# Understanding Standardized Scores
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"The various segments of the system of profound knowledge proposed here cannot be separated. They interact with each other. Thus, knowledge of psychology is incomplete without knowledge of *variation*." (emphasis added)
*---W. Edwards Deming (1900-1993)*

**Purpose:**
The twin purposes of this handout are to help students understand 1), the relationship between un-standardized scores and standardized (z-transform) scores, and 2), the relationship between multiple standardized scores and relative weights of assignments.

**Un-standardized and Standardized Scores:**
For each quiz and exam, students earn a score.  This is an *un-standardized* (or "raw") score.  For each quiz and exam, the instructor will provide several descriptive statistics, including the mean and the standard deviation.  While the value of the mean is often interesting (usually to the instructor), the value of the standard deviation is always compelling (especially to the student).

Recall from your elementary statistics course the concept of a *standardized* (or "*z-*") score.  The formula to derive a z-score is as follows:

$$zscore = \frac{rawscore - mean}{std.dev.}$$

Each raw score, therefore, is associated with a *z*-score.  Standardized scores have several advantages.  1), Standardized scores retain the order of the values and more important, the shape, center, and spread of the distribution.  2), Standardized scores enable more reliable (consistent) evaluation of performance across all students on a single quiz or exam.  3), Standardized scores enable more valid (accurate) evaluation of performance across all students for all assignments, quizzes, exams, etc. throughout the semester.

**Relative Variation:**
Each assignment, quiz, exam, etc. has a "relative weight" as articulated on the syllabus.  However, this "relative weight" is a single number applied to each z-score.  This "relative weight" (normative variation between assignments) is interesting, but the "relative variation" (formative variation within students) is compelling.  The coefficient of variation is a useful summary statistic that provides a guide to relative variation of a particular assignment, quiz, exam, etc.  This formula is as follows:

$$CV = \frac{std.dev.}{mean}$$

**Student Performance:**
All students should always strive to do their best work on each assignment, quiz, exam, etc.  Strong students will tend to demonstrate consistent performance that is at least 1 standard deviation above the mean on each assignment, quiz, exam, etc.