# Leveraging AI for Machine Teaching: A Bi-Directional Symbiotic Relationship Between Navigator (Student) and Driver (LLM) to Foster Critical Thinking, Academic Integrity, and Workforce Readiness

## Campus and Unit

Queens College — Computer Science Department (in collaboration with the School of Business, Accounting Department, Center for Teaching and Learning (CTL), Center for Career Engagement and Internships (Career Services), and Information Technology Services (ITS))

## Project Title & Leads

**Project Title:** Bi-Directional Symbiotic Relationship Between Navigator (Student) and Driver (LLM): Machine Teaching for Critical Thinking and Workforce Preparation

**Project Leads:**

- Peter Heller — Adjunct Lecturer, Computer Science (Project Lead)
- Dr. Ted Brown — Associate Professor, Computer Science Department
- Zavi Gunn — Director, Center for Career Engagement and Internships

## Priority Area(s)

This project aligns with the following priority areas:

1. **AI Education & Literacy** — Through hands-on workshops, self-paced modules, and iterative prompt engineering activities, we promote deeper understanding of AI tools while providing opportunities for experimentation in ethical AI use.
2. **AI in Courses** — We integrate AI into existing courses in Computer Science, Business, and Accounting, enhancing student AI literacy within disciplinary contexts.
3. **AI-Enabled Student & Academic Support** — Collaborations with Career Services and CTL will tailor AI resources for career preparation, including resume building, interview simulations, and skill articulation aligned with employer expectations.
4. **Addressing Ethical & Social Implications of AI** — The project develops frameworks for responsible AI supervision, addressing bias, hallucinations, privacy, and societal impacts through required guardrails like reasoning journals and hallucination detection.

## Executive Summary

In an epoch where artificial intelligence permeates every facet of professional life, transforming entry-level roles and devaluing traditional metrics like GPA in favor of demonstrable skills, Queens College proposes a visionary initiative to redefine AI education. Drawing from the timeless principles of pair programming, we introduce a bi-directional symbiotic relationship between the Navigator (student) and the Driver (Large

Leveraging AI for Machine Teaching- A Bi-Directional Symbiotic Relationship Between Naviator (Student) and Driver (LLM).md

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Language Model, or LLM)—a dynamic where students do not merely consume AI outputs but actively teach, correct, and supervise them. This Machine Teaching ecosystem elevates AI from a passive tool to a Socratic mentor, compelling students to refine prompts iteratively, detect hallucinations, and document reasoning pathways, thereby honing metacognitive skills essential for an AI-driven workforce.

As the job market for 2025-2026 graduates tightens—with only 30% securing full-time roles in their fields amid AI's displacement of entry-level positions—this project equips students with high-demand competencies: prompt engineering, AI literacy, critical thinking, and ethical judgment. Grounded in NACE's Career Readiness Competencies (updated 2024), it emphasizes Technology (ethical use of tools), Critical Thinking (debugging AI logic), and Career & Self-Development (continuous learning). By leveraging existing Metal-as-a-Service (MaaS) infrastructure for reproducible environments, we create equitable, cross-platform workspaces without capital costs, fostering skills-based readiness that aligns with employers' shift toward platforms like HackerRank for verifiable abilities over degrees. Critically, this initiative includes a conceptual recommendation for a future CUNY-wide Academic HackerRank-like platform to enable proctored assessments, identity verification, and reasoning capture, mirroring industry skills-based hiring practices— though no procurement is sought herein.

This $25,000 operational investment—fully expendable by June 30, 2026—unites Computer Science, Business, Accounting, CTL, Career Services, and ITS in a collaborative framework. Deliverables include a comprehensive Machine Teaching curriculum, configured MaaS environments, faculty workshops, and a pilot implementation across departments. By addressing academic integrity gaps without preempting CUNY-wide policies, this initiative positions Queens College as a beacon of responsible AI pedagogy, preparing graduates not just to navigate but to lead in a landscape where skills eclipse credentials, as explored in foundational articles on AI's evolutionary role in society and human excellence (The Revolutionary Evolution of Society Driven by Disruptive Technologies and In the Race for AI Excellence: Survival Is About Being Fit for Purpose).

