Using Gestures to Signal a Causal Lesson Structure: Effects on Meaningful Learning

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Introduction

Learners build **mental models** according to the structure of a lesson. Assisting students in building these models improves meaningful learning. [1]

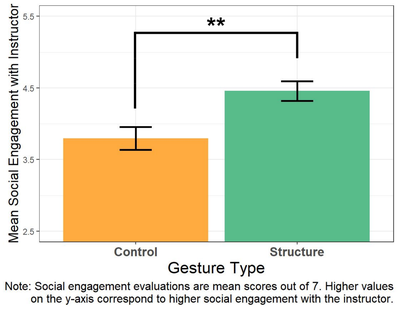
Learners do not ignore an instructor's **gestures**. [3,4,5]
- gestures can convey subtle information about a person's thinking [2], alternative problem-solving strategies [4], and **lesson structure** [5]
- gestures can improve social engagement [3,5]

Structure gestures should cue learners to think about the incoming information in a certain way, leading to greater transfer of learning.
- effect of structure gestures on transfer has already been seen in a compare-and-contrast lesson [5], ***so...***

Question

Do gestures that emphasize the causal structure of a lesson lead to improved learning outcomes?

Results - *Social Engagement*



Note: Social engagement evaluations are mean scores out of 7. Higher values on the y-axis correspond to higher social engagement with the instructor.

Structure gestures resulted in significantly higher rates of social engagement, $t(211) = 3.12$, $\boldsymbol{p = .002}$, $d = 0.43$.

References, Figures, Materials, *PDF*

Design

PARTICIPANTS

***n* = 213**
Undergraduate students recruited through SONA; 162 female, 45 male, 6 non-binary / other

DESIGN – Between-Subjects

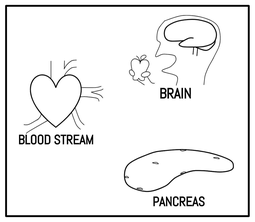
Independent Variable: Type of gesture:
- ***Control** gestures* (deictic, to direct attention)
- ***Structure** gestures* (metaphoric, to link two concepts on the diagram)

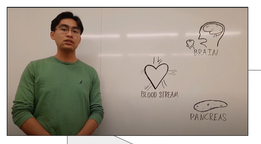
Dependent Variable: Cumulative transfer score
Calculated from responses to 4 transfer questions

EX:
What could a scientist do to make it so that an animal refuses all food that it is given?

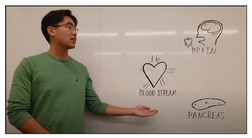
MATERIALS

Glucose lesson



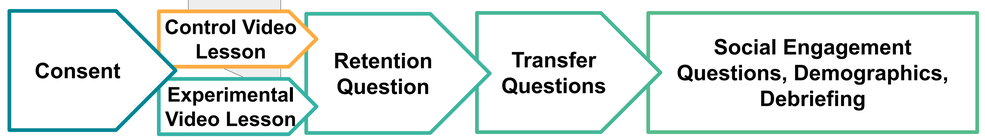


Control gestures



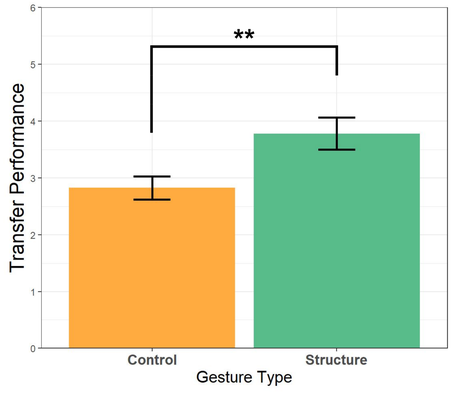
Structure gestures

PROCEDURE



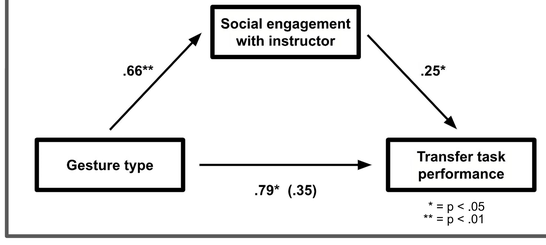
Results - *Transfer Performance*

Does gesture type affect meaningful learning?



Structure gestures led to significantly higher transfer performance when compared to control gestures, $t(191) = 2.76$, $\boldsymbol{p = .006}$, $d = 0.38$.

Does social engagement mediate the relationship between gesture type and meaningful learning?



Social engagement significantly ($p = .014$) but only **partially mediates** the relationship between gesture type and transfer performance, as there is still a direct effect of gesture on learning ($p = .042$).

Discussion and Limitations

Structure gestures led to **significantly higher rates of meaningful learning** via the communication of the causal structure of a lesson and via increased social engagement with the instructor.

Can gestures signal a causal lesson structure?
Yes; the results suggest that learners process this subtle information to build a mental model that aids learning.
- **social connection explained some variation** in transfer, though a **direct effect** of gesture type on meaningful learning is still present

The current lesson uses a visual aid to anchor gestures.
- could investigate the unique visual capabilities of gestures by using a simpler unidirectional lesson

The study lacks a condition in which no gestures are used.
- should compare rates of social engagement between gesture types and gesture presence

Acknowledgments

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