

GEOGIRLS: A GEOLOGY AND GEOPHYSICS FIELD CAMP FOR MIDDLE SCHOOL GIRLS AT MOUNT ST. HELENS

Catherine Samson^{1,2}, Kate Allstadt³, Abi Groskopf³, Sonja Melander², Elizabeth Westby⁴ and Carolyn Driedger⁴

¹ Western Washington University, Bellingham, WA | samson@students.wwu.edu || ² Mount St. Helens Institute, Amboy, WA | agroskopf@mshinstitute.org | smelander@mshinstitute.org || ³ USGS Geologic Hazards Science Center, Golden, CO | kallstadt@usgs.gov || ⁴ US Geological Survey, Cascade Volcano Observatory, Vancouver, WA | lwestby@usgs.gov | driedger@usgs.gov

MOUNT ST. HELENS PROVIDES A NATURAL LABORATORY FOR AN EXPERIMENTAL STEM PROGRAM. GeoGirls is a five-day, hands-on geoscience field camp for middle-school girls that was launched jointly by the Mount St. Helens Institute (MSHI) and the USGS Cascades Volcano Observatory (USGS-CVO). Initial funding support came from a National Science Foundation (NSF) Postdoctoral Fellowship (Award No. 1349572). During August, 2015, eighteen girls from Washington and Oregon explored Mount St. Helens with the guidance of four high school mentors, two local teachers, an undergraduate intern and female scientists (see Partners). Through fundraising efforts, girls participated in the program free of charge (see Funders).

GEOGIRLS SOUGHT TO ACCOMPLISH THE FOLLOWING GOALS:
 Inspire enthusiasm for Earth sciences
 Introduce opportunities in the geosciences
 Increase confidence when doing science

GEOGIRLS HAVE FUN LEARNING ABOUT AN ACTIVE VOLCANO IN THEIR BACKYARD. Typically students learn about volcanoes from within the four walls of the classrooms. GeoGirls, however, lived on a volcano, fully immersed in their learning environment and free from everyday distractions. They explored their outdoor laboratory by venturing through lava tube caves and examining past volcanic eruptions preserved in the stratigraphy (Figure 1). They tested their outdoor skills on a strenuous day-hike on the Pumice Plain and developed confidence as they challenged their abilities (Figure 2). Back at camp, girls relaxed after the activities of the day and had fun singing camp songs, playing games and cultivating friendships.

WITH GUIDANCE FROM MENTORS, GEOGIRLS WORK AS A TEAM TO TACKLE HANDS-ON PROJECTS. In small groups, girls worked on applied research projects led by female scientists and graduate students (Figures 3-10). Girls gained a better understanding of careers in the geosciences as they explored real technologies used to monitor volcanoes. Through the scientific processes, girls learned to form hypotheses, think critically, make observations and report their findings. Each group kept track of their findings from their activities and projects through blog entries created on Surface Pro tablets. These projects involved:

- Seismology
- GPS
- LIDAR
- Photogrammetry
- Stratigraphy
- Water systems

GIRLS APPLY THEIR COLLECTIVE KNOWLEDGE TO A VOLCANO CRISIS MISSION ACTIVITY. The girls reconvened at CVO on the final day and divided into five teams focusing on communication, hazard assessment, monitoring ground deformation, seismic activity and gas emissions. Working in teams, girls learned how every person in a scientific team contributes to the whole. Teams shared their data with one another in order to evaluate the potential risk of an eruption and determine areas of high risk. They took on leadership roles as they reported their findings in a mock press conference (Figures 12 and 13).



Figure 1: GeoGirls split into groups to examine stratigraphy along an outcrop in an abandoned drainage near Lava Canyon. The girls made observations about each distinct layer, noting the grain size, orientation and layer thickness. They made hypotheses for the origin of these deposits and shared their findings with the group.



Figure 2: GeoGirls make their way across a drainage during their day hike on the Pumice Plain. Almost half the girls reported hiking as one of their favorite activities at the end of the program.



Figure 3: GeoGirls sieve water samples from Coldwater Lake during their water systems research project. Sieve samples were taken at different locations along the lakeshore which allowed the girls to generate a map of relative grain size distribution.

