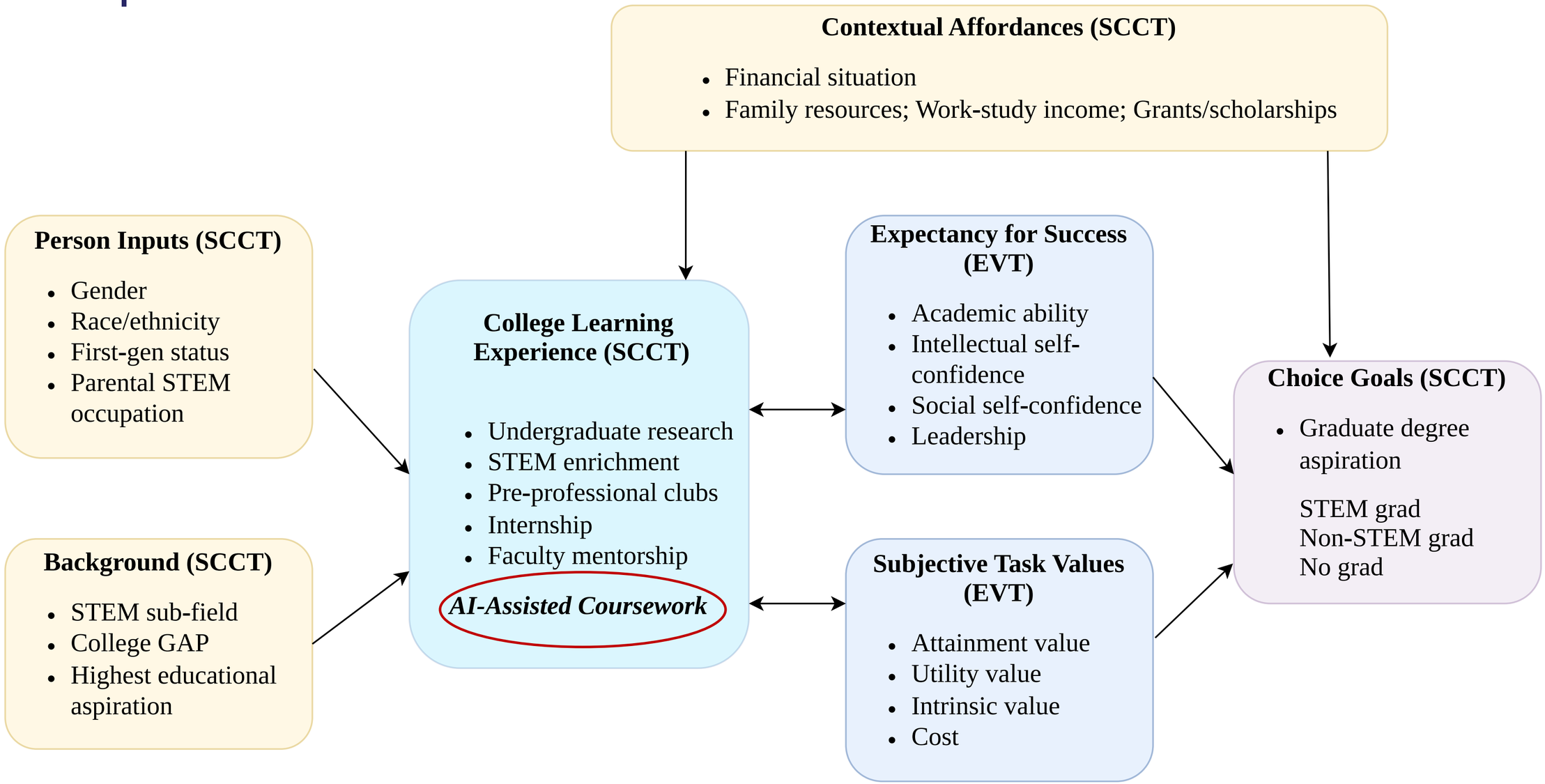
- **RQ 1:**
  - How do STEM seniors' background characteristics, ability and aspirations, values and career concerns, and college experiences differ across levels of AI-assisted coursework frequency?
- **RQ 2:**
  - To what extent do students' ability and aspirations, financial situation, and values and career concerns predict the likelihood of using AI tools for coursework?
- **RQ 3:**
  - Controlling for relevant background characteristics and college experiences, to what extent does the frequency of AI-assisted coursework predict STEM seniors' intentions to pursue STEM graduate degrees?



