ROI Growth Norms Guide
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Introduction

Rate of improvement (ROI) is a numerical index that reflects how rapidly raw scores on a measure increase during a given school year. Expressed as raw-score points per week in AIMSweb, ROIs have several valuable applications. For example:

- The ROI of a student whose progress is being monitored is the primary indicator of the effectiveness of the intervention.
- The magnitude of the ROI needed to reach a goal (i.e., goal ROI) is useful for determining the reasonableness of the goal.
- The distribution of ROIs for a group of students—such as a class or grade that participates in universal screening three times a year—serves as a measure of the effectiveness of the general educational program.

ROIs have long been a component of AIMSweb reporting, in individual progress monitoring reports and in local and national norm tables. However, the ROIs found in AIMSweb norm tables are group ROIs that indicate the rate of increase of the norm group’s raw-score distribution. By contrast, the ROIs and ROI growth norms discussed in this guide reflect the progress of individual students.
Concept

In most situations, it is useful to know how a student’s rate of improvement compares with the ROIs of other students in the same grade. The ROI growth norms are percentile norms that indicate the percentage of students in the large, representative national norm sample who had ROIs equal to or smaller than a particular ROI. Because growth rates vary by initial performance level, these norms are most meaningful when the comparison group consists of other students who had a similar level of initial performance. To be able to make such comparisons, five separate sets of ROI growth norms were developed for each grade and time interval that correspond to five ranges of initial scores (very low, low, average, high, and very high). By stratifying the comparison groups, the AIMSweb ROI growth norms can help teachers more accurately interpret each student’s progress and set realistic yet challenging goals.

The ROI growth norms provide information that is different from and supplementary to the score percentiles available for AIMSweb measures. A universal screening raw score percentile indicates the percentage of students in the norm sample (local or national) who scored at or below a particular raw score at that point in time (e.g., fall of Grade 3). By contrast, an ROI growth norm percentile indicates the percentage of students in the national norm sample whose rate of improvement is at or below a particular value. (Note that ROI growth norms are available for Kindergarten through Grade 8, based on the national norm sample.)

The following example illustrates how the ROI growth norms supplement and enhance the national and local norms that apply to screening scores obtained at one point in time:

If Peter, a third-grader, had a fall R–CBM raw score of 32 (7th percentile on national norms) and a spring raw score of 86 (17th percentile on national norms), then he improved by 54 raw-score points over a 36-week period and achieved an ROI of \((86 - 32) / 36 = 0.50\) points per week. This ROI is at the 85th percentile of the ROI growth norms. In other words, Peter improved faster than about 85% of third-graders whose fall scores were in the bottom 10%. Although Peter’s spring score is still in the below-average range, his improvement over the year was unusually rapid when compared with the growth rates of his peers who began the year at a similar score level.

To further illustrate the application of ROI growth norms, consider three students (Jorge, Sara, and Nina) who obtained the same R–CBM raw score (77) in the fall of Grade 3. This raw score is at the 40th percentile on national norms. Jorge’s raw score increased to 140 in the spring (64th percentile for spring screening scores), Sara’s raw score increased to 122 (46th percentile), and Nina’s increased to 104 (30th percentile). The ROIs for these students—assuming 36 weeks between fall and spring screening—are as follows:

- Jorge’s raw score increased by 63 points \((140 - 77)\) over the course of 36 weeks, resulting in an ROI of 1.75 raw score points per week \((63 ÷ 36)\).
- Sara’s raw score increased 45 points over 36 weeks, corresponding to an ROI of 1.25 points per week.
- Nina’s raw score increased 27 points over 36 weeks, resulting in an ROI of 0.75 points per week.
Based on these results, the corresponding ROI growth norms indicate that

- Jorge’s fall-to-spring ROI of 1.75 is at the 95th percentile of ROIs; that is, he improved faster than about 95% of students in the national norm sample with similar fall scores.

- Sara’s ROI is at the 65th percentile, an above-average rate of growth when compared to her peers.

- Nina’s ROI is at the 25th percentile, meaning she improved at a below-average rate compared to the national sample of Grade 3 students who had similar fall scores.

The concept of ROI growth norms is further illustrated in Figure 1, which shows the fall-to-spring raw-score growth on R–CBM for 50 students in Grade 3 whose fall raw scores (words read correctly [WRC] per minute) were in the average range when compared to the national norms (i.e., between the 25th and 75th percentiles). Note that each line represents one student. Some lines are nearly flat, indicating that the student’s raw score increased very little from fall to spring (and the ROI was therefore low). Other lines are very steep, demonstrating relatively high ROIs. The heavy, solid black line represents a student with an average ROI of 1.11 points per week; this line is steeper than half of the other lines in the sample, so it has an ROI growth norm percentile of 50. The ROI of the steeper of the two heavy dashed lines (ROI = 1.47) is at the 75th percentile—that is, this student improved more rapidly than three-quarters of students in the norm sample who had average scores in the fall. Finally, the flatter dashed line represents the 25th percentile (ROI = 0.78).

Figure 1. Fall-to-spring R–CBM growth for 50 students in Grade 3
**Use and Interpretation**

ROI growth norms are valuable for several applications, such as setting a goal in progress monitoring. For example, if the ROI required to reach a proposed goal is equal to the average rate of improvement of the student’s peers, you would probably decide to set a more challenging goal. Conversely, if reaching the proposed goal would require an ROI that is faster than the growth rate of 95% of the students in the same grade with the same level of initial performance, that goal may be too ambitious. Having a frame of reference for ROIs is beneficial for group applications as well. For instance, if most of the students in a class had ROIs above the average ROI of a larger reference group (e.g., the district or the nation), one could infer that the instruction in that class was particularly effective.

