Module 5b: Pre- and Post-testing for Student Learning

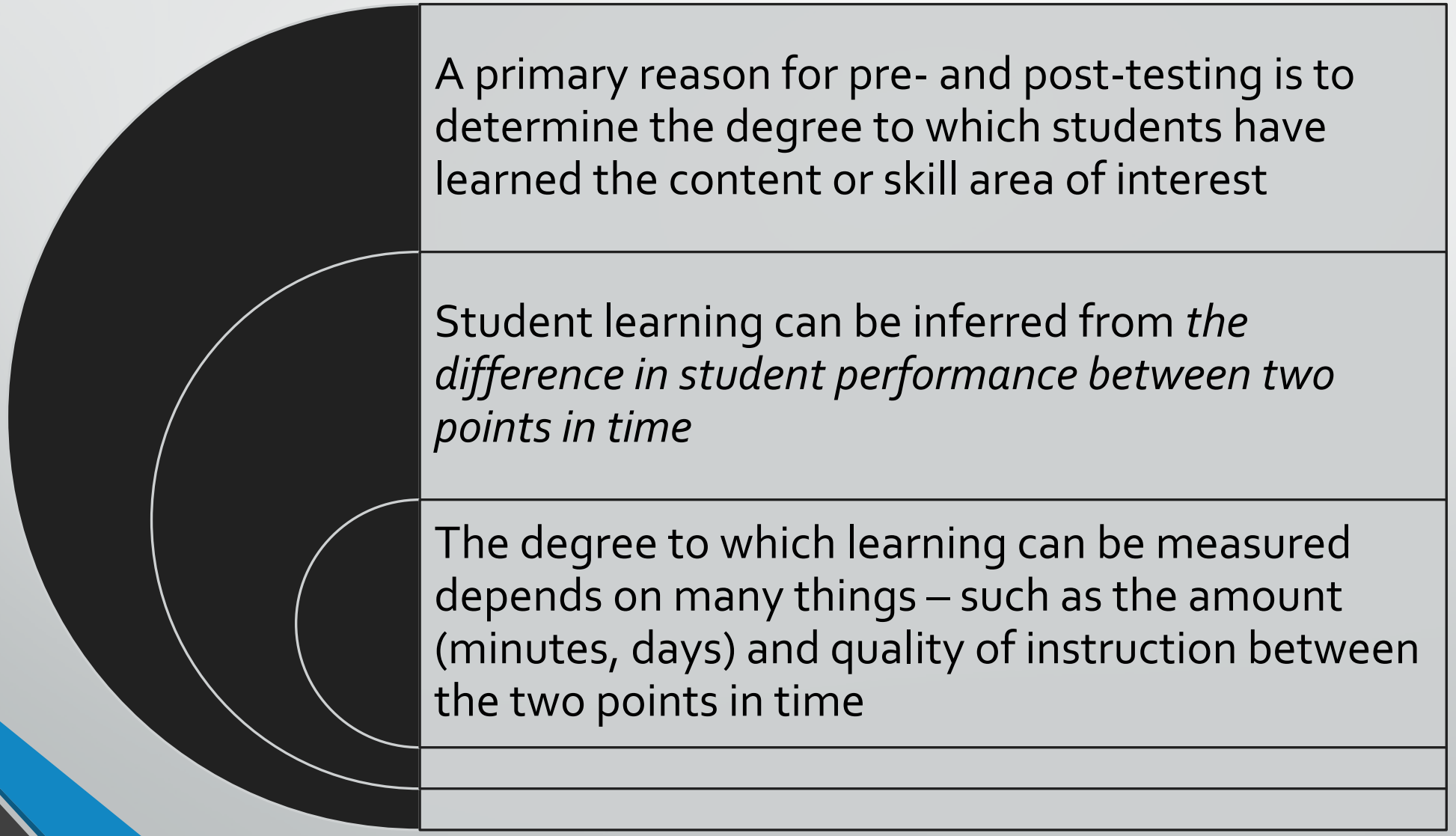
Passport to Great Teaching – Creative Assessment

Timothy S. Brophy

The Value of Pre- and Post-Testing

- Pre- and post-testing, when done well, can yield valuable data for teacher use
- The process starts with the administration of a test of the knowledge and/or skills to be taught/refined at the beginning of a sequence of instruction
- The process continues with the administration of the same test at the end of a sequence of instruction
- The process ends with an analysis of the difference between the student's test scores or performance at these two points in time

Student Learning



A primary reason for pre- and post-testing is to determine the degree to which students have learned the content or skill area of interest

Student learning can be inferred from *the difference in student performance between two points in time*

The degree to which learning can be measured depends on many things – such as the amount (minutes, days) and quality of instruction between the two points in time

Pre-testing

Most teachers develop their own tests and performance assessments

In some cases, a third-party test – one developed by an individual or organization other than the teacher – is used (for example, ETS field tests)

In the pre-test phase, the teacher administers the test and records student data to guide instruction and for later analysis

Post-testing

- When the instructional period is complete, the teacher administers the same test
- The is the *Post-testing phase*
- The student achievement data is recorded for each student
- This data can be analyzed comparatively in two ways: one is by a qualitative review, the other is usually via a paired-samples t-test

Qualitative Analysis

A *qualitative analysis* consists of a review of the scores or performance data with the teacher noting changes in the results over time

Using professional judgment, the teacher determines the degree to which students have learned content or improved their skills by comparing the two sets of scores qualitatively

Some guiding questions are:

1. How many students increased their scores?
2. How many did not?
3. How large are the differences between the scores?
4. What does this tell you about student growth and the effectiveness of instruction?

