



Visualizing Moon Phases with WorldWide Telescope

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What is WorldWide Telescope and its Ambassadors Program?

WorldWide Telescope offers an unparalleled view of the world's store of online astronomical data. This free software weaves astronomical images from all wavelengths into an interface that resembles their natural context—the Sky—while offering deep opportunities to teach and learn the science behind the images.

The **WWT Ambassadors Program** promotes WWT as a future-leaning way to teach and learn STEM concepts by recruiting astronomically-literate volunteers who are trained to be experts in using WWT as a teaching tool.



WWT is free for non-commercial use. All but the 3D mode runs in any modern browser (PC or Mac). The 3D mode runs in Windows, including "virtual" Windows installations, e.g. on Macs.



What is the WWT Moon Phases Visualization Lab?



WWT Screenshots from the Moon

Why?

We found that teachers had interest in trying the new WWT technology in their classrooms, but many worried about having sufficient time to cover required topics in the required curriculum, so did not feel they had time for WWT, which they viewed as "supplementary" rather than "curricular."

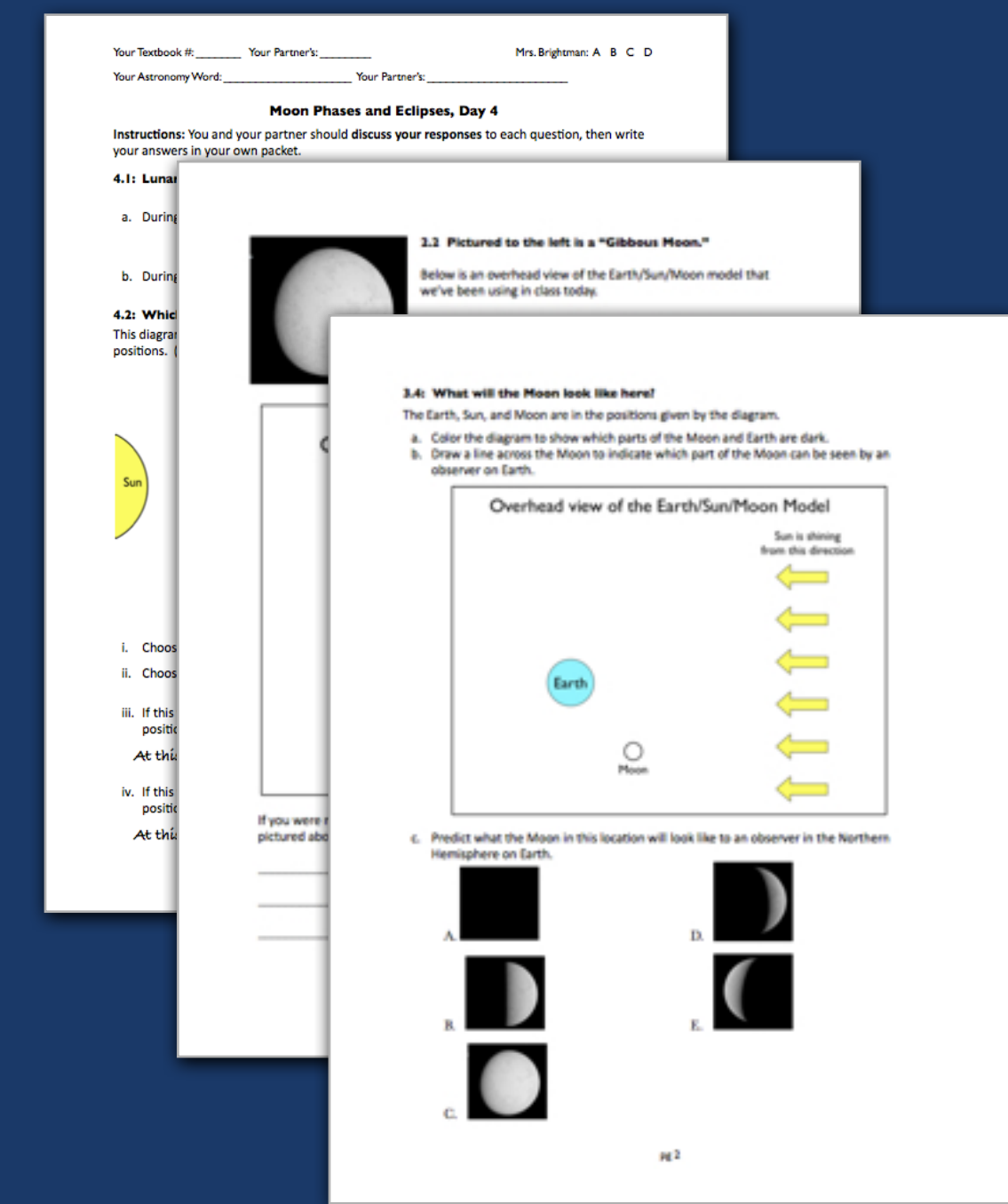
What?

To address this need, our group developed and tested a "WWT Visualization Lab" or WWT VizLab, to help students understand what causes the Moon's phases and eclipses. The lab uses a combination of computer simulations and a styrofoam ball/lamp to model the Sun-Earth-Moon system.

