Measuring Footprints

Students learn how to calculate their carbon impact.

\\ BY DAVID CASEY

LESSON PLAN

DESPITE ALL THE recent media attention given to global warming, a significant number of people either don't believe the threat or refuse to change their behavior to reduce their overall energy consumption. While the idea of a carbon footprint has lodged itself in the public consciousness, many people still aren't sure exactly how to compute the impact their actions have on the planet's resources.

LESSON DESCRIPTION: Students will learn how their choices for transportation, recycling and energy usage impact the carrying capacity of the planet and the subsequent connection to global warming.

An eco-footprint, also known as a carbon footprint, is the amount of acreage necessary to sustain the food and energy needs of an individual. There are many Web sites that calculate this acreage and then show how much land would be needed if everyone lived in the same manner. It can be a real shock for some students when they see that if everyone on the planet lived the way they do, it would require four or five planets' worth of acreage to sustain.

Students take 10 minutes to answer the 16 questions about housing, car and plane travel, and food choices on *www.earthday.net/footprint*. The result: The number of acres required for the choices is calculated, as is the number of planets needed. Now students can analyze their statistics, comparing their individual results with the class average. They then input the individual values for the number of acres into a spreadsheet or graphing calculator. Once done, they can enter the function for average or complete the "one variable statistics" if using a TI 83-84 graphing calculator. If you are working on a computer spreadsheet program, such as Excel, you'll have to go to separate functions to determine these values. Ideally, the students should produce a box plot or a histogram for the distribution of number of acres needed.

TEACHING TIPS

✔ Before starting the lesson in class, have the students do the following:

- calculate the area of their home in square feet;
- determine a major city with weather similar to theirs;
- figure out how many miles per week they travel by car, bike and on foot;
- find out how many miles per gallon their parents' car gets.

✔ For homework, have students retake the "quiz" by changing the one answer they think has the greatest impact and observing their resulting footprint.

SUBJECT AREA: This is primarily a math lesson (with applications to science) designed for students from grades six through 12. The wide spread of grades can be addressed through varying degrees of statistical analysis, from a simple histogram to box plots, standard deviation and correlation.

CURRICULUM STANDARDS: This lesson meets the California mathematics standards in the area of statistics for grades six through eight but can be taught through grade 12.

Grade 6: Identify different ways of selecting a sample; analyze data displays; identify claims based on statistical data.

Grade 7: Understand the meaning of the minimum, the lower quartile, the median, the upper quartile and the maximum.

Probability and Statistics: Students know the definitions of the mean, median and mode of a distribution of data and can compute each in particular situations.

RESOURCES: For online statistical analysis, visit *www.shodor.org/interactivate/activities*, click the Statistics tab, and select Box Plot, Bar Graph or Measures (to view the mean, median, variance and standard deviation). Use of a TI 83-84 graphing calculator is optional.

GRADING RUBRIC: This activity can be a method to introduce a statistics unit on mean, median and box plots. It can be graded as a single assignment or as part of a larger set of assignments on statistical analysis or environmental awareness.

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SABINE SCHECKEL/PUNCHSTOCK

LESSON PLAN

Frame by Frame

Show your students how to create animated drawings using Flash.

\\ BY KEVIN DRISCOLL

ANIMATION IS AN excellent extension to an investigation of digital-image editing. This introductory lesson demonstrates the origins of animation in a pre-digital era and carries these core principles to the personal computer. Students will also be able to integrate this work into ongoing, Web-based projects as animated GIFs and Flash movies.

LESSON DESCRIPTION: Class begins with a simple prompt: "Use the brush tool to draw a face." The teacher will circulate to assist with any technical issues. The teacher describes frame-by-frame animation while a video of Glen Keane, the lead character animator at Walt Disney Studios, plays silently. The class considers the tracing paper and charcoal pencil. How do they compare with other drawing tools?

The teacher next demonstrates the same frame-by-frame technique using "onion-skinning," or semi-transparent layering, in animation software. Students are then prompted to think about the opposite expression to the one their face is currently making (for example, bored/excited), and they begin to draw more frames. Students experiment with cut, copy and paste as well as simply drawing.

While students are working, the teacher passes out printed flip books. What happens if the reader flips faster or slower? How many pages does it take to produce believable motion? The teacher should demonstrate how to change the animation's frame rate.

SUBJECT AREA: This lesson can be adapted to art, media and computer applications courses for middle school and high school students. An ideal setting is a computer lab in which each student has her own computer and can see the teacher's desktop on a projector. The examples in this lesson use a Flash platform for creating animations, but the work can be adapted to any multilayered, digital-image editing software.

TEACHING TIPS

✔ It is helpful to start up the software in advance of class, with a new empty project opened and the desired drawing tool selected.

✔ Keep a simple text editor (such as Notepad) open on the teacher's desktop. Use it to display instructions and record interesting student comments or questions. This can be an invaluable log of the day's work.

✔ Play the Keane video without sound and narrate it live for the needs of the particular class. Art students will need different direction than computer-science students.

✔ Pair students or provide mirrors so they can observe the changes that faces make between expressions.

✔ Limit students to using one drawing tool, one foreground and one background color to help focus everyone on creating high-quality animation.

CURRICULUM STANDARDS: This lesson addresses the following areas of the National Educational Technology Standards for Students:

Creativity and Innovation

- Students apply existing knowledge to generate new ideas, products or processes
- Students create original works as a means of personal or group expression

Technology Operations and Concepts

- Students select and use applications effectively and productively
- Students transfer current knowledge to learning of new technologies

RESOURCES:

- Over-the-shoulder view of Glen Keane sketching frame-by-frame: *youtube.com/watch?v=JA7Naf0RF4M*
- Stunning flip-book collection: *www.visionaireworld.com/issues.php?id=39*
- Free image-editing software: *gimp.org*
- Detailed instructions and sample Flash projects for use with this lesson: *www.curriki.org/xwiki/bin/view/Coll_driscoll/Day1of8?bc=Coll_driscoll.IntroductiontoAnimationwithFlash*

GRADING RUBRIC: This is a project to introduce a unit and should be counted among a larger portfolio of work. Students should be required to exhibit a selection of their work publicly.

KEVIN DRISCOLL *is co-founder of Developing Curriculum, a nonprofit dedicated to developing high-quality free/open learning materials. He is currently a graduate student in Comparative Media Studies at MIT and a former computer science and mathematics teacher at Prospect Hill Academy Charter School in Cambridge, Mass.*

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