

Using VR to improve 3D spatial abilities in the geosciences

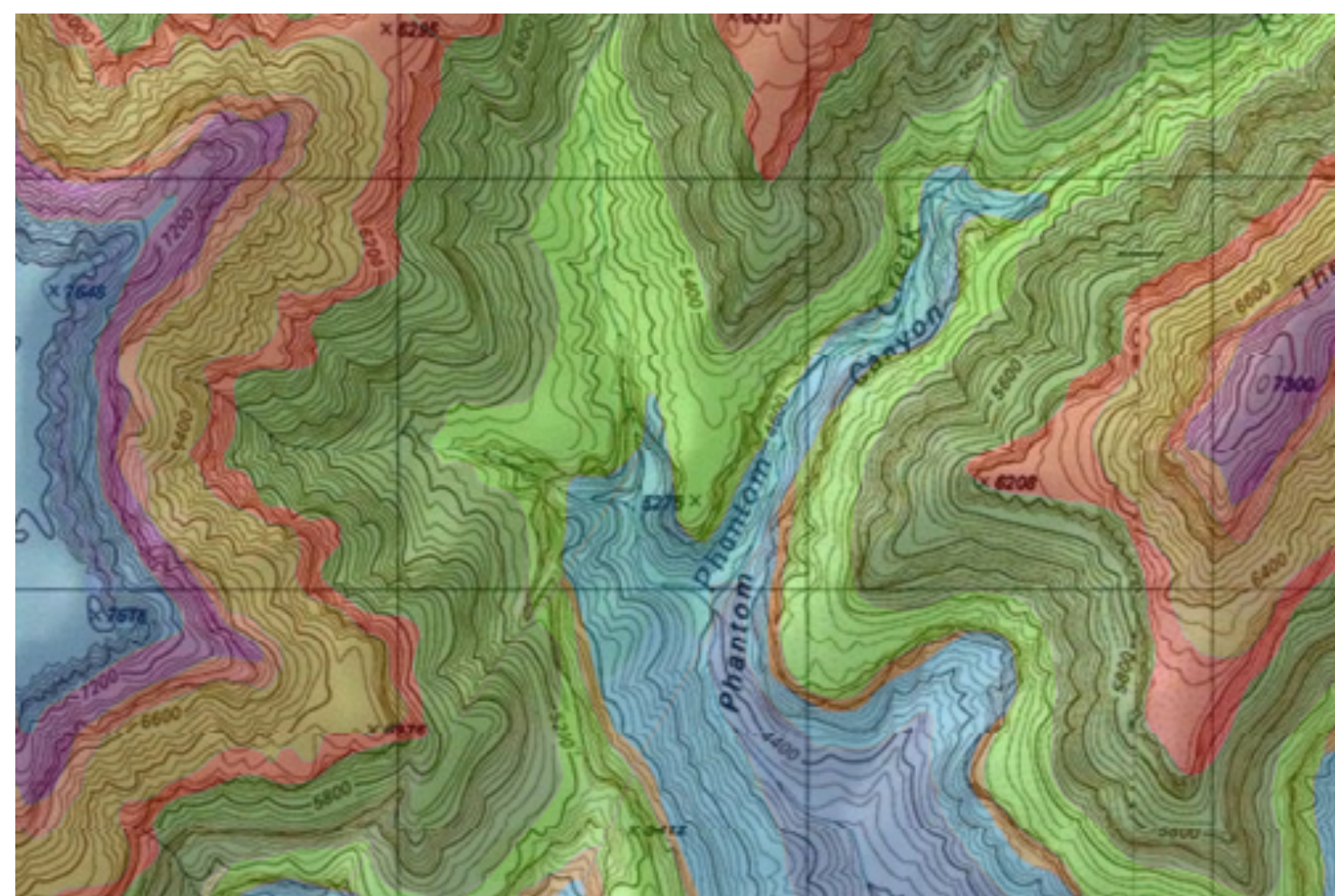
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Hypothesis

We hypothesize that the students who engage in the virtual reality-based instruction will perform better on tests of geo-spatial reasoning, compared to students who engage only in standard instruction.

