CRA
Computing Research Association

Pedagogy in the Age of AI: Emerging Strategies and Key Questions for Undergraduate Computing Education

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Introduction

Williams College

University of Colorado Boulder

The Hong Kong Polytechnic University

Computing Research Association

University of New South Wales Sydney

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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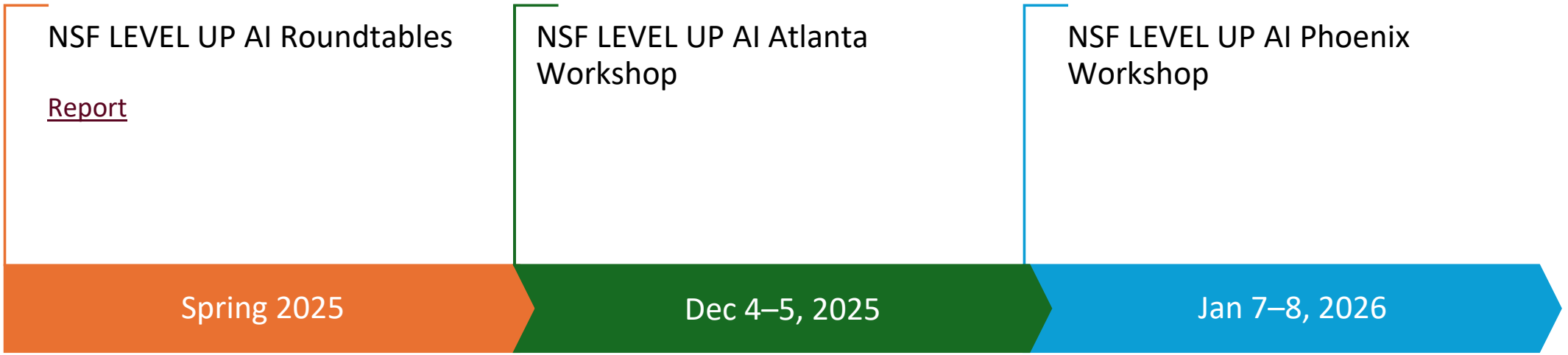


Supported by the U.S. National Science Foundation (Awards CNS-2434416, CCF-2518797, and others).

