

Generative Artificial Intelligence for Learning Recursion in CS1

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Introduction

- Generative **AI tools** are relevant in modern education.
- Research on how **AI affects student learning** of CS concepts is needed.
- **Recursion** is a challenging topic for students in introductory programming courses.



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Research Question

Goal: To explore how AI-assisted learning compares to more traditional learning methods.

- ***Does AI improve student understanding and retention?***
- ***Does AI affect student confidence and performance?***

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Design and Methodology

Two Instructional Guides

Students used the following tools in the lesson plans:

- ChatGPT (AI)
 - Given specific prompts to aid in learning recursion
 - Students were encouraged to analyze the generated responses
 - Concept exploration through real-time feedback
- GeeksForGeeks (written guide)
 - Popular online programming education resource
 - Students were guided through reading documentation and solving practice problems
 - Traditional, self-directed learning using a trusted source

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Study Design of 3 Meetings

1. Pre-Survey

- Consent form
- Participant background information
- Pre-study Confidence level

2. Two Instructional Guides (*independent variable*)

- to teach recursion fundamentals
 - AI (*with example prompts*)
 - Written Guide (*topic overview*)

3. Post-Quiz & Survey

- Each group was tested on their understanding of recursion
- Quiz questions (*concept checks, output prediction*)
- Post-study Confidence level & feedback

Participants

- CSCI Procedural Programming class
 - Enrolled in one of two sections (29 student participants)
- Mixture of male and female
 - 14 - AI Usage Group Ratio 13:1
 - 15 - Written Guide Group Ratio 10:5
- Mostly CSCI majors
- Some had Previous Programming experience
- Participation was voluntary and required informed consent

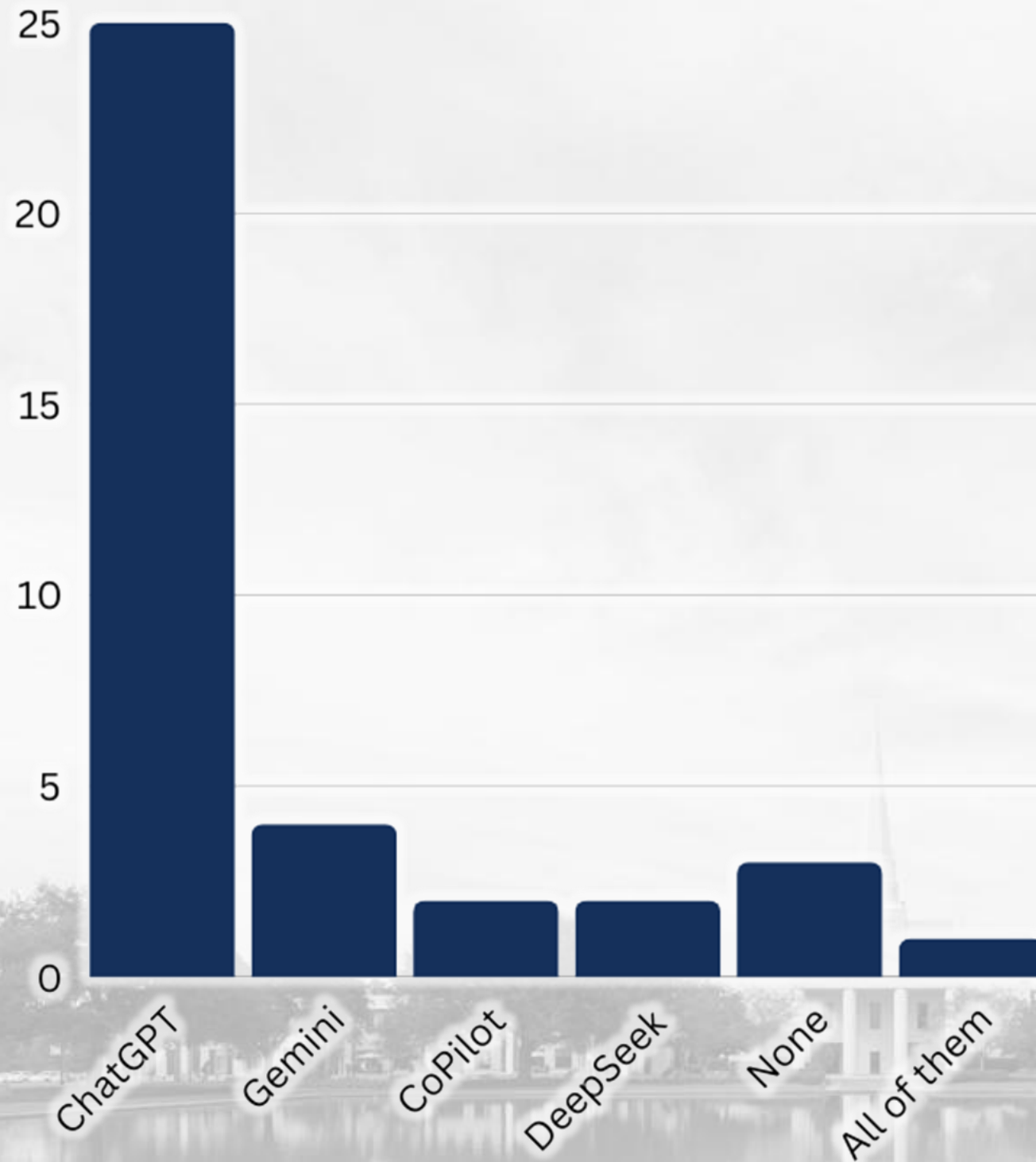
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Results



