# GESTURES IN GEOMETRY: HOW DO GESTURES CONTRIBUTE TO ENGAGEMENT AND VOCABULARY ACQUISITION THROUGH GAME PLAY?

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Gestures have been shown to improve students' abilities to process new mathematics concepts (Goldin-Meadow et al., 2009) and reduce cognitive load (Ping & Goldin-Meadow, 2010). Producing gestures related to mathematical concepts have been shown to support reasoning as learners ground their understanding of math concepts in body-based movement (Walkington et al., 2014). Such findings show the affordances of gesturing to create meaningful representations in mathematics. However, less is known about how giving students the option to gesture in activities impacts engagement and vocabulary acquisition for geometry concepts.

We adapted a modified version of the game Taboo, designed for high-school geometry students (Carter, 2015), where players take turns being the hint-giver with 60 seconds to verbally describe geometry terms on cards (e.g., *intercept*, *parallelogram, function*). The hint-giver creatively describes each term, avoiding the taboo words (e.g., intercept: *cross, axis, graph*).

A pilot study was conducted to examine whether the option to gesture while playing Geometry Taboo may contribute to engagement, performance, and vocabulary acquisition for high school geometry students. The study took place in two tenth grade geometry classes. The first day, 25 participants completed a paper-and-pencil timed pretest that required matching the 25 terms from the Geometry Taboo cards with pictures. The second day, students played the game in small groups for two rounds consisting of each player in the group having one turn to describe as many geometry terms as possible to their group. One group was able to use *speech and gestures* to describe terms on the cards; the other group was restricted to *speech only* hints. The next day, students completed a mirroring posttest and online survey about their experience.

An ANCOVA, controlling for pretest performance revealed no significant differences in posttest scores by condition but overall students improved slightly from pretest ($M$ = .34, $SD$ = .19) to posttest ($M$ = .48, $SD$ =.23). Next, an ANCOVA predicting total points earned by each student during the game, controlling for pretest found no significant differences but there was a trend that students in the *speech-and-gesture* condition ($M$ = 8.2 points, $SD$ = 4.2*)* scored more points than students in the *speech-only* condition ($M$ = 6.0 points, $SD$ = 2.9)*,* $p$ = .08. This suggests that the option to gesture may make describing terms easier rather than relying on speech alone. Surveys suggested largely positive perceptions of the game; 21 students responded that they would like to play again in class.

We draw limited conclusions from this pilot study. The exposure to the intervention may have been insufficient; more time playing could have led to increased learning. However, differences in game performance and student input suggest that the option to gesture makes the game easier and accessible for students, which in turn, could impact engagement and learning.

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