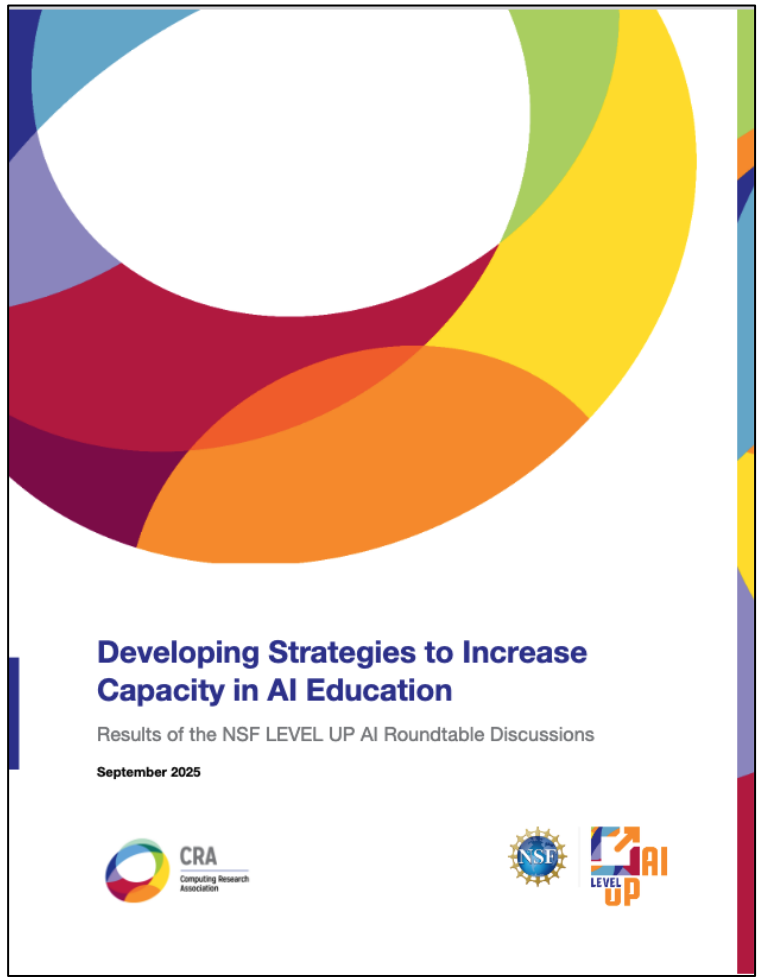
About the Roundtables

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 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, moving toward a nation-wide community and best practices.

About the Atlanta Workshop

90 experts committed to improving AI education

7 Rotating Charrette Discussions

7 Backwards Design Workshops

You are the first group to hear a report out from the Workshops!

How to Understand this Talk

An overview of opportunities, challenges, and strategies of navigating computing education in the age of generative AI.

There is no one right thing to do, nor one position that I (or CRA) highlight as ideal.

Every undergraduate education institution has differing goals and access to computing and AI educational resources.

Agenda

Pedagogy

- Challenges, Opportunities, Strategies

Assessment

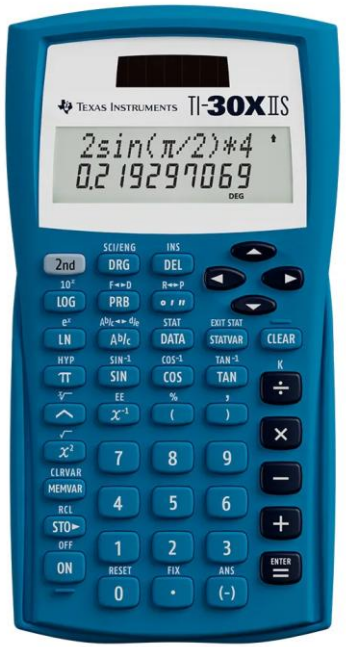
- Challenges, Opportunities, Strategies

Other Initiatives

- AI in CS-ed Resources

Teaching Computing in the Age of Generative AI

What is the Relationship Between Professional Computer Scientists and Automated Tools?



Key Role of People

AI tools are **sometimes incorrect**, and what is produced is often unfinished and inaccessible to non-experts.

Human editors and supervisors are required to modify and maintain AI outputs.

Navigating Learning Fundamentals: Two Key Knowledge Areas

Foundational Mastery
(mental models)

Tool Competency
(industry skills)

How do AI tools help students learn, and how do they inhibit them from learning?

Talk To a Partner (2 minutes)

What are key challenges around teaching computing in the age of generative AI tools?

Student-Focused Challenges

Too Easy to Learn:

LLMs bypass the "productive struggle" required for students to develop deep mental models of code in CS1.

Using Without Understanding:

Relying on LLMs as a "black box" without understanding *what* the tool is good for or *why.*

Faculty-Focused Challenges

Faculty Comfort with GenAI:

Many faculty do not have AI expertise or comfort using generative tools in teaching and assignment design.

No Longer Syntax Focused:

While AI handles syntax, faculty struggle to transition from syntax-focused teaching to higher-level design quickly.

Talk To a Partner (2 minutes)

What are key opportunities around teaching computing in the age of generative AI tools?

Student Focused Opportunities

Lower Barriers to Entry:

Tangible things can be built quickly ("vibe coding"), making CS more accessible and interesting to diverse students.

Chatbot Tutors:

Individualized tutoring and mentorship, breaking down problems and offering concept-specific assistance.

Cooler Projects:

Larger, more complex capstone projects can be done in workplace-similar contexts.

Faculty Focused Opportunities

Focusing on the Concepts:

Instructors can focus on key conceptual ideas, rather than syntax specifics.

Curriculum Reordering:

AI enables a top-down learning approach, where applications and ideas are introduced before mechanics.

Ethics For All:

There is opportunity to teach ethical, societal, and bias issues to all students, grounded in application and experience.

Talk To a Partner (2 minutes)

What are key strategies to teaching computing in the age of generative AI tools?