## Project Description & Activities

### 1. Project Overview: Addressing the Evolving Job Market and AI Integration Challenges

The landscape for college graduates has evolved dramatically from April 2023 to projections for 2026 and beyond. As documented in our attached analyses ("What are companies looking for from college graduates-20230416.docx" and the updated "What are companies looking for from college graduates updated to 2026 -20251115.docx"), employers have shifted from valuing theoretical knowledge and GPA to prioritizing applied skills, portfolios, and verifiable competencies. GPA's role in hiring has diminished significantly—less than 40% of employers use it as a screening tool for the third consecutive year, with 90% reporting better outcomes from skills-based hiring. This devaluation stems from AI's automation of routine tasks, making entry-level jobs scarcer (only 30% of 2025 graduates secured field-specific roles) and elevating demands for AI-augmented skills like prompt engineering, data literacy, and ethical AI oversight.

In this context, our project establishes a responsible AI education ecosystem rooted in a bi-directional symbiotic relationship between the Navigator (student) and Driver (LLM). Modeled on pair programming, the student (Navigator) supervises the LLM (Driver), correcting reasoning flaws, refining prompts, and documenting decisions. AI is positioned exclusively as a mentor and cognitive partner—not a substitute for student work—ensuring academic integrity while building workforce-ready skills. This approach mirrors the Socratic method, updated for generative AI: through iterative cycles, students confront ambiguities, resolve contradictions, and deepen understanding, as articulated in Socrates and the Evolutionary Dialogue: From Ancient Wisdom to Generative AI. Echoing the transformative vision in "Transforming Computer Science

Education - Bridging the Ivory Tower with Industry Synergy.docx," this initiative dismantles academic silos by adopting a dual-track model—blending theoretical rigor with applied practice—and fosters synergies with business partners, such as the NYC CEO JOBS Council, to integrate real-world challenges into curricula, emphasizing "Ditch the Resume, Show Your Work!" through public portfolios on GitHub or Kaggle.

Key to this is Machine Teaching, where students "teach" the AI to think correctly, developing metacognition and ethical judgment. This directly counters unregulated AI use threatening assessments, while preparing students for a market where AI supervision is essential—e.g., in tech roles demanding NACE competencies like Technology (using tools ethically), Critical Thinking (root-cause analysis), and Teamwork (collaborative debugging).

**Concluding Summary of Overview:** By integrating real-time job market insights—such as the rise of AI-exposed fields seeing 13% employment declines for early-career workers—this ecosystem transforms AI from a risk to an amplifier of human potential, ensuring graduates are versatile, adaptive, and competitive in a skills-first economy, poised to thrive through industry-aligned portfolios and multi-faceted expertise.

## 2. Machine Teaching Through Iterative Prompt Engineering: Core Activities and Skills Development

Machine Teaching activities will embed iterative prompt engineering into coursework, requiring students to examine LLM reasoning, identify gaps, and refine instructions. This cultivates independent thinkers capable of supervising AI in professional settings.

**Detailed Activities:**

- **Stepwise Prompt Refinement Labs:** Students start with ambiguous prompts, iterate based on LLM outputs, and document improvements using structured templates with reasoning constraints.
- **Navigator/Driver Pair Programming Sessions:** In groups, students alternate roles, challenging AI hallucinations and comparing logic paths.
- **AI-Reflection Journals:** Mandatory documentation of thought processes, justifications for accepting/rejecting outputs, and ethical considerations (e.g., bias detection).
- **Agentic Workflow Verification:** Using tools like Multi-Chain Prompting (MCP), students build and audit AI agents for tasks in data analysis or business simulations.
- **Hallucination Detection Workshops:** Hands-on exercises to spot and correct AI errors, aligned with ethical implications like privacy and societal bias.

