

# Accuracy of Metacognitive Predictions in an Introductory Physics Course

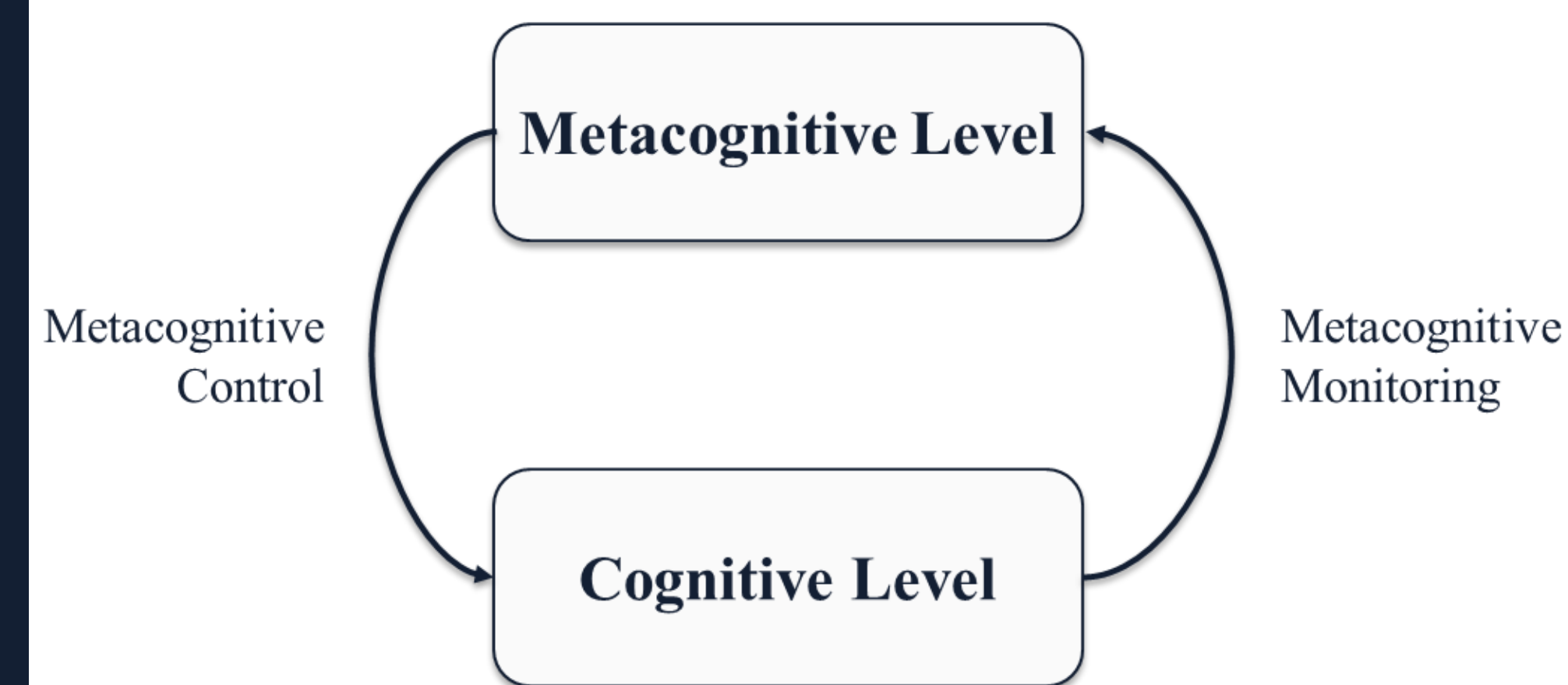
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## INTRODUCTION

- Metacognition consists of two components, metacognitive knowledge and metacognitive skills.
- Metacognitive skills include monitoring and control of one's thinking.



## AIM

- Success in STEM courses depends on accurate metacognitive monitoring and control.
- Summative exams measure an individual's metacognitive ability to determine when they have sufficiently prepared as well as their ability within the domain (Nelson, 1996).
- Learners often use cues such as **Fluency** and **Familiarity** to make metacognitive judgements (e.g., Koriat and Levy-Sadot, 2001; Rhodes and Castel, 2009).
- Low-performing individuals overestimate their performance, more so than high-performing individuals (e.g., Ehrlinger, et al., 2008).
- However some studies have found that low performing students may be better at indicating what they don't know (Lindsey & Nagel, 2015).
- Metacognitive monitoring accuracy generally does not improve over the course of a semester (e.g., Foster, et al., 2017).

