Designing Faculty Professional Development for Technical and Socio-technical AI

NSF LEVEL UP AI Workshop Recommendations

Computing Research Association

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Introduction

As part of the NSF LEVEL UP AI project, the Computing Research Association (CRA) and New Mexico State University convened educators, researchers, and professionals across the computing community to build consensus on strategies to increase capacity for undergraduate Artificial Intelligence (AI) education. The LEVEL UP AI Atlanta (December 2025) and Phoenix (January 2026) design workshops addressed key bottlenecks in AI education infrastructure, which had been identified in Spring 2025 roundtable discussions (Cowit et al., 2025). The *Designing Faculty Professional Development for Technical AI* and *Designing Faculty Professional Development for Socio-technical AI* in-person design workshops in Atlanta and Phoenix were attended by 39 participants from 38 institutions (Link to Contributors). Utilizing a backwards design methodology (Wiggins & McTighe, 2005), workshop sessions facilitated the creation of this recommendations document.

As demand for AI education increases, higher education institutions face the challenge of offering a full range of AI courses to all interested undergraduate students. Addressing this challenge requires a workforce of educators capable of teaching both the rigorous technical foundations of machine learning and the complex sociotechnical frameworks necessary for its responsible training, deployment, and use. However, many institutions report a shortage of faculty with this specialized expertise. This strain is compounded by a competitive labor market where industry frequently poaches top talent, leaving academic departments to rely on overextended staff. This document highlights strategies for implementing professional development in AI instruction for existing faculty, covering (Section 1) important topics of training, (Section 2) useful pedagogical strategies, (Section 3) potential structures of development, and finally (Section 4) incentives for faculty to not only attend but be fully motivated to upskill their ability to teach AI.

1. A Tiered Approach to Training Topics

To ensure institutions remain at the forefront of AI readiness, this document recommends adopting a tiered approach to faculty professional development, as shown in Table 1. The three tiers reflect three distinct depths of engagement with AI. The Focus Areas identify broad topics appropriate to each tier. The Integrated Elements describe specific topics in each focus area, incorporating both technical and socio-technical considerations.

Table 1: Tiered Approach to Training Topics

Proficiency Level	Focus Area	Integrated Elements (Technical + Socio-Technical)
Awareness & Critical Recognition	Foundations & Everyday AI	Establishes shared terminology (AI, ML, GenAI) and traces the history of AI. Focuses on recognizing AI in daily life and developing the critical literacy to evaluate basic AI outputs.
	Socio-Technical Awareness	Introduces the real-world costs and benefits of AI. Costs can include job loss due to increased automation, the environmental footprint of data centers, commodification of human labor (e.g., from annotators, artists, Wikipedia, etc.), the erosion of public trust in media due to the proliferation of AI-generated content, and the dangers of misrepresentative and libelous content. AI benefits can include democratizing access to knowledge via chatbots, amplifying human intellect through help with brainstorming and critical review, and accelerating the pace of scientific discovery.
	Basic Policy & Ethics	Helps faculty understand current AI Policies and regulations to distinguish between what is legally permissible, ethically responsible, and culturally appropriate when interacting with AI tools. Additionally, faculty should become familiar with problems of fairness in automated decision making.
Application, Management & Pedagogy	ML & Generative AI Fundamentals	Moves beyond awareness into mechanics. Covers conceptual differences between supervised and unsupervised learning and training vs. inference, and explains prompt engineering and the probabilistic nature of LLMs to demystify confabulations (hallucinations).
	Applied Pedagogy & Bias Management	Equips faculty to integrate AI into assignments. This includes faculty integrating AI tools in their instructional design and integrating AI tool usage by students for learning. Provides concrete frameworks for managing classroom dynamics, handling student complaints about algorithmic bias, and fostering culturally responsive discussions.
	Data Ethics & Classroom Governance	Explores the lifecycle of data acquisition. Addresses the ethical issues in obtaining training data, scraping of copyrighted materials, privacy leaks, and how to draft clear, enforceable AI policies for individual courses.

