PROJECT POEM: IN PERSON AND VIRTUAL STEM AND MENTORING PROGRAMS FOR STUDENTS WITH VISUAL IMPAIRMENTS. S. R. Buxner[1], S. Kortenkamp[1], S. Hong[1], G. Tsinajinie[1], I. Topor[1], L. Lunsford[2], A. Strauss[1], R. Lipson[1], J. Park[1], T. Alshuli[1], and E. Joseph[1]. [1]University of Arizona (1430 E. 2nd Street, Tucson, AZ 85721, buxner@arizona.edu), [2]Campbell University.

Introduction: Project POEM (Project-Based Learning Opportunities and Exploration of Mentorship) engages middle and high school students with visual impairments with experiences to support their knowledge, interest, and ability to pursue STEM subjects in future education and possible STEM (science, technology, engineering, math) careers. The project combines project-based activities in Earth and space science with mentoring activities over the course of a year.

First Cohorts: The program, now finishing the third year, has had two cohorts of students. The program engages students in a two-tiered mentor approach with students working with both a STEM student mentor, either undergraduate or graduate STEM student at the University of Arizona, as well as an industry mentor who is an individual who has a visual impairment and works professionally in a STEM industry. All mentors receive an online training before their participation in the program that covers the basics of learning, working with students who have visual impairments, and project-based learning.

Students are introduced to the program over the summer through a week-long readiness academy at the University of Arizona Sky School facilities on Mt. Lemmon near Tucson, Arizona. Students engage in various hands-on STEM related activities and conduct investigations in small groups with a research mentor. At the end of the week, teams present their projects and results to each other, the POEM team, and friends and family. Participants then begin a year-long remote learning STEM program during which they receive monthly packages with 3D tactile models and science activities aligned with Next Generation Science Standards.

Over a second summer, students complete a week-long residential enrichment institute at the University of Arizona. The visit labs on campus and learn about resources for students with visual impairments in college settings. Each student prepares and gives a 20-minute final presentation.

3D Tactile Models: Advances in 3D-printing and the availability of high-resolution data from NASA spacecraft have reached a convergence in the last few years. It is now possible to produce relatively inexpensive tactile models of terrain on the Moon, Mercury, Mars, and Earth. A cornerstone of Project POEM is our collection of such tactile terrain models as well as similarly produced NASA spacecraft models (see Figure 1). Our terrain models are produced from public digital elevation maps available through the US Geological Survey. The modeling process begins with conversion of a portion of an elevation map into a 3D-printable file. A draft model is then 3D printed and post-processed by hand to remove printing artifacts. The model is then labeled with embossed braille and ascii text. We then produce a mold of each prototype using a liquid silicon rubber. After curing, the silicon mold is filled with a urethane resin to produce casts of the original prototype. The process is fairly robust, with molds typically able to mass produce about 100 duplicates before deteriorating. The urethane casts are nearly indestructible in ordinary educational settings. They can withstand drops, prolonged exposure to sunlight, excessive heat in vehicles, cleaning with strong solvents, etc. Production of tactile spacecraft models such as those shown in Figure 1 uses a similar technique. One key difference however is that the 3D-printable spacecraft files obtained from NASA are modified to accommodate our visually impaired participants. Connection points for various spacecraft components are enlarged and given unique shapes.

Mentoring: During the school year, participants engage in ongoing astronomy related activities at home with support from a university student mentor. Participants also engaged with industry mentors completing monthly activities including interviewing them about how they conduct their job, accommodations they used, and other information about how to successfully enter a STEM career.

Changes Due to Pandemic: The shutdown of schools, universities, and businesses in March 2020 necessitated a change to the in-person programming. The summer 2020 enrichment institute for the second cohort was postponed and students continue to be offered monthly telecons to engage in additional science activities. Planning for the third cohort is ongoing and includes virtual programming due to the uncertainty of the public health situation.

Preliminary Results: Results from the first three years of the project has revealed that students value their interactions with industry mentors who help them understand how to navigate a professional STEM career with VI. Additionally, students have increased in their knowledge of practical science skills and their knowledge of STEM careers. Mentors value the training they receive and report that it helps them in other aspects of their job. Additionally, mentors value working with students and sharing their passion for STEM. University mentors value the 3D models for working with students and have found them useful for additional teaching.

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Learn more about Project POEM on our website: https://poem.coe.arizona.edu/

Figure 1: All models shown are urethane resin casts produced from silicone rubber molds of 3D printed prototypes. 1st row at bottom, left to right: LRO spacecraft parts, MRO spacecraft parts, MER Spirit (shown assembled), MSL Curiosity (shown assembled), standard Sharpie pen for size reference. 2nd row from bottom: Meteor crater (Arizona), Moon far side and near side hemispheres, Mars western and eastern hemispheres, Gale crater (Mars). 3rd row from bottom: a "Perfect" crater (Moon), Lunar highlands with Mendeleev crater, Lunar Mare with Copernicus and Eratosthenes craters, Gusev crater and canyon (Mars), Olympus Mons (Mars). Top row: Tycho crater (Moon), Orientale basin (Moon), Lowell crater (Mars), Davies crater (Mars), crater in Athabasca region (Mars), Orson Wells crater (Mars).