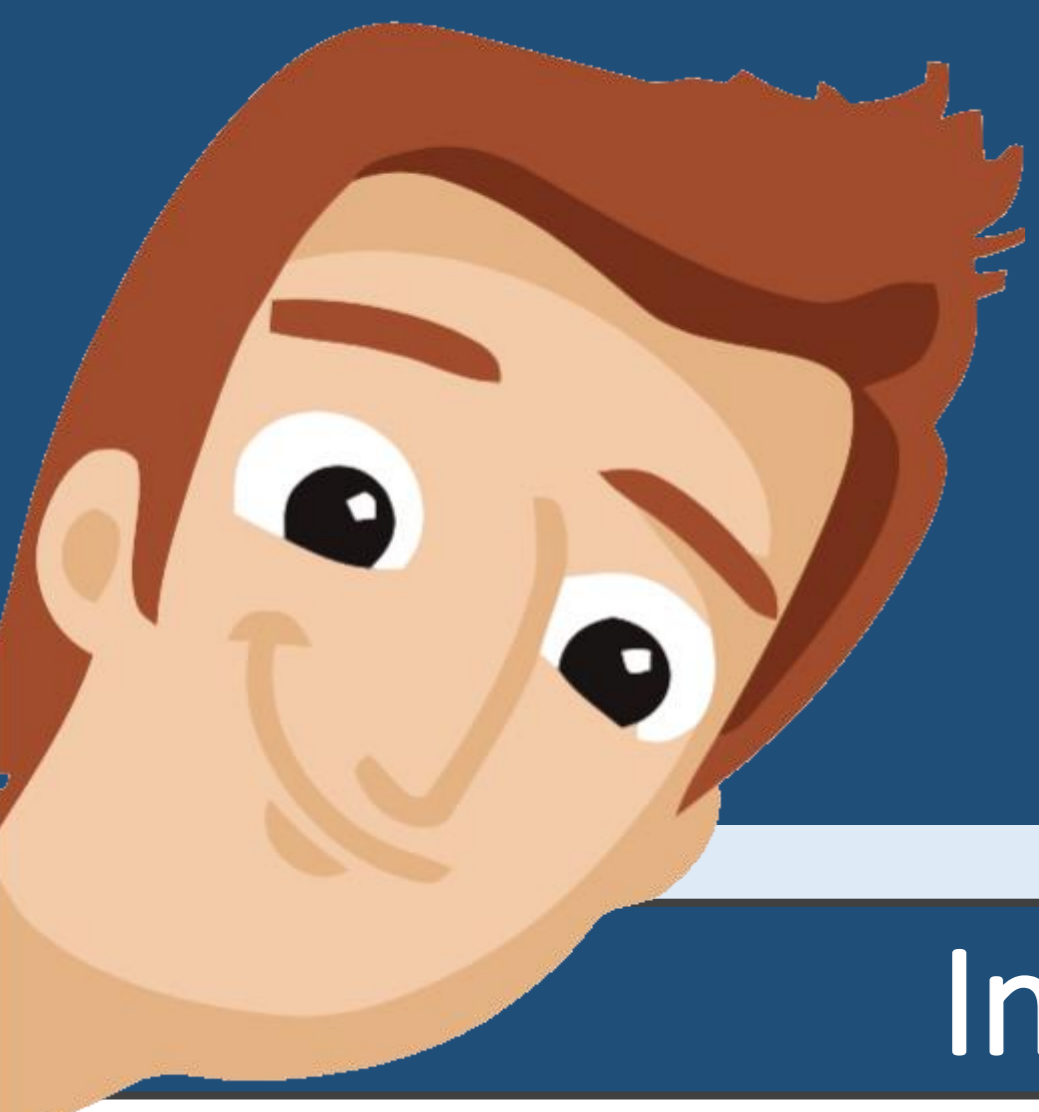


# Metacognition and exam performance: Tools for effective learning

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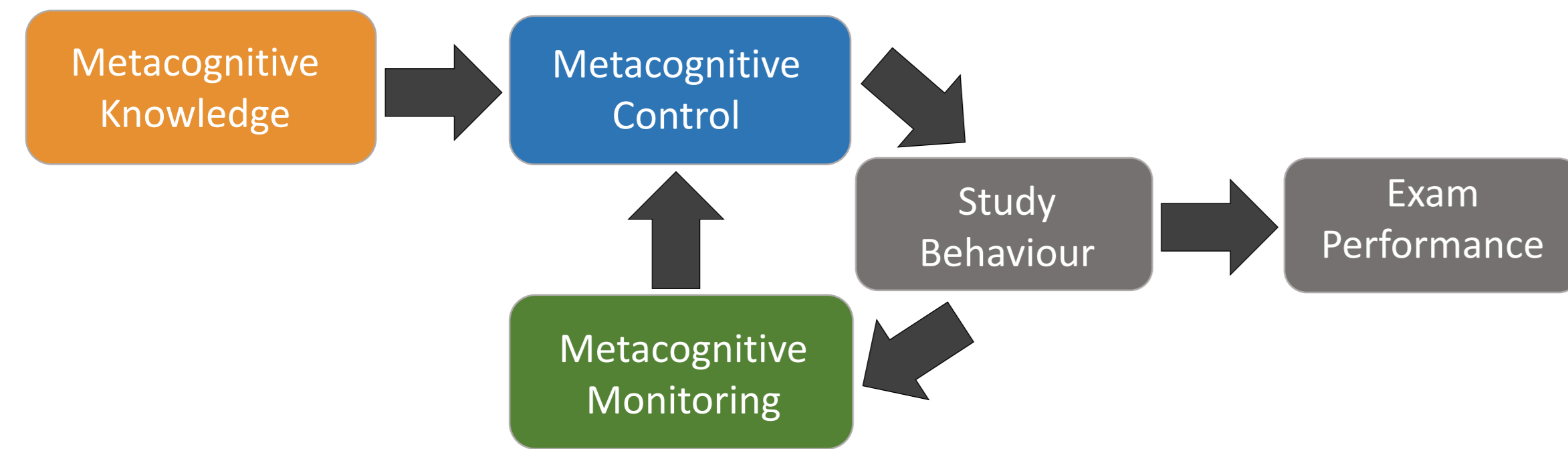
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## Introduction

Metacognition is a person's knowledge concerning their own cognitive processes<sup>1</sup>. Three aspects exist in the literature:

- **Metacognitive knowledge:** stored information about learning strategies and conditions. I.e. knowledge bank
- **Metacognitive control:** the regulation of behaviours affecting cognition (i.e. selecting strategies, etc.)
- **Metacognitive monitoring:** the capacity to identify discrepancies between current and desired comprehension



**Fig 1.** A model of how the three aspects of metacognition interact to impact study behaviour and subsequent exam performance.

- Explicit instruction is necessary to improve metacognition in students<sup>2</sup>
- This is challenging in post-secondary due to the high number of students and the cost of such programs
- We propose an online learning tool as an alternative to costly in-person instruction

### Objective:

1. To determine if the proposed model is functional.
2. To determine if an online metacognitive learning tool is sufficient to improve student's exam performance.

## Methods

### Participants

- Respondents were students enrolled in a first year biology class at the University of Guelph
- 98 of the approximately 400 students in the class consented to participate (N=98)