What type of AI do the students use?

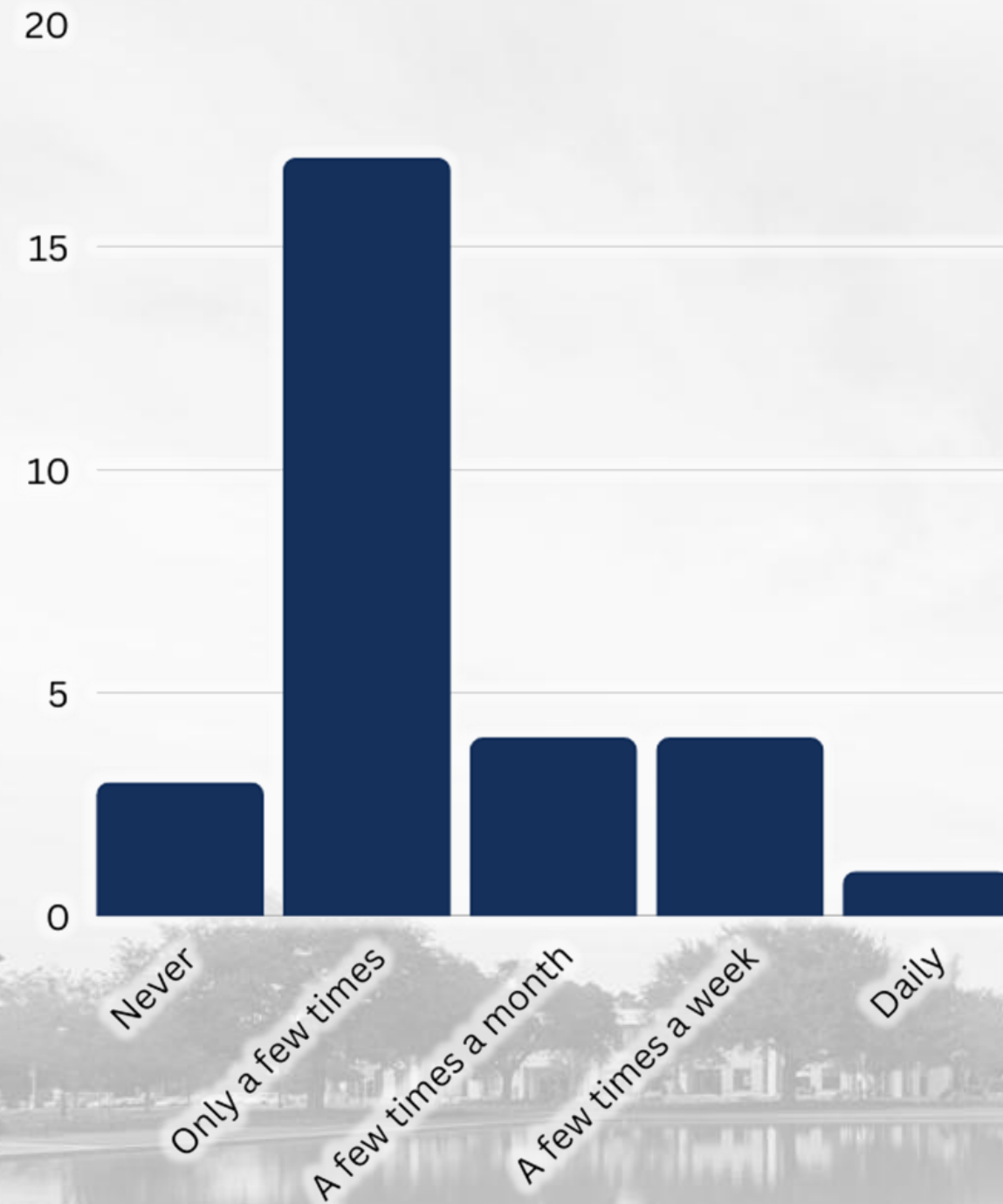


