

***Functional Requirements  
for the  
2011  
Minnesota Growth  
Calculations***

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## Introduction Overview

In 2008, Minnesota established a **School Improvement Reporting System** and designed methods to measure individual student growth for students taking the math and reading accountability assessments (the MCA-II, **MCA-III** and the MTELL). The purpose of this document is to describe the Minnesota Growth calculation and how it is applied to schools and districts.

### Context (place in the system)

The Minnesota Growth computational software (the calculation “engine”) interacts with the existing ASSESSMENT and Assessment Transaction databases to acquire test results over multiple years. It also interacts with the NCLB2004 database to acquire information on which students to include. Final calculation results are placed in the NCLB2004 database. Working tables and reference tables also reside in the NCLB2004 database or the ORGUNIT database.

The results are made available **using the MDE web applications:**

**Educator Portal**

**Data Center**

### Target Users

The target audience for this document includes software developers as well as program area personnel familiar with assessment data and NCLB-AYP data.

## Glossary of Terms

<b>Term</b>	<b>Definition</b>
AYP Record	The student enrollment record linked with the appropriate assessment record created during Adequate Yearly Progress (AYP) processing.
Growth Level	A designator (Low, Medium or High) assigned to AYP Records based on the previous scale score compared to the current scale score.
Growth Target	For each subject, the expected scale score for a prior year grade and prior year scale score.
Growth Record	An AYP record which satisfies all the requirements to be included in the growth calculation.
Growth Component Percentage	One of six computed percentages based on Growth Records summarized by <i>Proficient</i> - low, medium or high growth and <i>Not Proficient</i> - low, medium or high growth.
MCA-II	Minnesota Comprehensive Assessment – Series II. Beginning in 2006, a census test given annually to grades 3-8 and 10 for Reading and grades 3-8 and 11 for Math.
<b>MCA-III</b>	<b>Minnesota Comprehensive Assessment – Series III. Beginning in 2011, a census test given annually to grades 3-8 for Math.</b>
MDE	Minnesota Department of Education
NCLB	No Child Left Behind. A federal act ensuring accountability (among other things) for schools designated as Title I and Title III.
ORGUNIT	A database maintained by MDE for the purpose of identifying various educational delivery organizations and their attributes. For example, this database holds information about schools and school districts.
TestWES	The Assessment Web Edit System where districts have the ability to update and verify assessment data as well as view the MARSS demographics assigned to each record

## References

2011 NCLB – AYP Calculations - Functional Requirements

<https://education.state.mn.us/MDEAnalytics/Data.jsp>

Select Adequate Yearly Progress, then list files, then select one of the help files:

Determining Growth Target Ranges for 2011 (Excel Workbook)

<https://education.state.mn.us/MDEAnalytics/Data.jsp>

Select Assessments and Growth, then select GROWTH from the dropdown menu, then list files and select Determining Growth Target Ranges for 2011.

## Functional Description Minnesota Growth Calculation

The purpose of the Minnesota Growth calculation software is to compute the percent of proficient and not proficient students demonstrating low, medium and high rates of growth on the NCLB Math and Reading accountability assessments (the MCA-II, **MCA-III** and MTELL). The MTAS and **MCA-Modified** assessments are not included in the Minnesota Growth calculation.

Results of current year individual student assessments (Math and/or Reading) are compared to the results on the student's previous assessments. A Low, Medium, or High **Growth Level** is then assigned to each of the student's current year records. The growth levels are based **Growth Targets** derived from a set of statewide assessment data from the 2005/06 school year **through 2009/2010 school year**. The methodology to derive these targets is described in *Appendix A – Determining Growth Targets*. The actual targets are listed in **the companion Excel workbook called *Determining Growth Target Ranges for 2011***.

In addition to the growth level, the Minnesota Growth calculation also considers if the student is proficient in the subject in the prior year.

These two values (growth level and prior year proficiency) are then summarized for schools and districts to determine the six **Growth Component Percentages** for each group included in the measurement.

The methodology to assign growth levels and compute the growth values are described in the following sections.

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### 1.1.1 Student Record Selection from AYP

The Minnesota Growth calculation only uses student records included in the Minnesota Adequate Yearly Progress (AYP) Proficiency calculation. During AYP processing, current year assessment records are combined with MARSS enrollment records to create an **AYP Record** used in the AYP Proficiency calculation.