The VizLab supports key practices from the Next Generation Science Standards:

- Developing and Using Models
- Constructing Explanations
- Engaging in Argument from Evidence

Detailed Activity Sheets keep students accountable for their learning



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How did the WWT VizLab impact students?

Student Learning

Phase 1, Lexington, MA
Treatment-Control design: half the classes used WWT for the computer simulation, while half the classes used a more traditional 2-dimensional Java simulator*. We used the simulator recommended by the textbook in use by the teachers at the school, and we refer to it as the "textbook simulator," or TS.

Pre/post assessments: 7 distractor-driven multiple choice questions from the Astronomy and Space Science Concept Inventory (Sadler et al, 2010).

Results: Students in both Phase 1 groups (WWT and TS) showed strong learning gains (see Table to right), but the WWT group outperformed the TS group. We attribute this to the added richness (interactivity, three dimensional views) offered by the WWT in contrast to the TS. A t-test showed the gain difference between the two groups to be statistically significant, with a probability of the gains for each group being drawn from the same distribution being 3%.

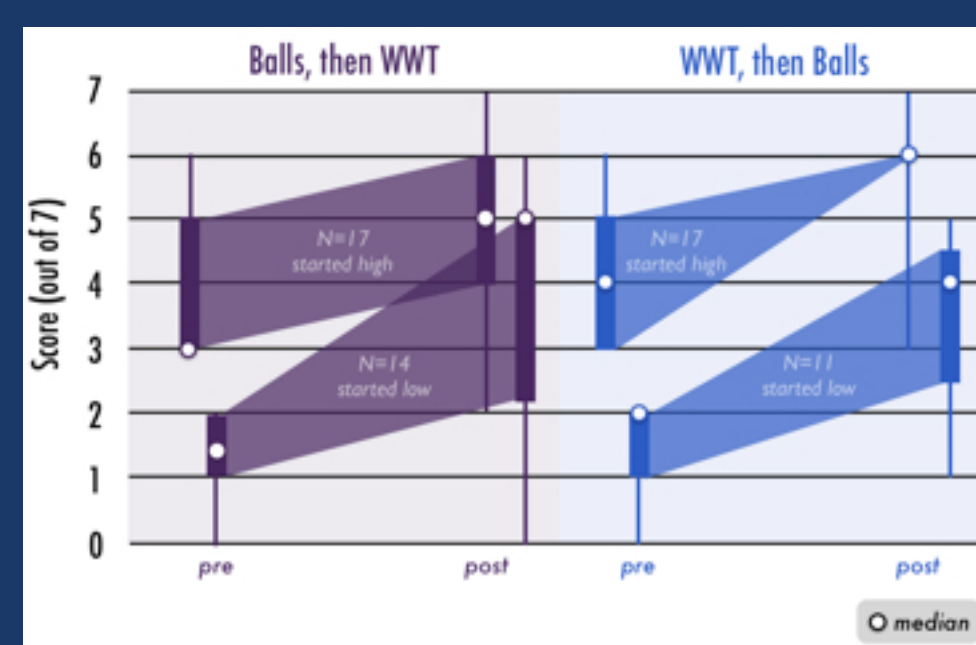
Phase 2, Cambridge, MA

Compared order of activities: WWT, then Styrofoam vs. Styrofoam vs. WWT

Results: The box-and-whisker plot to the right shows the change in pre/post scores. Plotted are the full range (thin lines), inner two quartiles (rectangular boxes), and medians of score distributions. Students with low prior knowledge benefited from using the styrofoam ball model first, while students with high prior knowledge benefited from using WWT first.

*<http://www.astro.wisc.edu/~dolan/java/MoonPhase.html>

(MAX SCORE = 7)	AVERAGE PRETEST SCORE	AVERAGE POSTTEST SCORE	AVERAGE PRE-POST TEST GAIN	EFFECT SIZE
WWT Lexington	2.7 (sd=1.2)	5.1 (sd=1.3)	2.5 (sd=1.3)	2.0
TS Lexington	2.6 (sd=1.2)	4.3 (sd=1.4)	1.7 (sd=1.6)	1.5
WWT Cambridge	2.7 (sd=1.5)	4.4 (sd=1.7)	1.7 (sd=1.5)	1.1



Eighth Grade Students at work in a Cambridge, MA Public Middle School

Student Interest

Phase 1, Lexington, MA

Students who worked with WWT were more engaged and more interested in continuing to use the visualization than those who used the "traditional" simulator. After the post-test was completed, students were given the option to continue exploring "a computer model of our solar system," or to quietly read a book. 95% of the students in the WWT classes chose to continue their explorations in WWT, even after the post-test was given and the unit was complete. The TS students hadn't yet seen WWT, and about 50% of those students at first opted to read a book. The TS students who did choose to explore the computer model were taught how to use WWT for the first time. After observing their peers use WWT for a few minutes, 100% of the book-readers in the TS classes stopped reading and asked to try WWT.

