Guess My Birthday: Demonstrating the Significance of Significant Figures

On the first day of my course on material and energy balances, we briefly discuss significant figures. At this point in the curriculum, students understand how to determine the correct number of significant figures in calculated values. However, they do not have a tangible understanding of the relationship between significant figures and precision in measurement, and often report calculated values with greater precision than justified. The following 10-minute exercise does not focus on the rules of rounding significant figures, but rather shows how reporting too many significant figures falsely conveys the degree of precision of a measurement. It's also a fun way to engage students actively in the classroom early in the semester.

I tell the class that I am 40 years old and ask them to determine my birthday. After getting several quizzical looks and a couple of clever remarks, I point out that we generally truncate our ages rather than rounding, and tell them that I am really 40.9 years old. Smiles recognizing an approaching birthday appear, and some students venture to predict, correctly, that my birthday is in September. But that's as precise as they can get without an outright guess.

When I tell them instead that I am 40.92 years old, some of them get the idea and pull out their calculators and calendars. After talking with classmates, they guess again, and they are close, but still a few days off. And now they're eager for the next digit.

So I tell them that I am 40.923 years old. Buttons click, voices hum, they "guess," and they are right!

Now comes discussion time. These questions can be posed and discussed in pairs or groups:

- We were working with a measurement. What was the device used for measurement?
- What is the precision of a calendar? That is, how closely does a calendar measure time?
- Can a calendar alone be more precise than the nearest day?
- With three decimal places, the correct day was determined. What would be implied if I gave more than three decimal places?

The fact that they can always correctly predict a birthday with three decimal places results from the fraction 1/365, which equals 0.00274… . If I gave another digit, it would not change their determination of my birthday, but it would misleadingly report the time of day I was born. That's the important point of the exercise, as students tend to give answers with too many significant figures. The value I gave them told the nearest day, and any more digits would represent an unwarranted precision. We discuss how this is analogous to reporting too many digits in calculations involving process variables.

There are a couple of caveats to implementing this exercise.

Due to rounding and occasional terminal zeroes, students sometimes get the correct answer with two decimal places, or, though rarely, with one. Try it yourself, and if that is the case, wait a class period to do the exercise. If you used a 366-day leap year in your calculations, remind them of that as they do their calculations. If your birthday is February 29 and it's not a leap year, you'll have to choose another day. And then when you tell them leap day is your real birthday, chances are they will not forget it! So far, they haven't remembered mine.

—Christy Wheeler West, University of South Alabama

This one-page column presents practical practical teaching, advising, and diversity tips in sufficient detail that others can adopt the tip. Focus on the teaching method, not content. The column should be maximum 550 words, but subtract 50 words for each figure or table. Submit as a Word file to Phil Wankat <wankat@ecn.purdue.edu>.