Background and Motivation

- Past research proves that we are able to train our spatial abilities, we can improve our potential to think about concepts in 3D
- Role of spatial abilities in geology – strike and dip, tectonic plate motion, topographic profiles
- High ability in spatial reasoning skills is linked to persistence in STEAM courses
- Goal of our research is to test whether virtual reality programs improve learning in earth science and geology classrooms



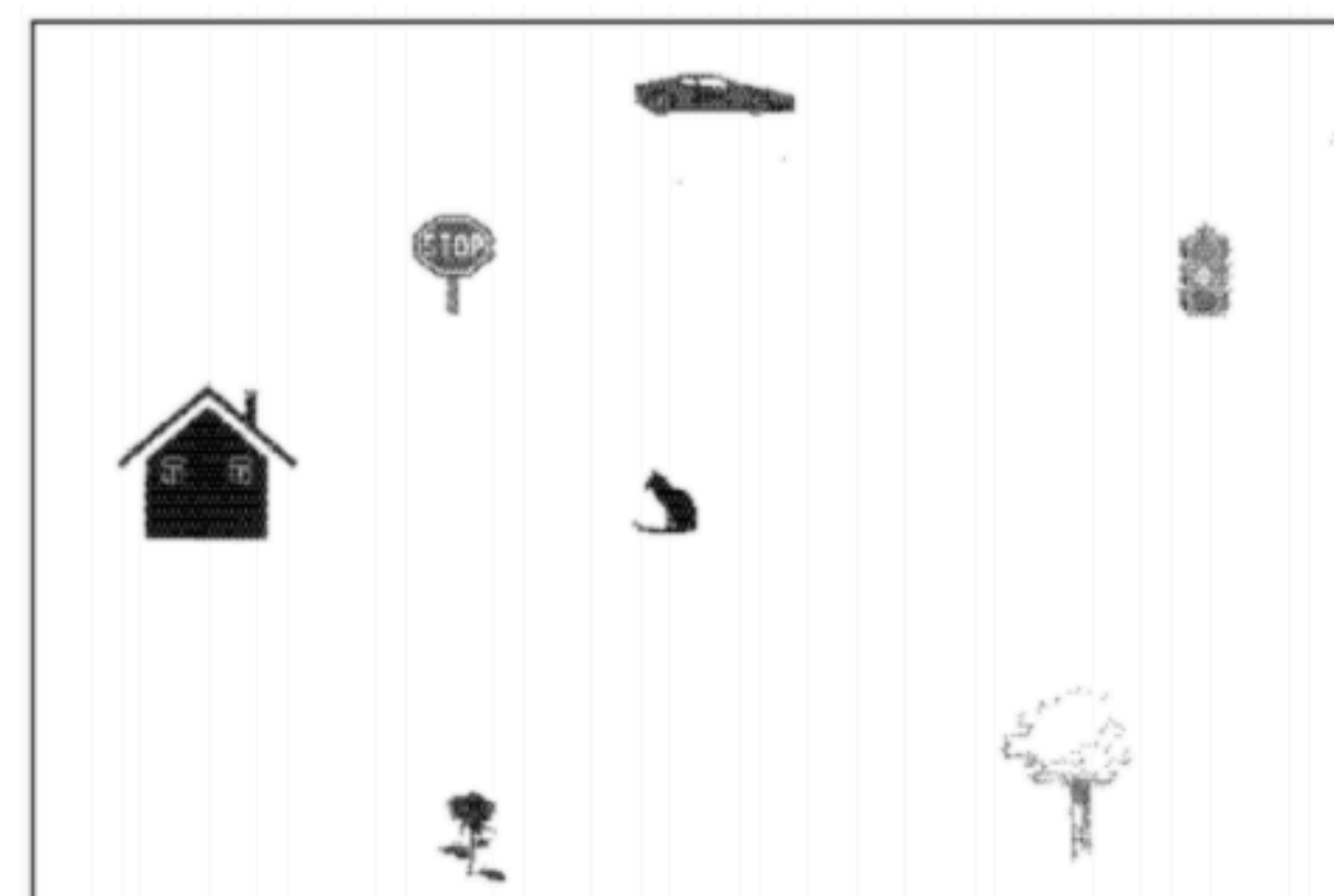
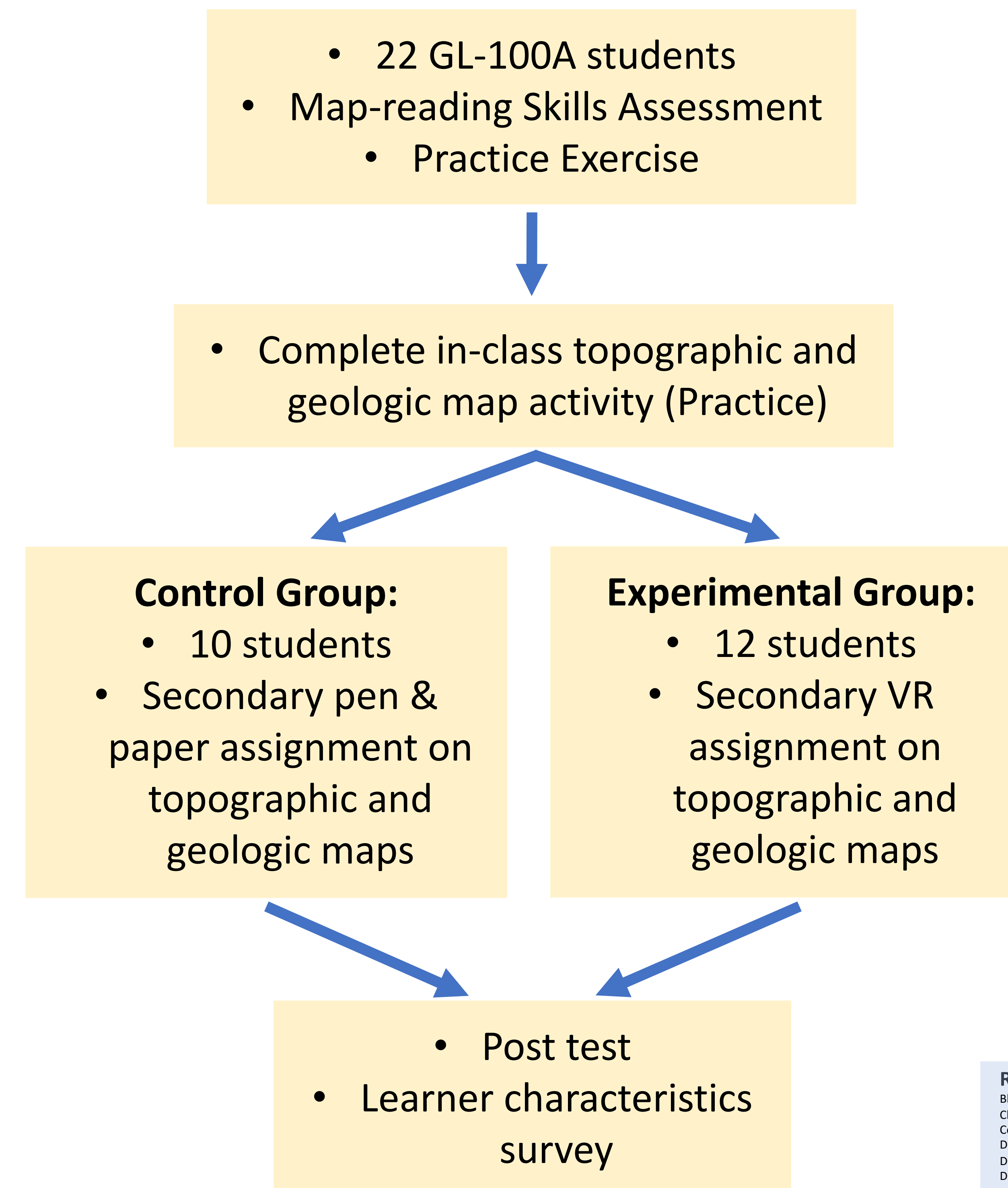
The geologic map on the left, showing an area of the Grand Canyon, is a portion of the map that students will be using to answer questions during the session of the study.

