



**Program Development  
and Evaluation**



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**Quick Tips**  
**38**

# How to Compute and Present Individual Change with Before and After Survey Data

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## Introduction

It is common practice for Extension educators to measure program effectiveness based on perceived changes in learners' knowledge, understanding, skill, attitude, perception, etc., from before and after a program. The most commonly used scale to measure such change is a Likert-type scale. The measured outcome can be computed and presented for the group as a whole or for each learner as individual change. This Quick Tip builds on the individual change method discussed in **Quick Tips #30**<sup>1</sup> and uses Microsoft Excel\* to compute individual change and frequency distribution. With this method, each learner's before and after responses are paired and can be matched to show individual change.

## Example

The University of Wisconsin-Extension's Conservation Professional Training Program (CPTP) offered an online course titled *Introduction to Soil Health*. To measure the perceived changes in learners' understanding of three main course concepts, a survey was administered to learners after they completed the training. Three example questions from that survey are provided in figure 1.

## Computing individual change

Using figure 1, let's assume a learner indicated "Slight Understanding" on a question before taking the course and "Moderate Understanding" on the same question after taking the course.

**FIGURE 1.** Questionnaire used to evaluate the *Introduction to Soil Health* course.

**Please rate your level of understanding of the soil health concepts taught in the course from before to after taking the course.**

	Before taking the course					After taking the course				
	1	2	3	4	5	1	2	3	4	5
Q1. Understand how the biological characteristics of soil contribute to soil health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q2. Understand how the chemical characteristics of soil contribute to soil health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3. Understand the barriers for adopting best practices for improving soil health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Scale.** 1= No Understanding; 2= Slight Understanding; 3= Moderate Understanding; 4= Good Understanding; 5= Excellent Understanding

*\* Using this product example is not intended to endorse it over others that may be similar, but rather as a convenience to readers. Microsoft Excel® is a registered trademark of Microsoft Corporation in the United States and other countries.*

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## HOW TO COMPUTE AND PRESENT INDIVIDUAL CHANGE

This increase in understanding indicates the learner progressed by one level on that question. Similarly, if the same learner indicated “Good Understanding” after the course, he or she progressed by two levels; if “Excellent Understanding” was reported after the course, understanding progressed by three levels.

If the same learner indicated “Slight Understanding” after taking the course, he or she neither progressed nor retrogressed (i.e., the level of understanding remained the same from when he or she entered the course).

The individual change would be negative if the post-course understanding levels were lower compared to pre-course levels (i.e., learners’ understanding levels retrogressed by one, two, or three levels). Learners can indicate a lower level of understanding post-course if they fail to recognize the extent to which they don’t know the subject matter or the content the course covers. This can be addressed by using a retrospective post-then-pre scale. Refer to **Quick Tips #28**<sup>2</sup> for learning more about designing retrospective post-then-pre questions.

## Computing individual change with Microsoft Excel

1. Enter the “before taking the course” responses to question 1 from each individual learner in column A and the “after taking the course” responses in column B as shown in figure 2. Enter the formula  $=B2-A2$  in cell C2, and using your keyboard, press the **enter** or **return** key. The resulting number represents individual change.

Follow the same method for questions 2 and 3 as shown in columns D through I of figure 2. In this example, 13 people took the survey and each row from 2 through 14 represents the ratings from individual learners.

2. Count the numbers from columns C, F, and I, and present the individual change frequencies and percentages as shown in figure 3. Refer to UW-Extension publication *Using Excel for Analyzing Survey Questionnaires*<sup>3</sup> for details on computing frequencies and percentages using Excel.

FIGURE 2. Calculating individual change with Microsoft Excel.