**Skills Developed (Mapped to Job Market Demands):**

- **AI Literacy:** Socratic prompting, hallucination detection, explainability evaluation—critical as 85% of employers prioritize skills-based assessments over degrees.
- **Technical Proficiency:** SQL, Python (via Miniconda + uv), GitHub/GitLab, Docker Swarm, WSL2 + Ubuntu, cloud fundamentals—mirroring 2026 employer expectations for cloud-native development, DevOps (Docker, Kubernetes, YAML), and AI tools (e.g., GitHub Copilot), with emphasis on data harmony as in From Database Chaos to Enterprise Harmony: The $D^4$ Metamodeling Revolution.
- **NACE-Aligned Competencies:** Critical Thinking (debugging), Communication (explaining tradeoffs), Technology (ethical tool use), and Career & Self-Development (adaptability to new frameworks).
- **Workforce Competencies:** Problem decomposition, audit-level documentation, hybrid computing fluency—addressing the devaluation of GPA by emphasizing portfolios and verifiable skills via platforms like HackerRank.

These activities will be piloted in CS courses (e.g., algorithms), Business (analytics), and Accounting (financial modeling), with CTL supporting pedagogy and Career Services aligning with employer trends (e.g., prompt engineering as an essential skill).

**Concluding Summary of Activities:** This structured inquiry not only reinforces academic integrity—requiring students to produce original work—but equips them for a job market favoring practical engineers (85-90% of roles) over theoretical scientists, where AI fluency differentiates top candidates.

## 3. Responsible-AI Guardrails: Yin/Yang Framework

To ensure ethical use, we implement a Yin/Yang model:

- **Yin (AI as Mentor):** Guides assumptions, reveals reasoning, provides perspectives—amplifying cognition.
- **Yang (Student Accountability):** Students validate outputs, detect hallucinations, document rationales, and demonstrate independent reasoning.

**Guardrails Include:**

- AI-use policies articulating boundaries.
- Reasoning journals revealing human cognition.
- Faculty oversight of logs.
- A highlighted conceptual recommendation for a future CUNY-wide Academic HackerRank-like platform (not procured or implemented here) to enable proctored assessments, identity verification, and reasoning capture—directly aligned with industry skills-based hiring practices on platforms like HackerRank, Codility, and CodeSignal, ensuring verifiable competencies in an AI-era, while addressing governance gaps as critiqued in The Governance Gap: A Critical Analysis of DAMA's Architectural Blind Spot.

This addresses ethical implications like bias and privacy without creating new infrastructure.

**Concluding Summary of Guardrails:** By placing verification on students, we foster supervisory skills for workplaces where AI oversight is routine, while providing evidence for CUNY's future integrity solutions.

## 4. MaaS Implementation: Reproducible Environments for Equitable Learning

Using existing MaaS infrastructure on the Occam server (no capital costs and no current GPU acceleration), we configure:

- Private-cloud student workspaces for reproducible Python/SQL/agentic environments.
- Cross-platform experiences (Windows Server + WSL2 + Ubuntu).
- Docker Swarm orchestration for reproducible containers.
- Zero Trust VPN for secure access, leveraging solutions like Palo Alto or Tailscale to ensure reproducibility without proctoring capabilities.

This ensures equity, aligning with job demands for cloud literacy (AWS/Azure/GCP) and DevOps.

As a forward-looking prototype, this MaaS configuration lays the groundwork for transforming the Computer Science department through future AI-capable upgrades. Post-grant, we suggest pursuing capital funding for enhanced servers, such as those available in November 2025: a PowerEdge R760XA with 4x NVIDIA H100 NVL GPUs (94GB each), 1.5TB RAM, 2x Intel 8568Y+ CPUs, and 2x 3.84TB storage at approximately $189,199 (open

box condition), or a variant with 4x NVIDIA L40S GPUs (48GB each), 2x Intel Xeon Platinum CPUs at approximately $47,600. Given ongoing hardware improvements and market dynamics, these configurations could be further optimized or procured at competitive costs, enabling GPU-accelerated AI tasks to bridge academic theory with industry practice.

**Concluding Summary of MaaS:** These environments bridge theory and practice, preparing students for skills-based assessments that dominate 2026 hiring, while positioning the department for scalable, AI-enhanced infrastructure.