Scaffolded Progression in Using AI Tools

First Year:

AI Literacy/Tutor Mode.

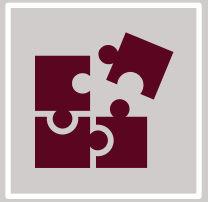
Sophomore/Junior:

Debugging/Test Cases.

Senior:

Full Workflow Tool.

AI “Agents” in Problem Solving



The “Socratic Agent”:

Use AI as a required team member that **provides explanations and hints**, but avoids giving the final answer. This promotes the “reflective practitioner”.

The “Bad Agent”:

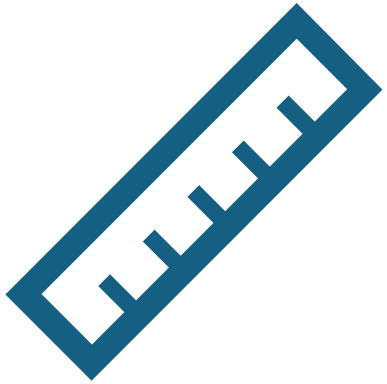
Design an AI tool (or prompt) that is **intentionally bad** at a specific concept to force students to develop critical thinking skills and fix errors.

Faculty Learning Communities

Encourage faculty to **co-develop** AI-infused curriculum and share assignments, breaking down siloed pedagogy.

Challenges, Opportunities, and Strategies of Assessment in the Age of Generative AI