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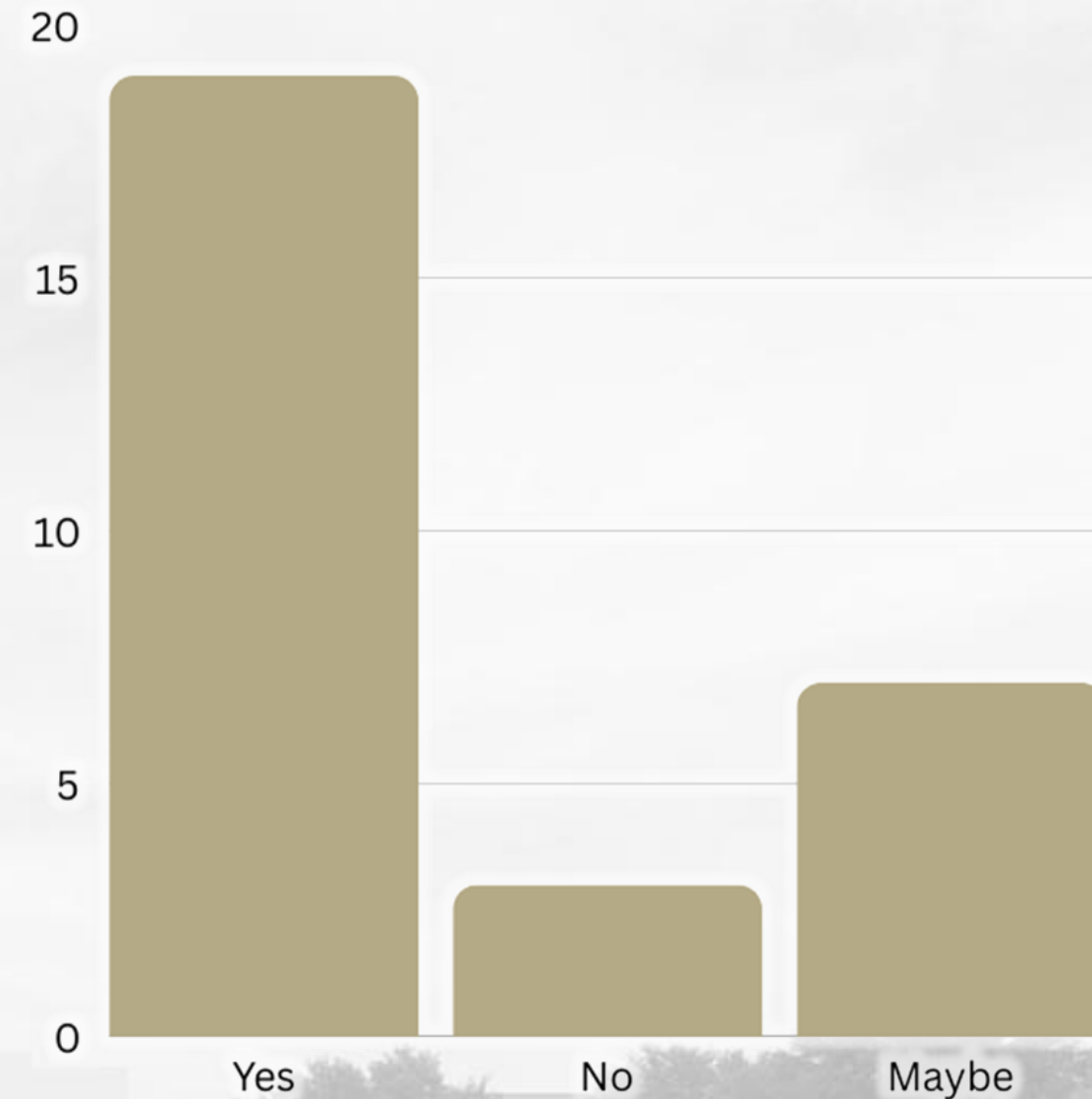


