Challenges and Opportunities for Undergraduate AI Education in the U.S.

Findings of the 2025 Computing Research Association Roundtable Report

LAB FOR APPLIED AI

3 November 2025

LOYOLA UNIVERSITY CHICAGO

Welcome

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Speakers

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Agenda

1. Welcome and Introduction to the Lab for Applied AI
2. Presentation: Challenges and Opportunities for Undergraduate AI Education in the U.S.-Findings of the 2025 Computing Research Association Roundtable Report
3. Q&A
4. Closing

Introduction to the Lab for Applied AI

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Background

The Lab for Applied Artificial Intelligence:

Interdisciplinary hub at LUC to support faculty and student researchers, grants, and education.

A shared resource, focused on interdisciplinary research and innovation.

Assist faculty research, aid in securing major grants, and educate and attract students while remaining consistent with the LUC Mission of working to expand knowledge in the service of humanity through learning, justice, and faith in an ethical and responsible manner.

Vision

- Increase opportunities to secure computationally intensive/major grants.
- Impact faculty research publication productivity.
- Engage faculty across campus.
- Impact enrollment by offering in-demand skill training.
- Serve as a central coordination and communication hub.
- Publish relevant and significant research.
- Support faculty and student researchers, grants, and education.

Lab Activities

- Monthly faculty research presentation.
- Monthly faculty skills workshop.
- Monthly newsletter.

Let’s Connect!

Faculty affiliate engagement form:

Scan me

Challenges and Opportunities for Undergraduate AI education in the United States: Findings of the 2025 CRA Roundtable Report

Noah Cowit- ncowit@cra.org

Introduction

Williams College

University of Colorado Boulder

The Hong Kong Polytechnic University

Computing Research Association

UNSW Sydney

Disclaimer: I am a CS/Programming Education Specialist, not an AI Specialist

About the Computing Research Association (CRA)

- **Who We Are:** The Computing Research Association (CRA) represents nearly 300 North American academic units, laboratories, centers, and companies engaged in computing research, including affiliated professional societies (AAAI, ACM, CS-CAN, IEEE Computer Society, SIAM, and USENIX).
- **Our History:** Founded in 1972, CRA has a long history of bringing together academia, industry, and government.

The Mission of CRA

CRA's mission is to catalyze computing research by:

- Leading the community.
- Informing policymakers and the public.
- Promoting the development of an innovative and responsible computing research workforce.

The NSF LEVEL UP AI project is a key part of that mission.

NSF LEVEL UP AI

Microsoft Trustworthy AI Fellowship

2025 CRA Summit

Google GenAI (use) in CS Education Consortium

CRA AI Education Fellows

NSF LEVEL UP AI Roundtables

NSF LEVEL UP AI Workshops

NAIRR AI EDU Research Coordinating Network

NAIRR Pilot Roundtables & Conferences

NSF LEVEL UP AI

Launching an **E**ducational **V**ision to **E**xpand **L**eadership, **U**nderstanding, and **P**rogress in **A**rtificial **I**ntelligence:

A national, *community-led* effort to expand capacity and access in AI Education

- Build a shared vision for accessible, high-quality AI education
- Support educators and institutions in expanding AI offerings
- Leverage NAIRR resources to enhance teaching and learning

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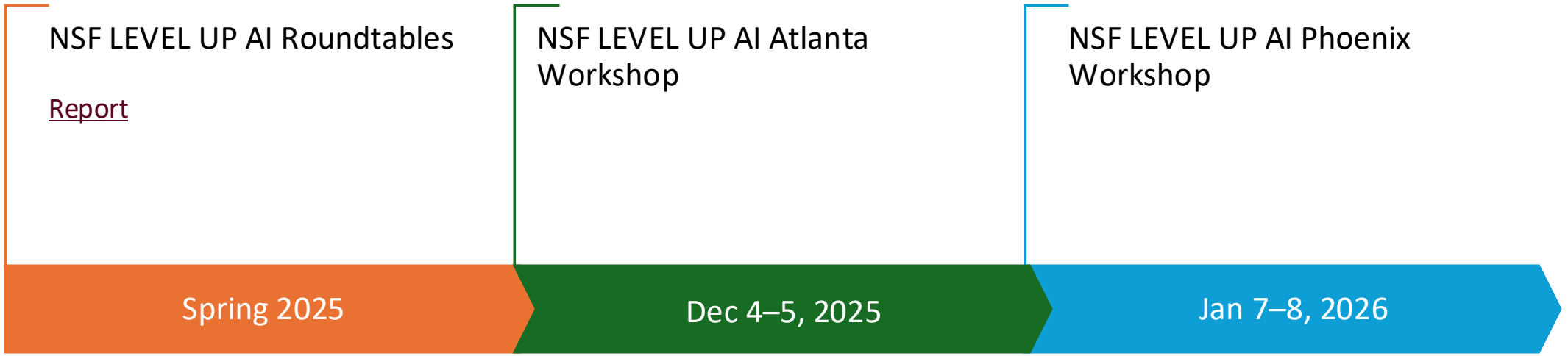