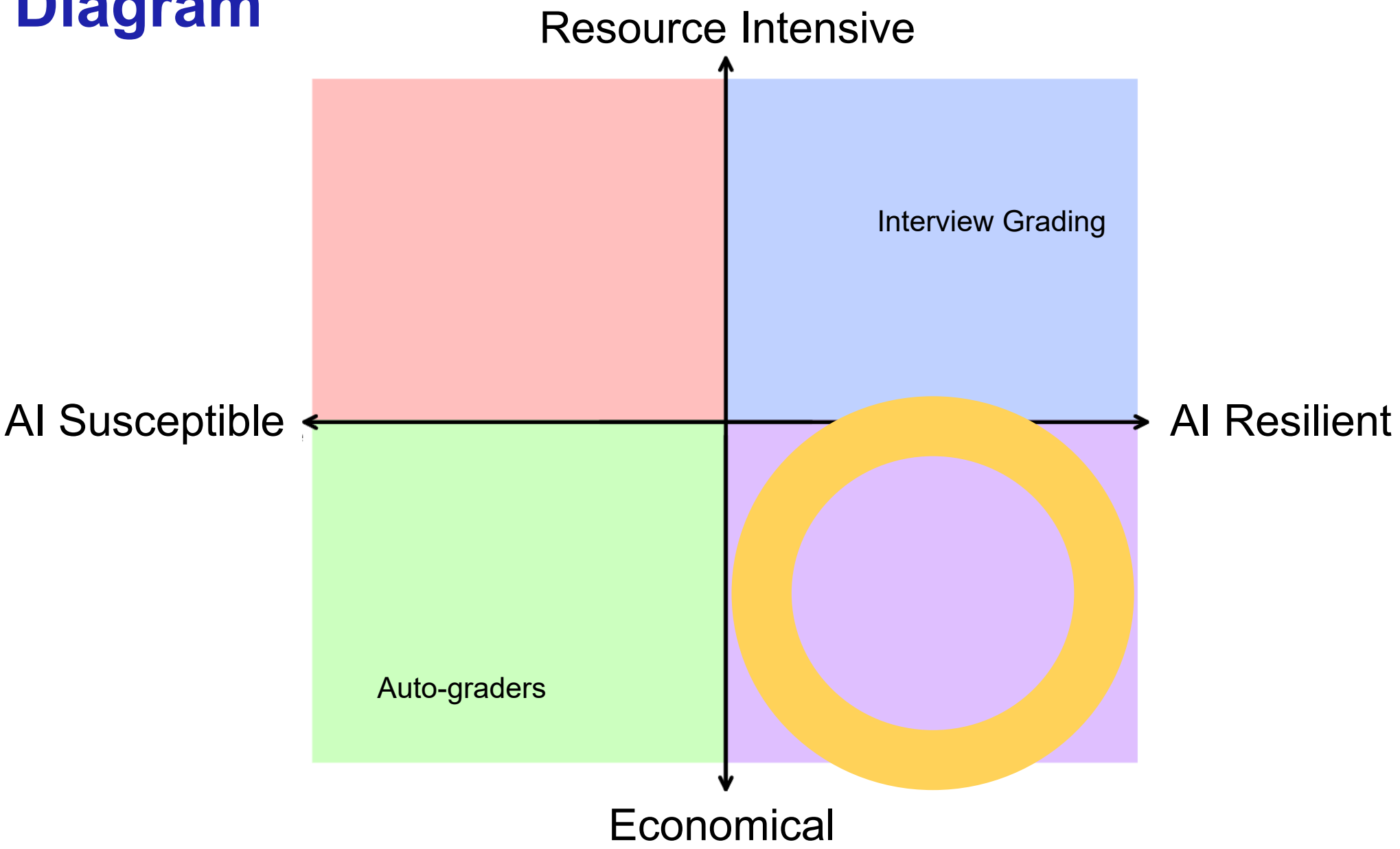
Primary Goals of Assessment



Accurately Measuring Learning

Fairness

Tradeoffs in Assessment: A Very Non-Scientific Diagram



Talk To a Partner (2 minutes)

What are key challenges around assessing computing in the age of generative AI tools?

Assessment Challenges

Traditional take-home programming assignments are no longer reliable.

High-touch assessments (oral exams, interviews) are hard and expensive to scale.

Live assessments risk disadvantaging introverts, language learners, and neurodiverse students.

Engaging in a "cat and mouse game" of policing output.

Talk To a Partner (2 minutes)

What are key opportunities around assessing computing in the age of generative AI tools?

Assessment Opportunities

Evaluating Higher Order Skills:

AI forces us to assess critical analysis, debugging, and computational complexity.

Workplace Alignment:

By assessing code auditing and process, we train students for critical maintenance and verification roles.

Thoughtful Design:

Creative, richer assessments can capture student thought processes.

Talk To a Partner (2 minutes)

What are key strategies to assess computing in the age of generative AI tools?

Controlling AI in Assessment

Testing Centers	Secure, controlled environment for student evaluation without access to AI tools.
Requiring Student Explanations	Interview grading or video submission, where students explain their code to verify authorship and understanding.
Requiring Student Documentation	Students submit prompt logs and version history (e.g., git logs) to demonstrate the process and effort applied to a problem.

AI-Integrated Assessment Strategies

Students Assess AI	Ask students to critique, debug, and deconstruct AI-generated code, focusing on where and why it fails.
3-Column Critical Analysis	1) Student attempt 2) AI output 3) Critical comparative deconstruction
Requiring AI	For advanced courses, AI can be required on large-scale projects, shifting focus to system design and evaluation.

Strategies of Clarity and Fairness in Communication to Students

Clearly specifying to students what AI-use is allowed.

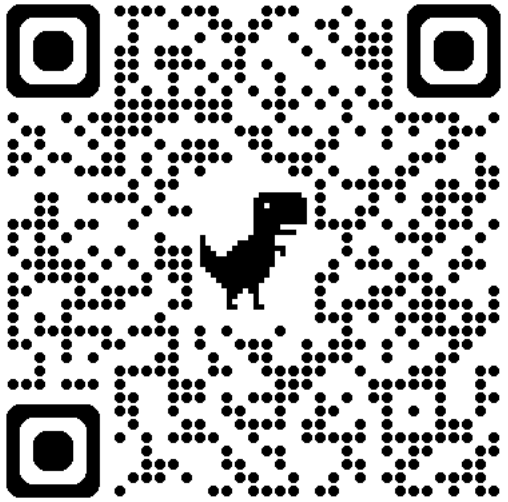
Focusing on addressing the root cause (student struggle/pressure) rather than the symptom (cheating).

Offering pre-recorded oral exams, to help students with less confidence in speaking live.