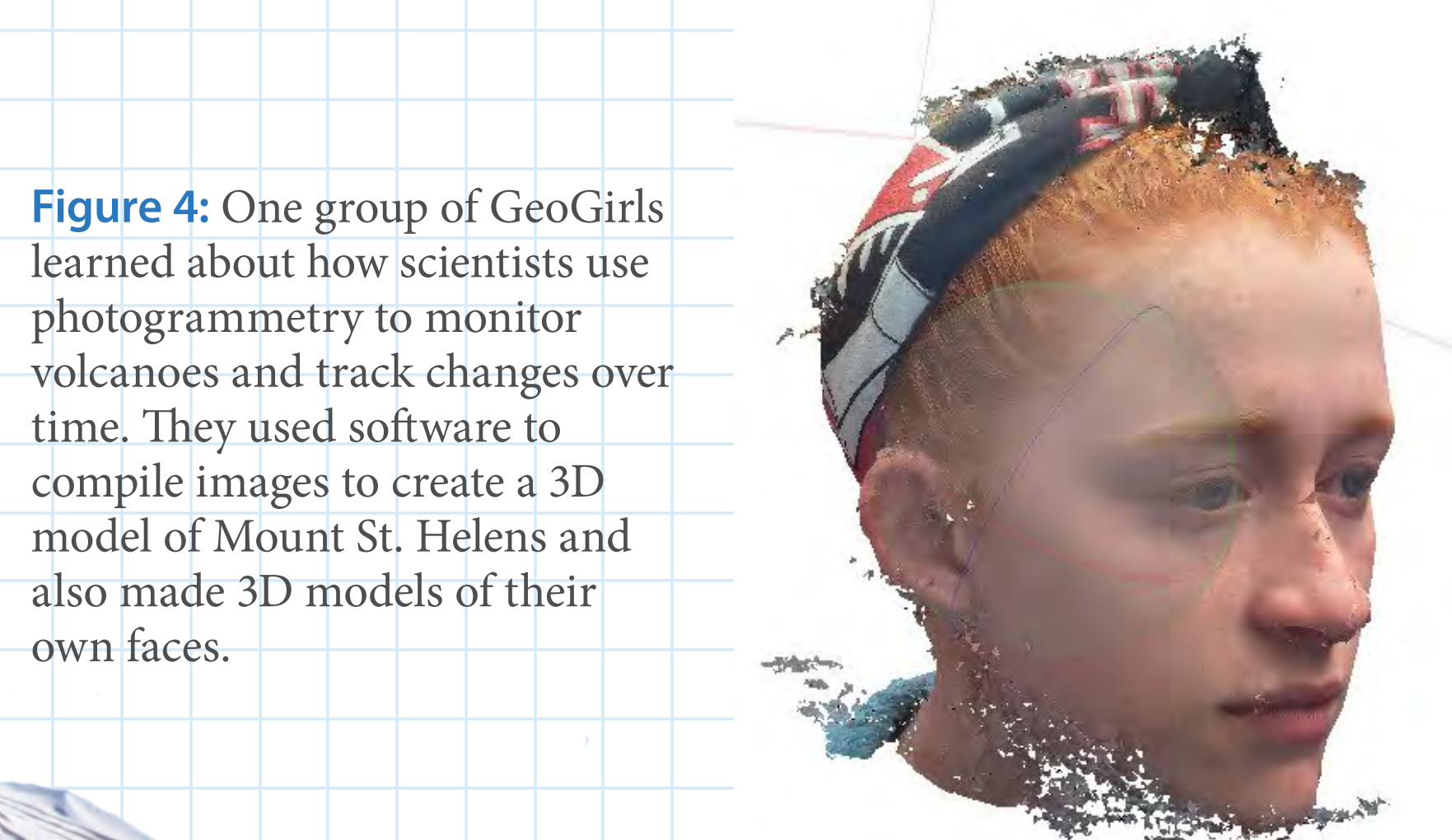


Figure 4: One group of GeoGirls learned about how scientists use photogrammetry to monitor volcanoes and track changes over time. They used software to compile images to create a 3D model of Mount St. Helens and also made 3D models of their own faces.

