

EXPLORING ASTRONOMICAL EVENTS AND TOPICS THROUGH ACCESSIBLE RESOURCES.

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Introduction: For more than a decade our team has been focusing on efforts to provide accessible material in STEM to students with disabilities. Although not limited to Blind and Visually Impaired (B/VI), the authors' resources start with those students in mind and branch to other adaptations and accommodations for other disabilities. Highlighting the need for resources is the most recent reports submitted by the American Printing House for the Blind (APH) which reports 55,249 students in educational settings are legally blind [1]. In addition to APH stats, 559,543 students in the United States have "serious difficulty seeing even when wearing glasses as well as those that are blind [2]." These statistics reveal the significant prevalence of blindness and visual impairment in our public school settings and highlights the need for accessible earth and space science materials. By providing accessible materials, students who are Blind or Visually Impaired will have a better chance being successful in STEM education and careers. Because these resources are universal in design [3] they are easily adapted to a variety of disabilities found in K-12 and informal educational settings. This allows teachers and mentors to devote more time to providing engaging activities with specific adaptations for those who may need it.

Tactile Earth and Space Science Books: Through the Solar System Exploration Research Virtual Institute (SSERVI), NASA has been developing, field-testing and publishing tactile resources for the blind and visually impaired (<https://sservi.nasa.gov/books/>). These resources include a variety of topics. The most recent addition includes a tactile book highlighting satellite imagery of Earth with an emphasis on weather and ice sheet monitoring. Three other books are in the pipeline and include a book highlighting the significant eclipses of 2023 and 2024 in the United States, light pollution, and meteorites' significance in understanding planet building.

The Eclipse book (figure 1) will illustrate the paths of the 2023 annular and 2024 total solar eclipses and details the specific parameters in which eclipses occur. The book consists of 4 tactiles and will be accompanied by field tested hands-on investigations and activities related to eclipses.

Like the eclipse book, a prototype of the *light pollution book* has also been created and field tested by both students who are Blind and teachers of the visually impaired. This 6-page tactile book highlights the effect of varying light pollution levels on the constellations of Cygnus (summer constellation) and Orion (winter constellation). The book is

accompanied by a family/student activity packet that walks investigators through the various tactiles.

The book on planet formation and meteorites is currently being developed and will also utilize Universal Design principles to make it accessible to every student, including those who are not B/VI.



Figure 1: Students and Teacher in Chile use tactile materials created by authors for learning about eclipses

Information on Universal Design for Learning:

"The ultimate goal of UDL is for all learners to become "expert learners." Expert learners are purposeful and motivated, resourceful and knowledgeable, and strategic and goal-directed about learning. UDL is a powerful approach because from the very start of your lesson, it helps you anticipate and plan for all your learners. It can help you make sure that the greatest range of students can access and engage in learning — not just certain students [3]." In short, UDL is inclusive of ALL learners.

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References:

- [1] 2019 Annual Report: American Printing House for the Blind, Inc. <http://www.aph.org/annual-reports>.
- [2] 2018 American Community Survey. <https://www.census.gov/programs-surveys/acs/>.
- [3] Posey, A. (no date) Universal Design for Learning (UDL): A teacher's guide. <https://www.understood.org/articles/en/understanding-universal-design-for-learning>