Star Coins – 3D Tactile Constellations

Teaching astronomy to the blind and visually impaired

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Image: NASA/ESA Hubble

Introduction

- 3D printed constellations
- Astronomy education using tactile objects
- Developed for blind / visually impaired
- Useful for all students

Materials

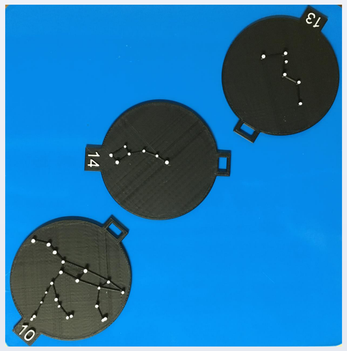
- 3D printable individual constellations
- 100 mm diameter disks
- Can be resized when printed
- Free to download and print

Design and Features

- IAU constellation patterns
- Designed with suggestions from Cleveland Sight Center
- Star diameter scaling basis
  - 2mm diameter at 5th magnitude
  - Able to resolve Orion's belt stars
- Identification
  - Numbers rather than Braille
  - Useful with sighted students
  - Students can be quizzed
- Loop at top
  - Beaded chain can link together a group of constellations
  - Useful for planetarium shows
- Contrast
  - 3D printed using black PLA
  - Star points painted with white
- Magnet backing
  - Disks can be moved around on metal white boards or any ferrous surface

Field Experience

Classroom demonstration with Cleveland Sight Center



Objective:

- Identify three circumpolar constellations
  - Ursa Minor, Ursa Major, Cassiopeia
- Place constellations in their relative orientations on a board

Materials:

- The three 3D printed constellations
- 18" x 24" metal board

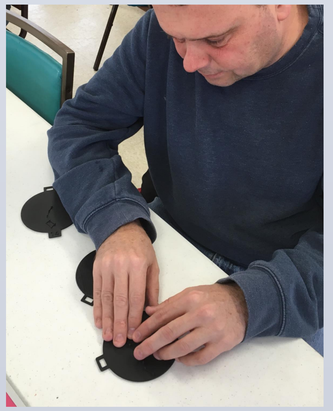
Method:

- Each student was assisted by a sighted volunteer
- Astronomer described each constellation with stories about the mythology
- Students were assisted with identifying each constellation
- The concept of Earth rotation and constellations in sky was explained by holding boards overhead
- Assistants placed constellations on the metal boards in the proper orientation
- Constellations were removed and students placed these back on the board in the correct orientation

Results / Observations / Key Findings

Students:

- Identified each constellation using the numbers on each disk
- Correctly orient these circumpolar constellations
- Added to their knowledge of the visual world



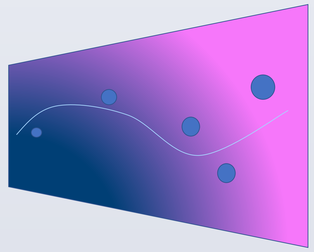
Advantages

- Collaboration with sighted students
  - Making the 3D prints
  - Pairing students during class
- Increases awareness of challenges to blind and visually impaired
- Extends to all students in learning astronomy
  - Use in any astronomy class
  - Provides a focused tactile object for students

Other Applications / Ideas

- Quiz sighted and non-sighted students
- Planetarium show objects for non-sighted students

Tactile constellation wall outside planetarium



Currently In Use or Planning

- Shaker Heights Ohio Public Schools
- Waukesha Wisconsin Public Schools
- Vision Forward – Milwaukee
- Adler Planetarium
- Science@Perkins.org
- Harvard-Smithsonian Center for Astrophysics "Touch the Universe Box"
- Geneva Lake Astrophysics and STEAM

Free 3D Files and Info

http://www.rovingbits.com/StarCoins/

Acknowledgements

- Cleveland Museum of Natural History
- Cleveland Sight Center

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