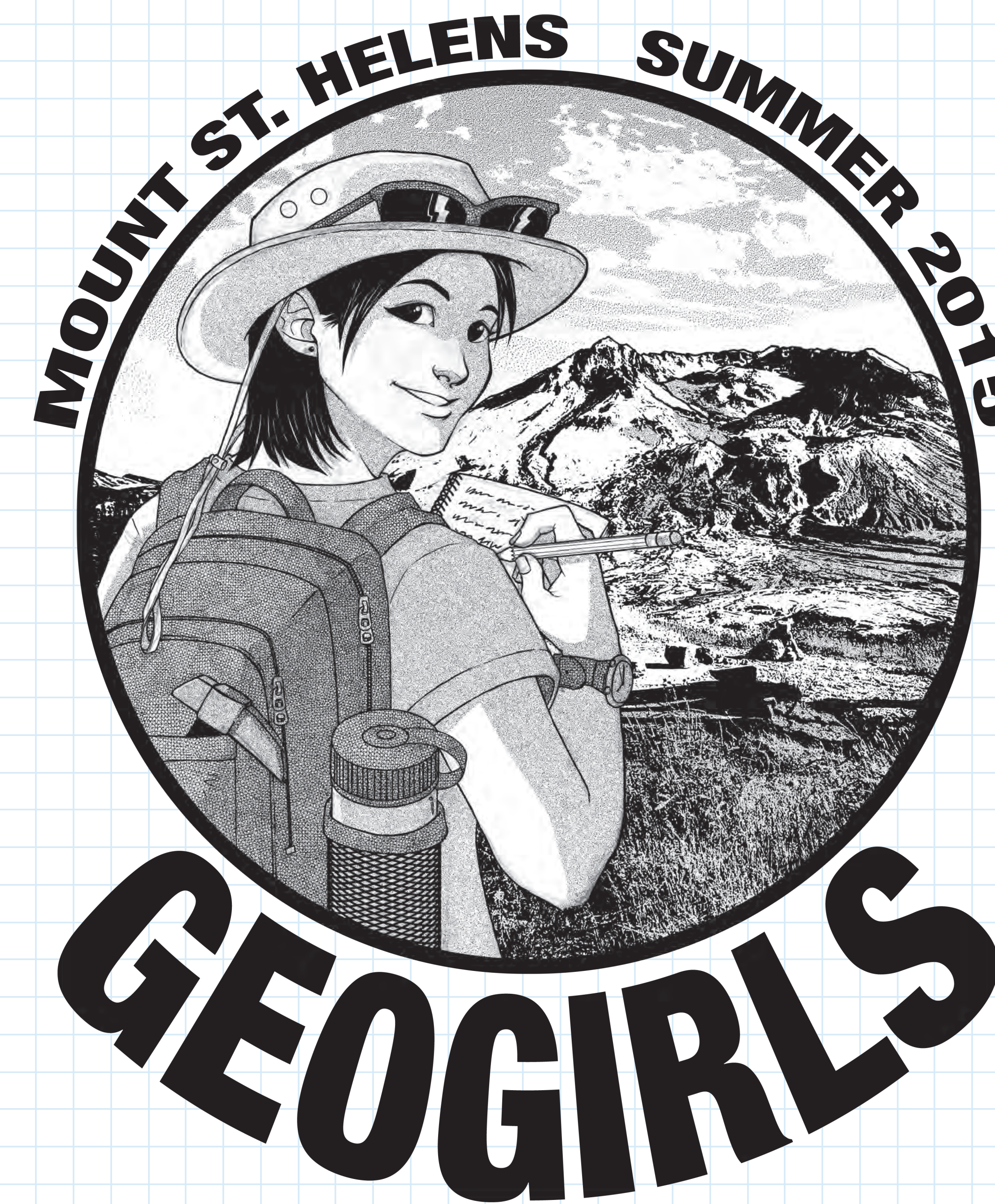


Figure 12 (top): During the volcano crisis mission activity, the hazard specialist team works together to determine zones of high risk based on the information they received from different monitoring teams.

Figure 13 (below): Each team elected one of their monitoring experts to report to the public during a mock press conference. They were prompted with questions and concerns from the town mayor (Carolyn Driedger). The girls addressed these concerns with safety precautions based on the risks they evaluated.



Figure 5 (left): For a seismology project, Kate Allstadt helps two girls install a seismometer near the volcano. A number of these devices were installed around the mountain and along nearby roads.

