

Module 21: Comprehension Instruction

As Time Flies By

Numerous films and science-fiction novels have used time travel to send their characters to the past and the future. The technology to make time travel possible, of course, does not exist. But even if the technology needed to travel through the ages did exist, how would it actually work?

That question may not have a simple answer at the moment, but it does raise a lot interesting points regarding what it means to “travel through time.” For a regular student, one piece of this challenge that is easier to think about is not time at all—it’s space.

In 2009, a blogger and scientist who goes by the username “Shechner” wrote a detailed examination of time travel in the film *Back to the Future*. The hero of that story, Marty McFly, travels from the year 1985 to 1955 by driving a car that has a time travel device built into it.

During an experiment at the Twin Pines Mall in Hill Valley, California, Marty videotapes the car as it accelerates to 88 miles per hour. Then it disappears in a burst of smoke and flames. One minute later, the car reappears precisely where it disappeared. It has travelled exactly one minute into the future.

The interesting thing that Shechner questioned when dissecting this moment is not whether it’s possible for an automobile to travel one minute into the future or 30 years into the past. His question is about where the vehicle will end up: if you do travel through time, how can you be sure you’ll end up in the exact same place that you left?

Module 21: Comprehension Instruction

Minutes in Motion

Astronomers have spent centuries charting the stars and tracking the movements of planets across space and time. Hundreds of years of research and observations have given our civilization the very idea of time, in the form of days and years.

A single day on Earth can be broken into daytime and night-time. The passing of day and night is caused by the rotation of the planet. Every 24 hours, the earth makes one complete rotation on its axis. During this rotation, the parts of the earth that face toward the sun are in daytime. The parts of the earth facing away from the sun are in night-time.

Just as the earth is rotating on its axis it's also traveling through space. Our planet, along with all the other planets in our solar system, makes an orbit around the sun. The amount of time it takes for the earth to make one complete orbit is about 365 days. The way we measure years is based on how long it takes our planet to make it all the way around the sun.

While it's common to think that time is continuously moving forward, it's also possible to think time is the result of Earth's planetary motions. In this way, time is about tracking the position of the earth in space.

Module 21: Comprehension Instruction

Back to the Future of Clung into Space?

Drawing on this knowledge about space and time, consider the case of Marty McFly.

In the film *Back to the Future*, Marty watches the time machine travel one minute into the future and appear in the exact same spot. Taking into account the movements of the earth, this seems impossible. If the planet is always rotating on its axis and at the same time always circling the sun, then the Twin Pines Mall parking lot wouldn't be in the same place it was just one minute earlier.

Just how far does the earth move in a single minute? According to Shechner's calculations, it moves precisely 1,123.17 miles. This number measures the speed of Earth's orbit around the sun as well as the speed of the Earth's rotations on its axis. It may not seem like it, but every human being on Earth travels over 1,000 miles per minute through space, just by being on the planet. The only thing that stops us from flying off into the atmosphere is gravity.

If a time-traveling car cruises one minute into the future, then it could reappear a thousand miles away on another place on the earth's surface, a thousand miles away from the earth in space, or a thousand miles deep into the earth's crust. It's very unlikely, however, that the car would be fast enough to catch up with the movements of the planet to end up in the exact place where it disappeared.

This puzzle isn't enough to ruin *Back to the Future*, which is considered by some to be a classic of blockbuster films. And if time travel technology is invented someday, the scientists may rely on a theory of time that doesn't depend on our current understanding of space.

In the meantime, though, all of us on planet Earth will keep moving with Earth, experiencing the passing minutes and changing seasons.