A test of the efficacy of the Augmented Reality Sandbox to improve students' reading topographic map skills

Megan Jankowiak and Alexandra Ranaudo / mj12@geneseo.edu amr43@geneseo.edu
Department of Geological Sciences, SUNY Geneseo, 1 College Circle, Geneseo, NY 14454

Abstract

The augmented reality (AR) sandbox is a teaching tool used to connect two-dimensional (2D) and three-dimensional (3D) map representations through modeling. Our hypothesis is: the AR sandbox is effective at teaching topographic map reading skills by comparing pre vs. post test scores. Student data was processed to analyze the efficiency of using the AR sandbox to increase student ability to read topographic maps. Data consists of student answers on a topographic map reading skills test at the beginning and the end of a Historical Geology college course. Between tests, students used the AR sandbox to complete short exercises during multiple labs. Data was collected for two years on paper-based topographic maps. The pre tests of student ability prior to the use of the AR sandbox is the control of this research. The experimental group is the post test data that showed students' understanding of topographic maps after engagement in AR sandbox activities throughout the semester. Data did not show evidence that the AR sandbox is an effective teaching tool beyond paper-based practices. Results suggest that the data collection was not efficient. Future research should focus on new methods of data collection and change in the audience that participates.

Through the use of an x-box connect sensor, the topography of the sand is mapped resulting in a new topographic map projected over the sand. The use of colors and contour lines being 2D map ideas into 3D.

Figure 1: Photograph image of the AR Sandbox.
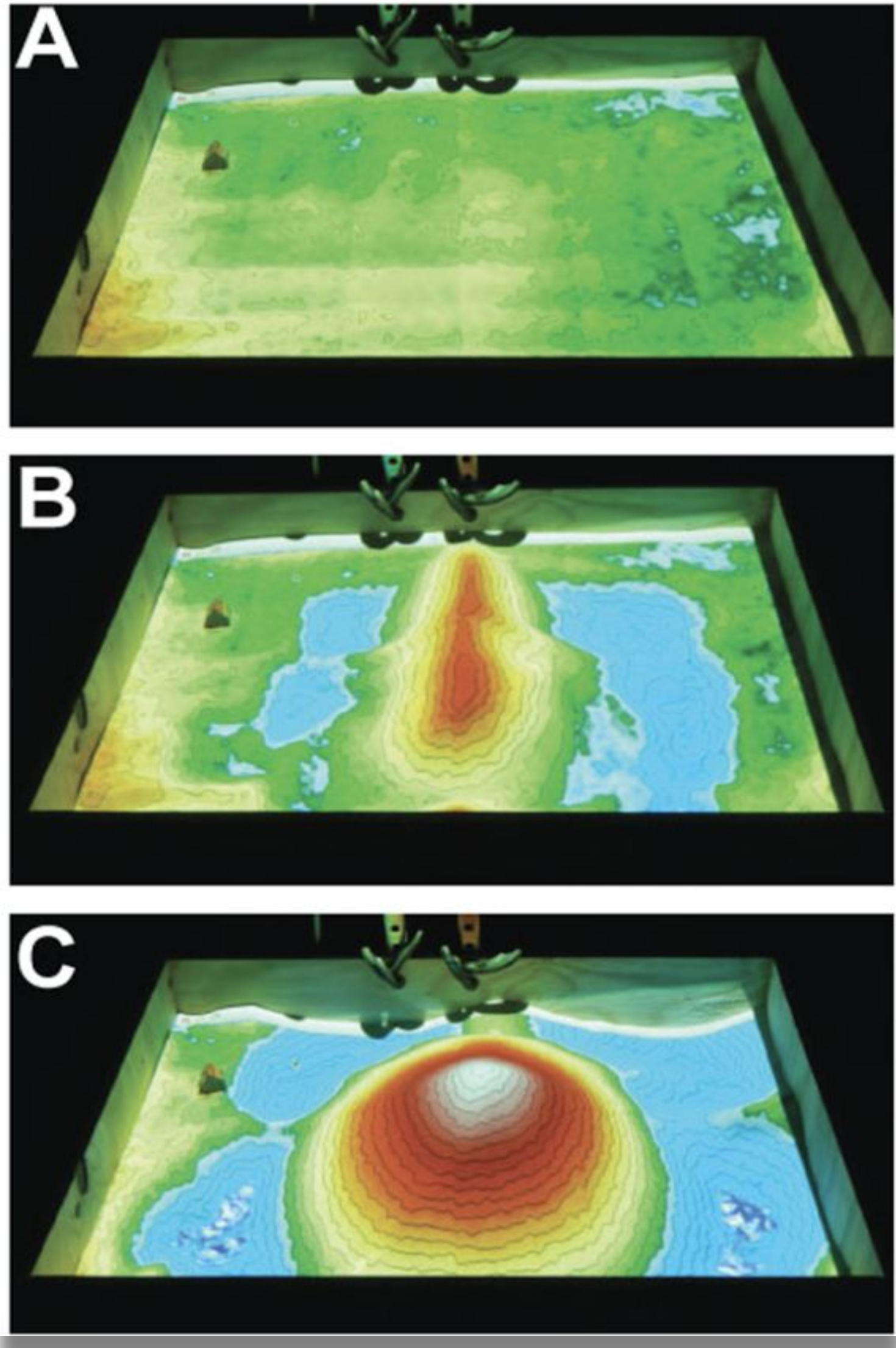
Hypothesis

The AR sandbox is effective at teaching topographic map reading skills by comparing pre vs. post test scores.

