



Motivation and Effort Moderating the Effects of Feedback on Adjunct Questions



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Background

Feedback and adjunct questions have been shown to improve learning (Metcalfe, 2017; Hamaker, 1986). However, for feedback to be effective, students must put in the effort to engage with it (Metcalfe, 2017). Research has also suggested that a student's motivational style may also impact how a student engages with the learning materials (Martens, Gulikers & Bastiaens, 2004).

Research Question

Does the effectiveness of feedback on adjunct questions depend on student characteristics like effort and motivation?

Hypothesis

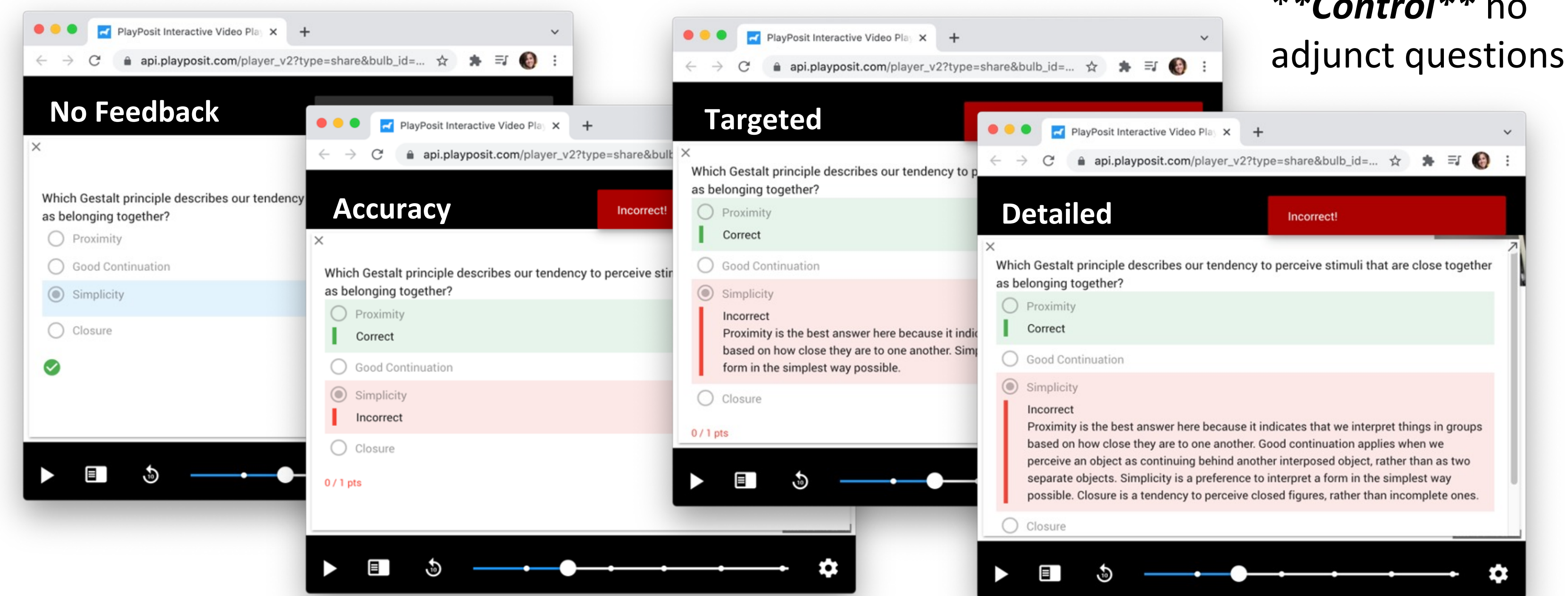
- Intrinsically motivated students putting in high effort would benefit from more feedback

Participants & Design

- 55 undergraduates enrolled in a summer Cognitive Psychology class (5 weeks)
- Online instruction with pre-recorded video lecture modules, containing 5-6 embedded adjunct questions
- Feedback was manipulated within-subjects, week by week
- Feedback order was counterbalanced across students

	Week 1	Week 2	Week 3	Week 4	Week 5
Student 1	Control	NF	Accuracy	Targeted	Detailed
Student 2	NF	Control	Detailed	Accuracy	Targeted
Student 3	Accuracy	Targeted	Control	Detailed	NF
Student 4	Targeted	Detailed	NF	Control	Accuracy
Student 5	Detailed	Accuracy	Targeted	NF	Control

Materials & Procedure



Students saw **one type of feedback for each week of the course**

- 6 modules in a row per week

Practice quiz at the end of each video lecture module:

