Large Language Models (LLMs) in STEM Education

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Using Large Language Models to Solve Problems

- Chain-of-Thought (CoT)[1]
  - Going step by step increases accuracy
  - Limited to LLMs with large size
- Few-shot Learning (FSL)
  - Use of similar problems improves accuracy
  - Trains LLM on example problems
- Tool-augmented LLMs[2]
  - Outside APIs improve LLMs
  - Giving ChatGPT a "calculator"
- Self-verification[3]
  - Uses LLM to check its own answer
  - Higher cost

Using Large Language Models to Create Math Problems

**Advantages**
- Fast
- Adaptable

**Disadvantages**
- Disconnected from the curriculum
- May be plagiarized
- Solutions it gives may be incorrect
- Generates only text (no diagrams or graphs)

**Vision**
- Use LLMs to improve math education
- Improve cognition and math skills
- Create math education that attracts a diverse workforce

**How can we help teachers partner with LLMs?**

**References**


**Relevance**

- Math is required in life sciences to:
  - Analyze data
  - Create models of biological systems
- Project contributes to cognition research: Understanding teaching is to understand how a human learns
- Research Question: How can we conduct prompt engineering to generate meaningful problems?

**Our Work**

- Surveyed literature on solving and generating math problems
- Composed guidelines for teachers on using LLMs
- Experimented with one LLM (ChatGPT) in generating problems

**Next Steps Toward LLMs in the Classroom**

- Guide teachers to use and understand LLMs
- LLMs are the sidekick, not the superhero

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