The AYP Proficiency calculation limits AYP Records to include only those students that participated in the assessment and received a valid score. Other criteria are also used to exclude

AYP Records from the proficiency calculation. For example, assessments from students who were new to the country are excluded. Assessments from students who were not enrolled for the full academic year are also excluded from certain summaries. The full description of the AYP Proficiency calculation is illustrated in the *2011 NCLB – AYP Calculations - Functional Requirements*.

During AYP processing, the proficiency inclusion rules are implemented and the AYP Records are marked with three separate flags. These flags indicate whether the record should be used in the proficiency denominator for the school, the proficiency denominator for the district, or the proficiency denominator for the State. The proficiency denominator flag must equal ‘Y’ to be included in the summarization for the respective aggregation (school, district or State).

### *1.1.2 Linking Current AYP Records to Prior Year Assessments*

During the TestWES processing, the Student Linking System (SLS) assigns an Alias Group ID to current year and previous year assessment records. The prior scores for the current year assessments are stored for later processing in a Prior Score reference table. To link prior assessments to current assessment, the MARSS Number, Alias Group ID and subject must match between assessments.

The Prior Score reference table holds the following information which is used in the Minnesota Growth calculation:

- Prior Test Name
- Prior Grade
- Prior Score Code
- Prior Achievement Level
- Prior Scale Score

Prior score information is then linked to the AYP Record for each student. For the current year grade 10 AYP Records, prior score information is obtained from the assessments from two years ago. For current year Grade 11 AYP Records, prior score information is obtained from the assessments from three years ago. For current year Grade 4 through 8 AYP Records, prior score information is obtained from the prior year. Current year Grade 3 AYP Records are not used in the Minnesota Growth Calculation.

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### *1.1.3 Limiting AYP Records used in Growth Calculation*

The Minnesota Growth calculation only uses AYP Records included in the AYP Proficiency calculation and further limits these records to ensure:

- there is an appropriate assessment in a previous year
- there is a normal grade progression from the previous assessment
- the previous assessment has a valid score

Once the prior score information is assigned to each of the AYP Records, additional checks are performed to determine if the record could be used in the Minnesota Growth calculation. The records are only eligible to be included when:

- The current year AYP Record test name is MCA-II, **MCA-III** or MTELL.
- The Prior Test Name is MCA-II or MTELL.

- For grades 4-8, the grade minus one equals the Prior Grade.
- For grade 10 and 11, the Prior Grade is 08.
- The current year AYP Record Score Code is ‘VS’ (Valid Score).
- The Prior Score Code is ‘VS’.
- The current year AYP Record has the ‘UseInSchoolSummary’ flag = ‘Y’ (this eliminates potential duplicates when a single student is reported more than once in a school).

Eligible AYP Records are referred to as **Growth Records**.

#### 1.1.4 Assigning Proficiency to Growth Records

Records that are eligible to be included in the Minnesota Growth calculation have Proficiency designators assigned.

- PROFICIENT: Prior year Achievement Level equal to M or E
- NOT PROFICIENT: Prior year Achievement Level equal to D or P

#### 1.1.5 Use of Growth Targets

Prior scores for each subject have two **Growth Targets** (High and Medium). The Growth Targets are the expected scale score needed in the following year to reach the appropriate growth level.

In the example shown below for Math, a current year 4<sup>th</sup> grade student who had a prior score of 330 in 3<sup>rd</sup> grade the year before has two targets established for the current year. If the student scored at least 435 for Math, a High Growth Level is assigned. If the student scored less than 435 but at least 424 for Math, a Medium Growth Level is assigned. If the student scored less than 424, a Low Growth Level is assigned.

Subject	Grade	Minimum Prior Score	Maximum Prior Score	High Growth Target Score	Medium Growth Target Score
Math	03	301	324	430	420
Math	03	325	327	431	421
Math	03	328	329	433	423
<b>Math</b>	<b>03</b>	<b>330</b>	<b>331</b>	<b>435</b>	<b>424</b>
Math	03	332	333	435	425
Math	03	334	334	437	427

The complete set of targets is listed in **the companion Excel workbook called *Determining Growth Target Ranges for 2011***.

#### 1.1.6 Assigning Growth Levels to Growth Records

Growth Levels are assigned in the following manner.

