Communicating Through Math & Measurement

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Introduction

Many studies have demonstrated that social interaction can improve learning. Understanding the mechanisms by which social interaction affects learning is important because it should be possible to design instructional activities attuned to its specific benefits. This study demonstrates that exercises where students communicate to others (versus making notes for themselves) led to increasingly precise and meaningful use of number on an unrelated projectile motion activity.

Study Design

Participants

- Two 6th grade advanced math classes (n = 19, 21)

Self-Other Manipulation

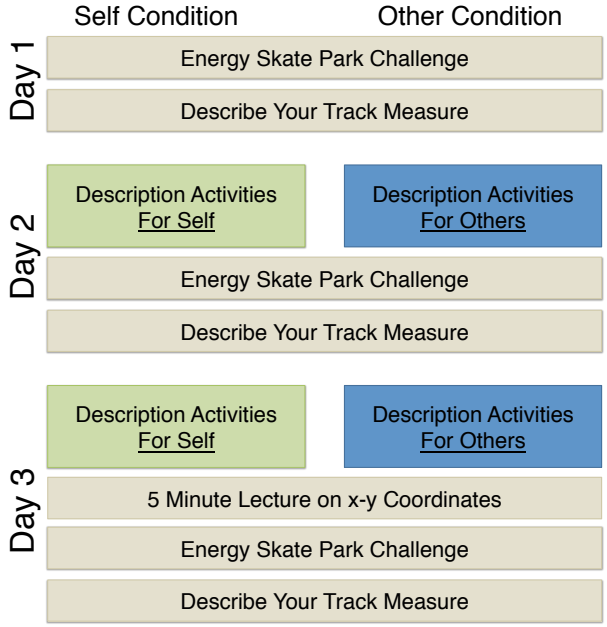
- Students completed description activities asking them to note the shape or position of an object either for themselves (*Self*) or for another person (*Other*)

For example, students described a card with a distorted copy of this painting

Self Condition: "Describe where the eye is exactly on your card, so that **you** could figure out which one matches yours later."

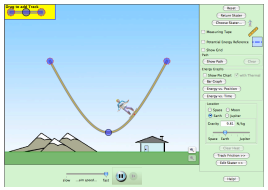
Other Condition: "Describe where the eye is exactly on your card, so that **someone else** could figure out which one matches yours later."

Timeline



Energy Skate Park

- The PhET Energy Skate Park Simulation[1] is an environment designed to teach projectile motion
- In the simulation, students manipulate the shape and position of a track to alter a skater's jump
- We made use of this simulation as a context in which careful measurement and numerical precision are important in designing and replicating solutions
- At the end of each period, we gave students a challenge (e.g. "Design a track for your skater to jump exactly 24.08m, the world record jump distance.")



- Students were instructed to use the simulation's measuring tape to check their attempts on each challenge

Describe Your Track Measure

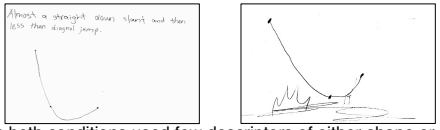
- Students were simply asked to "Describe your track exactly" in an open-ended task (no guidance or purpose for the task was given)
- No mention of self-other manipulation or cueing of relationship between the day's description activities and the simulation challenge

Observations

- Students in the Self condition were much more likely to fool themselves into believing that their descriptions were comprehensive
- In the Other condition, students more easily recognized the value of precise descriptions when they could not fill in missing parts with their own memory

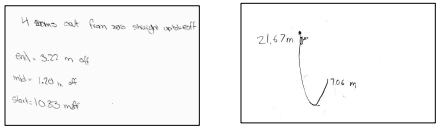
Example Data

Day 1



Students in both conditions used few descriptors of either shape or position

Day 2



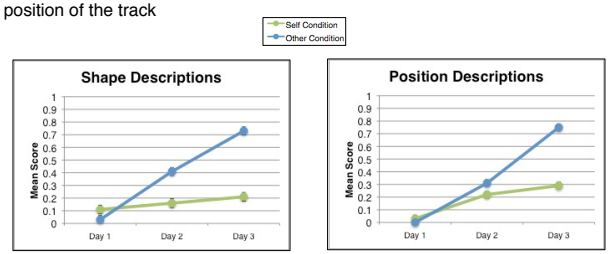
Students began to give numerical information, but it was often imprecise

Day 3

By the final day, students in the "Other" condition provided more precise and meaningful mathematical descriptions than students in the "Self" condition

Results

•Students' "Describe Your Track" responses from each of the three instructional days were coded for quality of descriptions regarding both the shape and position of the track



Conclusions & Future Work

- Throughout instruction, students who created descriptions for another person gave increasingly more accurate descriptions that demonstrated a more meaningful use of number than students who wrote descriptions for themselves
- By asking them to write descriptions to communicate to another person, learning activities can help students avoid making careless mistakes in assuming their descriptions are complete and precise enough to allow replication on a different task with an unspecified audience
- However, these condition differences were not apparent on a paper and pencil pre- and post-test
- To understand the mechanisms responsible for this difference, future studies may address the various benefits of describing for another person, like receiving different feedback or being motivated to express oneself clearly
- In the future, we plan to investigate whether this learning would transfer to new learning situations without social contexts

References

1 Wieman, C.E., Adams, W.K., & Perkins, K.K. (2008). PhET Research: Simulations That Enhance Learning. Science: 322 (5902), 682-683.