Aspire
INSTITUTE

CAPSTONE PROJECT

RESEARCH ONRAMP: AI-ASSISTED PDE MICRO-PROJECTS FOR UNDERGRADUATES

LEARNER INFORMATION

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TRACK 2: LEADERSHIP GROWTH INITIATIVE
OPTION 3: LEADERSHIP IN LEARNING AND RESEARCH

Origin of the creative idea

Context:

- As a mathematics student, I noticed PDEs are often taught as abstract theory, disconnected from real applications.
- This gap reduces confidence and limits curiosity in research.
- At the same time, AI is widely discussed but rarely integrated responsibly into math learning.

Spark of the Idea:

- I asked: “What if PDEs could be taught through a reproducible, AI-assisted project?”
- The idea emerged from combining my interest in applied math with leadership in education.
- My goal became designing a Research Onramp that bridges PDE theory with AI practice, giving math students clarity, confidence, and ethical guardrails.

Exploring creativity

Reseach findings

Through building the PDE-AI notebook, I realized that complex equations become approachable when reframed into small, reproducible projects. AI calibration allowed math students to connect theory with real data, while reflection prompts encouraged curiosity and critical thinking. These insights showed that confidence grows when students have clear workflows supported by ethical, transparent use of AI.

Exploring creativity

Reproducible Projects

AI Calibration

Confidence Growth

Frameworks or Concepts Applied

Human–AI Collaboration

I applied the Human–AI Collaboration Models from the AILP course to clarify the roles AI can play in learning and research. These models distinguish when AI should act as an assistant, advisor, augmenter, or collaborative partner. For math students, this framework provides role clarity and ensures that human judgment and agency remain central while AI supports inquiry.

Ethical AI Principles

I also integrated the Ethical AI Principles to guide transparency, fairness, accountability, and privacy in the project design. These principles ensure that students not only use AI effectively but also reflect on its limitations and responsibilities. By embedding ethics into the workflow, the project promotes responsible innovation and builds trust in AI-assisted learning.

AI Tools or Support Process

To operationalize the project, I integrated AI tools that supported both computation and learning. Python notebooks with libraries such as NumPy, Pandas, and Matplotlib enabled PDE simulations and visualizations, while AI-assisted regression models provided calibration with real data. Cloud platforms like Google Colab and GitHub ensured reproducibility and equitable access, allowing math students to run, share, and reflect on results. Together, these tools created a transparent support process that balanced technical rigor with accessibility.

Exploring creativity

Proposed Strategy

1 Notebook Development

Built a reproducible PDE–AI notebook for simulations, calibration, and reflection.

2 Survey Design

Created a survey to measure confidence, curiosity, and ethical reflections.

3 Workshop Facilitation

Conducted a collaborative workshop to promote peer learning and responsible AI use.

4 Integration & Reflection

Combined notebook, survey, and workshop into a cohesive model for confidence and leadership.

Impact

The project builds student confidence in tackling PDEs by connecting theory with real data through AI calibration. It fosters curiosity, ethical reflection, and leadership, enabling students to see themselves as capable researchers. The reproducible notebook and collaborative workshop model ensure that learning outcomes are measurable and transferable.

