

University of Washington Mobile Planetarium

Bringing HST Science to Seattle Public Schools

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Abstract

We present a cost-effective design for a mobile digital planetarium powered by Microsoft Research's WorldWide Telescope (WWT).

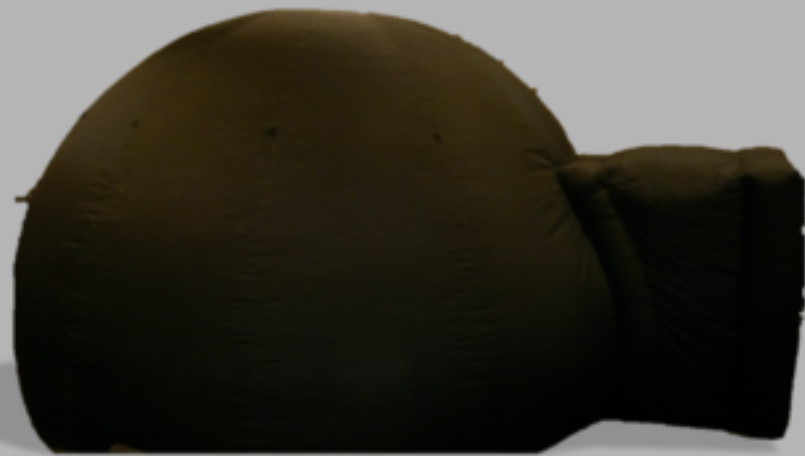
We used an HST education and public outreach grant (EO-12512) to offset transportation costs to the UW planetarium, and to build a mobile planetarium to bring astronomy directly to Seattle-area classrooms.

The UW Mobile Planetarium was developed for less than \$18,000, and allows us to increase the number of underserved elementary and high school students the UW Astronomy department reaches.

We are beginning to test and evaluate the efficacy of teaching using the mobile planetarium in a high school setting. The mobile nature of the planetarium allows us to develop interesting inquiry-based lessons that incorporate WWT tours.

Building the Planetarium

Our digital planetarium runs Microsoft Research's World Wide Telescope (WWT), which creates a distorted image of the sky to project from a home-theater HD video projector. The image bounces off a curved hemispherical mirror and projects as a realistic scene on the inner surface of our dome. We needed: an inflatable dome, a Windows laptop with a fast video card, an HD projector, a flat mirror, a hemispherical mirror, and a housing for the optical assembly.



Choosing an inflatable Dome

Our goals are to include up to 30 high school students, be able to accommodate students with disabilities, and to keep costs as low as feasible. All of our goals were met with the 5-meter diameter "Go-dome". This dome has a large removable airlock, and requires constant airflow to maintain inflation.

Choosing a laptop

WWT runs on any modern PC laptop, although one with an excellent video card and plenty of memory will ensure a seamless planetarium show.



Choosing a video projector

We chose an affordable HD, high lumen, "Home Theater," DLP projector.

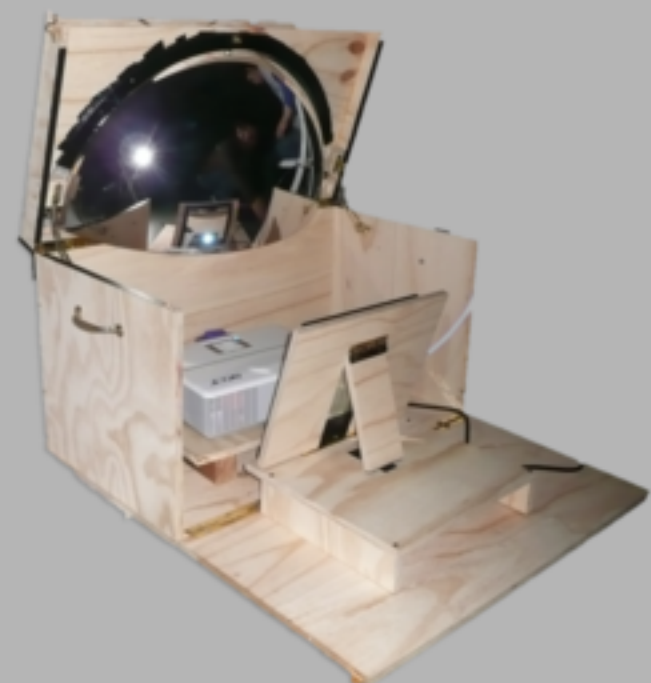


Optics housing

Professionally made housing for the optics are commercially available for approximately \$3,000. We designed and fabricated our own for roughly \$500 (parts and labor).