- HIGH GROWTH: Current score meets or exceeds the High Growth target set for the prior grade and prior score.

- **MEDIUM GROWTH:** Current score falls below the target for High Growth, but meets or exceeds the Medium Growth target.
- **LOW GROWTH:** Current score falls below the target for the Medium Growth.

### 1.1.7 Summarizing Growth Records

Growth Records are summarized for each grade in a school, the school as a whole, each grade in a district, the district as a whole, each grade in the State, and the state as a whole. The number of Growth Records is totaled and is called the growth denominator. Additional summaries are made using the Growth Records to calculate growth numerators for the six Growth Component Percentages. These are:

1. Proficient with Low Growth
2. Proficient with Medium Growth
3. Proficient with High Growth
4. Not Proficient with Low Growth
5. Not Proficient with Medium Growth
6. Not Proficient with High Growth

Schools and districts that have fewer than 20 Growth Records as a whole are not included in the Minnesota Growth calculation. This can occur when a school only serves a small number of students or only serves students not eligible for a growth measurement (such as K-3 school).

### 1.1.8 Computing Growth Component Percentages

For schools and districts with 20 or more Growth Records, the Growth Component Percentages are computed to one decimal point from the six growth numerators created above divided by the growth denominator.

These charts illustrate a typical set of Growth Component Percentages for two subjects, showing percentage of students included in each growth measure:

<b>MATH</b>	<b>Low Growth</b>	<b>Medium Growth</b>	<b>High Growth</b>
<b>Proficient</b>	19.0	27.9	19.3
<b>Not Proficient</b>	8.1	13.9	11.9

<b>READING</b>	<b>Low Growth</b>	<b>Medium Growth</b>	<b>High Growth</b>
<b>Proficient</b>	19.3	29.7	21.9
<b>Not Proficient</b>	7.0	12.0	10.1

### 1.1.9 Disaggregated Student Groups

All of these summaries listed above contain the same disaggregated student groups as computed in the AYP calculation. Growth Component Percentages are also computed for each of these student groups:

- A. All students
- B. American Indian / Alaskan Native Students
- C. Asian / Pacific Islander Students
- D. Hispanic Students
- E. Black Students, not of Hispanic Origin
- F. White Students, not of Hispanic Origin
- G. Limited English Proficient Students
- H. Special Education Students
- I. Students Eligible for Free or Reduced Price Meals.

The full description of how demographics are assigned to AYP Records is included in the *2010 NCLB – AYP Calculations - Functional Requirements*.

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## Appendix A – Determining New Growth Targets for 2011 Math

New growth targets for 2011 were established for Math in grades 04 through 08 using MCA-II, MCA-III and MTELL assessment data from 2010 and 2011. Growth Targets for Math Grade 11 and Reading grades 03-08 and 10 remained the same as in prior years.

A series of steps were conducted to arrive at the final Growth Targets for each grade and set of scale scores. A companion Excel workbook called *Determining Growth Target Ranges for 2011* contains the detailed output of this calculation. The calculation begins with a selection of student records from 2010 and 2011.

### Step 1: Select assessment records.

- Fiscal Year = 2010 and grade in 03, 04, 05, 06, 07 and test name = MCA-II or MTELL
- Fiscal Year = 2011 and grade in 04, 05, 06, 07 or 08 and test name = MCA-III
- Subject = M
- Score Code = 'VS' (valid score)
- MARSS Number = 13 digit numeric value greater than 0
- Exclude district 5555 (the control district) or MARSS number beginning with 5555 or 9999

### Step 2: Assign the Alias Group ID using the Student Linking System (SLS).

### Step 3: Remove any duplicated records within a single year.

Records are considered duplicated if the Fiscal Year, MARSS Number and Alias Group ID have multiple records for a single subject. For example, an MTELL record and an MCA-II Math record would be considered duplicates if the Fiscal Year, Alias Group ID and the MARSS Number matched on both records. Both records would be removed from the calculation.

### Step 4: Determine if there is a qualifying linked record in the following year.

Records are linked if the MARSS Number, Alias Group ID and Subject match on both assessments from the two years. Qualifying records must have a normal grade progression between the years. For example, a grade 3 record in 2010 qualifies if there is a linked record in grade 4 in the 2011 set of data.

- Remove 2010 records in grade 3 through 7 that do not have a qualifying linked record in the 2011 set of data.