Phase 2, Cambridge, MA

Students reported their level of interest in astronomy on the pretest and posttest. On the pretest, 25% of students reported little or no interest in astronomy. On the posttest, after completing the 3-day WWT Moon unit, **70% of those non-interested students reported a higher level of interest in astronomy.**

Become an Ambassador!



Do you work with schools and science teachers?

Share WWT with them and help them integrate WWT-based lessons into their classrooms.

The Moon Phases VizLab can be downloaded from:

<https://wwtambassadors.org/wwt/WWT-MoonPhasesVizLab>

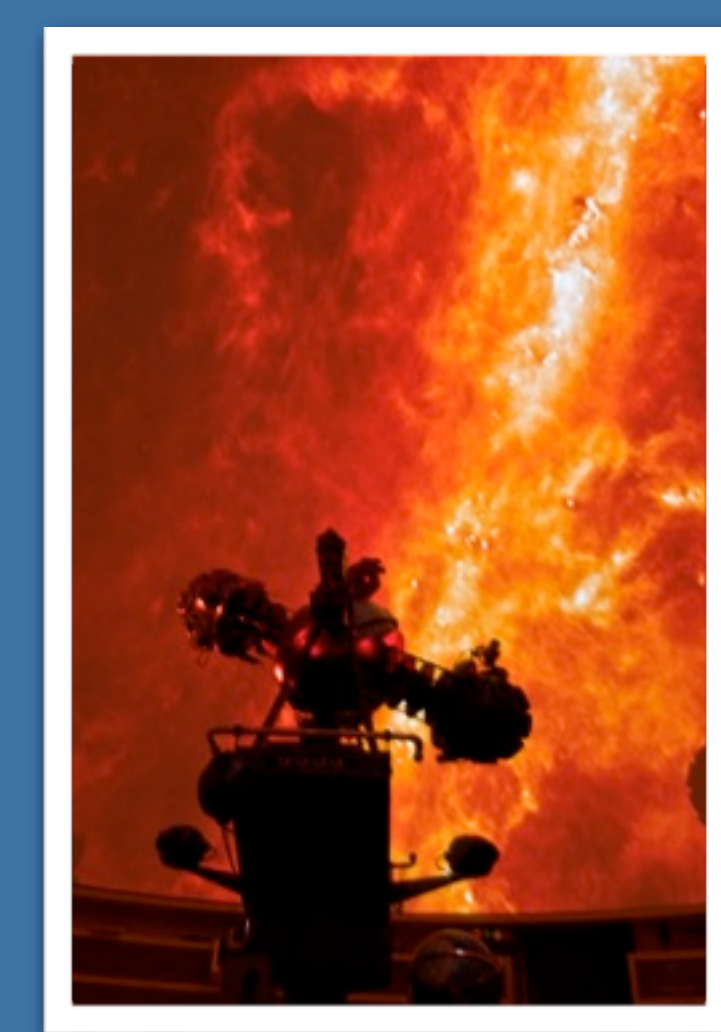


Photo credit, Mary Levin

Are you affiliated with a planetarium?

This image showcases U. Washington's new digital planetarium, powered by WWT, built for ~\$30,000, and featuring a resolution of ~8 million pixels.

Ask us how you can easily author new shows and content using WWT's Tour interface, and share them with WWT users worldwide.



Do you do EPO work for a telescope or space mission?

Create interactive WWT Tours that teach the public about your group's work. Beautiful imagery can be viewed in proper context in WWT - in the right position on the night sky, and in relation to views at other wavelengths.

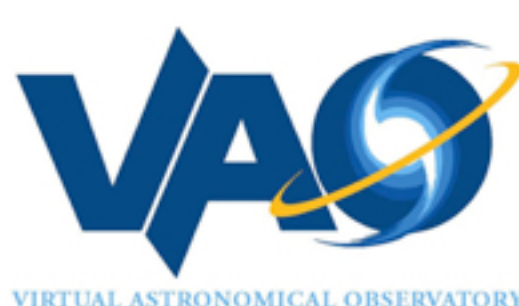
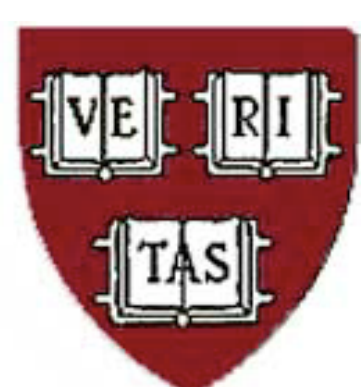
This is a screenshot from a Tour by Nancy Ali, highlighting recent results from the WISE mission. This tour is now directly available to all 9 million+ users of WWT.

Yes! Tell me how.

Please add your name and email address to the sign-up list, or drop a business card in the envelope. You can add a note letting us know about your specific interest in the program.

You can also email Pat Udomprasert at pudompra@cfa.harvard.edu for more information.

If you are in the Boston Area, you can attend a New Ambassador Training Session at the Harvard-Smithsonian Center for Astrophysics. If you are not local to Boston, we can arrange a remote online training session.



wwtambassadors.org