Supported by the U.S. National Science Foundation (Awards CNS-2434416, CCF-2518797, and others).

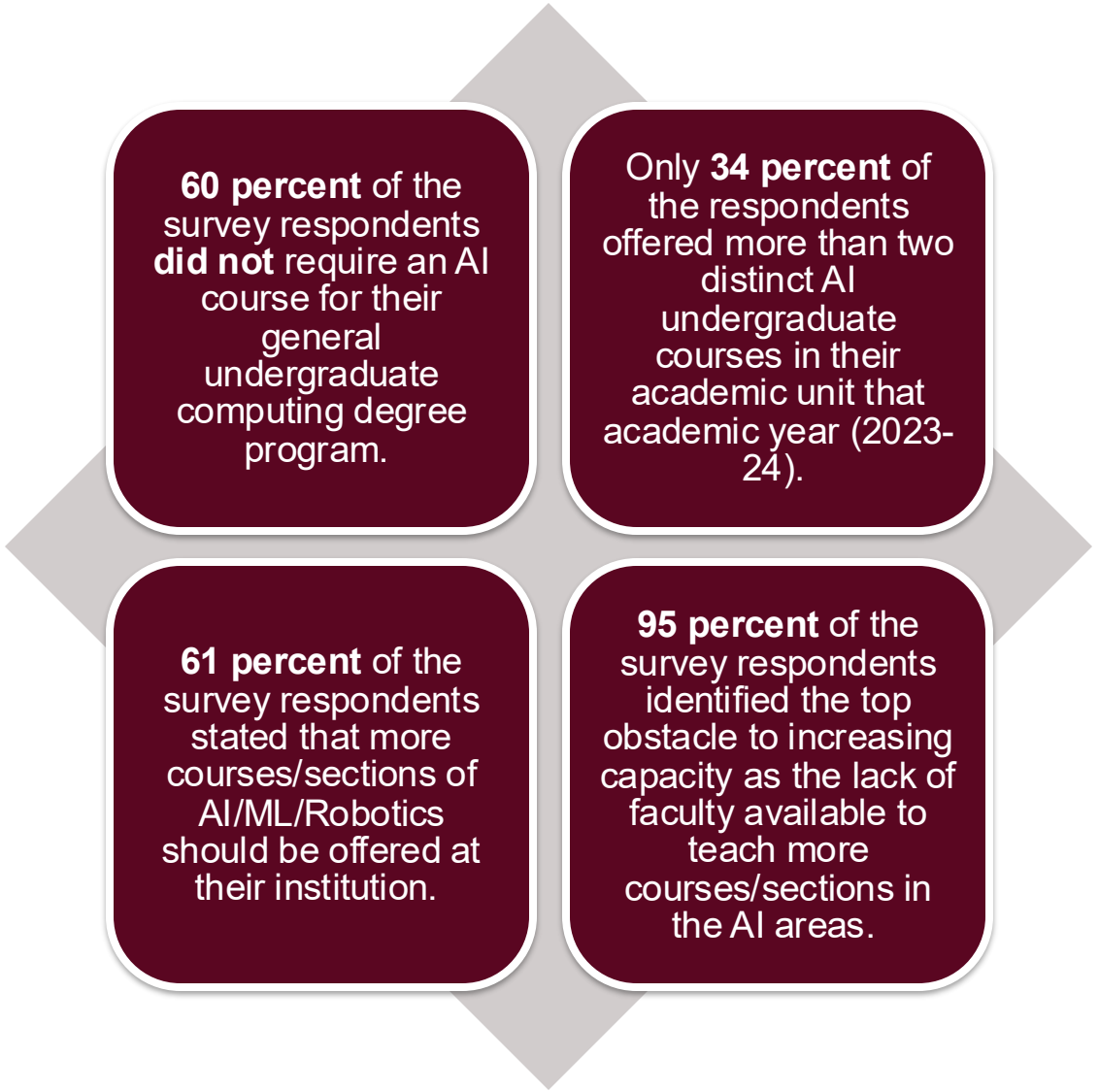
The Core Challenge of NSF LEVEL UP AI

There is a growing demand for AI professionals across all sectors but a shortage of skilled individuals to fill these roles.

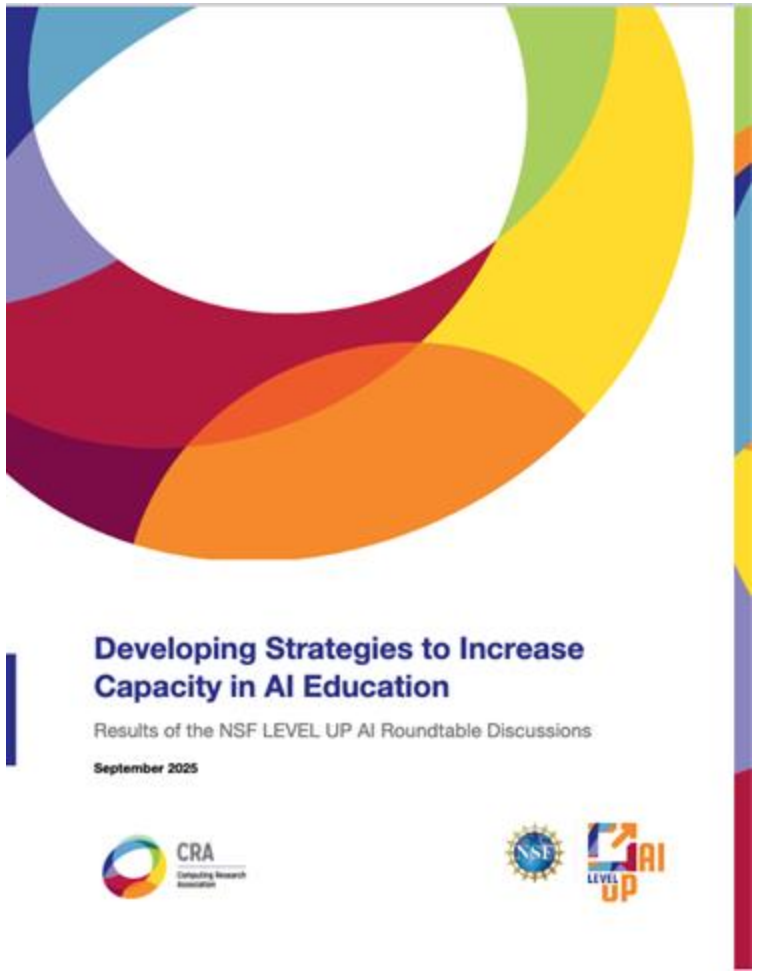
Institutions are grappling with teaching AI in the face of this growing demand and relevance.

We need to increase access and capacity for AI education to train this workforce.

Results of a 2024 CRA Survey (56 programs)



The LEVEL UP AI Roundtable Report



This report discusses the **first round of convenings, 32 virtual roundtables**.

Goal: To summarize the "practices, challenges, and strategies" institutions are exploring and move toward a nation-wide community and best practices.

Talk Summary

Methodology: Who we talked to and how we analyzed the data.

Extended Findings: The bulk of this talk, covering the four key themes.

Next Steps: Next Steps for LEVEL UP AI and complimentary CRA initiatives.

