Is there a metacognitive trait? Investigating individual differences in performance predictions

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Introduction

Lower performing students are thought to be very overconfident test grade predictors compared to higher performers. Although there is evidence of otherfactors affecting metacognition1 ,it is often assumed that poor domain knowledge leads to overconfident predictions (i.e., the Dunning-Kruger Effect2 or the Unskilled and Unaware effect). Furthermore, overconfident predictions may reduce study behavior (a cycle of failure).

Research question: Is domain knowledge the only cause of overconfidence?

Hypotheses:

- People have a trait metacognitive ability
- Domain knowledge is more complicated than previously thought

Methodology

Participants made a series of 16 test grade predictions across two study sessions in a laboratory (78 subjs, N = 10903) . Session one involved completing four test types, and making a grade prediction before and after each (Prediction Time 1-2). Session two repeated this procedure one week later with different versions of the same tests (Prediction Time 3-4). Variations in Prediction Time and Test type were operationalized as variation of domain knowledge. Dependent Variables (accuracy of prediction):

- Calibration (Prediction-Performance)
- Calibration Magnitude (Absolute value of Calibration)

Independent Variables:

- Control Demographics (Gender, Race/Ethnicity, First Generation Student Status)
- Domain Knowledge (Test Performance, Test Type4, Pre/Post-Dictions, Session)
- Trait Metacognitive Ability (Participant)

Results

Data were analyzed two in ways: a GLM comparing Calibration across Domain Knowledge variables (Simple but misleading) and a Mixed Model predicting Calibration Magnitude from Domain Knowledge, Control Demographics, and trait-participant as a random effect for intercept and Test Performance. Error bars are Standard Error.

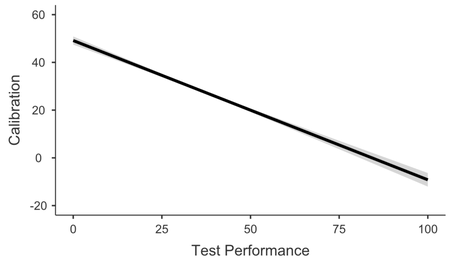

Figure 1: Simple but Misleading

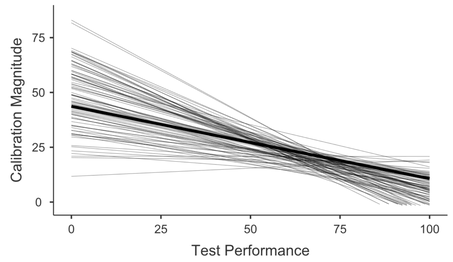

Figure 2: Complex

Lower performers5 were more overconfident.

Independent variables: Random effect of trait (participant) was significant ($p < .001$, R2change = .247, ICC = .6286).
Random effects suggest trait metacognition may mediate effect of test performance.

Conclusions

There was significant evidence for a trait metacognitive ability as represented by a random effect of participant beyond demographics or Domain Knowledge.
At least two unique types of significant domain knowledge were identified: Test Performance, Pre vs. Post Dictions, and Test Type. Testing session was surprisingly not significant, suggesting that people may somehow lose learned metacognitive information.
Takeaway: Lower performers are more overconfident, but there may be a significant mediating metacognitive trait.