

Explanation videos available online can improve learning, sometimes

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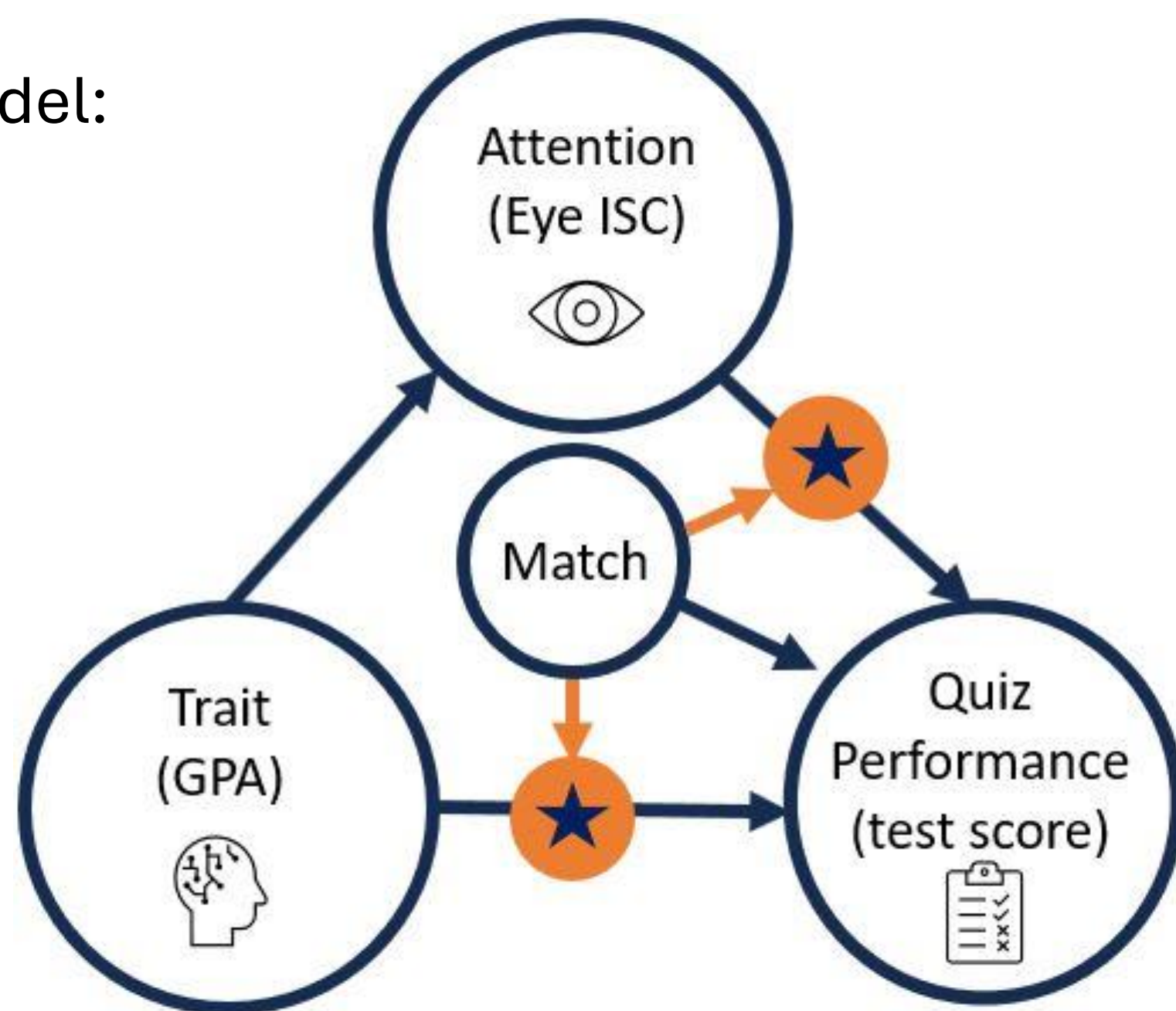
Summary: Students often search for answers online, and gravitate to short explanation videos, which are abundant online. While they seem useful and can be quite engaging, it is unclear if these videos benefit classroom learning. We hypothesized that when carefully matched to the class instruction, video can be helpful, but that benefit will depend on the ability of students to pay attention. To test this, we recruited students from first- and second-year college physics classes (n=139) and showed them videos matching their course material. Quizzes before or after the videos measured the benefit of the video. We also measured eye movement to gauge attention and analyzed results as a function of grade point average (GPA). We saw a benefit of video on quiz performance for the average student (Cohen's $d=0.31$ across quizzes, 0.45 best case), and larger effects for students with higher GPA. GPA did not predict attention, nor did attention consistently affect performance. In an online replication with participants of a broader STEM background (n=215) the benefit was apparent for only one of the four videos tested (Cohen's $d'=1.0$). We conclude that some short explanation videos available online can be an effective support to classroom instruction. However, they benefit mostly students that are strong academically, despite similar levels of overt attention across all students.