**Step 5: Link records together.**

Using the MARSS Number, Alias Group ID and subject, link the records together.

- Grade 3-7 records from 2010 are linked with grade 4-8 records in 2011.

The following fields are used from the linked records and are placed in a temporary Growth Target Detail table for later processing.

- MarssNumber
- AliasGroupID
- Subject
- Year 1
- Grade in Year 1
- Test Name in Year 1
- Score Code in Year 1
- Scale Score in Year 1
- Year 2
- Grade in Year 2
- Test Name in Year 2
- Score Code in Year 2
- Scale Score in Year 2

**Step 6: Establish Score Range Groups**

Scale scores by grade and subject for Year 1 are summarized. During summarization, the Year 2 scale score is averaged and the standard deviation is computed. The average of the Year 2 scale scores in conjunction with half of the standard deviation will eventually be used to create the Growth Targets.

The 2011 growth targets for MCA-II remain unchanged from 2010. These MCA-II growth targets were calculated using an iterative approach that combined adjacent prior-year score groups until each score group contained at least 100 students, and within-group current year score averages increased monotonically with prior year score.<sup>1</sup> The iterative approach resulted in some irregularity in targets due to sampling fluctuation, and required students with disparate prior year scores to be grouped together in some instances.

In 2011, Minnesota transitioned students in grades 3-8 to the mathematics MCA-III, requiring new growth targets to be calculated for that test. The new targets were calculated using an improved, statistical methodology that was approved by Local Assessment and Accountability Advisory Committee (LAAAC) and the National Technical Advisory Committee (NTAC). The improved methodology uses nonparametric kernel density estimation to calculate smooth growth targets

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<sup>1</sup> For more information on the MCA-II growth target calculation methodology, please see the file named "Determining Growth Target Ranges for 2010", available from [MDE's Data Reports and Analytics web site](#).

without collapsing score values.<sup>2</sup> The calculation starts with student-level data consisting of matched prior year and current year scores. Current score means and standard deviations are then calculated for each observed prior score. The observed means, standard deviations and counts are then used to calculate smoothed targets. During the smoothed estimation, conditional means and standard deviations with greater precision/more students receive more weight.

The results of these computations and more detailed explanations are shown in the Excel Workbook called *Determining Growth Target Ranges for 2011*.

### Step 7: Establish Growth Targets

Once the Year 1 scale scores groupings satisfy the above requirements, the final Growth Targets are established.

#### High Growth Target:

The average of the Year 2 scale score plus one half the standard deviation.

$$\text{AVERAGE}(\text{Year2ScaleScore}) + (.5 * \text{STANDARDDEVIATION}(\text{Year2ScaleScore}))$$

#### Medium Growth Target:

The average of the Year 2 scale score minus one half the standard deviation.

$$\text{AVERAGE}(\text{Year2ScaleScore}) - (.5 * \text{STANDARDDEVIATION}(\text{Year2ScaleScore}))$$

The results are rounded to 0 decimal places.

#### Example to compute a High Growth Target:

- There are 5175 records in the set where the Year 1 Grade 03 Scale Score = 358.
- The Year 2 average scale score for these records = 457.193623188406
- The standard deviation for this average = 7.94195201265927
- One half the standard deviation = 3.970976006
- High Growth Target = 457.193623188406 + 3.970976006 = 461.164599194406
- Rounded to 0 decimal places = 461

The results of these computations are shown in the Excel Workbook called *Determining Growth Target Ranges for 2011*. A sample for 5 sets of scores is shown below.

Number of Records	Subject	Year 1 Grade	Minimum Year 1 Scale Score	Maximum Year 1 Scale Score	Average Year 2 Scale Score	Standard Deviation	One Half Standard Deviation	High Growth Target	Medium Growth Target
570	M	03	301	324	424.7385	10.2004	5.1002	430	420
272	M	03	325	327	426.1213	9.7062	4.8531	431	421
363	M	03	328	329	427.8236	10.3892	5.1946	433	423
548	M	03	330	331	429.4470	10.5153	5.2577	435	424
520	M	03	332	333	430.3230	9.76503	4.8825	435	425

<sup>2</sup> Bowman, A. W., & Azzalini, A. (1997). *Applied smoothing techniques for data analysis: The kernel approach with S-plus illustrations*. Oxford University Press.