Literature Review

- **Who Uses AI and Why?**
  - URM and first-generation vs. international students (Arum et al., 2025; Farrelly & Baker, 2023). Male STEM students vs. female non-STEM students (Kim et al., 2025).
  - Key adoption drivers: performance expectancy, ease of use, and peer/instructor influence (Strzelecki, 2024; Abbad, 2021).
  - Most UTAUT-informed studies drop price value as a predictor.
- **Short-term Benefits**
  - Task efficiency, computational thinking, self-efficacy, and motivation (Yilmaz & Yilmaz, 2023; Hmoud et al., 2024).
  - Frees from lower-order tasks → creative problem-solving.
- **Long-term Concerns**
  - Short-term score gains do not transfer (Fan et al., 2024).
  - Critical thinking, creativity, and deep mastery (Chan & Hu, 2023).
- **Other Predictors of Graduate STEM Degree Aspirations**
  - Demographic background, ability and aspirations, values and career concerns, college experiences.

Conceptual Framework



Data

- **Dataset**
  - HERI: 2021 Freshman Survey and 2025 College Senior Survey.
  - TFS: incoming first-year demographic, family, and pre-college academic background.
  - CSS: senior-year experiences, goals, and post-graduation aspirations.
- **Study Sample**
  - Restricted to 2025 STEM seniors with a non-missing AI-use response.
  - Analytic sample: N = 1,456, drawn from 20 institutions.
  - 62% are women, 68% White, and 13% Asian.
  - 43% reported not using AI tools for coursework, 47% used them occasionally, and 10% used them frequently.

Variables

- **Outcome**
  - Graduate degree aspiration (CSS): (0) no graduate aspiration (reference), (1) non-STEM graduate aspiration, and (2) STEM graduate aspiration.
- **Key variable of interest**
  - AI-tool use for coursework (CSS): (0) Not at all (reference), (1) Occasionally, and (2) Frequently.
- **Covariates (X)**
  - (a) Students Background
    - race/ethnicity (effect coded), gender, first-gen, parental STEM occupation; financial situation.
  - (b) Ability and Aspirations
    - college GPA, academic ability, intellectual/social self-confidence, leadership, habits of mind
  - (c) Values and Career Concerns
    - personal goals, utilitarian career concerns, etc.
  - (d) College Experiences
    - URP, internship, mentorship, enrichment programs

Method

- **Stage 1 – RQ1:**
  - Descriptive statistics and cross-tabulations
  - Factor analysis for the career concerns
  - Omnibus Pearson χ^2, one-way ANOVA
- **Stage 2 – RQ2:**
  - Multinomial logistic regression model was estimated to predict the three-level AI-use outcome
  - AIC/BIC; VIF
- **Stage 3 – RQ3:**
  - Multinomial logistic regression model was used to predict the three-level graduate degree aspiration outcome
  - AIC/BIC; VIF

- **Missing Data**
  - 1%–12.5% missingness; average 2.8%; pattern consistent with MAR.
  - MICE with stochastic imputation

Findings – Descriptive statistics

- **Distribution of Graduate Degree Aspirations by AI-Tool Use for Coursework Among STEM Seniors**

AI-Tool Use	No Grad Aspiration	Non-STEM Grad Aspiration	STEM Grad Aspiration
Not at all	342 (41.4%)	31 (29.0%)	257 (49.1%)
Occasionally	389 (47.1%)	67 (62.6%)	230 (44.0%)
Frequently	95 (11.5%)	9 (8.4%)	36 (6.9%)

