Module 5B: Pre and Post Testing for Student Learning

by Dr. Tim Brophy

Hello, my name is Tim Brophy. And welcome back to Passport to Great Teaching. This is Module 5b, and in this module, we're going to focus on pre and post-testing for student learning. We know that when pre and post-testing is done well, it can yield some valuable data for teacher use. And the process starts when you administer a test of either the knowledge or skills that you expect students to know. But you do this at the beginning of your sequence of instruction. You continue this process by administering the same test at the end of the sequence of instruction. And then the process ends with an analysis of the difference between the student's test scores or performance between these two points in time.

So a primary reason for pre and post-testing is really the determination of student growth in the content or skill area that you're interested in. So we define growth as simply the difference in student performance between two points in time. So, therefore, the pre and post-test service those two points. Now the degree to which we can measure growth really depends on a lot of things, such as the number of days and minutes of instruction that you have. And also the quality of instruction between those two points in time. So if you see students two or three times a week, it's going to be different than if you saw them five times a week. So growth will vary based on that. So it's important to bear that in mind when you are analyzing your data to determine student growth.

So let's talk about the pre-testing phase. We know that we're developing almost always our own tests and performance assessments. However, in some cases there could be a third-party test such as one developed by an individual organization other than the teacher or someone outside of the institution. For example, the ETS field tests are sometimes used for this purpose. In the pre-test phase, the teacher simply administers the test and records the student data to help guide their instruction, and for later analysis when we get to the post-test.

In the post-testing phase, when the instructional period is complete, the teacher simply administers the same test. In the post-testing phase, student achievement data is recorded for each student again. And then we analyze it comparatively in one of two ways, or in best situations, we analyze it both ways. One is a qualitative review and the other is via a correlation analysis. You remember we talked about correlation back in Module 4.

So let's talk about this qualitative analysis, or what I like to put in lay terms is what I call the good old fashioned eyeball approach. And this is where it just consists of a review of the scores of the performance data. And you simply note the changes and the results over time. You kind of do this qualitatively just by reviewing. So using your professional

judgment, in this case, the teacher simply determines the degree to which students have learned content or improved skills by simply comparing the two sets of scores or the two performances qualitatively.

Now some questions that often guide this kind of-- this kind of inquiry. How many students increased their scores or improve their performance? How many did not? How large are the differences between the scores or levels of performance? And what does this tell you about student growth and the effectiveness of the instruction that you've delivered? So the teacher uses this analysis, obviously, to modify and improve their instruction. Because one of the overall consistent goals of all assessment is to help us understand where our students are, what they've learned, and how we can go back and modify and improve our own instruction to help increase student learning.

Now the quantitative analysis is a different process. We know that if we have pre and post-test scores, they're going to vary. We talked about variance also back in Module 4. So in addition to the qualitative review, it could be useful to know the size and strength of the relationship between pre and post-test scores in cases where you have scores that are continuous variables. So when the data permit, we can use a correlation to calculate a coefficient that numerically describes this relationship.

So let's take a look at this again. So again, remember what a correlation is. It's a statistical estimate of the strength and direction of a relationship between two continuous variables. And in this case, the continuous variables would be the scores on the pre and post-tests. Two scores for each student. That is for every observed change in one variable that is in a pre-test score, there is a related observed change in the other. That is they vary together. So these can be positive or negative remember, ranging from negative 1 to positive 1.

And then there are several types of correlation, but we're going to use the Pearson r, because that's an easy one to access. And you can read about other types of correlation there at that link that I put on the page for you. But for today, or for this video, we're just going to talk about Pearson's r. Now to use the Pearson r coefficient correctly, the variables really must be continuous interval data. That is the scores that are derived should be derived from a point scale where the points equidistant. That is the distance between the points does not vary.

So an example of an interval measurement simply is a ruler. We all know what rulers are. Because the distances between the points of measurement say the inches or the sub-inches, and 1/4 inches, 1/8 inches, that doesn't vary across the entire length of the ruler. Now interval scales are most familiar when we use to measure achievement on a test.

For example, we have a test with 50 questions. Each question is worth two points for a total of 100 points. And then the points earned from the test form the test taker score. That is, the number of questions the students get correct form their score. Because the points we have determined are going to be equal in value and represent the test takers

amount of knowledge. Here again, remember our discussion of objective as in back in Module 1. It's assumed that the higher scores represent higher knowledge attainment.

So let's work an example of a quantitative analysis. So here, pre and post-test scores, qualitative analysis. Sorry, we're going to do a qualitative and quantitative analysis of this. So we're going to start here with a qualitative piece. So here's the pre and post-test scores from 10 students on a mathematics quiz. The max score was 50 points. Now you might want to pause the video here just for a while and review these and answer these questions. What do you notice about the student's performance between the quizzes? And what is your qualitative analysis reveal? Now take a moment and look at that. Or you can go on, it's up to you.

Now continuing on with this example, the quantitative analysis, the same two sets of scores, we can analyze them with the Pearson r correlation, because the scores are based on an interval scale of 50 points. So how do we do that? Well, let's try it out. I would suggest that you open up the online free correlation calculator that I have linked here. And cut and paste the pre-test scores in the x column on that site, and then the post-test scores go in the y column. Now pause the video while you do this and then find the coefficient at the bottom of the display under the r calculation at the end of the proof. And that will be where you find it on that particular page.

Now how do we interpret the correlation? Well, the coefficient turns out to be 0.942 which we round to 0.94. So a perfect correlation is 1.00. This is really close to that. So what that means is that for this sort of scores only, for almost every pre-test score, there was a corresponding increase in the post-test score. Now this is a very strong relationship and can be interpreted that the students overall know more about the tested mathematics concepts or skills after instruction than they did before the instruction.

So how do we interpret correlation coefficients? Because these represent size and strength of relationship between two sets of variables, we can generally identify these as you see here, from 0.70 to 1.0, a positive strong relationship. Actually 1.00 is perfect. Hardly ever happens, but it can happen. And then you see the gradations of positive moderate, positive weak, and then zero, of course, is no relationship. There is no correlation at all, they're varying so differently.

Now when we get into negative correlations, remember that for every change in one, there is a corresponding negative change in the other. So that would be interesting to find out if your students do worse on the post-test than they do on the pre-test, then you would probably want to do some work to figure out why that would be the case.

Now let's talk about the concept of triangulation. So as we've discussed previously, most people, most teachers I should say, and most of us instructors, find the best information when we triangulate analysis to come to obtain a complete picture of student growth. So how do we do that? Well, when there is both a qualitative and quantitative analysis of pre and post-test scores, teachers can obtain really a better idea.

So how do we do that? Well, the qualitative analysis revealed in this particular score set that 8 of the 10 students are into higher post-test scores. So we just looked at that, and we could see that qualitatively. The quantitative analysis supports that finding with a strong positive correlation, or r equals 0.94, which we would expect if 8 out of the 10 in the group scored higher the second time than they did the first time, and that is, they increased their scores.

Now let's take a moment to pause to practice this. And here you're going to find a set of scores on a chemistry test. And we're going to analyze them both quantitatively and qualitatively. So the first part of this will be a qualitative analysis. Do again, just take a look at the scores and see how students did pre-test, post-test, and come up with some ideas of how you think the correlation might also support your finding. And you can use the Pearson r correlation calculator there. And the question is, what do these analysis tell you about the growth of these students and their knowledge of the tested chemistry concepts?

And now it's time to pause to think. What value does pre and post-testing your students add to your teaching? And that concludes Module 5. Thank you.