Methodology

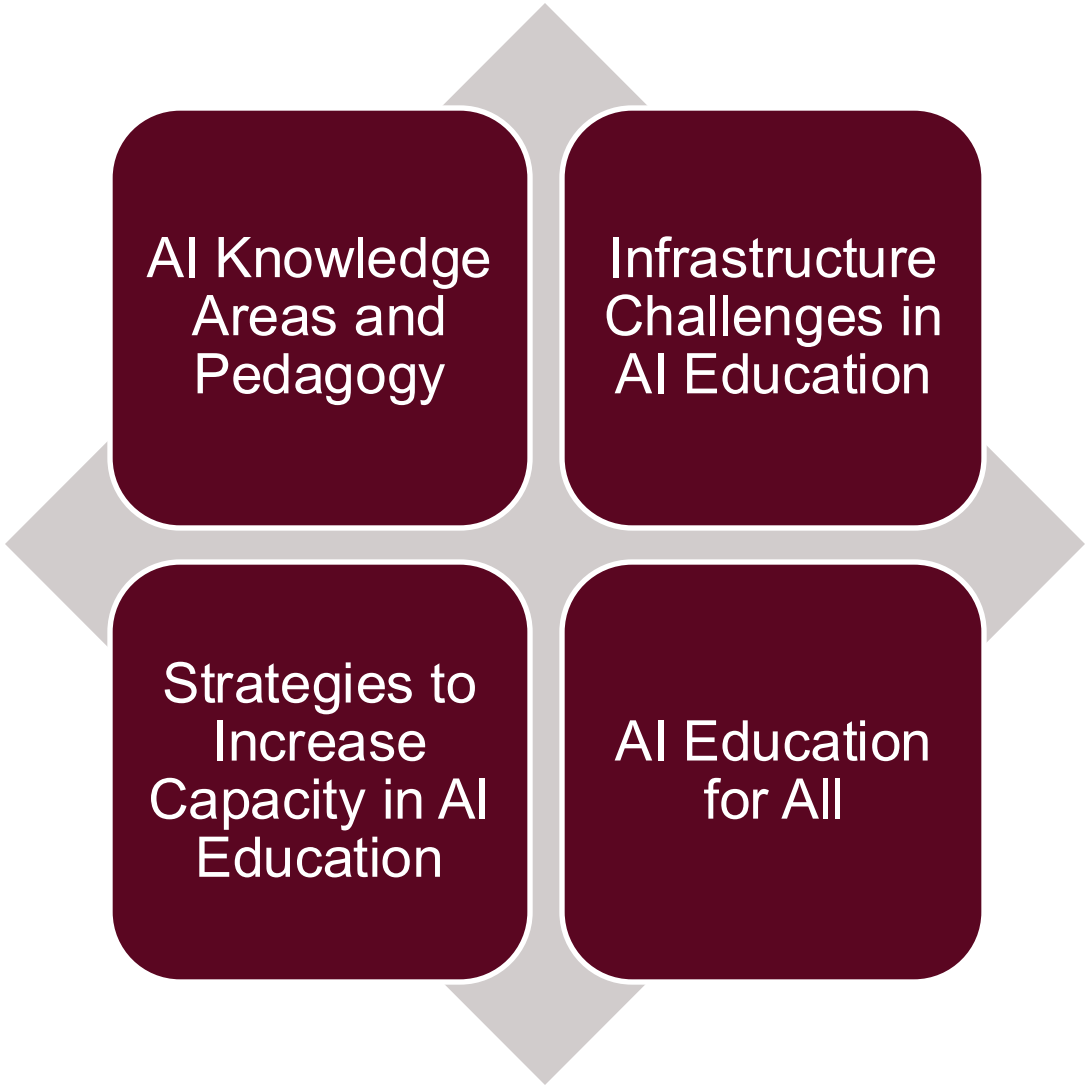
How We Gathered Data

32 moderated virtual roundtable discussions.

202 experts committed to improving AI education.

Experts were grouped by institution type (R1, R2, MSI, Community College, etc.) to discuss "shared challenges and opportunities" at their similar institutions.

The Four Themes



How We Analyzed the Data

Data Set: Full transcripts, structured notes, and chat logs from all 32 sessions.

Process: A Human-AI hybrid analysis process.

AI: Used Google's Gemini 2.5 (pro) with a prompt methodology inspired by retrieval augmented generation (RAG) to produce structured thematic summaries.