Reported AI Usage vs Interest in AI for Academia

Reported AI Usage



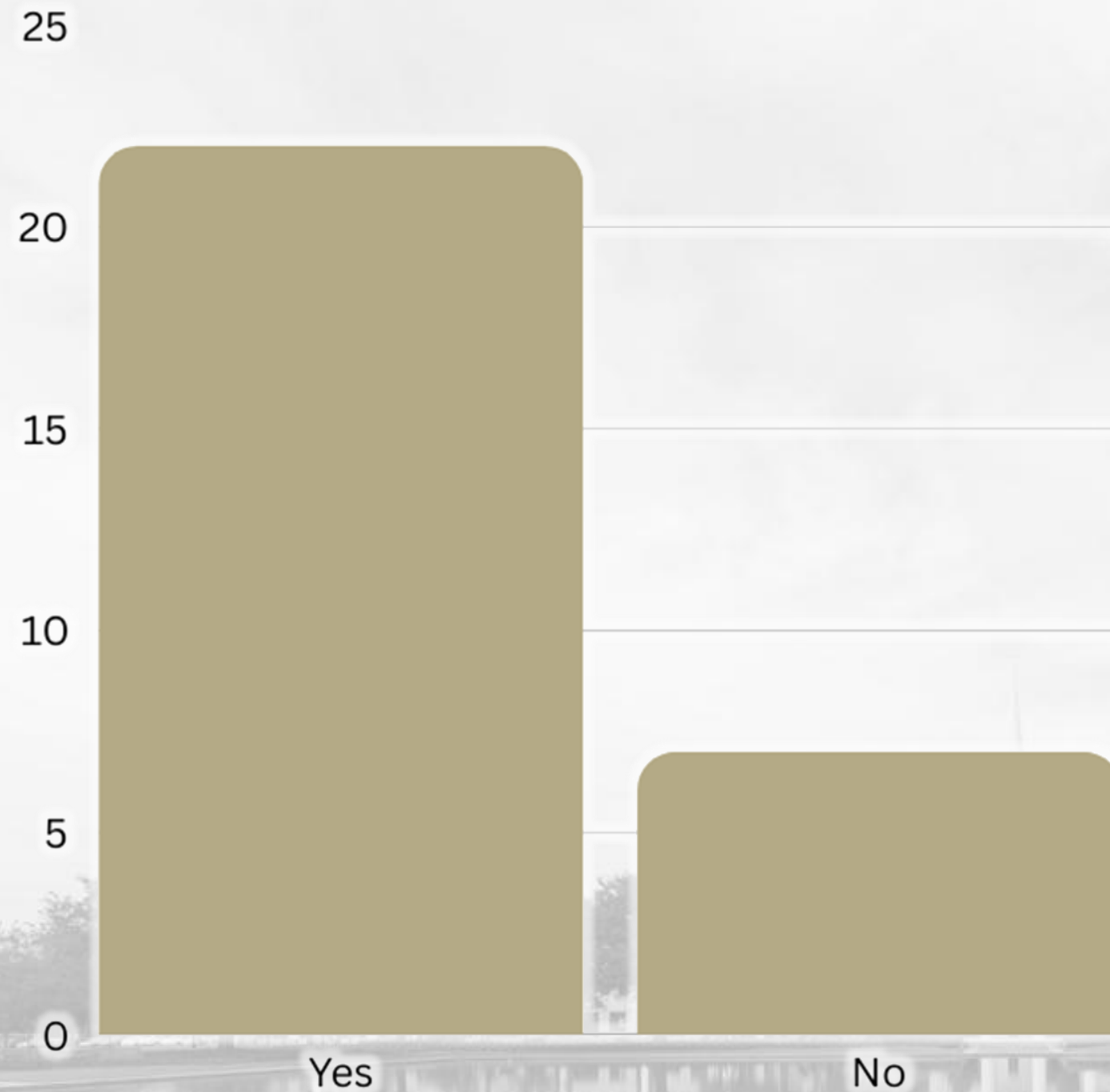
Should AI be used in Academia