Proficiency Level	Focus Area	Integrated Elements (Technical + Socio-Technical)
Deep Technical & Systems-Level Design	Mathematical & Architectural Depth	Dives into the underlying technology. For instance, in generative AI, professional development may include teaching large language model architectures (attention mechanisms, mixture of experts, RAG, agentic AI, direct preference optimization, and RLHF). Some other important topics include linear algebra, probability, backpropagation, and parameter tuning.
	Compute Infrastructure & Interpretability	Provides hands-on experience with hardware and tools (GPUs, PyTorch, Jupyter Notebooks). Explores system guardrails, interpretability algorithms, and the deep technical choices that drive algorithmic bias.
	Complex Systems & High-Stakes Automation	Examines agentic models and the integration of multiple AI components (e.g., autonomous robots, self-driving cars). Focuses on automated planning, system safety, and guiding university-wide or federal AI policy. This should include key concepts of ethical AI design (transparency, explainability, accountability, fairness, etc), as uncritical adoption of autonomous decision-making systems can cause serious harm.

Awareness & critical recognition is important for all faculty to navigate an AI-saturated world. Application, management & pedagogy is important for instructors actively integrating these tools into their teaching. Deep technical & systems-level design is important for technical/socio-technical faculty who teach AI.

2. Pedagogical Strategies

The following pedagogical strategies are recommended for designing professional development training for faculty.

- **Active and Scaffolded Learning** (Freeman et al., 2014)
    - Use hands-on activities in Jupyter or Colab notebooks (e.g., to train a classifier) to help faculty build conceptual and technical fluency.
    - Incorporate general-use scaffolded frameworks such as UMC (Use-Modify-Create) (Lytle et al., 2019), PRIMM (Predict–Run–Investigate–Modify–Make) (Sentance et al., 2019), and EDGE (Explain–Demonstrate–Guide–Enable) (Sheppard, n.d.) to support progressive skill development.
    - Employ a spiral approach, revisiting concepts at increasing depth across training modules.
    - Include "Is this AI or not?" exercises and discipline-based AI terminology to ground learning in faculty members' own fields.

- **Problem-Based Learning & Case Studies**
  - Integrate real-world socio-technical cases—AI ethics, bias, misinformation, labor impacts, environmental harms—to help faculty understand the links between technical mechanisms and societal implications.
  - Focus on critical evaluation of technology and its impact on end users, recognizing that specific topics change over time.
- **Reflection and Feedback**
  - Build structured time for faculty reflection on how new content maps to their own courses and disciplinary contexts.
  - Use self-assessment, peer feedback, and other formative assessments (high-structure approaches) to support continuous improvement, assess whether faculty have grown in their ability to teach socio-technical concepts, and collect faculty feedback on coverage of socio-technical topics.
- **Dialogue-Based, Culturally Relevant Instruction** (Gay, 2018; O'Leary et al., 2020; Scott et al., 2015)
  - Provide training for facilitating difficult conversations in judgment-free spaces, especially on AI ethics, bias, fairness, and socio-technical harms.
  - Explain social issues while engaging with the technologies that shape them.
  - Emphasize culturally relevant and asset-based pedagogy, helping faculty connect learning to students' lived experiences and strengths.
- **Incorporate "Yes, And" dialogue strategies when faculty make perplexing or challenging comments**
  - **Student:** "AI doesn't have feelings, so it's actually less biased than a human judge or hiring manager."
  - **Teacher: Yes,** you're highlighting that AI models don't have emotions like humans do. **And** when we look at how that math is 'trained' on historical data, it raises a critical question: how do these algorithms amplify patterns of exclusion? Let's look at the 'Garbage In, Garbage Out' principle."
- **Collaborative Co-Design**
  - Encourage faculty to **co-design professional development activities, modules, and assignments** with non-computing domain experts to ensure relevance and disciplinary alignment.
  - When possible, support **co-teaching arrangements** between non-technical faculty and AI experts to model integrated socio-technical instruction.
  - Leverage external trainers and ambassadors from prior workshops to scale professional development delivery.
- **High-Structure, Formative Assessment Emphasis** (Boon, 2023)
  - Prioritize formative, low-stakes assessment practices to help faculty adopt evidence-based teaching that supports diverse learners in AI-aligned instruction.