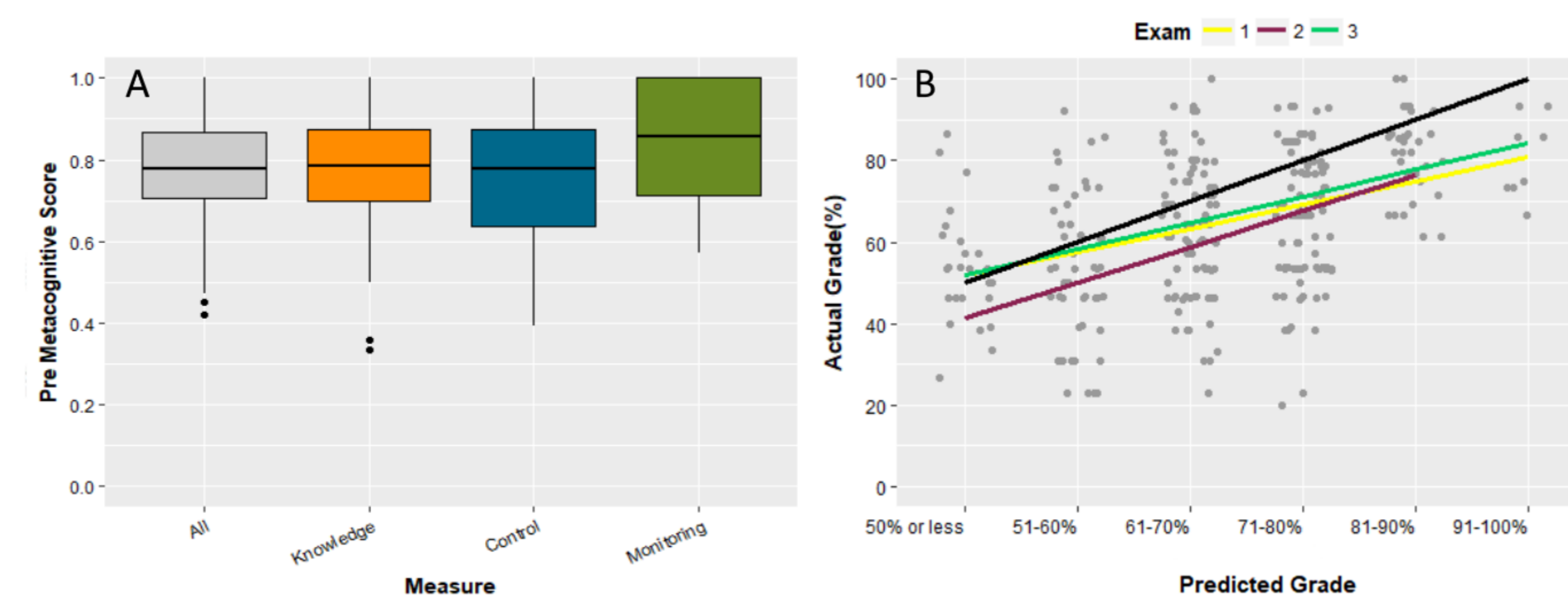
### The Learning Tool

- Students were given access to the online learning tool throughout the semester which aimed to inform student's **metacognitive knowledge**. It included:
  - Information on evidence based study strategies
  - Study questions
  - Calendar of dates and recommended study sessions

## Measures

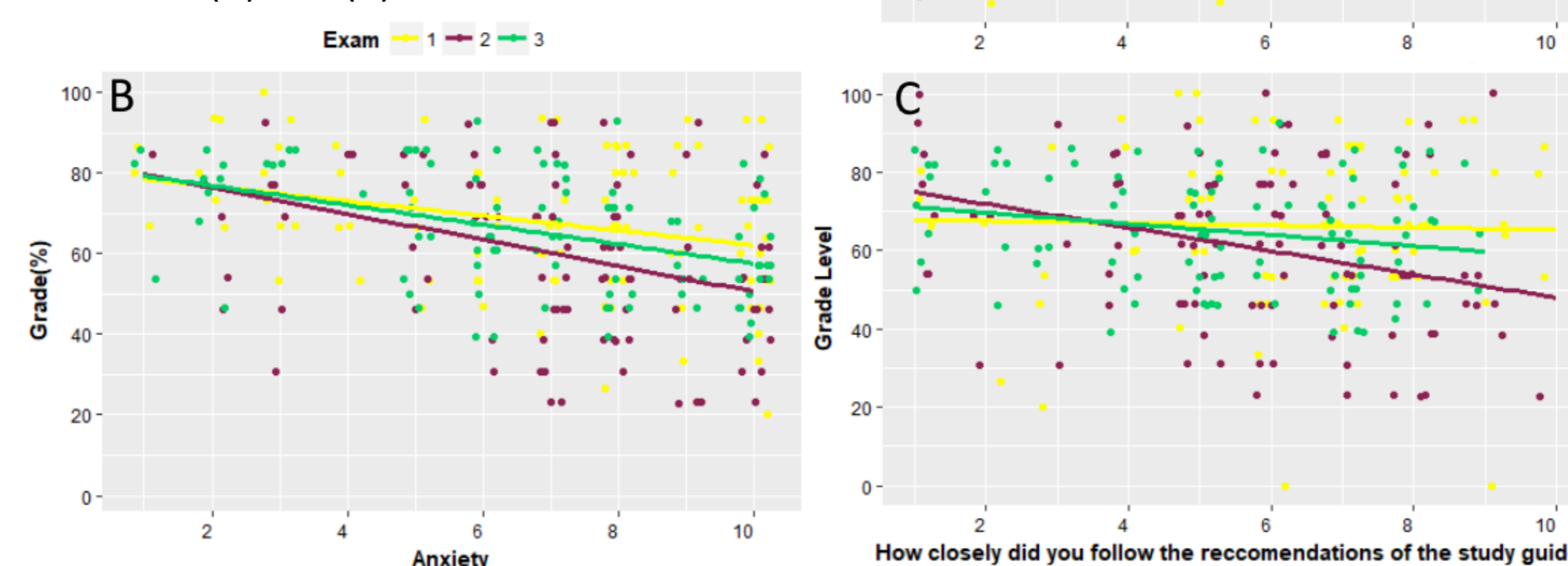
1. Pre and Post *Metacognitive Awareness Inventory*<sup>3</sup> administered at the beginning and end of the semester.
  - 52 items (Knowledge, Control and Monitoring)
  - Reliability of  $\alpha=.90$
2. *In Semester Survey*, administered before receiving exam grades
  - Surveyed students about: time spent studying, motivation, self efficacy, anxiety and study strategies surrounding each exam
3. Exam grades: Midterm 1 and 2, Final Exam