Spatial Abilities Tests

- Vanbenberg and Kuse Mental Rotations Test (1978)
- Object Perspective Taking Test (Hegarty & Waller, 2004)
- Hidden Figures Test (Ekstrom et al., 1976)
- Mental Cutting Test (Németh, 2007)
- Water Line Task Test (Piaget & Inhelder, 1956)

Timeline

- **Fall 2019:** running the experiment and data collection
- **Spring 2020:** analysis of data and write up, repetition of experiment with adjustments



The image on the right is a screenshot of the Object Perspective Taking Test (Hegarty & Waller), testing the perspective taking spatial ability.

Practice and Post-Tests

The practice test contains questions about learner attitudes and practice exercises. The post-test contains a combination of 20 questions about general spatial tests, 15 questions about geology-specific spatial tests, and a series of attitude/interest questions.

Preliminary Results

- Students in VR group performed significantly better
- VR likely has positive effect on spatial thinking
- Enhanced performance on Perspective Taking and Disembedding

Future Plans

- IEL grant to create VR game to train 3D geoscience concepts
- Test using spatial reasoning assessments

Acknowledgements

Thank you to Professor Katy Johanesen and Professor Territa Poole for their cooperation and collaboration on this research project, as well as Justine Black, the TSC, and the CS/IT Department for providing the HTC Vive headset and virtual reality program.

Grant money from NSF project 1557378, *Energizing STEM Teachers Across Rural Schools*, helped to fund this research.

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