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Leveraging AI to Improve STEM Engagement for Black & Latine Youth

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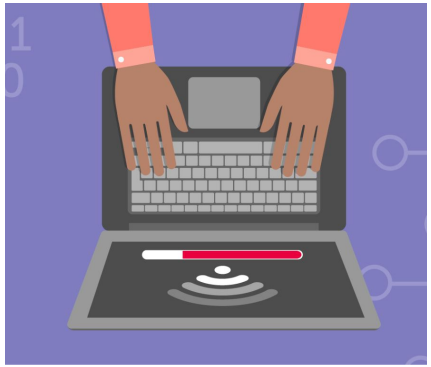
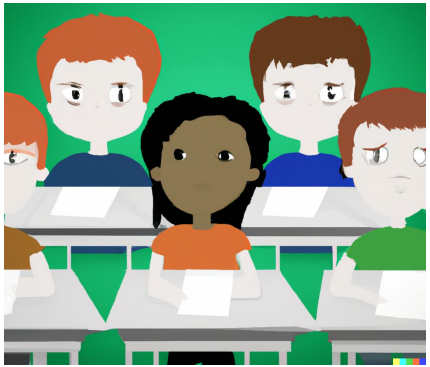
Unequal Technology Access: The Digital Divide

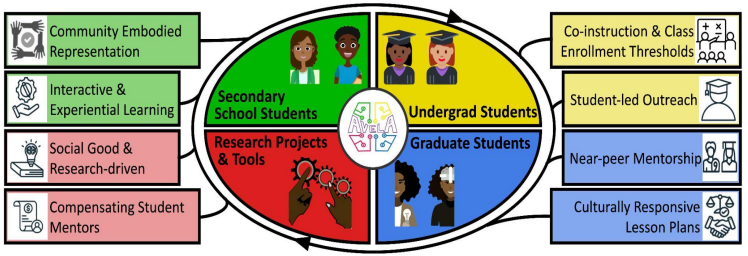
Digital Divide Definition: The multifaceted gap leading to inequities in socio-technical access.



Alone, physical access to technology is not enough [1]



Students lack representative and experienced mentors



Holistic student-led STEM engagement outreach model [1]

[1] Johnson K. and Cora A., et al "*AVELA - A Vision for Engineering Literacy & Access: Understanding Why Technology Alone Is Not Enough*". arXiv:2309.06725 (2024).

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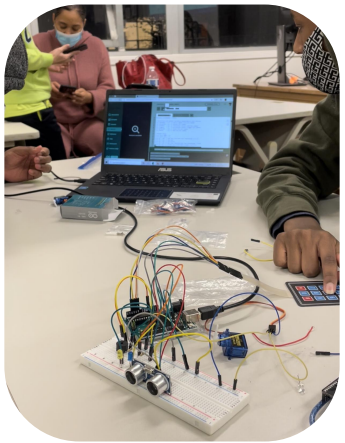
Leveraging AI Tools To Support CS Instruction

Large Language Models (LLM's) Definition: A type of Artificial Intelligence (AI) that is pre-trained on vast amounts of data to be capable of recognizing, interpreting, and generating human text (e.g. ChatGPT).

Inexperienced CS Instructors

- ChatGPT can provide simple step-by-step instructions for beginner programmers
- It has been observed that ChatGPT provides the highest increases in productivity for novice programmers [2]



Experienced CS Instructors

- GPT-4 can generate fully correct programs from a single prompt
- GPT-4 can generate both hardware and software recommendations, which is especially helpful in robotics

[2] Englhardt Z., et al. "*Exploring and Characterizing Large Language Models For Embedded System Development and Debugging*". arXiv Preprint (2023).

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Proposed Study & Approach

Proposed Study: We aim to evaluate the capacity for AI tools, like LLMs, to help reduce the digital divide by exploring the limitations/effectiveness as well as the potential hesitations Black and Latine communities may have with integrating LLMs into their classrooms.

- Assets-Based Community Cultural Wealth Approach
- Design-Based Research
- Constructive Grounded Theory Approach
- Mentor-Embodied Community Representation
- Near-Peer Mentorship
- Hands-On & Service-Learning Based Lessons

[1] Johnson K. and Cora A., et al "*AVELA - A Vision for Engineering Literacy & Access: Understanding Why Technology Alone Is Not Enough*". arXiv:2309.06725 (2024).