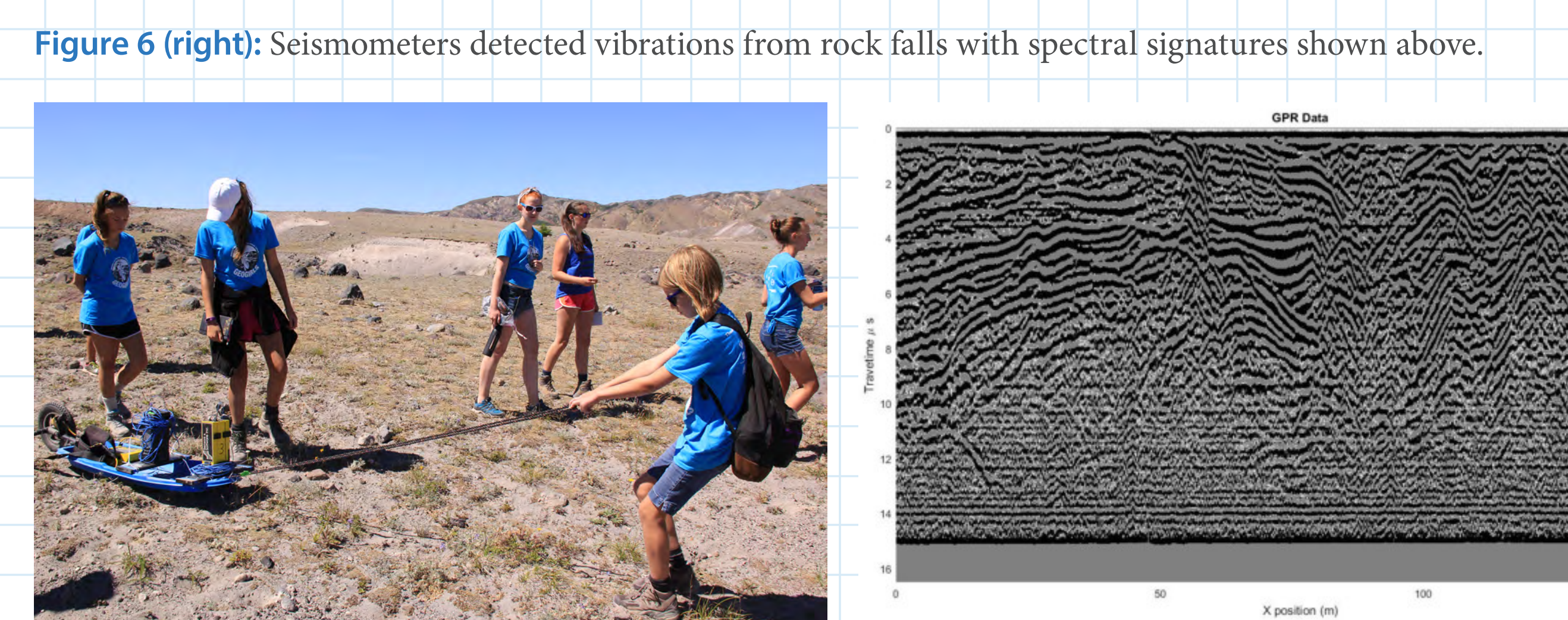


Figure 6 (right): Seismometers detected vibrations from rock falls with spectral signatures shown above.



Figure 7 (left): On the Pumice Plain, GeoGirls take turns collecting data using a GPR device assembled by field researchers from Boise State University.

