DESIGNING EXPERIMENTS IS NO SMALL POTATOES

written by: Lucas Landherr  
drawn by: Mary Visco

And while the formal strategy employed in a Design of Experiments is certainly important, it isn’t the first step. The first step is a student’s transition from pre-planned experiments with given instructions to developing the plan themselves.

Before students learn how to run a piece of chemical engineering equipment to solve a problem, shouldn’t they first learn how to design an experiment to solve a problem?

Can students even think up an experiment to conduct? And how do we best help them learn how to do that?

I’m sure you have different approaches you can think of or envision using with your students – there’s a lot of great options!

But my absolute favorite – that I’ve done a ton of times with students – is cooking potatoes.

In our lab course, I would have a station set up with boiling water, a cutting board and a knife, and a pile of potatoes. And I would give them a simple starting instruction and question:

“You’ve got 15 minutes to come up with an experiment that you could run on cooking potatoes. What can you study?”
I offer one starting hint — “toss a potato in the water, and let it cook for about a minute. Pull it out before it’s done.” When cut in half, there’s a ‘cooked’ line...

the potato only boiled so far, with a different colored uncooked center.

Time?

Area?

Now they’ve got a quantifiable output metric they can measure. And they can start considering the parameters they can change, like cooking time or surface area!

So what is your goal?

“Best?”

Cook it best!

Okay, fastest!

We can try different temperatures!

Maybe pH!

And you can reinforce the idea of reproducibility. Potatoes aren’t identical — so how can you compare results? Someone inevitably suggests carving identical spherical potatoes — somehow — but eventually they’ll realize they can cut potatoes into cubes, and, ta da! Reproducible.

“Here’s a bunch of different fluids, can you develop a viscosity experiment?”

“Here’s a hot plate and different materials, can you study cooling?”

Either way, it’s that critical transition into developing their own experiments so you can then start teaching them how to quantifiably study different parameters of interest for greatest insight.

There’s a bunch of other examples you can do, too.

Students will do tons of experiments in their careers. Start them off with something somewhat ridiculous, so it’s more approachable and they can figure out what an experiment even is before they get to the hard stuff!

THE END!