The equinox

During northern hemisphere fall, for the past two years, I have worked with students around the world on the Sun Shadow Investigation Project (SunShIP, *sunship.currentsky.com*). The goals of the online project are to collect mid-day pictures of shadows from various latitude locations, and to also allow students to share information with other participants about the altitude of the midday Sun on an equinox to calculate the polar circumference of the Earth. The third goal of the project is a high-tech reenactment of the famous calculation made by Eratosthenes. With the vernal, or March, equinox at hand, now is a perfect time to conduct your own Eratosthenes project. Visit the SunShIP website for more information about calculating the Earth's circumference and where to send shadow pictures.

The equinox also provides you with an opportunity to do some myth-busting with your students by exploring the popular notion that a raw egg will only balance on its end on the equinox.

Before the day of the spring equinox, ask students what they know about the equinox or the first day of spring. If they do not mention the myth about the egg, bring it up and ask how many of them have ever heard it. Explain the astronomy—Earth and Sun positions—that cause the equinox and then ask them to brainstorm reasons why people might think it is only possible to balance an egg on its end only on this day. Speculation will likely center around the possibility that gravity is somehow involved…that it "balances" when the Sun is over the Earth's equator at the equinox.

Challenge students to take on the part of the stars of the TV show *Myth Busters*. Like the two stars of the show, they have to carefully plan how they can prove or disprove the myth. Have them first work in small groups to determine what factors/conditions must be considered and controlled in proving if this myth is true or not. Share the results, compile a list, and devise a class plan.

Carry out the plan on the equinox and the days following. Students can research the structure of the egg and suggest how it is involved in the balancing. Ask them to write a summary of their findings that could serve as a concluding segment of the show. It should include how the structure of the egg is involved in the balancing, where the myth or legend originated, and how their findings do or do not support it.

The Colegio Menor San Francisco de Quito, in Quito, Ecuador, one of the SunShIP participants, is located just a few minutes of a degree from the equator. Consequently, the Sun is directly overhead at that location at midday during the fall and spring equinoxes. Last fall, we decided to take advantage of their fortuitous geographical location by investigating the egg-balancing claim. Oddly enough, the students were unfamiliar with this scientific urban legend, but they were eager to discover if it had any scientific basis. The students decided that

- groups should test their eggs at the same moment on the equinox,
- further trials using the same egg should be conducted at noon or midday on days either before or after the equinox,
- different surfaces should be used, and
- both raw and hardboiled eggs should be tested.

Observations

After several hundred attempts throughout the equinox day, there were a total of 13 eggs that balanced. In analyzing how this happened, we realized a few things that greatly determine whether an egg will balance or not. Eggs that are used repeatedly will develop cracks and or flatten on the ends. Once this happens the egg balances quite easily. Eggs that are placed on a rough-textured surface, such as the asphalt playground, generally balance better than eggs placed on a smooth surface, such as marble steps. Spinning hard-boiled eggs will balance as long as they are spinning.

FIGURE 1

An egg is balancing on the equinox at the equator—can it balance on any other day as well? See Resources for a link to the answer

PHOTO COURTESY OF THE AUTHOR

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Raw eggs are more difficult to start spinning but, interestingly, if stopped, they will start spinning again because the fluid inside is still in motion. Balancing an egg has nothing to do with the equinox—with patience you can make an egg stand on its end on any day of the year.

Moon phases

Moon phases	March
First quarter	3/6
Full Moon	3/14
Last quarter	3/22
New Moon	3/29

Visible planets

- **Venus** will be visible over the southeast horizon at sunrise.
- **Mars** will be over the southwestern horizon at sunset and will set several hours later.
- **Jupiter** will rise several hours after sunset and will be visible the rest of the night.
- **Saturn** will be high over the southeastern horizon at sunset and will set after midnight.

Celestial events

3/14	Penumbral lunar eclipse
3/20	March equinox (1826 UT, 1326 EST)
3/29	Total solar eclipse

Resources

Balancing an egg—*currentsky.com/articles/eggquinox/balance.html*
Colegio Menor San Francisco de Quito—*www.cmsfq.edu.ec*
SFA star charts—*observe.phy.sfasu.edu*
Sun Shadow Investigation Project—*sunship.currentsky.com*
The Eggquinox—*currentsky.com/articles/eggquinox/index.html*

Questions for students

1. What is your local latitude?
2. What is the direct distance (a straight line) from your location to the equator?
3. What is the altitude of the midday Sun at your latitude on the day of the equinox?
4. What is the altitude of the midday Sun at the equator on the day of the equinox?
5. Using this formula, determine the polar circumference of the Earth. (Earth's circumference = distance in kilometers from the equator times 360 degrees, divided by the angle difference in the Sun's altitude.)

Tracking the planets

Throughout the school year, data will be provided through this column for students to track the annual motion of the planets by plotting their position on either graph paper or a star chart using celestial coordinates. (See Resources for a free star chart source.)

Planet	3/5	3/19	3/26
Mercury			
Right ascension	$23^h42^m08^s$	$23^h02^m21^s$	$22^h57^m04^s$
Declination	1°39′32″	–3°35′55″	–6°02′19″
Distance	0.71214	0.62315	0.68606
Venus			
Right ascension	$20^h03^m56^s$	$20^h54^m39^s$	$21^h22^m19^s$
Declination	–16°10′08″	–14°50′37″	–13°36′43″
Distance	0.52266	0.63004	0.68475
Mars			
Right ascension	$4^h22^m31^s$	$4^h55^m18^s$	$5^h12^m18^s$
Declination	23°21′42″	24°22′13″	24°43′24″
Distance	1.38081	1.51931	1.58746
Jupiter			
Right ascension	$15^h07^m09^s$	$15^h05^m56^s$	$15^h04^m26^s$
Declination	–16°14′01″	–16°06′44″	–15°59′34″
Distance	4.92952	4.73713	4.65357
Saturn			
Right ascension	$8^h31^m48^s$	$8^h29^m19^s$	$8^h28^m35^s$
Declination	19°38′03″	19°47′23″	19°50′09″
Distance	8.32280	8.49084	8.58861
Uranus			
Right ascension	$22^h50^m43^s$	$22^h53^m40^s$	$22^h55^m06^s$
Declination	–8°09′09″	–7°51′07″	–7°42′25″
Distance	21.06851	21.03138	20.99304
Neptune			
Right ascension	$21^h23^m06^s$	$21^h24^m56^s$	$21^h25^m45^s$
Declination	–15°30′45″	–15°22′20″	–15°18′32″
Distance	30.94515	30.81798	30.73765
Pluto			
Right ascension	$17^h45^m56^s$	$17^h46^m30^s$	$17^h46^m37^s$
Declination	–15°51′48″	–15°49′55″	–15°48′54″
Distance	31.27578	31.04538	30.92986