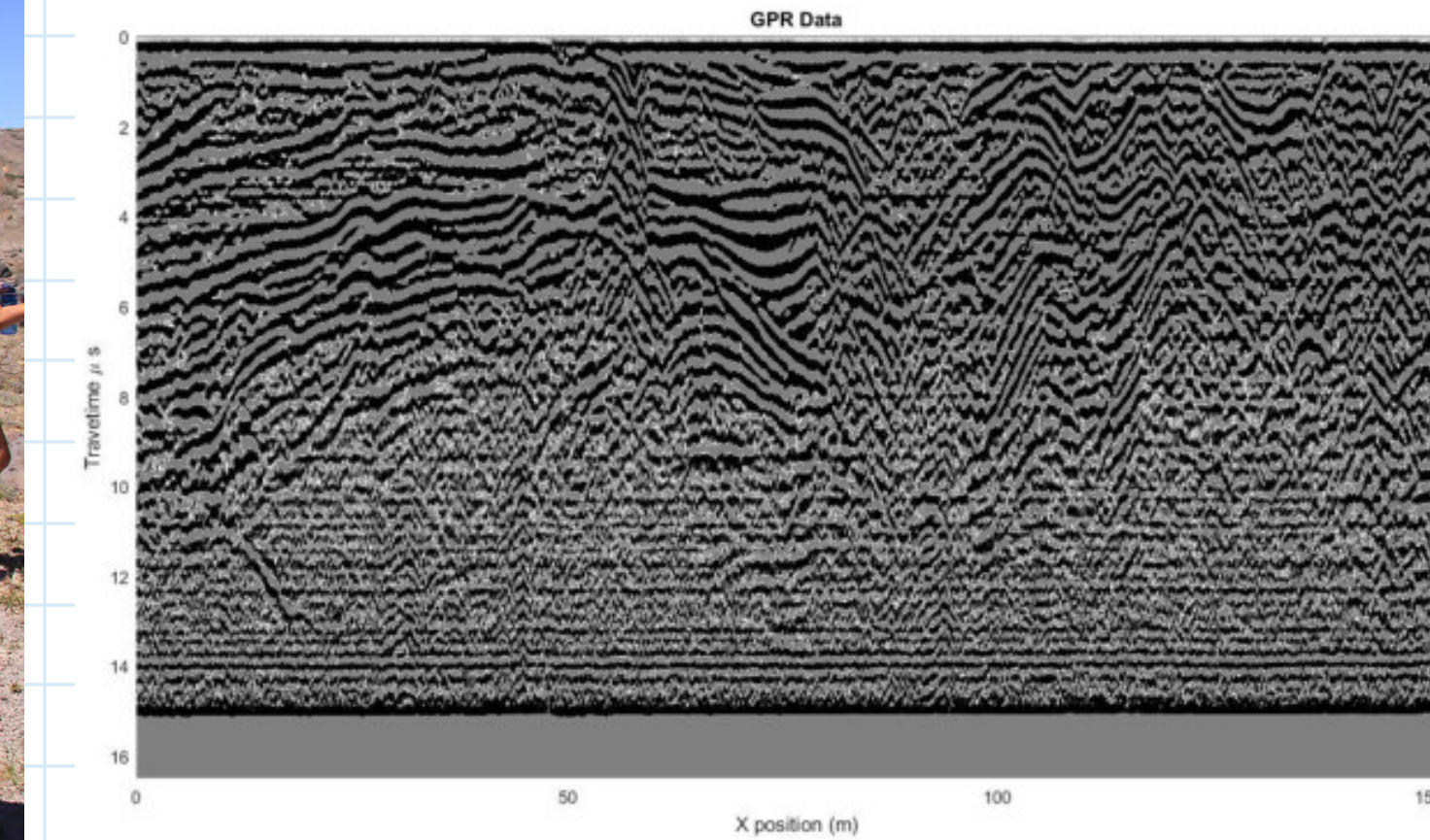


Figure 8 (right): GPR image of the subsurface layers where the girls collected data.

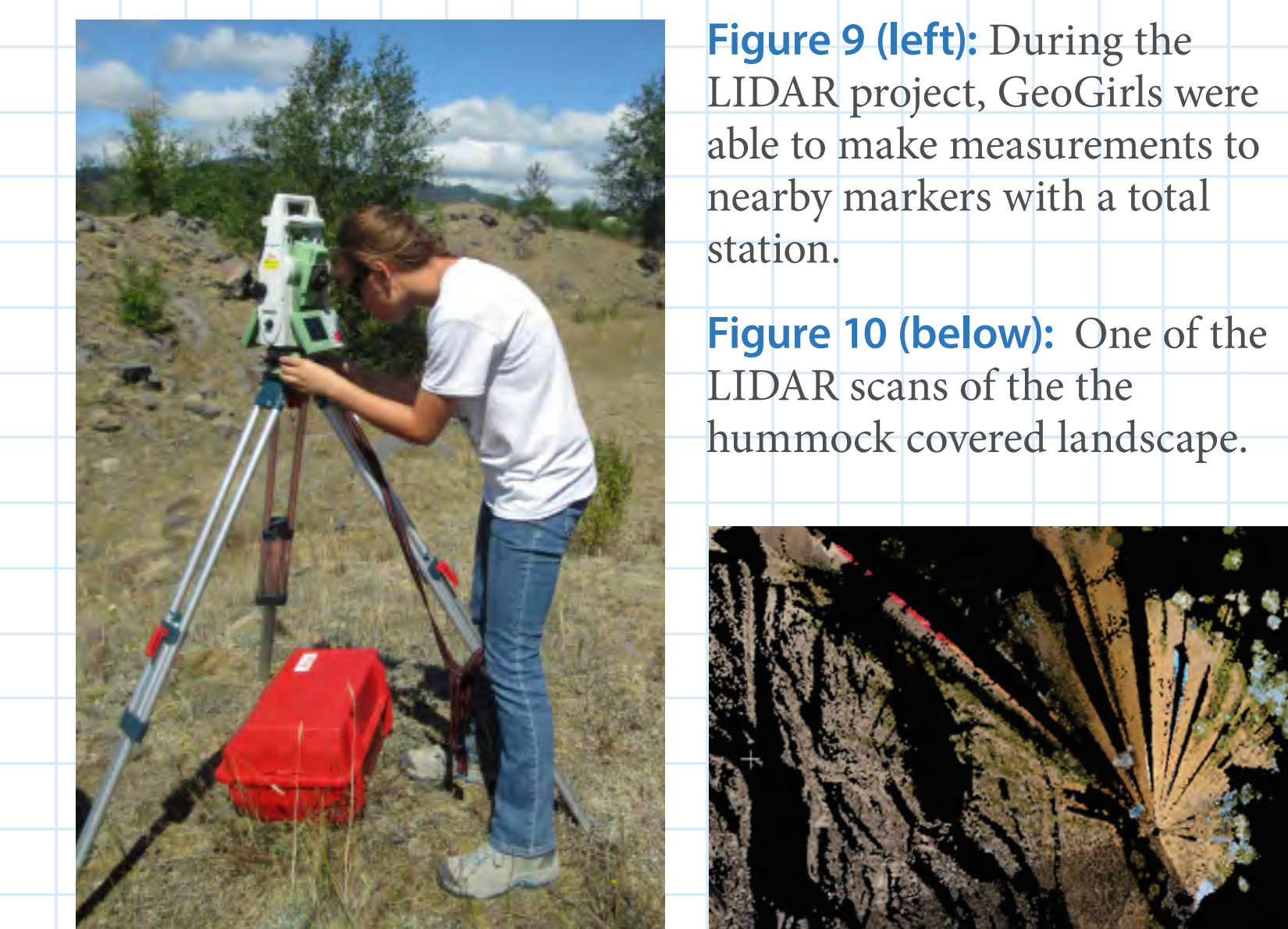


Figure 9 (left): During the LIDAR project, GeoGirls were able to make measurements to nearby markers with a total station.