    - Ask faculty to identify the key knowledge areas and pedagogical approaches they would like to develop.

3. Structure of Professional Development

Effective faculty professional development for AI should be sustained, flexible, community-based, and inclusive of participants with varying technical backgrounds. Below are potential structures for faculty professional development, which can be selected based on institutional context, such as department size or a computer-science-specific versus multidisciplinary focus.

Sustained Community-Based Models

- **Faculty Learning Communities** (Cox, 2004)
    - Small, interdisciplinary faculty groups that meet regularly to reflect on teaching practices, exchange strategies, and build collective capacity for high-quality, equity-minded instruction.
- **Communities of Practice and Communities of Transformation** (Reinholz et al., 2021)
    - Collaborative, cross-departmental networks that support sustained inquiry, shared leadership, and systemic instructional change across programs.
- **Interdisciplinary Collaboration**
    - Design professional development experiences that intentionally bring together computer science faculty, social science experts, and humanities faculty to explore socio-technical issues from multiple disciplinary perspectives.
    - Encourage cross-disciplinary pairing or group design work to enrich course materials and discussions.
- **Multi-institutional Collaboration**
    - Encourage cross-institutional collaborations and consortia for professional development, to pool shared abilities of small and lower-resourced departments.
    - Faculty from schools with more resources can co-teach and guide faculty from lower-resource schools, allowing them to offer more hands-on AI courses.

Flexible Delivery Formats

Provide multiple entry points for faculty learning through a mix of 1-hour Lunch and Learn seminars, focused single-day workshops, and Saturday course series.

- **Lunch and Learn Seminar (Brief overviews for mass involvement)**
    - Short, accessible sessions designed for mass participation, introducing key socio-technical AI concepts, tools, or teaching strategies.
- **Professional Development Workshops (Stand-alone in-depth sessions)**
    - Targeted workshops that guide faculty through updating assignments, revising syllabi, embedding AI ethics modules, or developing new course materials.
- **Saturday Course Series (Weekly sessions that build on each other)**
    - Two-to-three-hour weekend sessions that allow for deeper engagement with hands-on skill development, tool training, or curriculum redesign.

Institutional Supports and Infrastructure

- **Centers for Teaching and Learning**
    - Institutional partners provide pedagogical expertise, instructional coaching, technology integration support, and ongoing training aligned with professional development goals.
- **Institutional Integration**
    - Formally recognize professional development for faculty fellowships, in annual review processes, and other pathways.
    - Develop ambassador programs in which trained faculty mentor peers, support departmental adoption, and help scale implementation across the institution.
- **Online Resource Repositories**
    - Curated collections of teaching materials, sample assignments, rubrics, case studies, and socio-technical AI modules that faculty can access anytime.
- **Badging and Micro-Credentials**
    - Digital badges that recognize faculty participation, mastery of new competencies, or completion of specialized training modules.

4. Incentives

Faculty are busy, with their time in high demand. Below are strategies for incentivizing faculty to attend professional development opportunities and to be motivated to upskill in teaching AI. Providing many of the below incentives will likely require institutional buy-in and support, which is its own challenge, covered in a separate report on designing institutional infrastructure for AI education (Gropp et al., 2026).

- **Link to Review, Promotion, and Tenure Processes**
    - Link to the annual review process for faculty.

    - Link professional development to promotion and tenure processes or specific teaching evaluation requirements.
- **Tangible Rewards**
    - Provide monetary stipends, course releases, faculty fellowships, or grants for course redesign.
- **Professional Recognition**
    - Offer digital badges (e.g., Credly), certificates of completion, and awards for adopting AI in teaching.
- **Provide Resource Access**
    - Include funding for AI resources, compute power, graduate/undergraduate student TA/RA support.
- **Nurture Intrinsic Motivation**
    - Highlight benefits such as intellectual curiosity, reputation building, and preparing students for the future workforce.

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