Human: Authors and expert coders validated, spot-checked, synthesized, and refined all findings to ensure accuracy.

Extended Findings

Theme 1: AI Knowledge Areas & Pedagogy

Key Questions: What should we teach, and how should we teach it?

Key Idea

Every Computing Graduate Requires Basic AI Literacy

- But what is Basic AI Literacy?

Important AI Content Areas

For any kind of AI education, experts recommended that students be given the following five learning opportunities.

- A brief history of all forms of AI
- An introduction to symbolic AI (e.g., search, logic)
- An introduction to statistical AI (e.g., core concepts of ML, classification, regression)
- An overview of major AI application areas (e.g., NLP, computer vision).
- A standard computing core of programming, data structures, and algorithms.

Important AI Content Areas

Any AI curriculum should be designed to weave considerations of fairness, accountability, transparency, bias, privacy, and societal impact into technical courses.

Ethics

- A brief history of all forms of AI
- An introduction to symbolic AI (e.g., search, logic)
- An introduction to statistical AI (e.g., core concepts of ML, classification, regression)
- An overview of major AI application areas (e.g., NLP, computer vision).
- A standard computing core of programming, data structures, and algorithms.

What is Included Within Ethics?

A systemic, lifecycle view of the impact of AI

Data Provenance: Understanding where data comes from, how it's labeled, and the human labor involved.

Environmental Costs: The energy consumption and environmental footprint of training large models.

Societal and Community Impact: The effect of data centers on local communities and the labor behind models.

Math Prerequisites

Professional expertise in AI must be built on a robust mathematical foundation.

Experts consistently identified **linear algebra**, **calculus** (often multi-variable), **probability**, **discrete math**, and **statistics** as highly recommended or “non-negotiable.”

How should AI be taught?

Hands-on & Project-Based: Let students build tangible systems.

Case Studies: Use real-world, local, and relevant examples to teach ethics and societal impact.

Scaffolding: Includes curriculum scaffolding (revisiting topics), assignment scaffolding (skeleton code), and deconstruction (working backward from a complex system)

How Should AI Be Used to Teach AI?

The Consensus: Banning Gen AI tools completely can be impractical and counterproductive.

A Suggested Strategy:

Intro Courses (CS1/CS2): Many (not all) experts suggested prohibiting tools to ensure foundational skills.

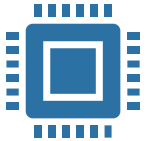
Advanced Courses: Actively teach their use. Shift the focus from writing code to evaluating, debugging, and integrating AI-generated code.

Theme 2: Infrastructure Challenges

AI Education Infrastructure is *not* just Hardware

Faculty Talent & Time

Curriculum & Professional Development



Computational Resources (GPUs)

IT Support Staff

Data Resources

The Faculty & Time Crisis

The Faculty Shortage: Intense market competition from industry and other schools makes hiring and retaining AI faculty difficult.

The Time Crisis: AI changes so fast. Faculty are “building the plane as they're learning how to fly it”.

The Burden: This creates an *uncompensated* expectation for faculty to "spend their weekends [or] spend their summers" constantly developing new materials.

Misaligned Incentives & Solutions

The Problem:

Traditional faculty metrics (grants, publications) do *not* adequately reward educational innovation or curriculum development.

The Solutions:

- Accessible, continuous professional development (PD).
- Faculty learning communities for co-learning.
- Institutional change: This work "has to be built into the recognition that we give faculty" (e.g., promotion, tenure, annual evaluations).

The Compute Challenge (GPU Access)

"Students want to do interesting things... And we just don't have the GPU access."

- A critical shortage of GPU access limits hands-on learning
- Even at R1s, HPCs are "primarily being used by researchers," forcing educational users to "compete for resources".

Cloud vs. In-House

In-House Hardware:

- ***Pro:*** Control, ease of access, "low stakes way" to "experiment and play around".
- ***Con:*** Costs in acquiring and maintaining infrastructure.

Cloud Services (AWS/GCP):

- ***Pro:*** Teaches industry-relevant "cloud skills on an actual cloud provider".
- ***Con:*** Cost & Unpredictability. Students get "worried that they're going to spend $10,000 accidentally".