## RESEARCH QUESTIONS

- 1) What is the difference metacognitive monitoring accuracy between students of different abilities?
- 2) To what extent does an intervention where students are given feedback about the accuracy of their metacognitive predictions affect exam performance and metacognitive monitoring accuracy?

## PARTICIPANTS

### Participants

Undergraduate students enrolled in an algebra based introductory physics course for non-majors (N = 284).

Randomly assigned to either receive feedback, or not, about their exam predictions and performance before the subsequent exam.

Ability groups determined by dividing participants into quartiles using their average on the four exams.

## PROCEDURE

Participants made metacognitive judgments about their exam grade before (prediction) and after (postdiction) each exam.

Control Group  
N=141

Exam 1

Exam 2

Exam 3

Exam 4

Feedback Group  
N = 143

Exam 1

Feedback

Exam 2

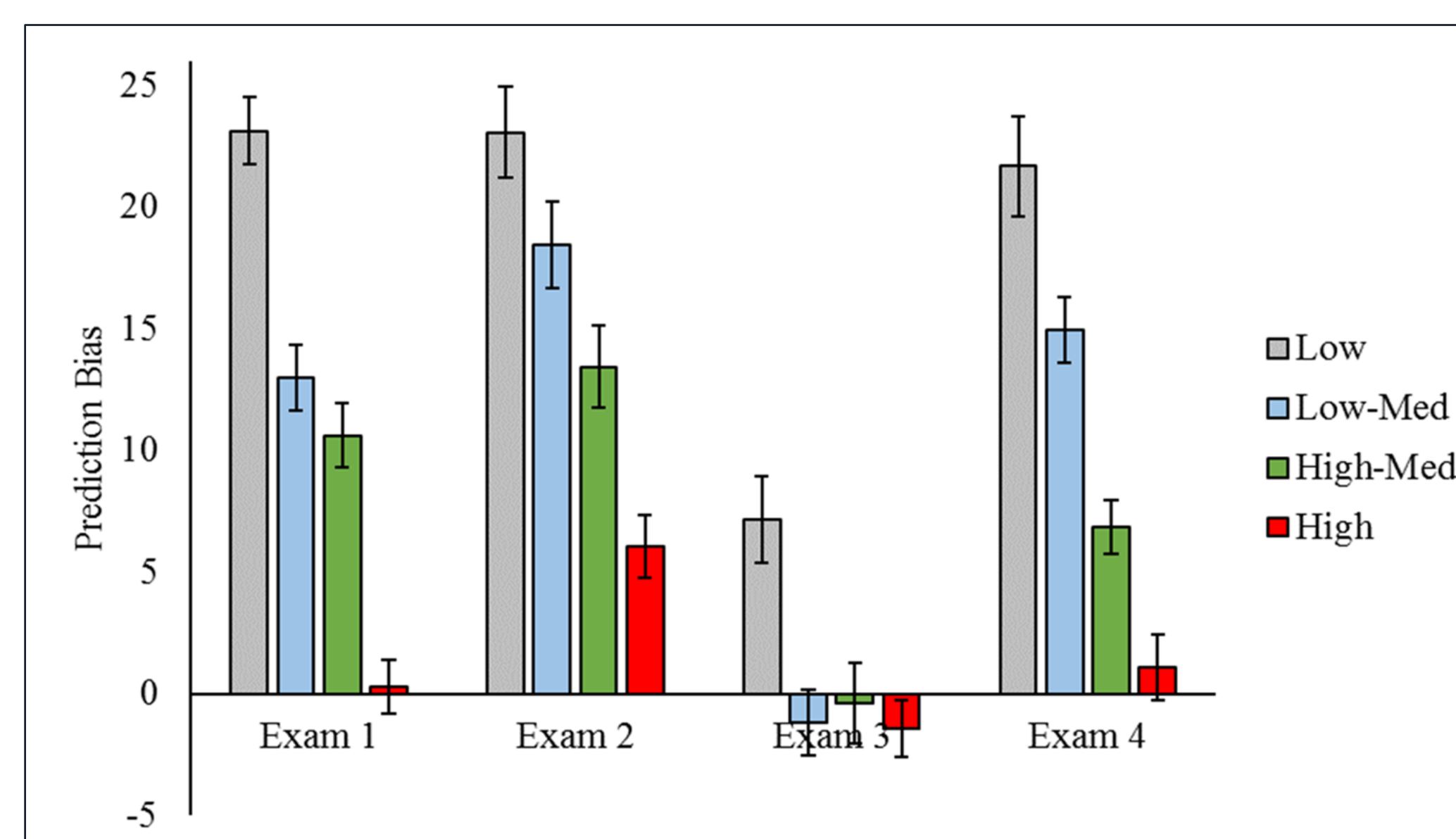
Feedback

Exam 3

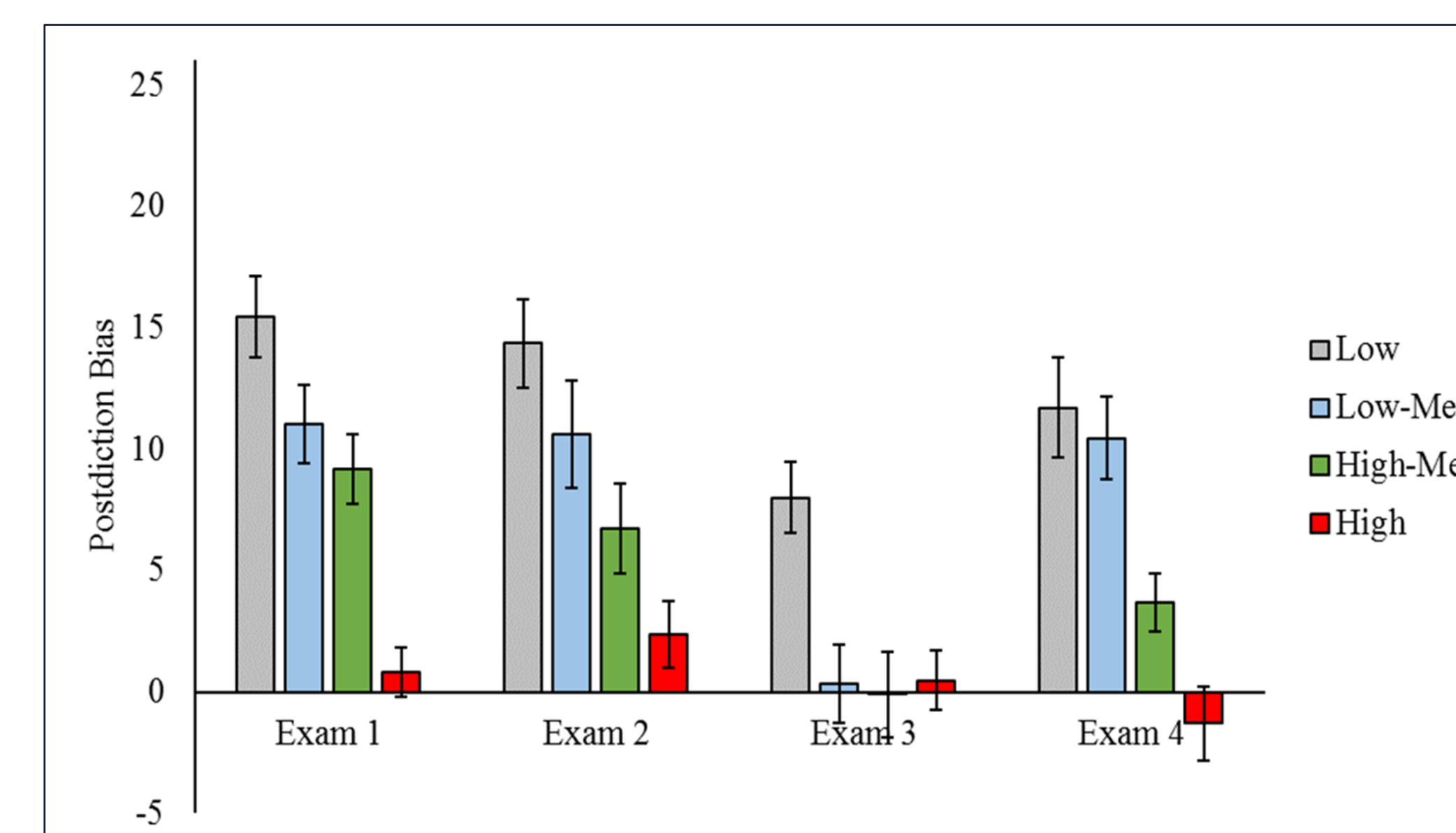
Feedback

Exam 4

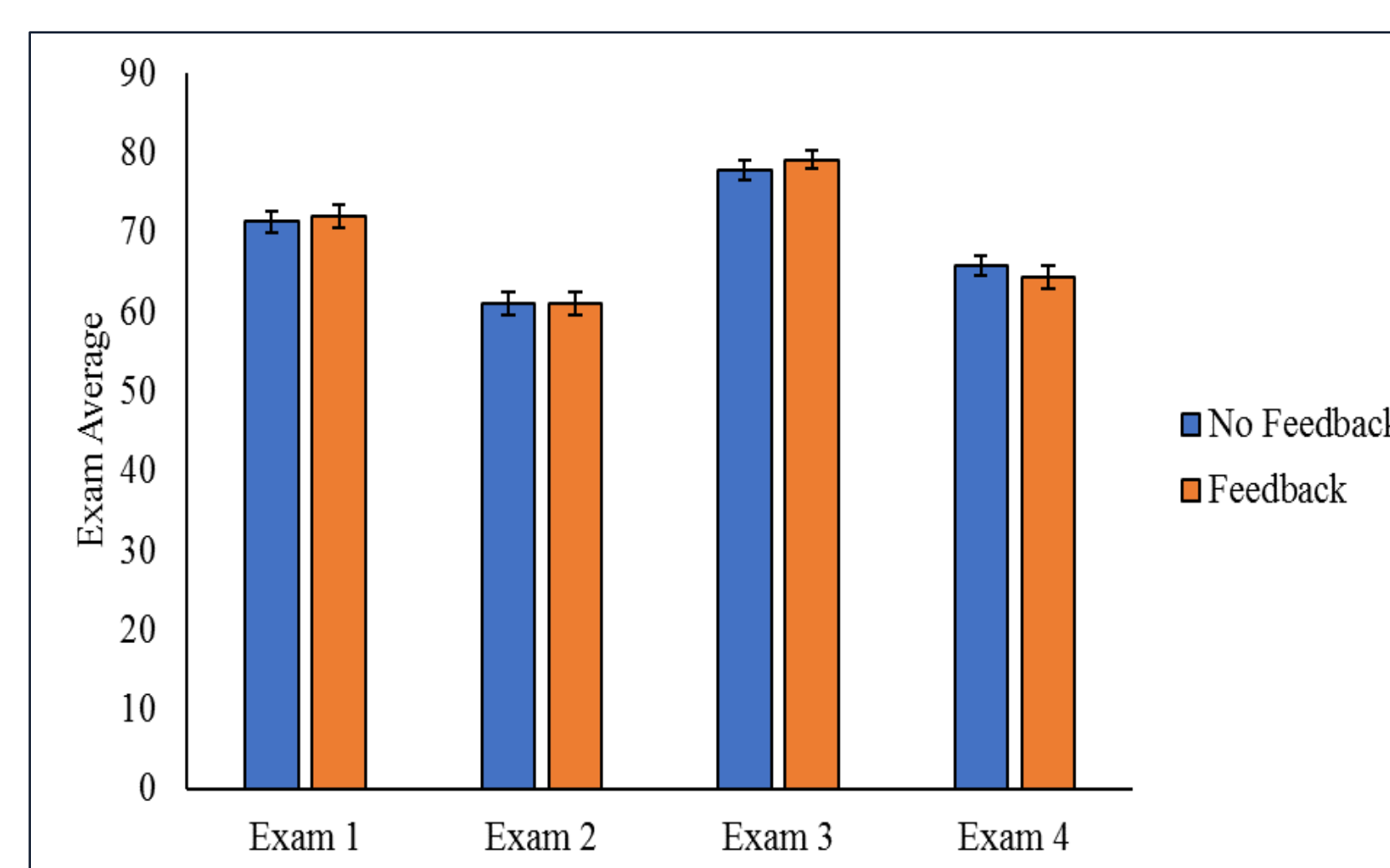
## RESULTS



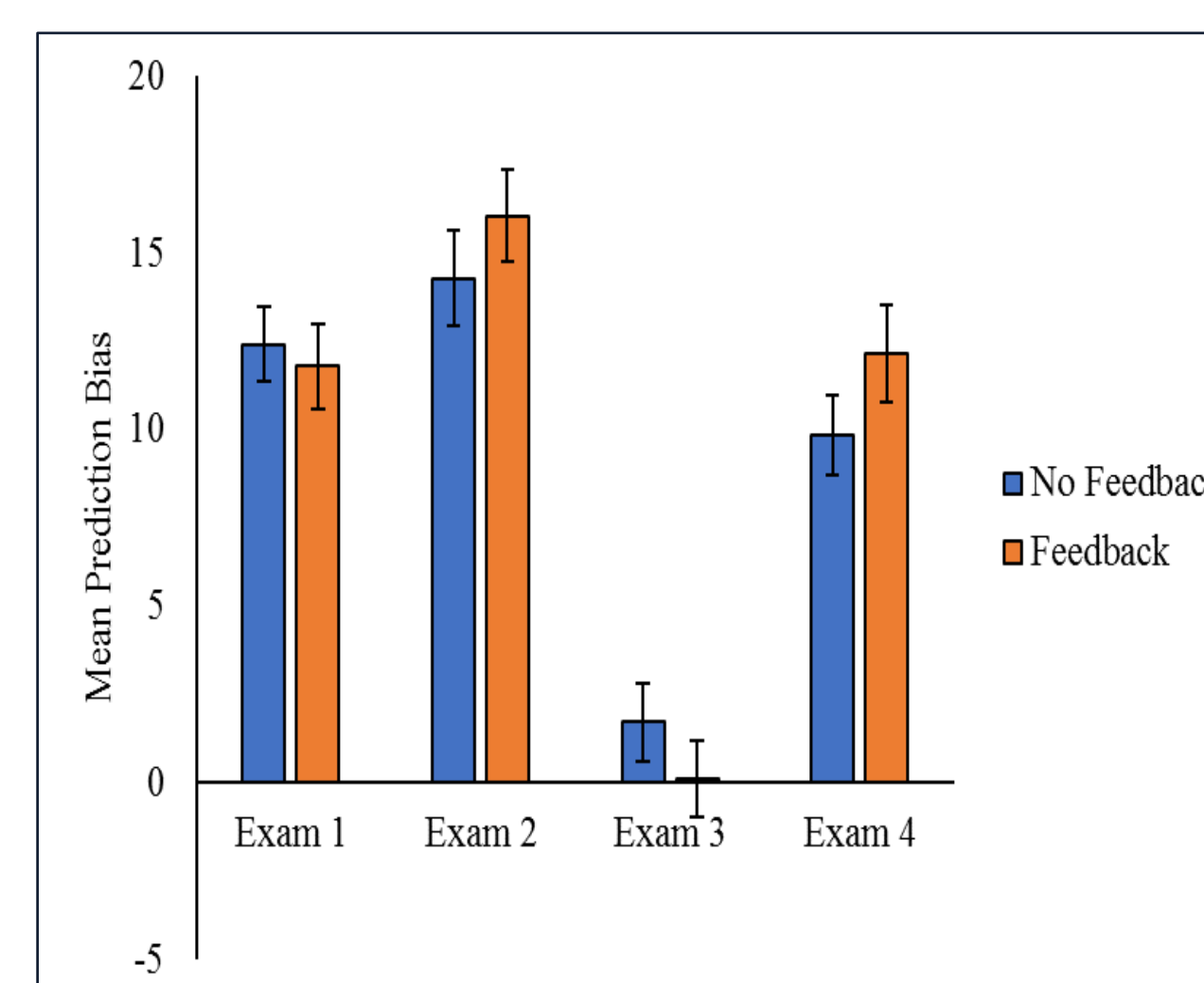
Mean Prediction Bias Score (Prediction - Exam Score) by Ability