## Results



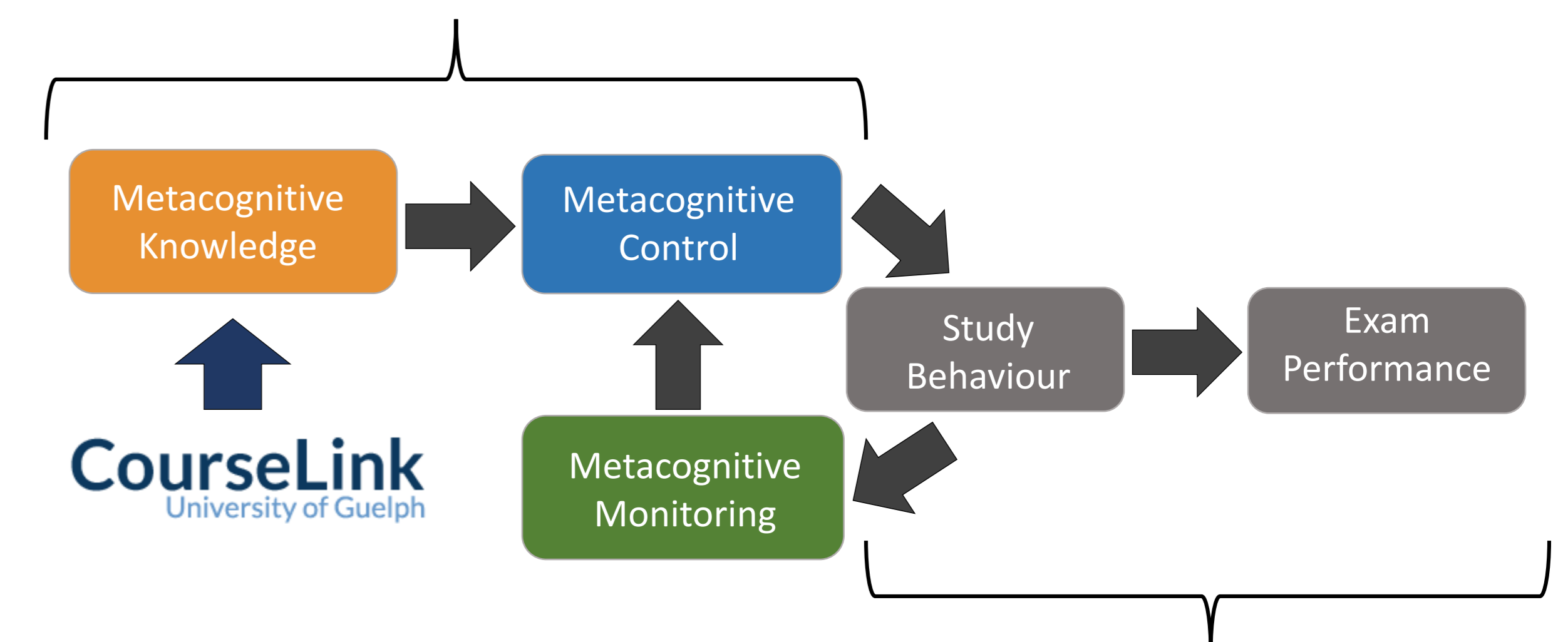
**Fig 2.** A) Student's overall metacognitive scores and the aspects of that score, at the beginning of the semester. B) A correlation between student's predicted and actual grades on each exam in relation to perfect predictive accuracy (black line). Student's predicted accuracy deviates from this line, indicating that their predictions were incorrect and their self reported scores in (A) were inflated.

**Fig 3.** A) Anxiety level is positively correlated with increased use of the study guide. B) Exam performance is negatively correlated with anxiety level. C) A negative correlation between use of the study guide and exam performance, may be a function of the relationships shown in (A) and (B).



## Discussion

Students self reported metacognitive scores were inflated, making it difficult to gauge the effectiveness of the model.



Students who felt more anxious about the exam, tended to use the study tool more, but were still more likely to do poorly on the exam. This indicates that the study tool is insufficient to adequately help the students seeking it out. It also indicates that anxiety may be an important predictor of exam performance.

### Conclusions:

1. Self report may not be a reliable measurement of metacognition.
2. Anxiety may be an important predictor of exam performance.
3. **An online metacognitive learning tool is not sufficient to improve students exam performance.**

### Next Steps:

1. To devise a scale or system that allows for accurate testing of each of the components of metacognition, such that changes over time can be measured
2. To consider the impact of exam anxiety on choice of study materials and exam performance

**Based on these results, we would recommend that education research focus on explicit, in-person interventions as opposed to online tools.**

## References

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