	A	B	C	D	E	F	G	H	I	J
1	Q1Before	Q1After	Change	Q2Before	Q2After	Change	Q3Before	Q3After	Change	
2	3	2	-1	3	1	-2	3	2	-1	
3	4	4	0	4	4	0	4	4	0	
4	4	5	1	4	5	1	4	5	1	
5	3	4	1	4	4	0	4	4	0	
6	2	4	2	3	4	1	3	4	1	
7	4	4	0	3	3	0	3	3	0	
8	5	5	0	4	4	0	4	4	0	
9	4	5	1	4	5	1	4	5	1	
10	4	4	0	4	4	0	4	4	0	
11	2	3	1	3	4	1	2	4	2	
12	2	3	1	3	4	1	2	3	1	
13	3	5	2	2	4	2	2	4	2	
14	2	3	1	3	4	1	3	4	1	
15										

**FIGURE 3. Frequency distribution of learners by individual change.**

Introduction to Soil Health

**Table 1. Frequency Distribution of Learners' Based on their Understanding of Soil Health Concepts Taught in the Course (n= 13)**

Q1. Understand how the physical characteristics of soil contribute to soil health

Change score	-4	-3	-2	-1	0	+1	+2	+3	+4
Frequency (%)	0 (0%)	0 (0%)	0 (0%)	1 (8%)	4 (31%)	6 (46%)	2 (15%)	0 (0%)	0 (0%)

Q2. Understand conservation practices appropriate for a producer

Change score	-4	-3	-2	-1	0	+1	+2	+3	+4
Frequency (%)	0 (0%)	0 (0%)	1 (8%)	0 (0%)	5 (38%)	6 (46%)	1 (8%)	0 (0%)	0 (0%)

Q3. Understand management practices appropriate for a producer

Change score	-4	-3	-2	-1	0	+1	+2	+3	+4
Frequency (%)	0 (0%)	0 (0%)	0 (0%)	1 (8%)	5 (39%)	5 (39%)	2 (14%)	0 (0%)	0 (0%)

**Likert-type scale categories.** 1: No Understanding, 2: Slight Understanding, 3= Moderate Understanding, 4= Good Understanding, 5= Excellent Understanding.

## Interpreting frequency distribution results

The majority of learners (53%–61%, or the range of the sum of positive change scores) improved their level of understanding on three concepts from before to after taking the course. However, about one-third (31%–39%, or the range of scores which showed no change from before to after taking the course) of the learners did not show change in their level of understanding on the concepts. Further, there was one learner (the same or different person[s]) who, for each question, retrogressed in their level of understanding on the concepts.

Refer to UW-Extension publication *Using Excel for Analyzing Survey Questionnaires*<sup>4</sup> for a detailed explanation on analyzing quantitative data to compute frequencies and percentages.

## Implications for course instructors from frequency distribution results

Figure 3 shows about one-third (31%–39%) of the learners did not indicate change in their understanding of the three main concepts from before to after taking the course. While that may not have been an anticipated course outcome, a closer examination of the data indicates that the majority (69%–92%) of the learners came into the course with at least “Moderate Understanding” of the concepts. Increasing learners’ understanding beyond one level with one course may not be easy in this case. The “Moderate Understanding” levels may be expected to improve to “Excellent” levels with “real world” application of course concepts. To see if the understanding levels sustain or improve over time with the working application of concepts, follow-up surveys can be administered to learners after six months or more. Such follow-up surveys are ideal for measuring behavior change (adoption of the taught course concepts).

Frequency distribution results calculated by individual change can provide valuable insights related to course content and design. Instructors can determine if learners show varying levels of progression or retrogression on different course aspects, and use that to improve course content, course design, or both. In this example (figure 3), the learners had similar levels of improvement in their understanding of the three concepts, which indicates the instructor may have covered each concept equally well.

## References

1. Program Development and Evaluation. *Analysis of Retrospective Post-then-Pre Data*, Quick Tips #30. University of Wisconsin-Extension, Madison, WI. <https://fyi.uwex.edu/programdevelopment/files/2016/04/Tipsheet30.pdf>.
2. Program Development and Evaluation. *Designing a Retrospective Post-then-Pre Question*, Quick Tips #28. University of Wisconsin-Extension, Madison, WI. <https://fyi.uwex.edu/programdevelopment/files/2016/04/Tipsheet28.pdf>.
3. Leahy, Jennifer. *Using Excel for Analyzing Survey Questionnaires*. UW-Extension publication G3658-14. <https://learningstore.uwex.edu/Using-Excel-for-Analyzing-Survey-Questionnaires-P1030.aspx>.
4. Ibid.



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