The teacher uses this analysis to modify and improve instruction

Quantitative Analysis

Teachers know that pre- and post-test scores on an assessment are different; if teaching has resulted in the expected learning, post-test scores should be higher

In addition to a qualitative review, it can be useful to review the statistical relationship between the pre- and post-test scores

When the data permit, we can use **the paired samples t-test to** determine if the difference between pre- and post-test scores is significant

Quantitative Analysis – Paired samples t-test

Paired samples t-test– a statistical test of the difference between a set of paired samples, such as pre-and post-test scores. This is sometimes called the *dependent samples t-test.*

For every observed change in one student's pre-test score, there is an expected change in that student's post-test score. For this test, the *null* hypothesis is that there are *no differences* between the scores.

The paired samples t-test provides an estimate of the significance of the difference between the means of the two samples from the same subjects – in this case, the pre- and post-tests of the students in a class.

The *p-value* that the test provides gives us information that allows us to accept or reject the null hypothesis.

If the test is significant at $p < .05$, we can reject the null hypothesis and ascertain that the pre- and post-test differences are different, and the differences is not caused by chance.

Quantitative Analysis – Paired Samples t-test

To use the paired samples t-test correctly, the measurement must yield continuous, interval data – i.e., scores derived from a point scale where the points are equidistant (the distance between the points does not vary)

An example of interval measurement is a ruler – the distances between the points of measurement (i.e., inches or millimeters) do not vary

Interval scales are most familiar when used to measure achievement on a test. For example, a test with 50 questions each worth two points is worth a total of 100 points. The points earned form the test-takers *score*.

Because the points are equal in value and represent the test takers amount of knowledge it is assumed that higher scores represent higher knowledge attainment.

Let's work an example: Qualitative Analysis

- Here are pre- and post-test scores for a group of 22 students on a mathematics quiz (max. score = 50). **Pause the video and review these**. The mean score on the pre-test is 34.8; the mean score on the post-test is 37.4. What does your qualitative analysis reveal?

Student	Pre-test	Post-test
John	28	38
Tim	24	35
Anne	31	37
Charles	21	34
Chrissy	46	49
Bernard	50	45
LaShawn	47	44
Kimara	18	30
Robb	17	25
Pooja	45	45
Charlie	30	35
Hadley	42	50
Parker	44	40
Emmy	32	33
Lily	25	40
Joe	15	10
Harper	35	34
DeJuan	23	34
Antonio	45	46
Mariadela	20	40
Tony	30	29
Tom	49	50

Let's work an example: Quantitative Analysis

- Here are the same two sets of scores. These two sets of scores can be analyzed with the Paired samples t-test because the scores are based on an interval scale of 50 points.

Student	Pre-test	Post-test
John	28	38
Tim	24	35
Anne	31	37
Charles	21	34
Chrissy	46	49
Bernard	50	45
LaShawn	47	44
Kimara	18	30
Robb	17	25
Pooja	45	45
Charlie	30	35
Hadley	42	50
Parker	44	40
Emmy	32	33
Lily	25	40
Joe	15	10
Harper	35	34
DeJuan	23	34
Antonio	45	46
Mariadela	20	40
Tony	30	29
Tom	49	50

Try it out!

- To analyze this, open this free online paired-samples t-test calculator in a new window.
- Cut and paste the pre-test scores in treatment 1 column, and the post-test scores in the treatment 2 column. Be sure that the significance level is .05 and the hypothesis is two-tailed. You might want to **pause the video while you do this.**
- Find the *t* value at the bottom of the page, and the significance calculation or *p* value.