  - Nearly half of STEM-graduate aspirers never using AI tools

- **Student-level Sample Distribution by AI-Tool Use for Coursework Among STEM Seniors**
  - STEM subfield the strongest association with AI-tool use ($\chi^2(8) = 33.27$, $p < .001$):
    - Engineering and Math & Computer Science most active users (13.3% and 12.8%, respectively)
    - Physical Science has the highest “not at all” rate (53.2%).
  - Among values and career concerns, utilitarian career concerns
    - Students who used AI occasionally or frequently reported higher utilitarian concerns than non-users.
  - Self-rated ability
    - Non-users academic ability highest, frequent users highest social self-confidence

Findings – Likelihood of using AI tools for coursework

- **Occasionally use vs. Not at all**
  - Engineering (OR = 1.14*) vs. Health Professions (OR = 0.68*)
  - Expenses covered by family resources (OR = 1.14*)
  - Academic ability (OR = 0.82*)
  - Social self-confidence (OR = 1.17*)
  - Utilitarian career concerns (OR = 1.18*)
- **Frequently use vs. Not at all**
  - Expenses covered by income from work, work-study (OR = 0.76*)
  - A or A+ (OR =3.75*) A− (OR = 3.18*) (ref: B− and below)
  - Academic ability (OR = 0.70**)
  - Aim to have recognition from colleagues (OR =1.33*)
  - Career concerns for social recognition/status (OR = 1.33)

Findings – Associations with graduate major aspirations

- **AI-assisted Coursework**
  - Frequent AI users had significantly lower STEM graduate degree aspirations than non-users (OR = 0.53**, 95% CI [0.336, 0.833]).
  - Occasional AI users had significantly higher non-STEM graduate degree aspirations than non-users (OR = 2.14**, 95% CI [1.318, 3.468]).
- **STEM Graduate Major Aspirations vs. No Grad Plan**
  - Majoring in the physical sciences, having a higher college GPA, holding higher educational aspirations, and aiming to make a theoretical contribution to science were each associated with a significantly higher likelihood of pursuing a STEM graduate major.
  - Establishing a mentoring relationship was also a significant positive predictor (OR = 1.54**).
- **Non-STEM Graduate Major Aspirations vs. No Grad Plan**
  - Students who majored in math & computer science, engineering, or the health professions, as well as those receiving more grants and scholarships, were less likely to pursue a non-STEM graduate degree.
  - Students with higher utilitarian career values were also less likely to pursue a non-STEM degree.

Discussion and Conclusion

- **Shortcut or Stepping-stone?**
  - Frequent AI use → lower odds of STEM graduate aspiration
    - interest & attainment value
  - Occasional AI use → higher odds of non-STEM aspiration.
    - cost & utility value & interdisciplinary

- **Contextual Affordances**
  - Family resources → occasional use
    - lowers the barrier to adopting AI tools (paid tiers)
  - Work/work-study → less frequent use
    - a cost barrier and a time barrier

- **Mentorship & STEM Graduate Degree Aspirations**
  - Students who established mentorship with faculty had 54% higher odds of aspiring to a STEM graduate degree.
  - Relational, cultivating pathway that AI can never replace.
  - Invest in structured, accessible faculty mentoring in an AI-saturated learning environment.

Limitations & Future Research Directions

- **Limitations**
  - Study design is correlational, cannot infer direct causation between AI-assisted coursework and STEM graduate degree aspirations.
  - Students are clustered within institutions and programs, leaving potential between-college variation unexplored.
  - HERI secondary data, AI-use measured roughly, without any using context information.

- **Future Research Directions**
  - Data directly measure how students use AI is needed (tool type, task type, and the quality of engagement).
  - Examine moderators and test some interaction effect.
  - More qualitative or mixed-method approaches to investigate financial barriers to AI access.

Q & A

Thanks for listening!

Welcome questions and constructive feedback.