- 3 open response questions
- 5-9 multiple choice
- Effort measured after quiz

Weekly quiz covers 6 all modules from that week

- 20 multiple choice

Cumulative final exam

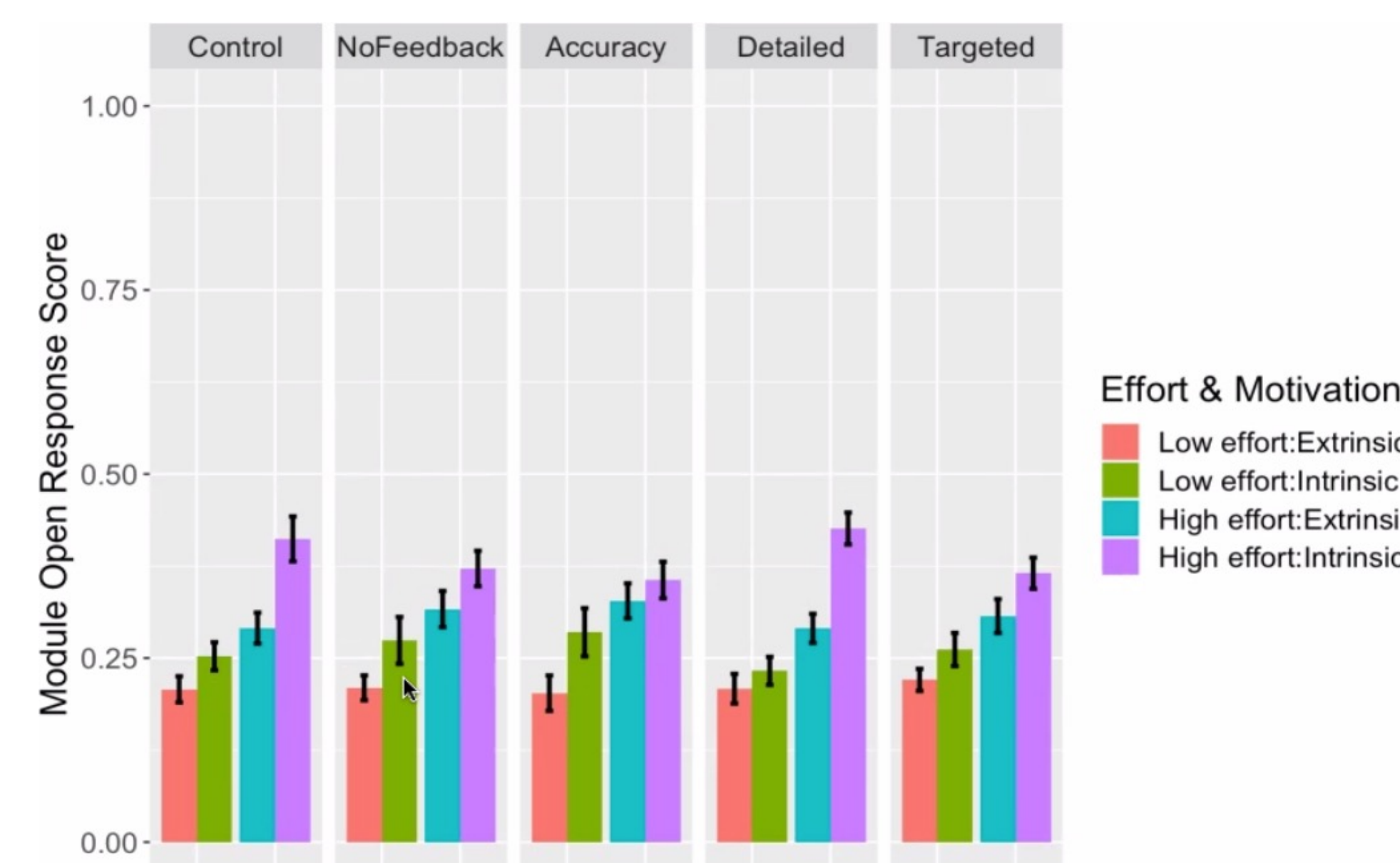
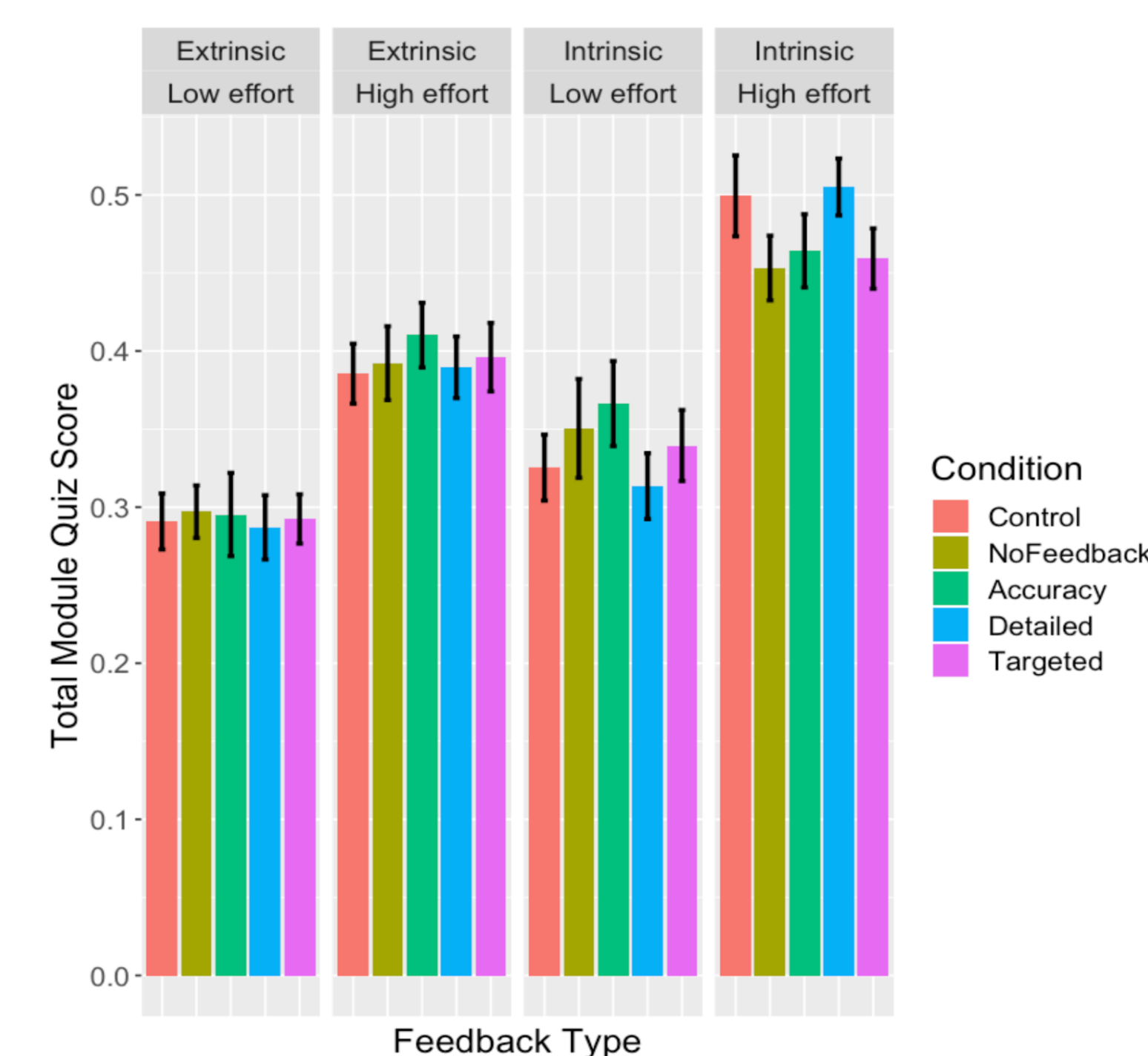
- 60 multiple choice