Research questions:

Do students benefit from videos provided as supporting material after a lecture?

Do some students generally pay more attention, which then helps them learn better?

Causal model:



Recruitment:

A. In-class: n=139

B. Online: n=215

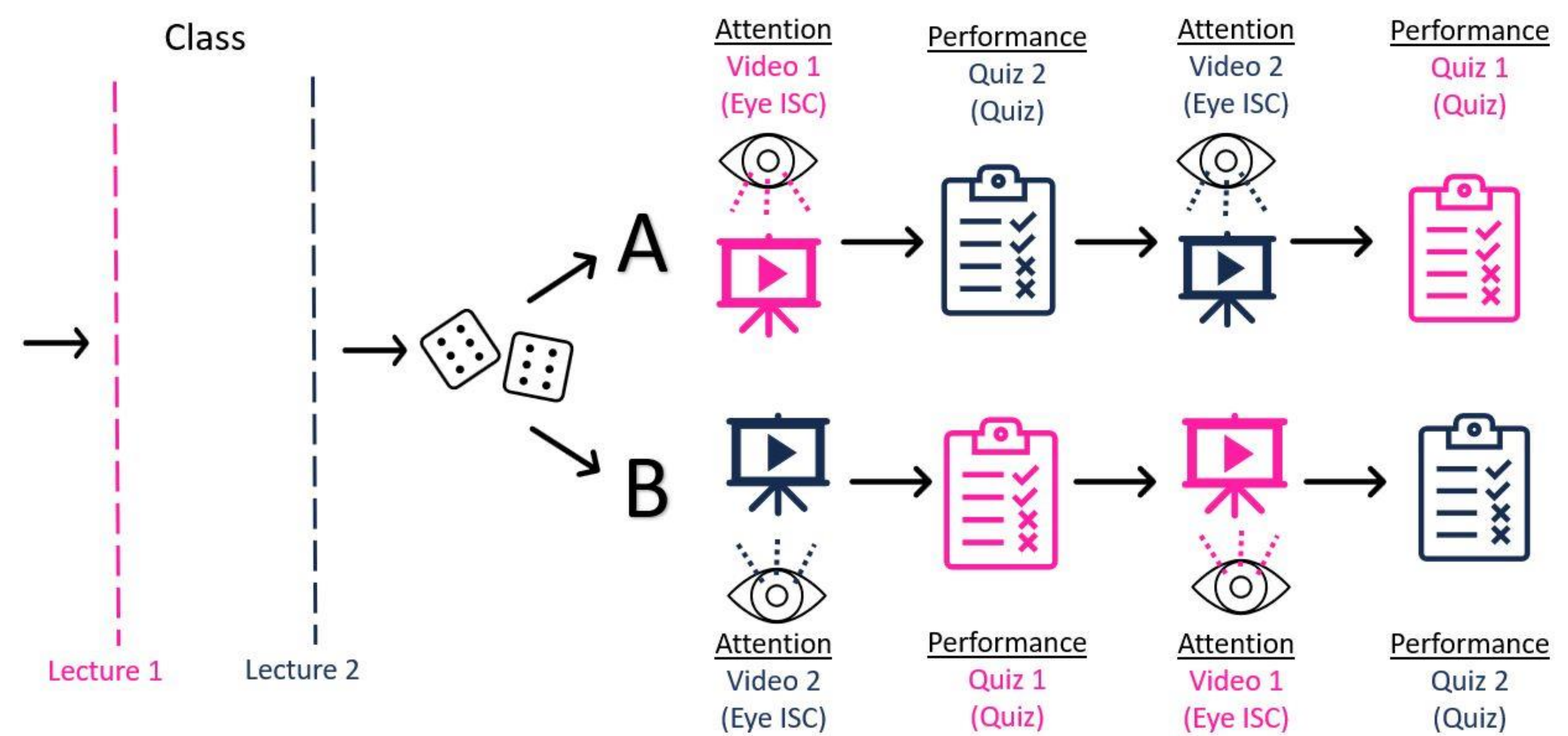


Tested 4 videos in 2 Physics classes

C. Video available on: Stored at: Experiments run on:

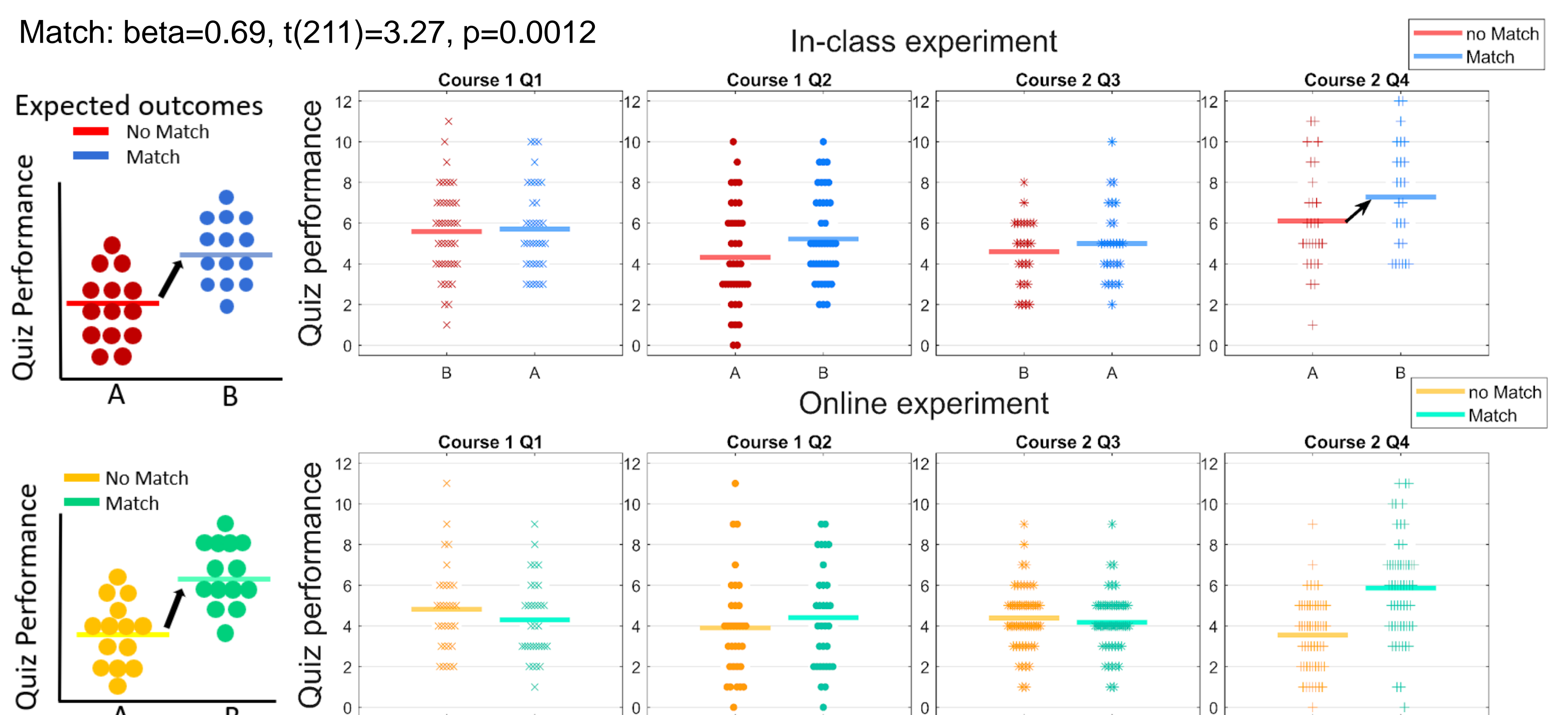
Videos were taken from: And: Online participants recruited from: Eye-tracker:

Experimental Design: a randomized controlled trial



Videos improved performance for the average in-class student by 0.69 points out of 12.

Some videos had a large effect size ($d=0.45-1.0$), while others had no effect.