Exploring creativity

Implementation Plan

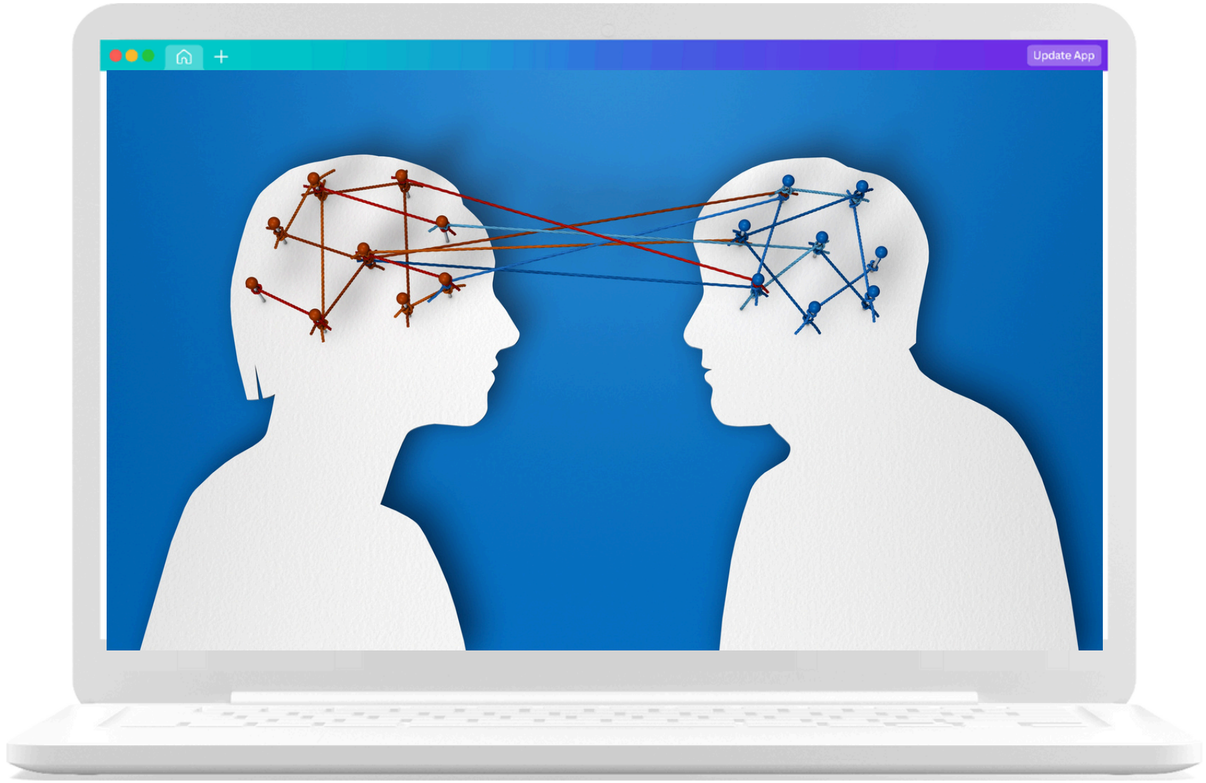
Pilot Phase: Introduce the notebook in small classes and gather survey feedback.

Workshop Expansion: Facilitate workshops across broader student groups to encourage peer learning.

Scaling & Integration: Share notebooks via GitHub and embed reflection prompts into course modules.

Reflection

Through building the PDE–AI notebook, survey, and workshop, I realized that complex equations become approachable when reframed into small, reproducible projects. The process taught me that AI is most effective when used as a supportive tool, not a replacement for human reasoning. Facilitating the workshop also showed me the importance of peer learning and role clarity in building confidence.



LESSONS LEARNED

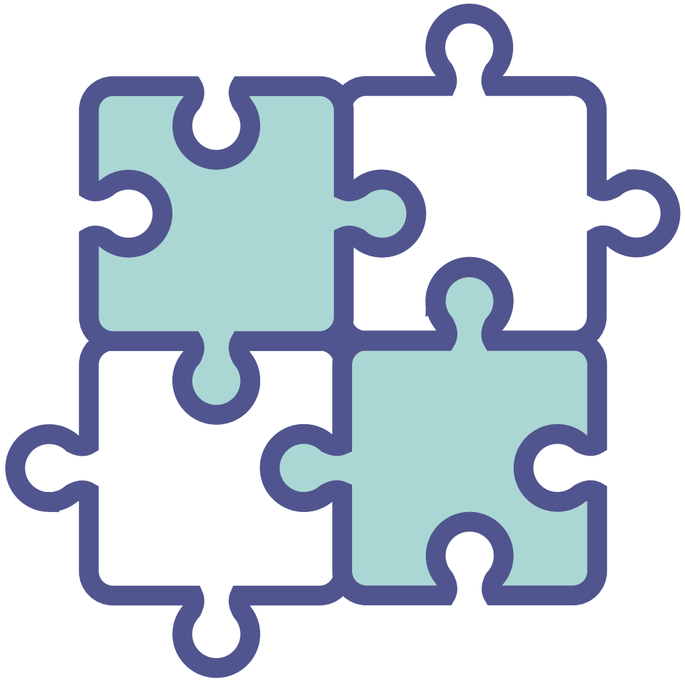
analysis

1

Reproducibility matters:
Clear workflows make advanced math accessible and transparent.

2

Ethics guide impact:
Embedding ethical AI principles ensures responsible and trustworthy use.



3

Confidence grows through practice:

Students gain agency when they experiment, reflect, and share results.

4

Leadership emerges from collaboration:

Workshops foster curiosity, teamwork, and student ownership of learning.

Thank you very much!

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