Presurvey measuring motivation

- 4 intrinsic, 4 extrinsic questions

Results

No effect of feedback, effort, or motivation on weekly quiz or final exam scores



Module Quizzes - Total Scores

- Main effect of motivation ($p=0.041$)
- Main effect of effort ($p<0.0001$)
- No effect of condition and no interactions

Module Quizzes – Open Response

- Main effects of motivation ($p=0.027$)
- Main effects of effort ($p<0.0001$)
- Three-way interaction with condition ($p=0.030$)
- High effort and Intrinsically motivated students scored higher on detailed and controlled

Discussion

- Supports that intrinsic motivation and effort lead to increased learning
- Weekly quizzes and final exams were graded for accuracy may explain why there was no effect of motivation and effort on these tests
- Learning promoted in the classroom is different from simply memorizing material which may be why the presence of adjunct questions by itself may not have improved learning (testing effect)

Three-Way Interaction

- Suggests motivation and effort may moderate the effects of feedback with detailed feedback benefitting students with intrinsic motivation that put in effort
- In the absence of extra learning materials (control group without feedback and adjunct questions), individual effort and motivation predict learning with intrinsically motivated students putting in high amounts of effort showing increased learning

Limitations & Future Directions

- Challenge of isolating the effect of a feedback manipulation in the complex instructional ecosystem of an online course
- Difficulty of measuring the learning that teachers try to promote in classes
- Effort was only measured during module quizzes
- Having in-person tests to limit cheating
- Attention checks to catch students that are just skipping through the material

References

- Hamaker, C. (1986). The effects of adjunct questions on prose learning. *Review of Educational Research*, 56(2), 212-242.
- Metcalfe, J. (2017). Learning from errors. *Annual review of psychology*, 68, 465-489.
- Martens, R., Gulikers, J., & Bastiaens, T. (2004). The impact of intrinsic motivation on e-learning in authentic computer tasks. *Journal of computer assisted learning*, 20(5), 368-376.