Methods

1. Correct answers from both pre and post test assessments were counted and marked in an excel sheet
2. Excel sheet was run through R Studio to go through the Cronbach Alpha Reliability Test
3. Used R software to find mean of scores, if the data was normally distributed, and ran a t test

Cronbach Alpha Reliability

- The **reliability** of the question was tested using R software and finding the **alpha** value.
- Before dropping the alpha value was **0.71**
- When we dropped Q17 alpha became **0.85**
- **Evaluation became more reliable**

Results

- Question 17 is not a **reliable** question.
- Mean of scores was **4.44**.
- Shapiro Normality test told us the data was **normally distributed.**
- T.Test value of **p=0.85**

2017 Pre vs. Post Assessment Average Scores

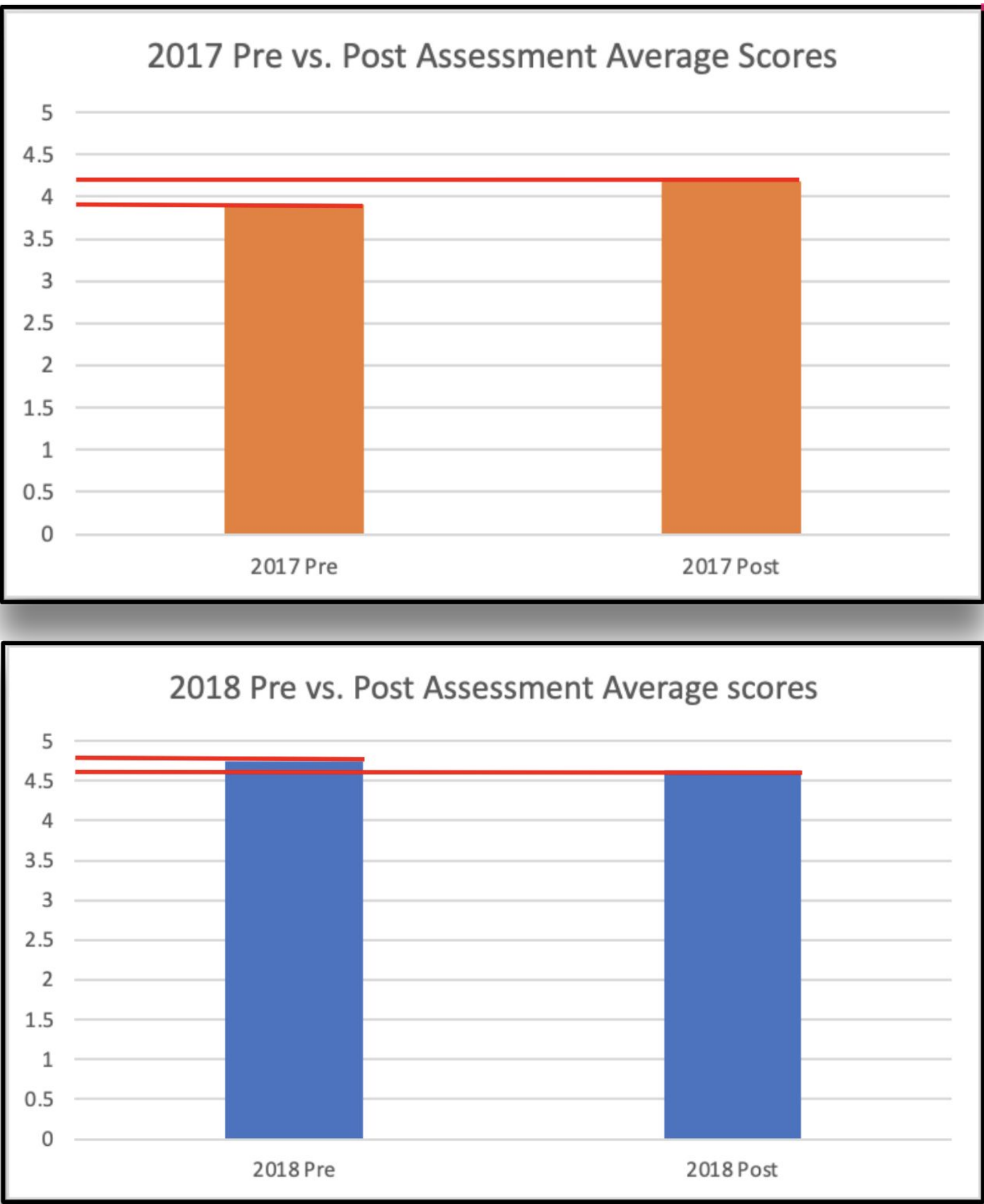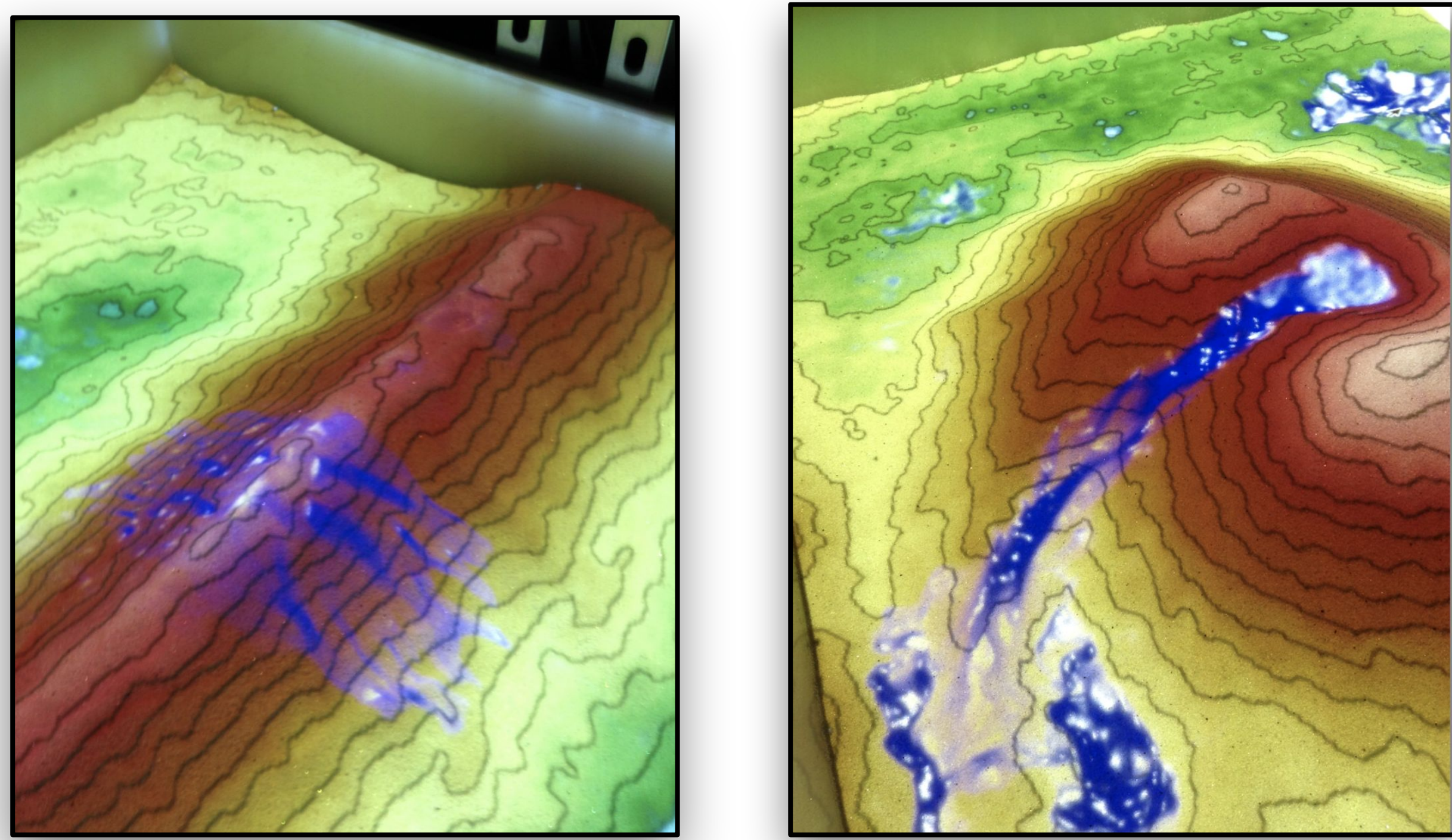

2018 Pre vs. Post Assessment Average scores

Figure 2: Bar graphs of the mean scores of the pre and post assessments for the years 2017 and 2018. For 2017 the pre-assessment average score was 3.89 and for the post assessment the average was 4.17. While there was a slight increase, our tests showed that there was not a significant difference between the two scores. In 2018 the pre-assessment score was 4.74 while the Post Assessment average score was 4.63 which shows a slight decrease but once again was not significant.

Discussion

The design of the study could have been better planned out. The students were told that the assessments they were completing were not for a grade so we knew they were not motivated to do their best. We were missing post assessments for multiple subjects so we had to greatly diminish our data pool. The subjects were also already geology students so their skill of reading topographic maps were already developed.

Next Steps

In future studies the assessment given should have more than 6 questions. It should be shown as a graded assignment to motivate the students to put more effort in. Using a high school class of students who are not as familiar with topographic concepts should be used in order to better track development of the skill.

Acknowledgements