IT Support

GPU clusters "by themselves are not enough unless there is somebody that knows how to use them properly". We need skilled *non-faculty* technical staff, but they are often "poached by industry".

High Quality, Education Ready Data Sets

Departments need "open data sets that... are ready to use for the classroom" and "curricular infrastructure built around them" (e.g., lesson plans, Jupyter notebooks).

Theme 3: Strategies to Increase AI Education Capacity

The Problem: Overwhelming student demand and acute course capacity problems.

Classes in AI are overbooked to a degree that "it's just a crapshoot whether you can get in," even if you are a declared CS major. For non-majors, it's "almost impossible”

Strategy 1: AI+X (Decentralization)

The "locked out" non-CS students led to a "proliferation of these... AI ML courses out in other disciplines" (e.g., social sciences, economics).

Positive:

Allows for domain-specific applications.

Negative:

Raises concerns about the "quality, consistency, and well-roundedness" of instruction outside of CS.

Strategy 2: Curricular Redesign

Waiting until junior/senior year is "too late because AI motivates them [students]".

01

Integrate AI concepts much earlier.

02

Embed AI assignments into CS1 and CS2.

03

Create freshman-level "AI literacy" courses.

Key Debate: AI Major vs. Concentration

Case AGAINST a new AI Major:

- It's a "jack of all trades... master of none".
- Do employers prefer strong, fundamental CS knowledge?
- It might be "hype" that's "going to be something else in a decade".

Case FOR a new AI Major:

- National Security: Critical for "global competition".
- Market Demand: Students are asking "what is the return of investment?".
- Institutional Survival: One dean saw a drop in CS enrollment and created an AI major as a direct "strategic imperative"

Strategy 3: Fix the Math Bottleneck

Problem: Traditional math prerequisites are a key *capacity bottleneck*.

Solution: Create an integrated, applied "Math for AI" course.

Strategy 4: Informal AI Learning Environments

Participants recommended investing in AI learning environments outside of the formal classroom.

Student Clubs: Highly successful. "It's their own community. It's their own leaders".

"AI Makerspace": A low-stakes environment for students from *all disciplines* to "play around" and spark interest.

Theme 4: AI for All

Key Questions: How do we make AI education accessible and welcoming to all students?

Building Confidence: Demystifying AI

Goal: Show that AI is not "magic," but a set of understandable processes.

Strategy: Use familiar tools and deconstruct complex ideas.

Example: A business professor built a "naked neuron" simulator in Excel. It "starts from not knowing anything... to making correct predictions within two-three minutes".

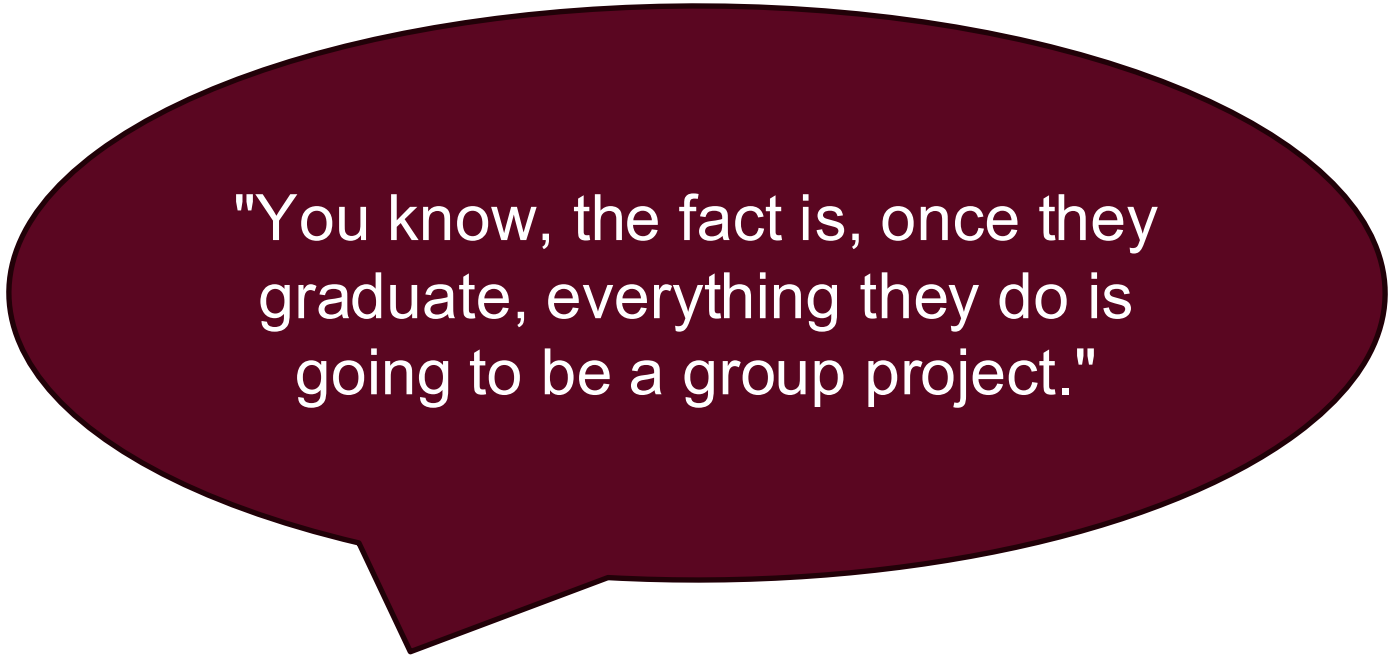
Assessment Strategies to Encourage Learning