Conjecture Map

Conjecture

Leverage LLMs to support and scale instruction

Embodiment

Tools/Materials:
- Arduino toolkit
- **ChatGPT**

Task Structures:
- 40 hour Arduino class
- Debugging
- Culturally relevant lessons
- Prompting workshop

Participant Structures:
- 1 expert, 1 non-expert near-peer instructors
- 10-15 students, varied skills, same school district

Discourse Structure:

Artifacts

Observable Interactions

Effects/Broader Impacts

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Discourse Structure:
- Holistic lesson plan
- Student explanations
- Instructors permit ChatGPT use without explicit instruction

Artifacts

Code files and Arduino hardware

ChatGPT logs

Pre/Post surveys

Observable Interactions

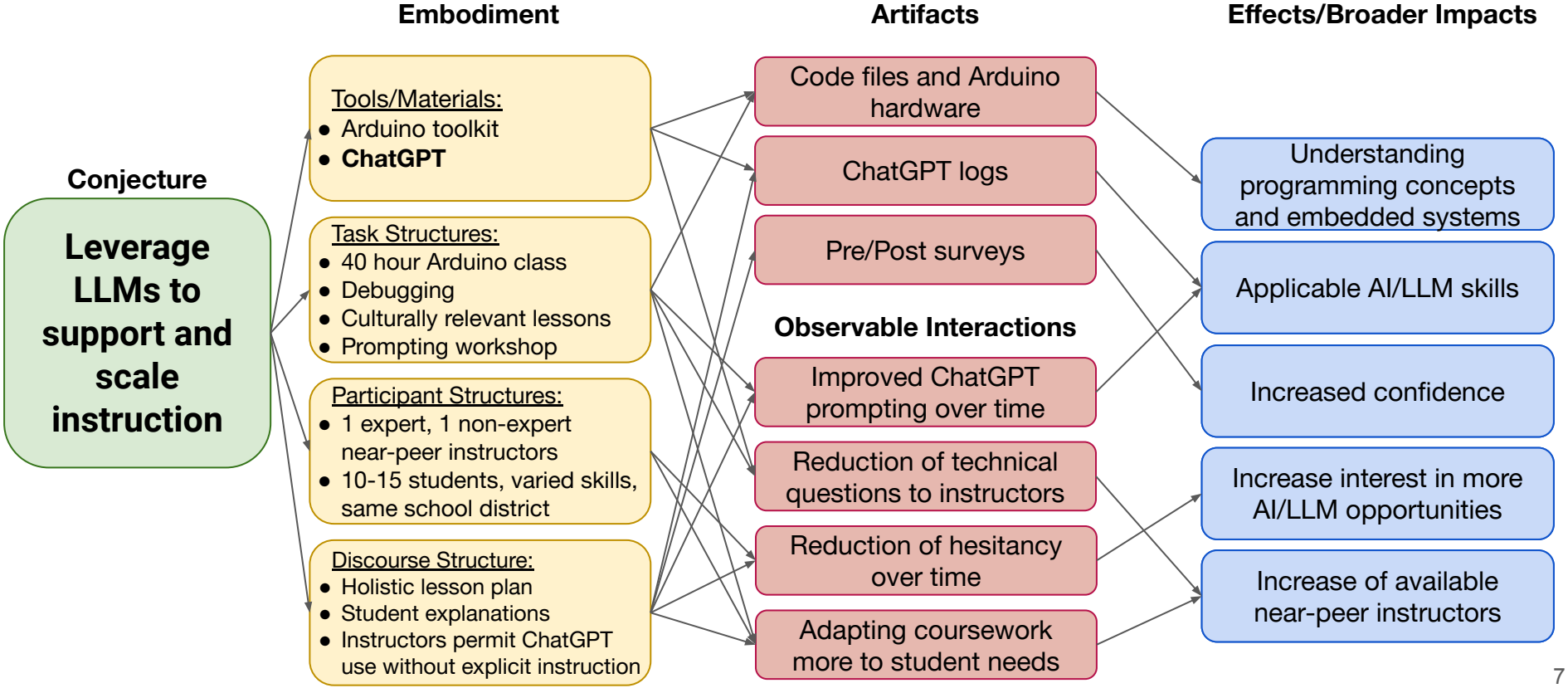
Improved ChatGPT prompting over time

Reduction of technical questions to instructors

Reduction of hesitancy over time

Effects/Broader Impacts

Conjecture Map



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Thank You For Your Time!

Please contact us if you have any questions:

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