Alright let's finish up Unit A here, or Lesson A, pardon me, with Example three. So we want to assess the effectiveness of a new method for teaching arithmetic to elementary school children. We take a sample of 30 first graders and we teach them using this new method. And then we take another sample of 30 first graders and we teach them using the currently used methods. At the end of eight weeks the children are given a test to assess their knowledge. And we want to specify the explanatory variable and the response variable. And then we want to determine what type of study. Is this an experiment or is it an observational study?

So, the first thing we want to look at is-well let's actually look at the response variable, first. I actually think it's sometimes easier to note the response variable first because you can think about, what are we measuring? Now in that case we would assess their knowledge. So maybe we could think of this as the knowledge assessment. So it could be a test or it could be a quiz or something along those lines. Now what we want to do is we want to think about what would the explanatory variable be? [Can't spell apparently, explanatory.] variable. So what is that going to be? So what are we trying to use to explain changes-explain differences in the knowledge assessment score for these first graders, while we're looking at the method by which we are teaching arithmetic. So I could just maybe say that this is the teaching method. So we're using teaching method to explain differences we see in the response variable.

The question that we have here is, is this an experiment or an observational study? Well that case, we would think that, we would consider this to be an experiment. Why is it an an experiment? Well one of the features of an experiment is how these treatments, how the explanatory variable, is applied to the individuals. In this case the individuals are the first graders I guess we could call them subjects, or experimental units. Feels a little dehumanizing to say experimental units but I guess that's the general term. But this is an experiment. So why is this an experiment? The reason that this is an experiment is because we assign the students to the teaching method So we're assigning them to this. We're saying you 30 first graders go here. You 30 first graders go over here and you are going to get one of two that different teaching methods. So because we're actively assigning them to the different treatments we would consider this experiment. Alright, very good.

So let's look at one more example. We have a study that is performed to determine how smoking affects people's health. So in the study people cannot be assigned to smoke. We'll talk about that here in a moment. Instead, people choose for themselves whether or not to smoke and scientists observed differences in health outcomes between the groups of smokers and non-smokers. So let's go back through the process here of which is the explanatory and the response and then we'll deal with the type of study. So again I think it's easiest, in my mind anyway, to think about the response variable first. So response variable, what are we actually measuring here? Oh, we're measuring health outcomes, And we're being a little bit, perhaps, ambiguous here, but that's okay for a moment. So it could look at incidents of lung cancer or incidents of gum disease or something along those lines. So what would my explanatory variable be? So my explanatory variable, that is going to be the smoking and non-smoking status. So I'm just going to say it's smoking status. So is somebody smoking or are they not smoking. And we're going to use that to explain differences in health outcomes.

Now there are other things that could kind of interact there. So we'll kind of talk about that here in a moment. But before we do that, would we consider this to be an experiments or would we consider it to be an observational study? Well they're is a key term here. And that is that we can't assign people to smoke or not. So I'm not actually assigning people to the different treatments of smoking and non-smoking. So as a result this is actually a observational study. And again, the reason for that is because we're not assigning the treatments to the subjects in this case. We're just observing when we would see people who are smoking and non-smoking and then from there we measure their health outcomes.

Okay so one thing to finish up on here is when we we talked about randomizing. I said we randomly assign to different groups and so on. So in an ideal world the groups, the groups that get the different treatments, would not really differ from each other in any way except for how they receive the treatments, which treatment they get. So from there we could say well if we see a difference between the groups, then that has to be a result of the difference in treatment. But in the real world, this is not the case. It's actually not reasonable to construct treatment groups that are exactly alike. So we can have things that are sometimes called lurking variables. Things that we might not take into account. And that makes it a little harder. So for example, let's go back to smoking and non-smoking. We might see something where we have different ages that would kind of go into the various groups. That's something that I really can't control. But that's one of the difficulties with an observational study.

But let's go back to example three where we actually have an experiment. So we're looking at the students. So we might have students, we'll have two groups, we'll have the, the new method of teaching. And then we'll have the current method. If I didn't randomly assign the 30 students, well the total of 60, 30 to each method, what I might do is I might, just. I don't want to say on purpose or intentionally. But I might assign students to the new method that are just stronger students. So I might just say, oh let me put my stronger students into the new method classroom. And then maybe I'll put the weaker students into the current method. So what is the problem with that. Well if I'm trying to sell a new teaching method, I might not... I might say there's no problem at all. Let's keep going.

But the problem with that is that if I look at the case where I put all the stronger students in the new method and the weaker students and the current teaching method for arithmetic, I might bolster the effect- that the difference between these two different treat, treatment methods, these two different teaching methods. If I randomly assign than ideally I would get a mix over here and I would get a mix over here. And so I wouldn't have the issue of what's going to be called biasing my results. So what I would like to do is randomly assign between the two groups. And then what that will do is that will kind of eliminate a situation like this where I split in the kind of systematic way as opposed to a random way. And when I do this then I can start thinking about differences and outcomes that are significantly large and say oh this is due to the difference in treatments and not due to any kind of what is called a lurking variable. So something I don't measure, like the strength of the students or maybe a student's accessibility to food at home. So if they if they have more, or higher, level of accessibility to food they're less hungry and so they pay attention in class better. Whereas maybe students don't have access to food on a regular basis or on a consistent basis, we could have a case where they're hungry so they're not paying attention. And so they do do more poorly and school. And so those are things we want to avoid.

Okay that wraps up Unit A or Lesson A, pardon me. I'm going to try and switch my terminology. I keep thinking in terms of units not lessons. We will pick up with unit B next.