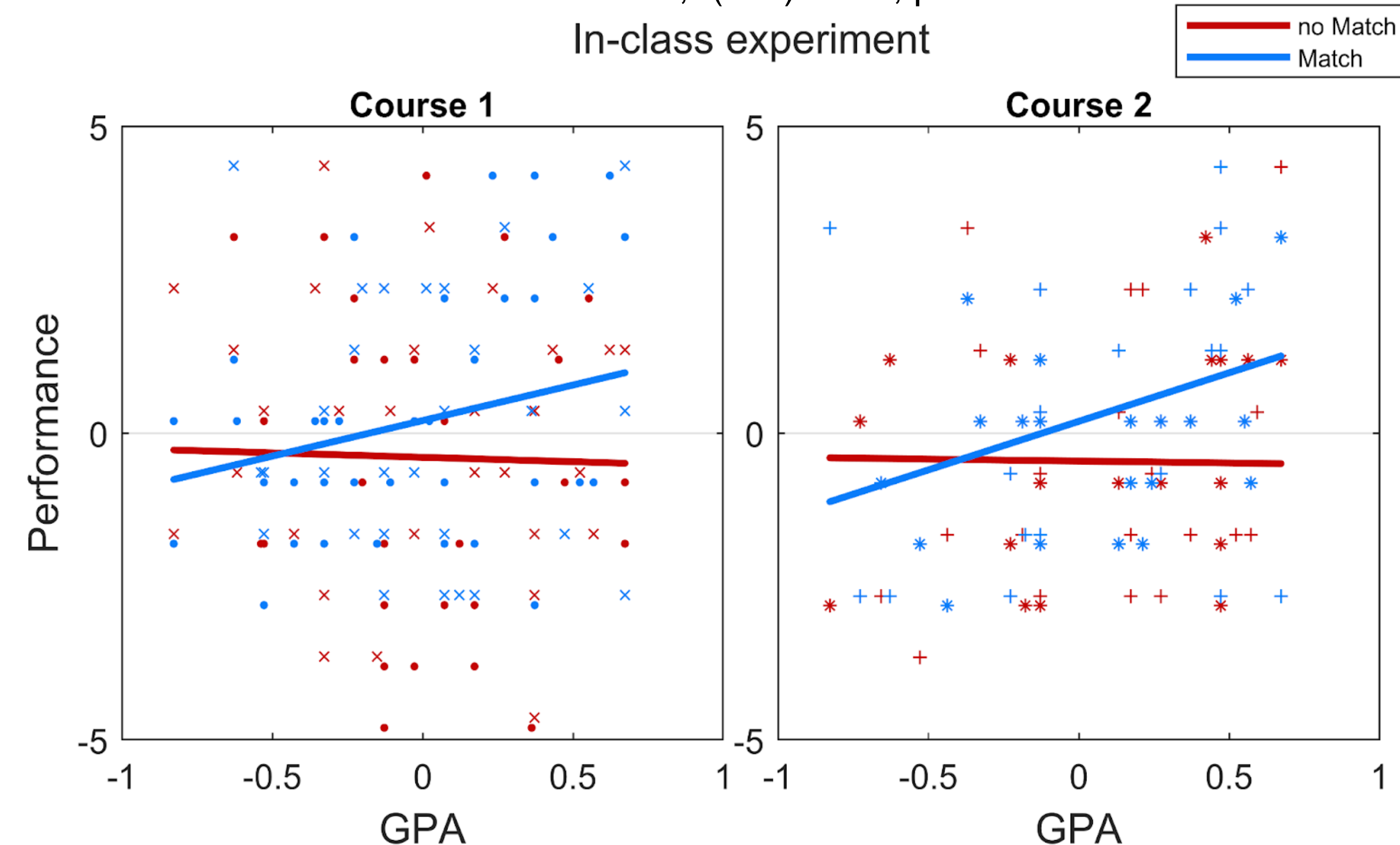


For the in-class cohort, all 4 videos showed a numerical benefit, whereas for the online cohort, only two videos showed a benefit.

This may be the result of a better alignment of video with class content.

