

Growth Scores Explained: A Brief Summary of Growth Z Scores

Minnesota's Growth Model could be described as representing an empirical, actuarial or normative approach to setting year-to-year expectations for changes in academic achievement. The basic approach is to define groups of students based on their MCA scores in Year 1 (grade N) and determine their MCA score distributions in Year 2 (grade N+1). For example, take 3rd graders who scored 339 on the Reading MCA-II in 2006, and determine their scores on the 2007 Grade 4 Reading MCA-II. (See Figure 1 below.) Their grade 4 score distribution can be summarized by calculating the mean and standard deviation of those scores. The mean (440 in the example) represents the expected grade 4 performance for this group, and the standard deviation (10 in the example) indicates how much variation was observed among these students in their grade 4 scores. A student who scored 339 in grade 3 and 445 in grade 4 has performed above expectation by 5 scale score points. We could also say that student has performed $\frac{1}{2}$ standard deviation ($5 \div 10 = \frac{1}{2}$) above expectation. Scores that report variations around a mean in standard deviation units are commonly referred to as z scores. The student just described would be awarded a growth z score of +.5. Similarly, another student who scored 339 in grade 3 but only 430 in grade 4 has scored 10 points (or 1 standard deviation) below the expectation (mean), and would earn a growth z score of -1.

More generally, a student's Minnesota Growth Z score can be calculated as:

$$\text{Growth Z Score} = (\text{Student Score} - \text{Expectation}) \div \text{Standard Deviation.}$$

The average student in any group would be expected to earn the group mean, or a z score of zero. Negative growth z scores represent Year 2 achievement below expectation, whereas positive growth z scores indicate achievement better than expected, given the Year 1 score.

To implement this approach, MCA-II growth expectations for grades 4-8, 10 and 11 were calculated. In order to produce more stable results, data used to create the tables were averaged across two years. "First year" data were collected using both 2006 and 2007 test administrations, and "second year" data were obtained in 2007 and 2008. (For the high school tests, the gap between grades 8 and 10 or 11 tests meant that the grade 10 and 11 "second year" data were collected in 2008 and 2009 (grade 10) or 2009 and 2010 (grade 11). The targets resulting from these first two years represent a consistent baseline against which subsequent years' results can be compared. Because the growth targets are held constant, it is possible for all students to achieve growth greater than baseline expectations. (See the "2011 Targets" tab of the [Determining Growth Target Ranges for 2012](#) document for growth expectations and standard deviations.)

Because of the way growth is calculated, unlike in other growth models, there is no requirement that Year 1 and Year 2 scores are on exactly the same scale. This allowed for the calculation of new Minnesota Growth Tables for the Mathematics MCA-III in 2011 (year 2) that are based on

2010 MCA-II performance (year 1). The same approach was used to calculate MTAS growth targets for 2010 and 2011, and was implemented with the MCA-Modified in 2012. New 2012 Mathematics MCA-III growth expectations were calculated using first year score data from the 2011 Mathematics MCA-III.

Individual student z scores are used in two different ways for accountability purposes in Minnesota. For the Multiple Measurements Rating (MMR), which was adopted as a result of Minnesota's approved ESEA Flexibility Request, a school's overall growth score is computed by averaging the z scores of all students enrolled within the school for the full academic year. As in the other domains of the MMR, a school's performance is given a percentile rank and multiplied by 25 possible points to determine a point total in the growth domain. MCA, MTAS and MCA-Modified student growth z scores are included in MMR growth calculations, but only MCA growth z scores are included in Minnesota Growth Model calculations.

The Minnesota Growth Model reports growth scores in three categories: Low, Medium and High Growth. For the Minnesota Growth Model, a school's growth is reported as the percentages of students who make Low, Medium or High Growth. These categories are defined by scale cut scores that correspond to growth z scores of -0.5 and $+0.5$, respectively. The Low, Medium and High Growth distinctions are not used in the MMR.

Figure 1. Hypothetical Year 2 Score Distribution for Students with Year 1 Score = 339