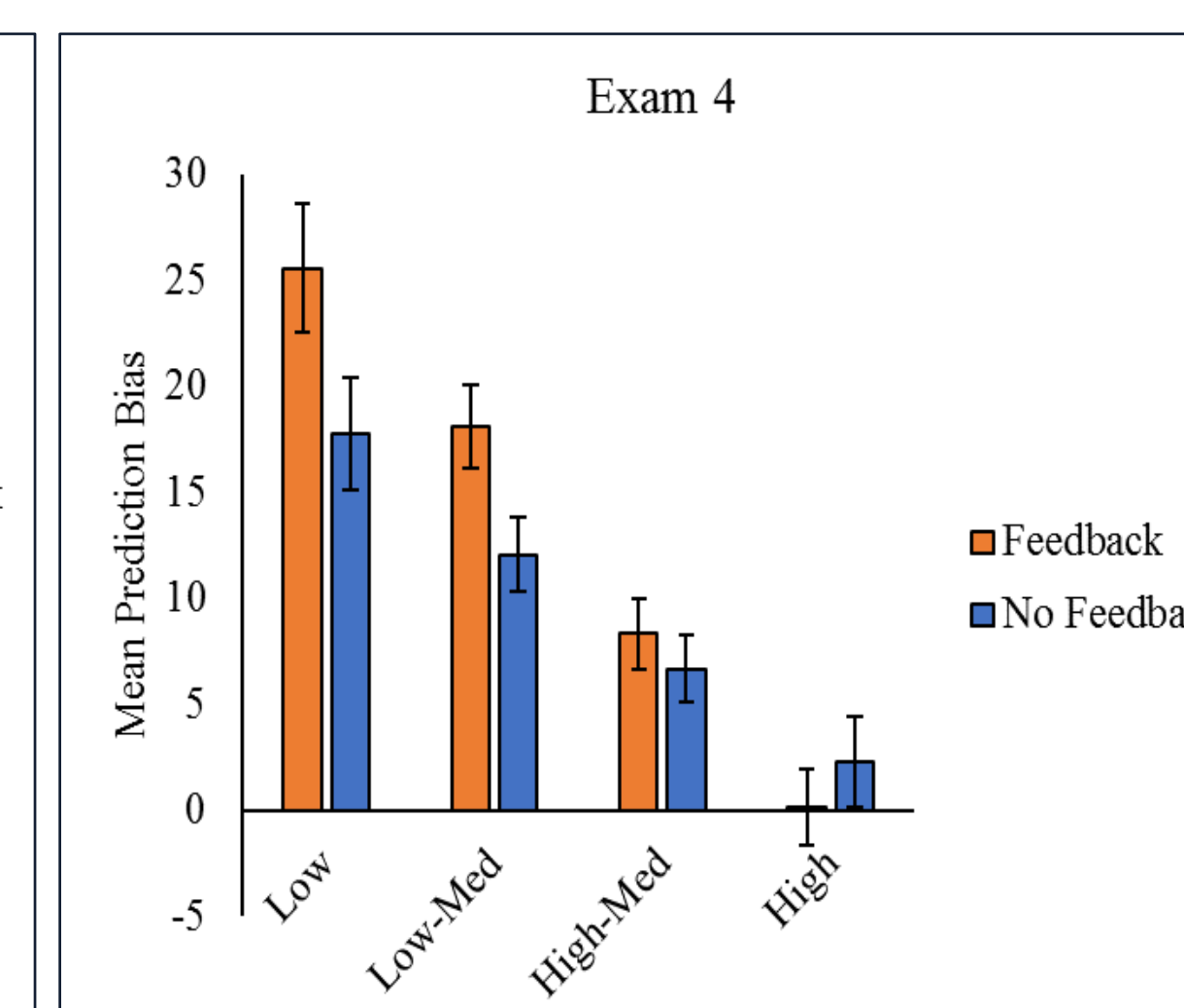
Mean Postdiction Bias Score (Postdiction - Exam Score) by Ability



Overall Mean Exam score by feedback group



Mean Prediction Bias by feedback group



Mean Final Exam Bias by Ability and feedback

## CONCLUSIONS/IMPLICATIONS

- Low-performing students overpredict their exam performance by about 20 percentage points on average. High-performing students are more accurate, predicting within 5 percentage points on average.
- Overconfidence is reduced, but remains after taking exams in the course for low-performing students .
- This indicates that interventions intended to help low-performing students may need to incorporate metacognitive training.
- Providing feedback about metacognitive accuracy to students does not seem to help students perform better or more accurately judge their performance.
- This indicates that three instances of feedback may be insufficient for changes in metacognitive accuracy.
- Paradoxically low-performing students may become more overconfident after receiving feedback.
- Interventions aimed at low-performing students need to attend to affect and efficacy when providing feedback.

## REFERENCES

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## ACKNOWLEDGEMENTS

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## MORE INFORMATION

For more information, or to see additional studies, please visit our website:

<https://go.illinois.edu/MorphewPER>