Figure 10 (below): One of the LIDAR scans of the hummock covered landscape.

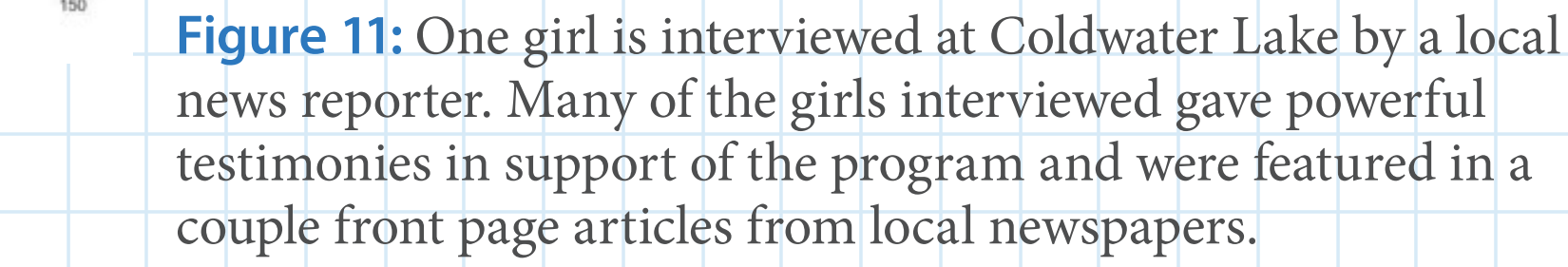


Figure 11: One girl is interviewed at Coldwater Lake by a local news reporter. Many of the girls interviewed gave powerful testimonies in support of the program and were featured in a couple front page articles from local newspapers.

MEASURING SUCCESS. One of the overarching goals of the program was to encourage girls with limited opportunities in science by showing that geoscience careers are fun and achievable. At the end of the program, 16 of 18 GeoGirls, 2 of 4 high school mentors and 17 of 22 parents completed surveys with the following results:

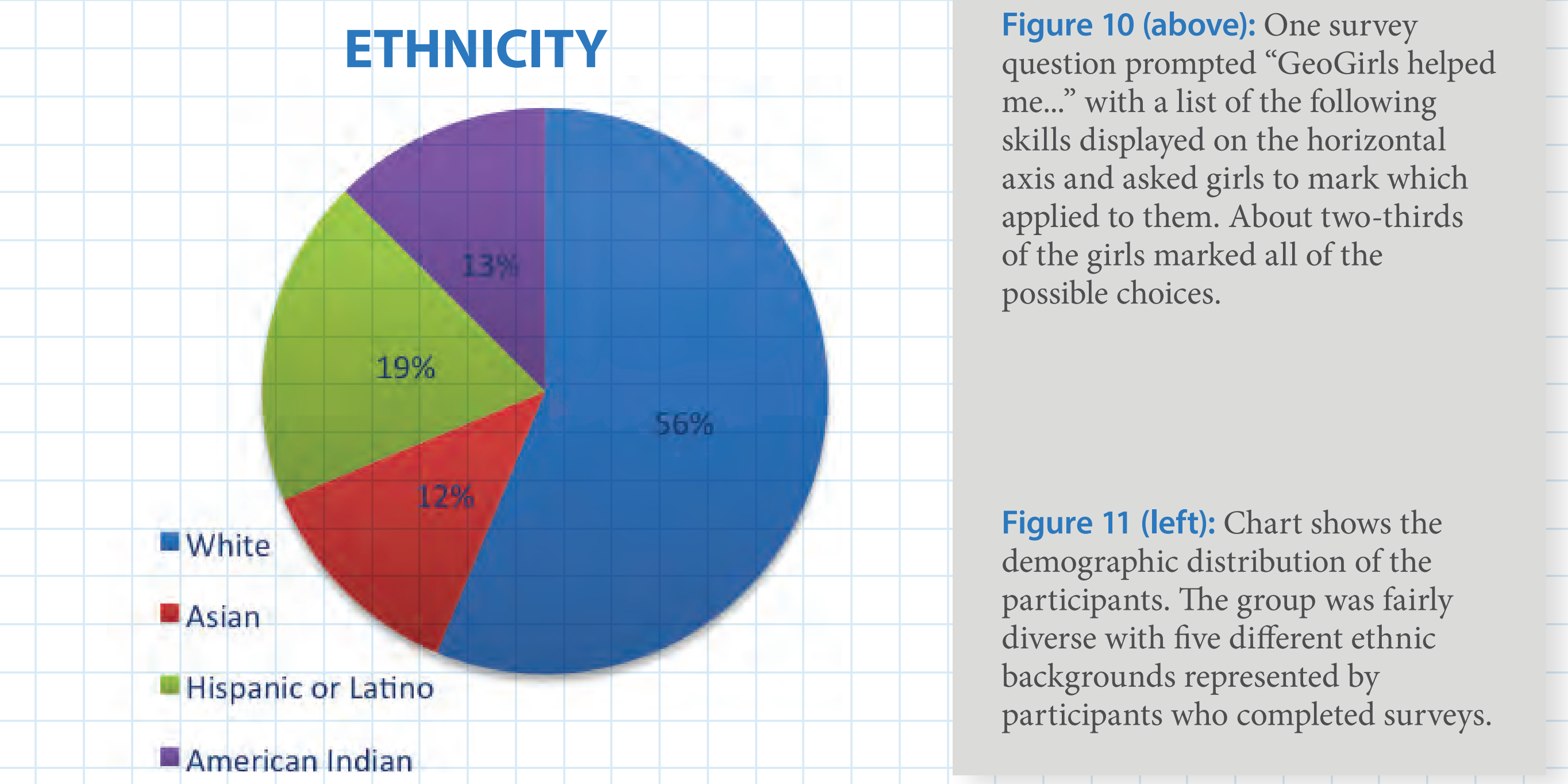
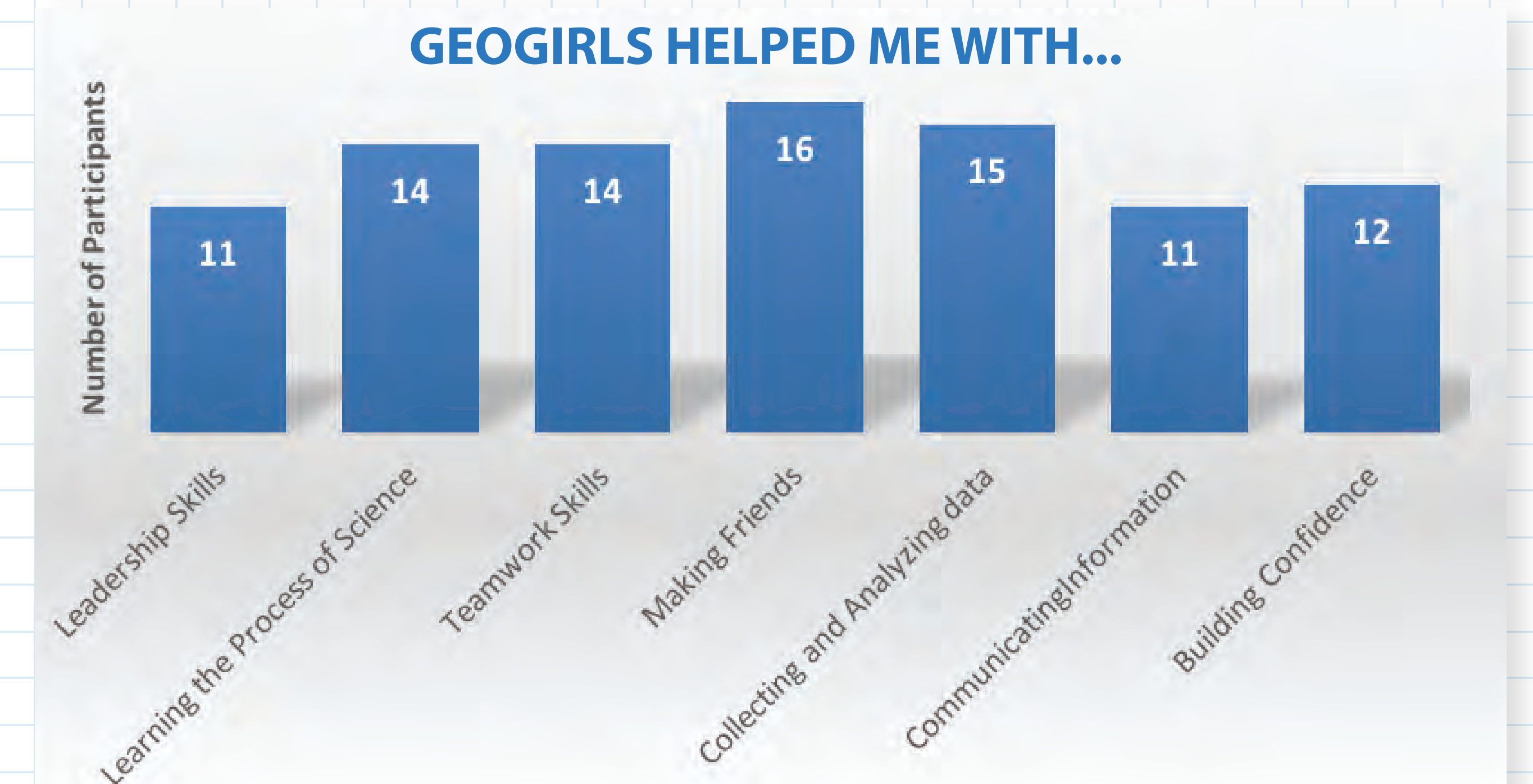


Figure 10 (above): One survey question prompted "GeoGirls helped me..." with a list of the following skills displayed on the horizontal axis and asked girls to mark which applied to them. About two-thirds of the girls marked all of the possible choices.