High GPA students benefited the most, despite similar levels of attention

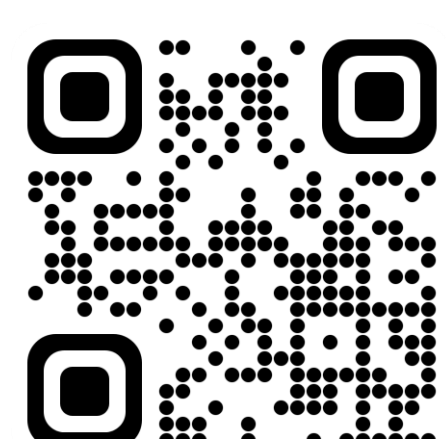
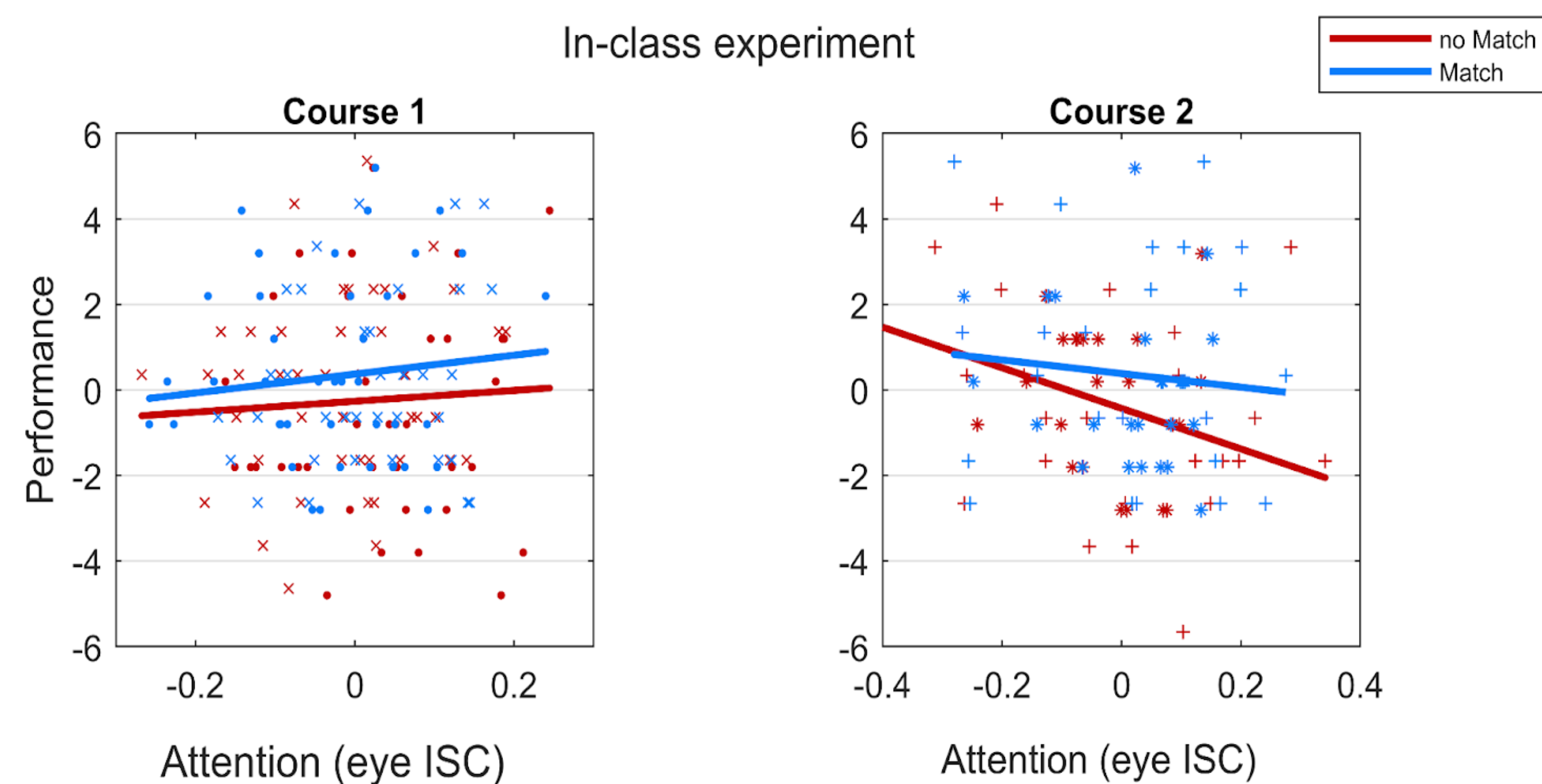
GPA*Match: $\beta=1.76$, $t(211)=3.35$, $p\text{-value}=9.61e-4$



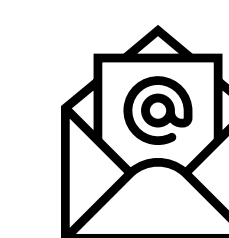
Teachers in a classroom can have a similar experience, namely, that some students require more help, not for a lack of attention, but a lack of comprehension. Here in this study, we find the same effect when the course material is presented as a video. Strong students were not generally more alert but apparently picked up information from the video more easily.

Are quiz benefits mediated by attention to the video? Attention (measured with eye tracker) correlates with performance, but negatively...

ISC: $\beta=-3.74$, $t(211)=-2.63$, $p=0.009$; ISC*Match: $\beta=4.75$, $t(211)=2.38$, $p=0.018$



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