We designed the housing to function for our specific configuration while keeping it general enough to work with minor changes to equipment (e.g., a replacement projector).

The housing is constructed out of plywood, Velcro, piano hinges, and friction hinges.



Approximate Equipment Costs

5m Go-Dome	\$13,000
Hemisphere mirror	\$1,300
Secondary mirror	\$30
Computer	\$1,500
Projector	\$1,000
Optics Housing	\$500
Misc. Equipment Costs	\$200
Total Approx. Cost	\$18,000

More resources

Our Website: www.astro.washington.edu/groups/outreach/mplanetarium

Projectors: projectorcentral.com

Domes: go-dome.com, e-planetarium.com

WorldWide Telescope: worldwidetelescope.org

Curriculum Design and Testing

We selected pre- and post-test with questions taken from the *Test of Astronomy Standards* (TOAST: e.g. Slater, S. 2009, BAAS, 41, 493) to address the following major questions:

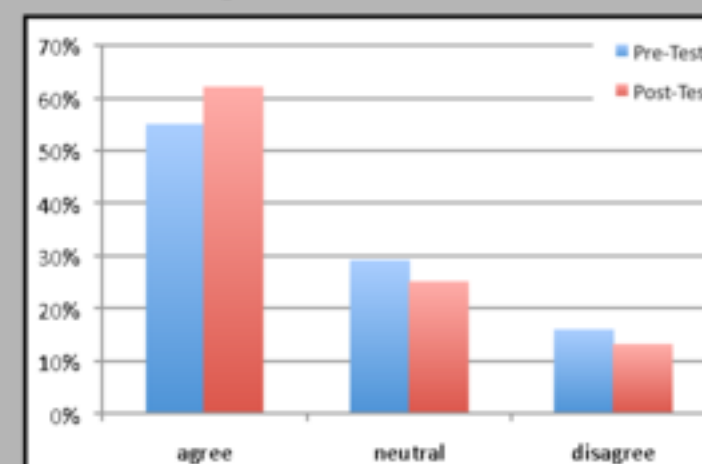
1. How will our planetarium affect student's attitudes towards science and learning
2. How well do planetariums convey difficult concepts in astronomy

We tested our equipment at Ballard High School in Seattle, WA one of our target schools. As a matter of convenience, JG then tested curriculum at his public high school in Port Angeles, WA. Below are survey results from 180 freshman science students and 25 junior and senior astronomy students at Port Angeles High School.

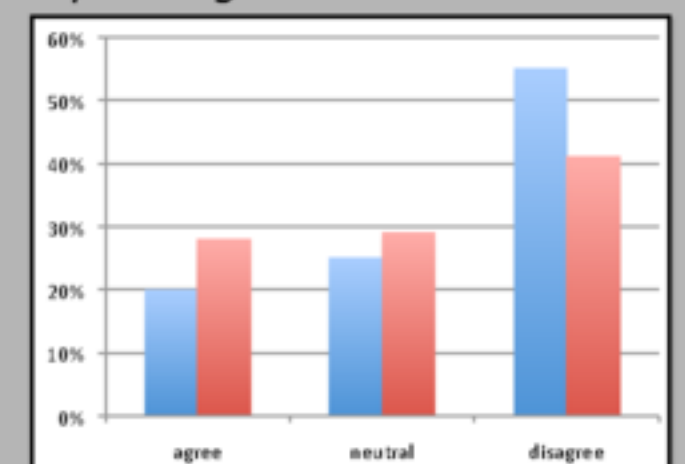
1) Testing Student Attitude

Students' attitudes toward studying science tend to be more favorable after their brief exposure to the planetarium

"I am interested in learning more about science"



"I am interested in pursuing a career in science"



2) Testing Student Comprehension

We asked students to order several objects in the universe by size.

In the pre-test, 47% of students answered correctly. After the presentation, 6% of the students corrected their responses in the post-test resulting in 53% of students giving the correct answer.

While our data show the overall affect of the planetarium increases students' comprehension, this conclusion is preliminary. As we gather more data from more schools, we will be better able to tailor our curriculum to be as effective as possible.

Future Plans

The long-term goal of the UW mobile planetarium project is to have an ongoing, UW undergraduate-driven educational program between UW astronomy and Seattle Public High Schools.

To accomplish this we will:

- Partner with more schools in the area, specifically those that do not already visit the UW Planetarium.
- Train UW undergraduates to bring traditional planetarium shows to classrooms.
- Develop a framework for inquiry-based projects based on student produced WWT tours, and train UW undergraduates to assist classrooms engaging in these projects.
- Share all materials online