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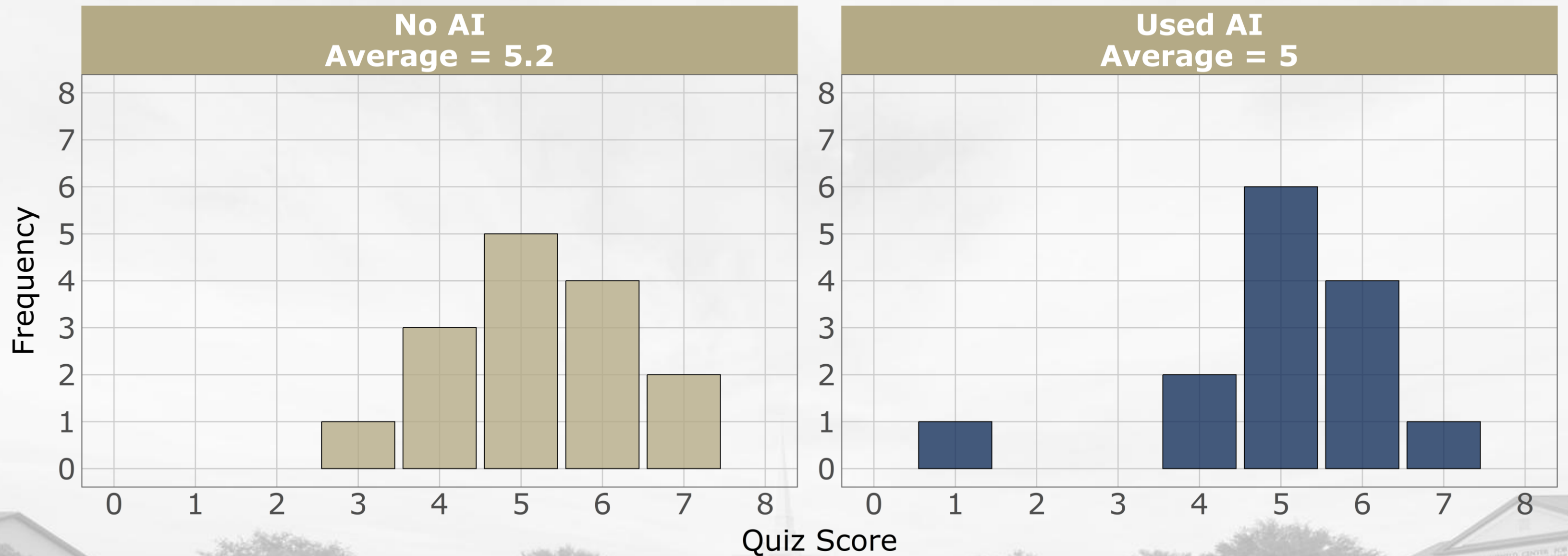
Are AI-Usage Guidelines Needed?



