Meaningful hand gestures for learning

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Recent studies in cognitive load theory and embodied cognition that focus on gestures have demonstrated the benefit of using and observing hands while learning. However there has been limited research on the difference between hand gestures performed, such as pointing and tracing in supporting learning. Pointing has been shown to assist learners in guiding attention, while whole body gestures support learning due to the embodiment of concepts, for example pantomiming an action while learning the associated foreign language vocabulary. This research is based on an embodied cognition perspective, arguing that biologically primary knowledge (knowledge that humans are predisposed to learn) in the form of attention-guiding gestures (e.g. pointing, tracing) may assist in the acquisition of secondary knowledge (knowledge endemic to cultures, such as mathematics or science).

This study investigates the effect that different types of gestures (pointing and tracing) have on learning geometry. Secondary School and University students will be recruited for three studies. There will be 4 experimental conditions:

1.Control: Static image video lessons with no gestures performed

2.Cue: Dynamic video lessons with animated realistic hand cues performing gestures, with no student gestures performed.

3.Point: Dynamic video lessons with animated realistic hand cues prompting students to perform pointing gestures.

4.Trace: Dynamic video lessons with animated realistic hand cues prompting students to perform tracing gestures.

Variables and Data collected

It is hypothesised that learners will benefit most from tracing gestures aligned to conceptual knowledge, as these gestures physically embody the shapes and relationships associated with the learning domain. It is hypothesised that learners with a lower visual-spatial working memory capacity (as measured by a Visual Pattern Task – VPT) will benefit most from tracing, but also from pointing gestures as well.

There will be three phases to the experiments:

Phase 1 (Pre-test): Participants will complete a working memory operations span task, as well as a visual-spatial working memory task to establish students' working memory capacities.

Phase 2 (Instructional Phase): Using iPads, students will engage in an interactive, self-paced audio/video lesson providing worked examples that encourages gesturing based on aforementioned conditions.

Students will complete both a 9-point Paas Mental Effort subjective rating scale, as well as a novel 5-point Emoji-based Leppink subjective rating scale after each worked example to measure cognitive load.

Phase 3 (Test Phase): Participants will complete a series of questions on the iPad, which require angle identification, and calculating related angle sizes. Students will complete both subjective rating scales after each test question as a measure of cognitive load.

A discussion of preliminary results of this study will be provided at the conference.