Exploring the Solar System with a Human Orrery

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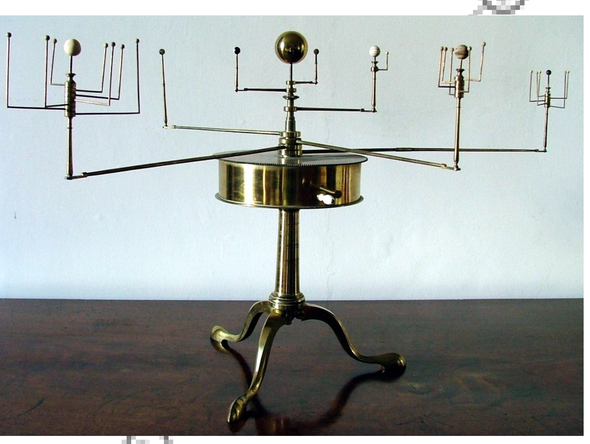
It's not what the instructor does that matters; rather it's what the students do.
Conceptual Astronomy and Physics Education Research (CAPER) Team

Astronomy and physics education research shows, again and again, that interactive instruction increases student learning. ASTR 310 (*Exploring the Solar System*) is a survey course in astronomy offered to 250–300 non-Science undergraduates each Term. Students attend three 1-hour lectures each week and, in smaller groups of 40, participate in a 50-minute, hands-on tutorial every 2nd week. We designed an interactive, engaging tutorial activity in which the students build and explore a working, scale model of the Solar System.

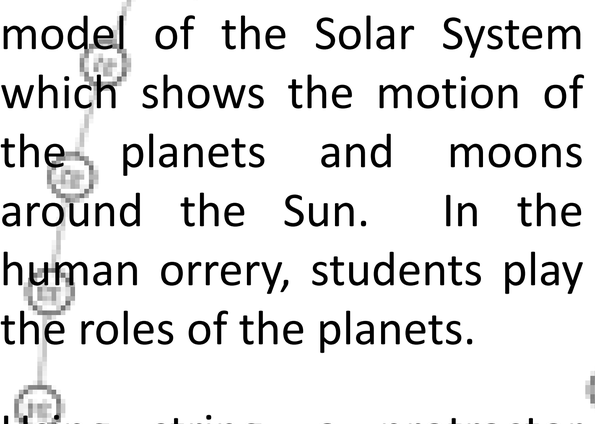
To support the "learning commons" mission of the Irving K. Barber Learning Centre and to celebrate the 2009 International Year of Astronomy, the activity was held in the IKBLC Foyer. Nearly 150 "passers-by" stopped to watch and ask questions about the activity and astronomy.

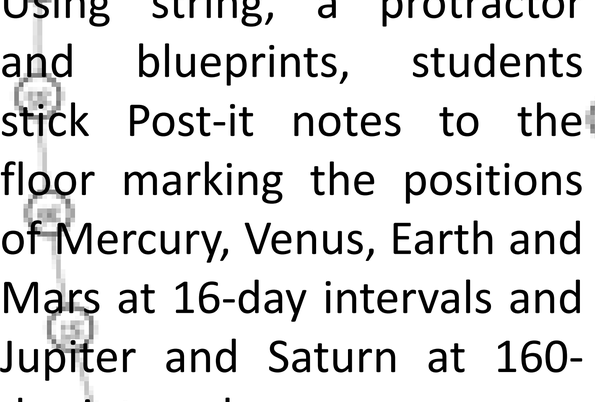
Part 1: Construction



An orrery is a mechanical model of the Solar System which shows the motion of the planets and moons around the Sun. In the human orrery, students play the roles of the planets.

Using string, a protractor and blueprints, students stick Post-it notes to the floor marking the positions of Mercury, Venus, Earth and Mars at 16-day intervals and Jupiter and Saturn at 160-day intervals.





Part 2: Planets in Motion

Once complete, volunteers play the roles of the planets and take their places in the model.

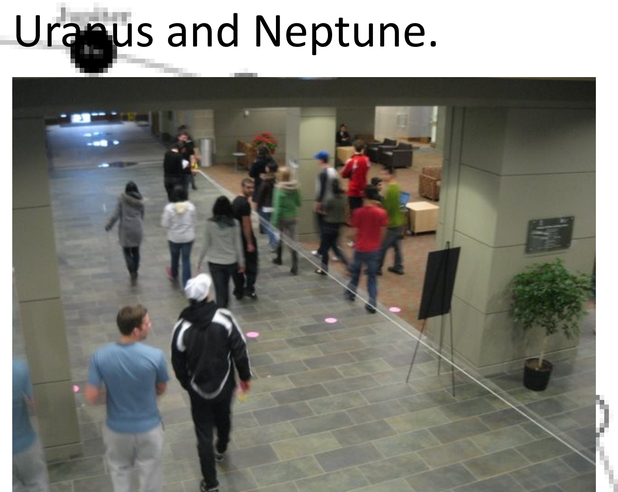
The rest of the class watches from the asteroid belt.

The Teaching Assistant starts counting out loud: "One! Two! Three!...." The inner planets step from marker to marker along their orbits. Jupiter and Saturn shift on every 10th count.

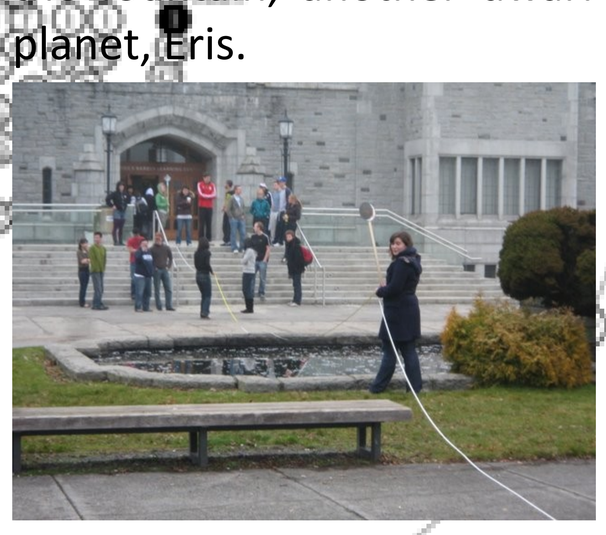
Because the markers are spaced at equal intervals of time, the speeds of the orbiting students correctly mimic the speeds of the planets – both distance and motion are properly scaled in the human orrery.

Part 3: Beyond Saturn

There's a lot more Solar System beyond Saturn. As they unwind a 100-metre tape, students travel past Uranus and Neptune.



Just outside the doors of the IKBLC, we find Pluto. Next to the fountain, another dwarf planet, Eris.



One hundred metres from the Sun and halfway to the Koerner Library, the Voyager spacecraft is the most distant man-made object.

Part 4: Exploration

Back in the inner Solar System, students answer a series of questions which require them to explore, measure and discover the Solar System for themselves.

Question: How many times farther from Earth is Mars when the two planets are on opposite sides of the Sun compared to when they line up on the same side?

Question: Proximity Centauri, the nearest star to our Solar System, is 267 800 AU away (An astronomical unit, AU, is the Earth–Sun distance.) If we want to include it in our model where 1 AU = 1 metre, where would we put it: bus loop? downtown Vancouver? Kelowna? Toronto?

To see the human orrery in action, search for "human orrery" on YouTube.