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Quiz Scores

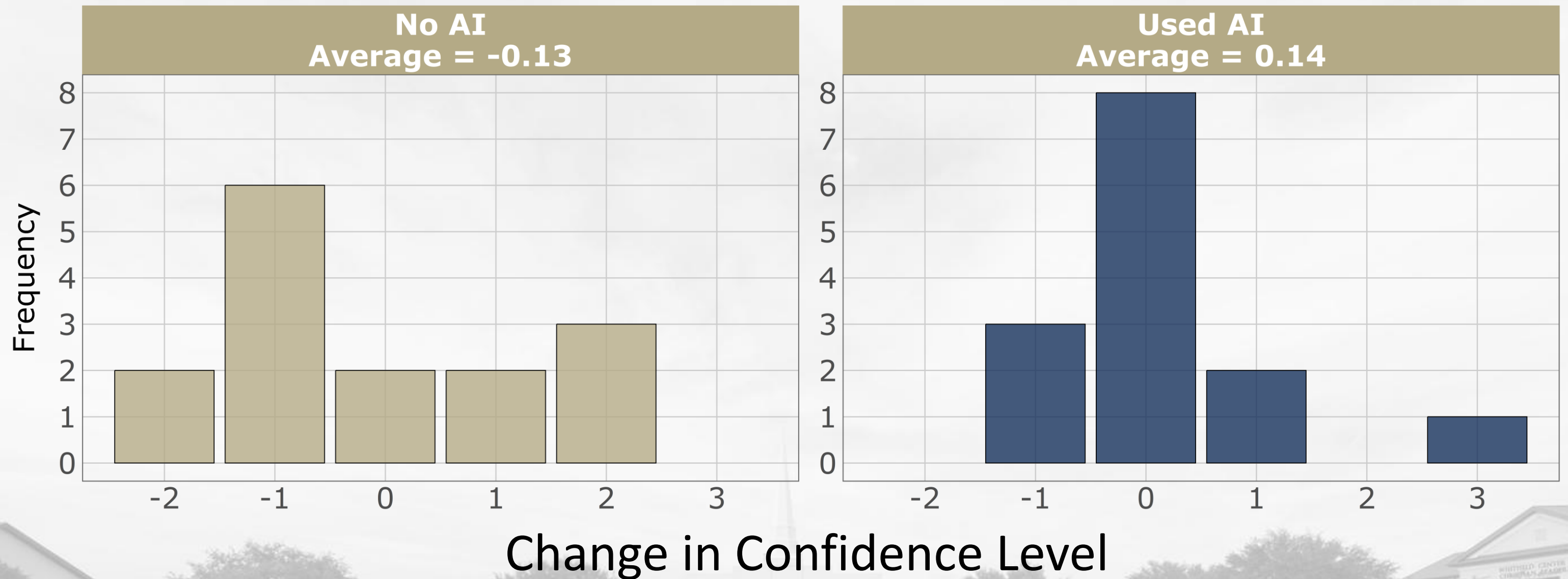


$t(28) = (-0.41969), p = (0.678)$

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Confidence Change



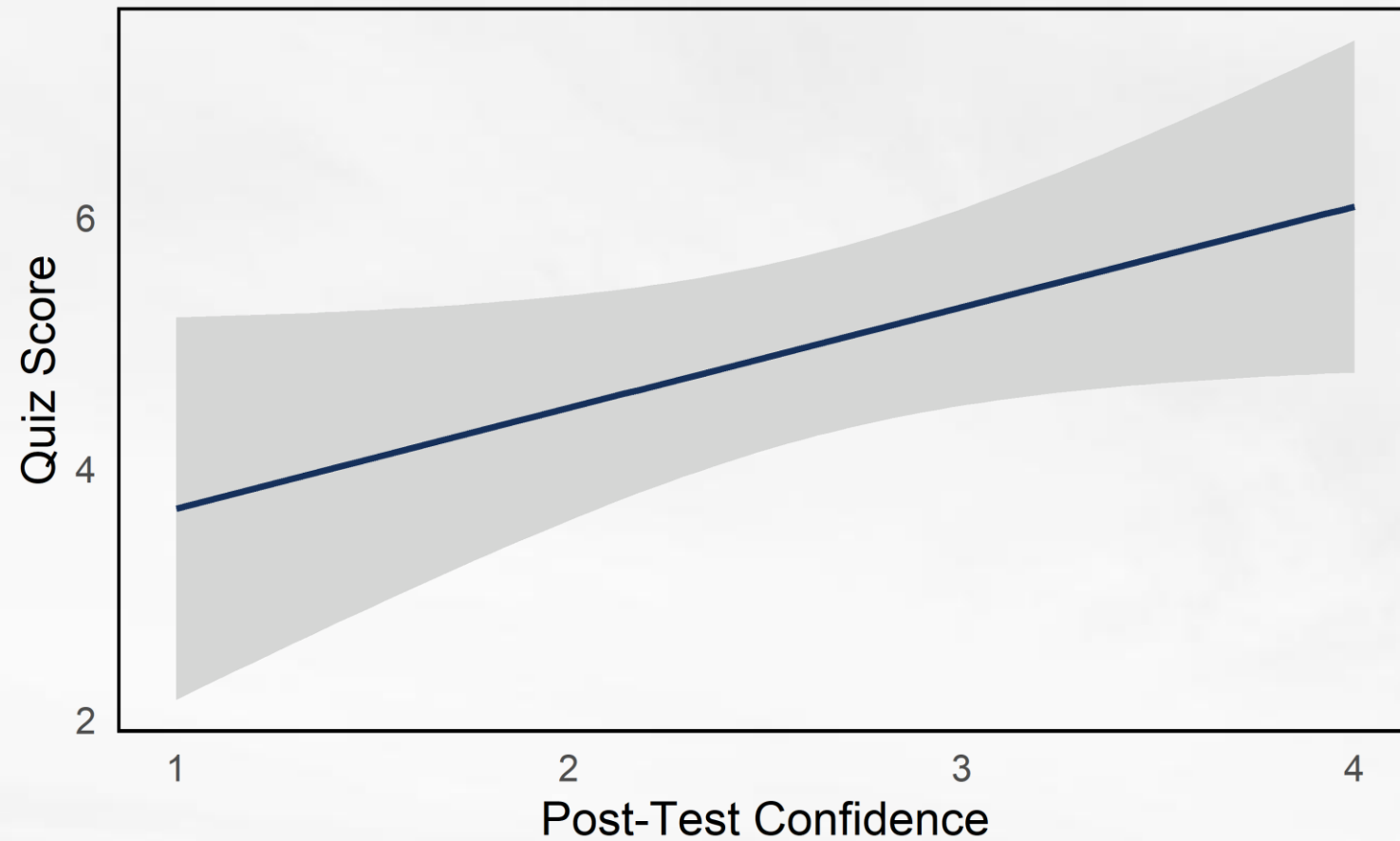
$t(28) = (0.59986), p = (0.5536)$

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Confidence Correlation

Used AI



R-squared: 0.278

No AI



R-squared: 0.017

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Future Work

Expanding the Research on Generative AI in CS1

- Longitudinal Studies on Learning Retention
- Long-term Retention and Understanding
- Debugging and Code Correction
- Comparing study results between CS1 and higher-level CS Classes
- Larger sample sizes

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Thank You

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