## 5. Collaboration and Long-Term Recommendations

This deeply collaborative project unites faculty from CS, Business, and Accounting to embed Machine Teaching; CTL for pedagogy; Career Services for employer-aligned competencies; and ITS for MaaS maintenance. Cross-departmental pilots will evaluate impact, producing student candidates with multi-faceted skillsets not currently available in their respective majors—such as CS students gaining business analytics proficiency or Accounting majors mastering AI-driven financial modeling—enhancing their versatility and workforce competitiveness.

We recommend (without procuring) CUNY explore a systemwide AI-secure platform like HackerRank, based on our POC outcomes—providing proctored testing, reproducibility, and equity.

**Concluding Summary of Collaboration:** This alignment creates a college-wide framework, scalable to CUNY, fostering interdisciplinary versatility demanded by employers.

## 6. Deliverables

1. **Machine Teaching Curriculum:** Modules, templates, labs, journals.
2. **MaaS Implementation:** Deployed cluster, integrated tools, VPN access.
3. **Cross-Department Pilot:** Enhancements in CS/Business/Accounting, workforce evaluation.
4. **Faculty Workshops and Evaluation Report:** Lessons learned, recommendations for scaling.

# Requested Amount & High-Level Budget Narrative

**Requested Amount:** $25,000 (operational only, no capital hardware).

**Budget Breakdown:**

- **Peter Heller ($15,000):** Maintain Occam-server via third-party support, expand storage (four 20TB NAS drives), add memory for hybrid workloads, and allocate reserves for parts replacement—ensuring MaaS reliability through FY2027.
- **Dr. Ted Brown ($5,000):** Stipend for CS curriculum development and pilot facilitation.
- **Zavi Gunn ($5,000):** Stipend for Career Services integration, workshops, and employer alignment.

All costs are allowable (stipends, maintenance, software configuration), fully expended by June 30, 2026, and aligned with OAA rules.

# Timeline

- **January-March 2026:** Curriculum development, MaaS configuration, faculty workshops.
- **April-May 2026:** Cross-department pilots, student activities.

- **June 2026:** Evaluation, report compilation, full fund utilization by June 30.

## Rubric Alignment

- **Project Design (28 pts):** Clear problem (AI integrity gaps, devalued GPA, skills shortage); benefits (workforce readiness); activities/deliverables detailed.
- **Strategic Alignment (18 pts):** Supports CUNY mission via AI literacy, student success, responsible use.
- **Collaboration (18 pts):** Multidisciplinary partnerships broaden impact.
- **Feasibility (18 pts):** Realistic scope using existing resources, achievable milestones.
- **Innovation (18 pts):** Novel Navigator/Driver model with Machine Teaching, scalable POC.

## Conclusion: Forging an Evolutionary Path to AI-Empowered Excellence

In synthesizing this initiative, we forge an evolutionary, cross-disciplinary model that unites Computer Science, Business, and Accounting to graduate students who are genuinely competitive in today's AI-saturated job market. By embedding Machine Teaching and iterative prompt engineering into coursework, we cultivate adaptive, AI-fluent problem-solvers equipped with NACE-aligned competencies—critical thinking, ethical technology use, and continuous self-development—that transcend devalued GPAs and focus on verifiable skills through portfolios and real-world simulations. This transformative ecosystem acknowledges broader institutional challenges, such as missing academic guardrails, while operating within grant constraints to deliver immediate value: equitable environments, deepened learning, and preparation for a workforce where AI supervision is paramount.

Through profound collaboration—faculty integrating pedagogy, CTL designing expectations, Career Services aligning with employers' demands for prompt engineering and hybrid fluency, and ITS ensuring reproducibility—this project becomes a beacon for responsible AI across disciplines. As AI reshapes employment, with skills-based hiring expanding talent pools 19-fold and reducing mishires by 90%, our graduates will not merely adapt but thrive, auditing automated systems and innovating solutions. Ultimately, this initiative safeguards the integrity of CUNY degrees, positions Queens College as a leader in future-focused education, and provides an evidence base for systemwide scaling—empowering students to harness AI as allies in their intellectual and professional journeys, drawing on insights from Socrates and the Evolutionary Dialogue, In the Race for AI Excellence, and The Revolutionary Evolution of Society.