Student	Pre-test	Post-test
John	28	38
Tim	24	35
Anne	31	37
Charles	21	34
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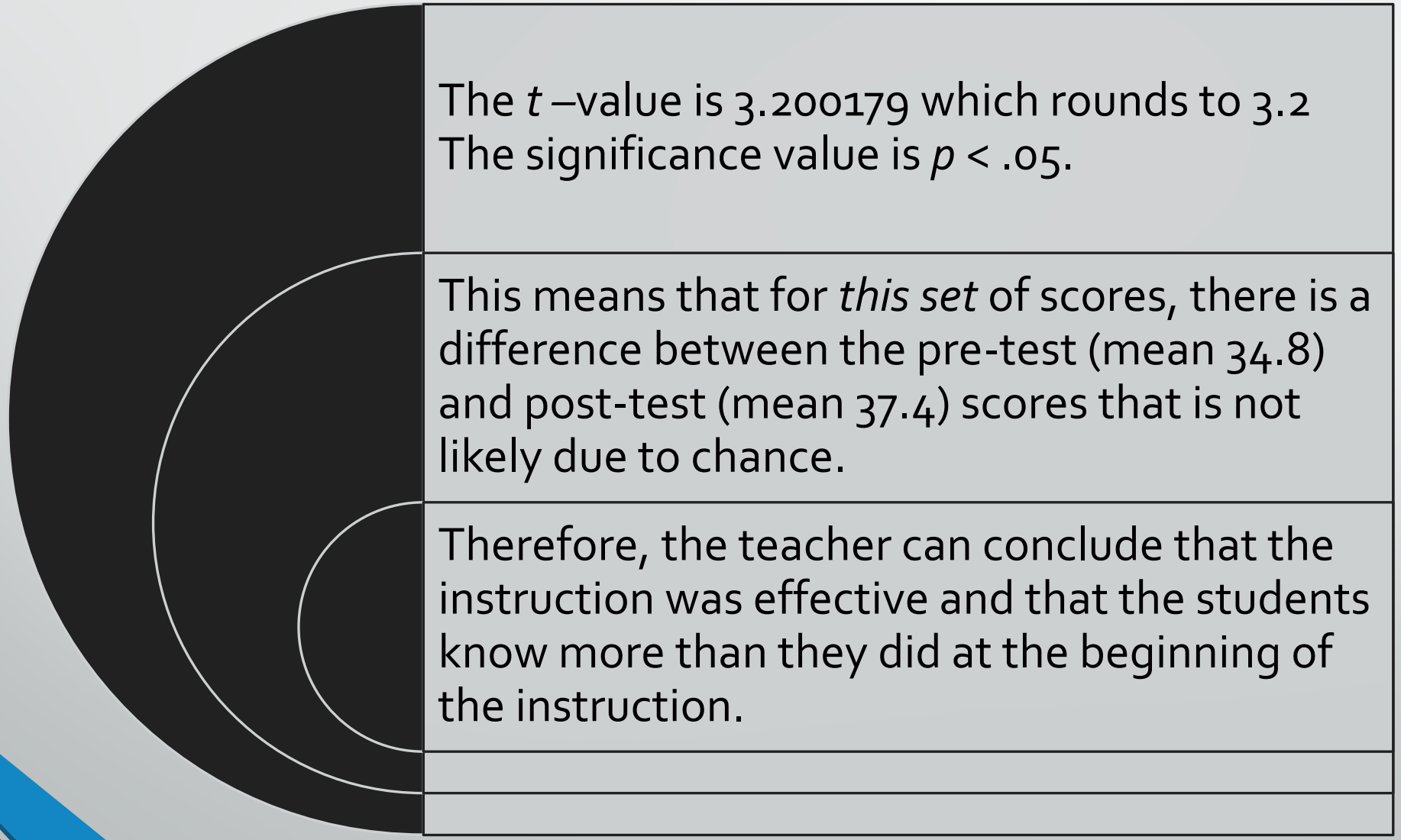
Interpreting the coefficient



The *t* –value is 3.200179 which rounds to 3.2
The significance value is $p < .05$.

This means that for *this set* of scores, there is a difference between the pre-test (mean 34.8) and post-test (mean 37.4) scores that is not likely due to chance.

Therefore, the teacher can conclude that the instruction was effective and that the students know more than they did at the beginning of the instruction.

Triangulation

Most teachers find the best information when they triangulate their analyses to obtain a complete picture of student growth

When there is both a qualitative and quantitative analysis of pre- and post-test data, teachers obtain a better idea of student learning

The qualitative analysis of these test scores revealed that 19 of the 22 students earned a higher post-test score

The quantitative analysis supports this with a significant paired samples t-test which we would expect if 19 of the 22 in the class increased their scores.

Pause to Practice

- You will analyze a set of pre- and post-test scores on a chemistry test qualitatively and quantitatively.
- Using the scores shown here, analyze these qualitatively and quantitatively (use the paired samples t-test calculator here). Write your results.
- Triangulate your findings. What do these analyses tell you about the growth of these students in their knowledge of the tested chemistry knowledge?

Student	Pre-test	Post-test
Sam	36	38
John	35	35
LeDarius	31	37
Wei-shin	29	34
Christopher	46	49
Spencer	45	45
Joe	48	44
Sally	34	30
Robbie	26	25
Arundahti	45	45
Terrance	23	26
Chi	27	20
Geraldo	39	42
Paul	41	41
Billy Joe	18	22
Betty Sue	37	41

Pause to Think

- What value does pre- and post-testing your students add to your teaching?