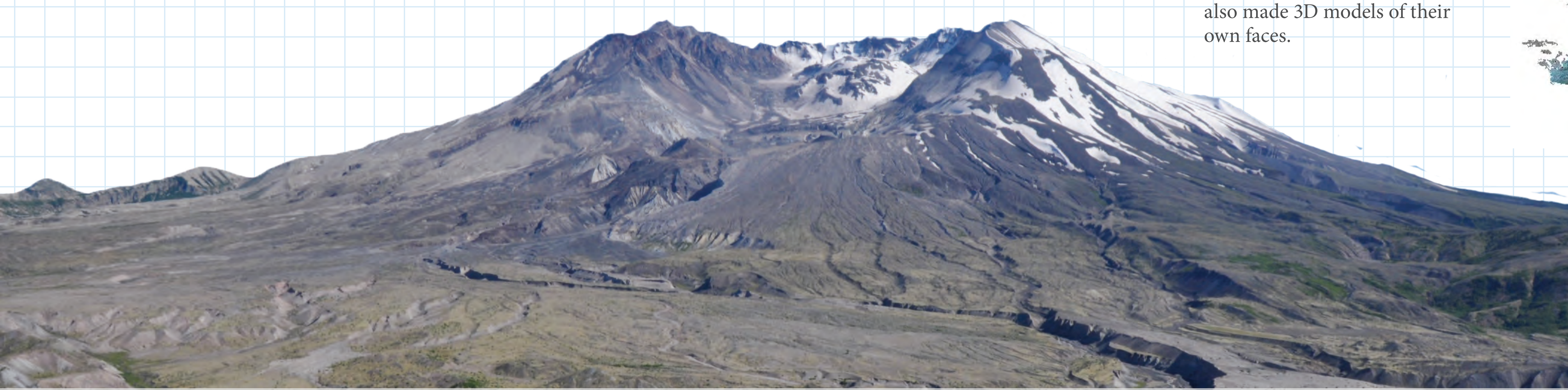
Figure 11 (left): Chart shows the demographic distribution of the participants. The group was fairly diverse with five different ethnic backgrounds represented by participants who completed surveys.

POSITIVE FEEDBACK.
*"Getting to learn more outside the classroom was very eye-opening."
 "I knew I wanted to be a scientist but now I for sure know that there's nothing I would rather do."
 "[My daughter] has a whole new perspective on life now and sees herself as a scientist someday!"*

THE FUTURE OF GEOGIRLS IS BRIGHT. GeoGirls will continue in August 2016 with second-year pilot funding from NSF, AWG and AAUW. Program partners seek on-going funding to ensure that girls from all financial situations with an interest in geology will be able to participate in this unique program promoting diversity for future generations of geoscientists.

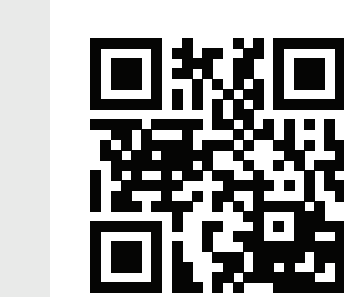
PARTNERS: USGS-CVO, MSHI, UNAVCO, Boise State, Georgia Tech, University of Washington and Oregon State University.

FUNDERS: NSF, the American Association of University Women, the Association for Women Geoscientists, the Association of Environmental & Engineering Geologists, and private individual donors. Seismic instruments were provided by IRIS PASSCAL.



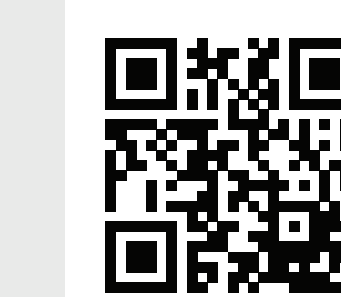
SIGN UP!

<http://www.mshslc.org/volcanic-explorations/youth-programs/geogirls/>
 Summer 2016 applications will be available online March 23-April 20.



MOUNT ST. HELENS INSTITUTE:

<http://www.mshslc.org>



GEOGIRLS BLOG:

<https://geogirls2015.wordpress.com>