The Dangers of High-States Assessments: A course with "only two exams" is high-risk; if a student fails the midterm, "they're going to drop the course".

Better: Frequent, low-stakes assignments and "multiple ways for students to demonstrate their mastery"

Fostering a Collaborative Classroom Climate

Participants suggested using group projects and peer learning environments to foster community.



Demonstrating Relevance to Students

Connect to “authentic problems that are really relevant to students [and] their lives”.

Examples: Projects with “local businesses and nonprofits” or analyzing COVID-19 data during the pandemic.

Accessibility Beyond Curriculum

The Digital Divide: Must address student access to personal devices, broadband, and high-end compute.

Disability: AI tools often have a "significant lag" in accessibility for disabled individuals

Next Steps

LEVEL UP AI Workshops

The high-level events of the NSF LEVEL UP AI Project to develop national consensus around shared challenges and opportunities in increasing capacity of undergraduate AI education in the United States. Will take place in Atlanta (Dec 4th and 5th) and Phoenix (Jan 7th and 8th)

NAIRR Pilot Classroom

CRA Computing Research Association
NAIRR Pilot
Expansion Conferences

National AI Research Resource (NAIRR) Pilot Classroom Conferences dedicated to building understanding about adopting NAIRR resources in undergraduate and masters AI education

- **Historically Black Colleges and Universities (HBCUs)**
- **Minority Serving Institutions (MSIs)**
- **Community Colleges**

- **Research-Emerging Institutions with Small-to-Medium Computing Programs**
- **Research-Emerging Institutions with Large Computing Programs**
- **Four-Year Colleges and Universities**

For each conference:

- **Phase 1: Roundtable discussions** - Engage stakeholders in short **virtual meetings**.
- **Phase 2: Workshops** - More extensive **face-to-face** discussions & developing action plans.

Supported by the U.S. National Science Foundation (CCF Awards 2515201, 2515526, 2515633, 2515656, 2515701, & 2518520).

NAIRR Pilot Classroom

01	Webinars and Monthly meetings	• Monthly meetings on best practices and NAIRR resources. • Collect/Share resources, including course materials, data sources, and assessments.
02	NAIRR AIEDU HUB	• Resources for AI education at undergraduate & MS levels. • Resources for preparing faculty to include NAIRR Pilot in AI courses.
03	NAIRR AIEDU Fellows	• Champion efforts at institutions across the country. • Best Practices for broadening access to AI education.

Supported by the U.S. National Science Foundation (CCF Award 2518797).

Get Involved and Apply Now

LEVEL UP AI Workshops in Atlanta and Phoenix!

NAIRR Classroom Expansion Conferences

Thank You!

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https://cra.org/level-up-ai

QUESTIONS

Thank you

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