A screaming roller coaster

How fast am I travelling (due to Earth's spin and Earth's orbit)?

Ask the pupils in your class what they do as they head down the steepest slope of a roller coaster; do they wave their hands in the air or grip the handrail with white knuckles?

Tell them that we are going to act out a roller-coaster ride together, but that this roller coaster is ten times faster than any that they have ever seen – and they need to face East as well.

Ask them all to face East, then to hold on tightly (to the furniture or to the person in front of them, if they like), or wave their hands in the air – and feel free to scream if they want to.

Then say:
'We're going up, up, slowly up - we're getting to the top, what a view - now we're starting down and aaaaaaaaaaaaaaaaaaaaaaaagh!'

After the class roller-coaster experience, ask your pupils 'Why were we acting like this?'

The answer is that you are all travelling very fast towards the East - due to the spin of the Earth. If you are on the Equator you are travelling at 1,674.4 km/h. To calculate how fast you're travelling at your latitude, multiply 1,674.4 km/h by the cosine of your latitude – for example, the speed in London is:
1,674.4 x cos 51.5 = 1,042 km/h (647 miles per hour)

Add that, of course, you're travelling even faster than this because of the Earth's orbit around the Sun – Earth orbits at a speed of about 108,000 km/h (more than 67,000 miles per hour) – quite enough to take your breath away!

The back up

Title: A screaming roller coaster

Subtitle: How fast am I travelling (due to Earth's spin and Earth's orbit)?

Topic: An introduction to the speed of the spinning and orbiting Earth.

Age range of pupils: 8-88 years

Time needed to complete activity: 3 mins

Pupil learning outcomes: Pupils can:
- give an idea of the speed of the spinning and orbiting Earth;
- explain that the Earth is, in universal terms, a very mobile body.

Context:
This activity can be used to introduce the Earth's spin, leading on to learning about day and night caused by the day-long rotation (24 hours). It can then lead on to the Earth's orbit, and an introduction to the seasons, caused by the year-long orbiting of the Sun by the Earth on its tilted rotational axis (23.5^{o} to the vertical).

Following up the activity:
Ask pupils how fast they would be moving due to Earth's spin if they were at the North or South poles (*they would not be moving at all – but just spinning slowly (once every 24 hours) on the spot).*

Underlying principles:
- The Earth has a 24 hour rotation at a speed of 1,674.4 km/h at the Equator.
- Meanwhile, the Earth is orbiting the Sun at around 108,000 km/h.

Thinking skill development:
Visualising the spin/orbiting of the Earth requires abstract thinking skills.

Resource list:
- a compass (to find East)

Useful links:
You can find animations of the Earth's movement by typing 'spinning Earth animation' or 'orbiting Earth animation' into a search engine like Google™. See the 'Earth on Earth' Earthlearningidea, using a globe in the sunshine to teach day and night.

Source: Chris King, Earthlearningidea Team.

Earthlearningidea	Strategies and skills developed
A screaming roller coaster: how fast am I travelling (due to Earth's spin and Earth's orbit)?	A quick 'starter' to remind pupils that the 'stable' Earth on which they live is in fact spinning in space (while orbiting the Sun).
Hot or not? Investigating how latitude affects the amount of solar radiation received	An activity to help pupils to visualise why solar radiation is more intense in equatorial regions than polar ones, involving abstract thinking to relate the activity to the Earth, together with construction and metacognition skills.
The seasons: an indoor demonstration of the seasons	An indoor activity to enable pupils to understand how the tilt of the Earth affects the seasons throughout the year, involving skills of construction and bridging to the real situation.
Earth on Earth: using a globe in the sunshine to show how day/night and the seasons work	A model Earth in the real sunlight brings the abstract nature of day/night and the seasons into a more concrete understanding, allowing the development of three dimensional skills and the use of construction, metacognition and bridging skills.