

Designing AI Curriculum Pathways

NSF LEVEL UP AI Workshop Recommendations



CRA

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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 AI Curriculum Pathways* in-person design workshops in Atlanta and Phoenix were attended by 29 participants from 29 institutions ([Link to Contributors](#)). Utilizing a backwards design methodology (Wiggins & McTighe, 2005), the two workshop sessions facilitated the creation of this recommendations document.

Undergraduate institutions are grappling with the task of building AI programs and pathways to meet student and industry demand. One of the core challenges is identifying what foundational knowledge, skills, and dispositions a graduate with a specialized AI credential should have. This workshop recommendations document articulates the core knowledge areas that any AI education program should include, while recognizing that different institutional types and programs will vary widely in the specifics of their implementation.

The structure of learning areas is not necessarily tied to the more traditional understanding of “course,” as institutions may differ substantially in how they offer necessary knowledge areas (e.g., full courses, combined courses, or modules that can be embedded in other courses as needed). Following the articulation of foundational AI knowledge areas is a brief — though certainly not exhaustive — overview of supplementary AI knowledge areas that may be essential for some AI pathways, but optional for others. Finally, this document offers key prompting questions for institutions developing their own AI Pathways from these AI knowledge areas. This document only concerns single-disciplinary AI Pathways. If you are interested in developing an interdisciplinary AI program, please see the LEVEL UP AI recommendation report (Peters et al., 2026).

It is important to note that among the main challenges in developing an institutional AI pathway are the administrative tensions of individual institutions. Disagreements between departments, bureaucratic roadblocks, and attaining buy-in from university leadership are all challenges that leaders aiming to increase their institution’s AI educational capacity must navigate and address.

Eight Foundational AI Knowledge Areas

- **Mathematical Foundations**, including calculus, linear algebra, probability/statistics, discrete mathematics (for example see the LEVEL UP AI recommendation report (Peterson et al., 2026))
- **Core Computer Science**, including introductory programming, data structures, theory of computation
- **Symbolic AI and Optimization**, including representation, reasoning, search, heuristics, planning, constraint satisfaction
- **Machine Learning**, including deep learning, reinforcement learning, general machine learning
- **Human Centered AI and Ethics**, including human computer interaction, FATE: fairness, accountability, transparency, ethics
- **Generative AI**, including large language models, semantic models, relevant uses of natural language processing
- **AI Applications and Systems**, including software design, embedded AI, agentic AI
- **Professional Skills**, including technical communication, teamwork, systems thinking, critical thinking, flexible problem solving, adaptability/learning new technical skills and systems

Supplementary AI Knowledge Areas

- **Security and Privacy in AI Systems**
- **Data for AI**, including analysis, management, governance, big data
- **AI Sustainability and Maintainability**
- **Advanced Math Topics**, including basic game theory, graph theory
- **Robotics**
- **Computer Vision**

Prompting Questions for Institutions Developing Curricula

These questions can help your institution consider its needs and constraints in adapting your AI knowledge areas into an implemented AI Pathway.

1. How will experiential learning be incorporated into the AI pathway?
2. What balance of applied, theoretical, and technical elements are appropriate for your student population, the institution's strengths, and local industry demand?
3. What resources and faculty are available to effectively deliver the program in desired modalities (in-person, online, hybrid)?
4. What prerequisites do you expect students to bring to each course?
5. What are opportunities for industry partnerships?
6. How will the AI curriculum pathway lead to industry careers (e.g., AI Developer, AI Facilitator, AI Power User), and what extended knowledge areas and pedagogical approaches are most appropriate for that pathway?
7. How will you continually revisit and update your program to meet the expectations of the rapidly changing field of AI?

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- Cowit, N. Q., Tadimalla, S. Y., Jones, S. T., Maher, M. L., Camp, T., & Pontelli, E. (2025). *Developing Strategies to Increase Capacity in AI Education* (arXiv:2509.21713). Computing Research Association (CRA). <https://doi.org/10.48550/arXiv.2509.21713>
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