Other AI in CS-ed Initiatives

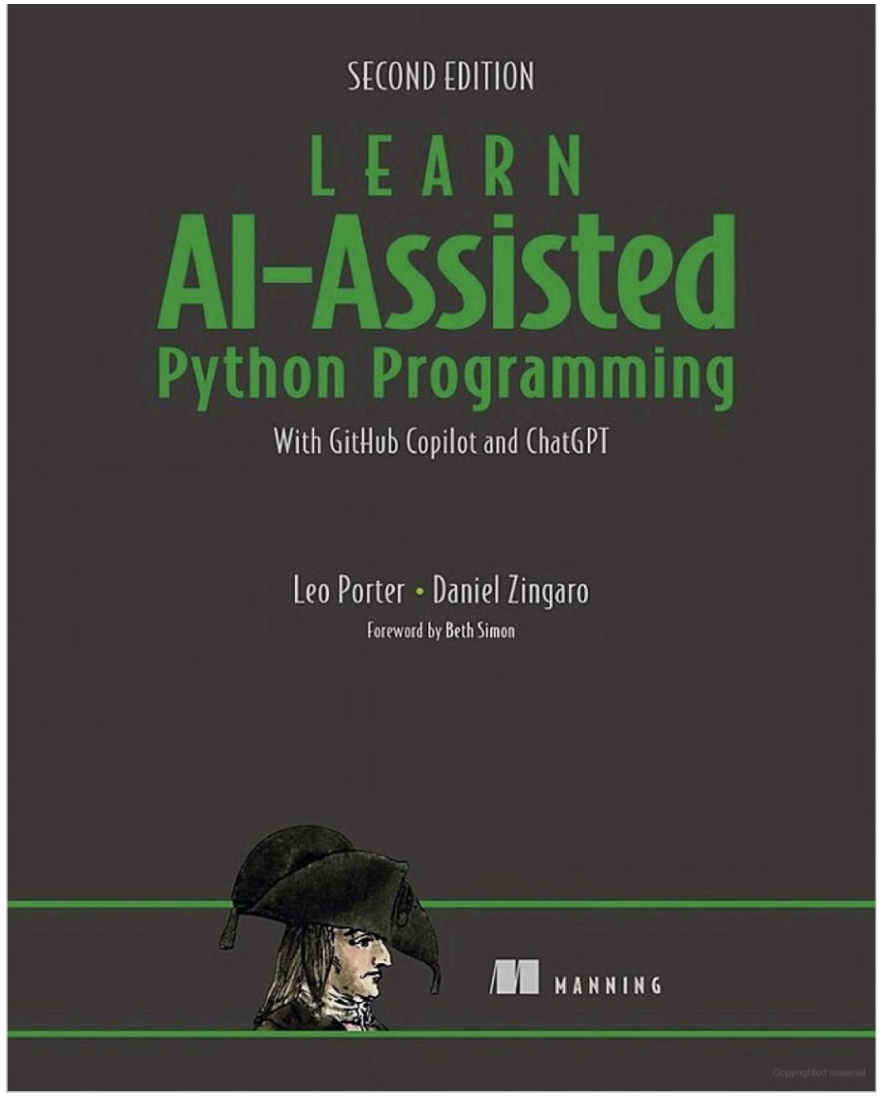
Gen AI in CS Education Consortium

A collaborative initiative dedicated to empowering postsecondary educators to strategically integrate generative AI tools into their courses (from CS1 to Capstone and Software Engineering) by providing resources, training, and model curricula that focus on developing advanced, industry-relevant skills while maintaining academic rigor.



https://www.teachcswithai.org/

Learn AI-assisted Python Programming:
With GitHub Copilot and ChatGPT



A beginner-friendly guide that teaches the essentials of Python programming while simultaneously showing how to leverage AI tools like GitHub Copilot and ChatGPT to accelerate coding, testing, and debugging in an AI-first world.

CS Splice:

A project dedicated to building infrastructure, documentation, and shared standards to facilitate the development, reuse, and data collection of innovative learning content and tools within the CS-ed community.

https://cssplice.org/

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.

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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

NAIRR Classroom Expansion Conferences

Thank You!
Any Questions?

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