The ROI growth norms differ from the familiar raw score norms in two ways. First, ROI norms refer to a time interval rather than a single point in time. Second, separate ROI growth norms are available for each of five initial score levels. These differences are further discussed in the following sections.

**Time Intervals**

The ROI growth norm tables offer a choice of three intervals: fall–winter, winter–spring, and fall–spring. Improvement tends to be more rapid in the fall than in the spring, and this is reflected in the AIMSweb ROI growth norms. For example, on R–CBM at Grade 2, the median ROI is 0.49 in the fall and 0.92 in the spring; at Grade 6 the values are closer, 0.75 and 0.67, but the general pattern of more rapid improvement in the fall is consistent across grades. Figures 3 through 10 (found at the end of this guide) illustrate this difference at selected grade levels for all of the AIMSweb measures that have ROI growth norms. Each figure shows the average ROI (by initial score level) for each of the three time intervals: fall–winter (solid green line), winter–spring (solid red line), and fall–spring (dashed black line). In almost every instance, the fall–winter value is greater than the winter–spring value, and the average fall–spring ROI is between the two.

It is important to use the norms for the interval that best aligns with the time span of your ROI data. Following the winter screening, you may evaluate students’ ROIs by comparing them to the fall–winter norms. You would also use this interval when evaluating the progress of a student being monitored during the fall and early winter.

After spring screening, the fall–spring or the winter–spring ROI norms could be used. For most applications, the fall–spring norms are more suitable. If a student’s progress has been monitored over the course of most of the school year, then the broadest picture of the student’s growth can be provided by comparing his or her full-year ROI with that of the norm sample. (Note that evaluation of the general instructional program is typically based on the entire school year as well.) Change is most reliably measured when the beginning and end points are far apart in time, so fall–spring ROIs tend to be more dependable than half-year ROIs.

The winter–spring ROI growth norms, however, serve a necessary function. If you wish to evaluate progress-monitoring data that comes mainly from the second half of the school year, then the winter–spring norms are more appropriate than the fall–winter or fall–spring norms. Winter–spring norms also can serve as a substitute for students whose fall screening score is missing (e.g., students who joined the class later in the fall).
Initial Score Levels

As previously noted, ROIs may differ for students at different levels of initial performance. Figures 3 through 10 illustrate these differences by showing the median ROI at each of the following five percentile levels corresponding to initial raw scores (fall score for fall–winter or fall–spring ROI growth norms, winter score for winter–spring ROI growth norms):

- 1st to 10th percentiles (very low)
- 11th to 25th percentiles (low)
- 26th to 75th percentiles (average)
- 76th to 90th percentiles (high)
- 91st to 99th percentiles (very high)

The figures reveal that students whose initial scores are very high (91st to 99th percentiles) tend to have lower ROIs than students whose initial scores are average or low. One reason is that some AIMSweb measures have “ceiling effects” in the spring, such that very high-ability students obtain perfect raw scores. Another cause is statistical regression, which tends to bring very high initial scores down on later assessments. On some measures at some grades, students who start in the lowest 10% also tend to have relatively low ROIs, which may reflect a continuation of the relatively slow growth rate that characterized their previous learning.

To adjust for systematic differences such as these, separate AIMSweb ROI growth norms were developed for each of the five initial score levels. As a result, students’ ROIs can be compared with the ROIs of other students who started in the same level, which provides an unbiased, apples-to-apples comparison.

Reports and Software

AIMSweb reports that include ROI information generally provide ROI percentiles. Note that the ROI growth norm percentiles are rounded to ten values in increments of 10, ranging from the 5th percentile (which covers the range of the 1st to the 10th percentiles) to the 95th percentile (91st to 99th percentiles). Because change scores such as ROIs are inherently less precise than raw scores, this level of precision is appropriate for reporting ROI percentiles.

There are new group reports based on the ROI growth norms; for example, box-and-whiskers charts representing the distribution of ROI growth percentiles for all the students in a class, grade, school, or district, with optional disaggregation. These reports reflect how the group is progressing relative to the average rate of progress in the national norm sample. If the average student in a group is improving at the same rate as the national average rate of improvement, then the box-and-whiskers plot will be centered at the 50th percentile of ROI growth norms. Note that the distribution includes all of the students in the group, including those who may have had very different initial scores and whose ROI percentiles therefore came from different ROI growth norm tables.

An example of a group ROI report is shown in Figure 2. This report compares the distribution of individual ROIs in one classroom (Mr. Eisenhower’s homeroom, in gray) with the distribution of individual ROIs for the entire school (in green). All three time intervals are displayed—fall-to-winter, winter-to-spring, and fall-to-spring. In the fall–winter and fall–spring intervals, the median ROIs for both the classroom and the school (denoted by the horizontal line within the box) were slightly below the national average of the 50th percentile; however, during the winter–spring interval, the average rate of improvement was slightly higher than the national average.
Figure 2. Sample Distribution of Student ROI Growth Percentiles report
The new version of the AIMSweb software, launching in the fall of 2013, uses the ROI growth norms to provide feedback during dynamic goal setting for progress monitoring. If the user proposes a goal whose goal ROI is below the median ROI, then the interactive screen will indicate that the goal is *insufficient* to help the student catch up. Any ROI below the median (50th percentile) will tend to result in a lower score-level percentile at the end of the interval than at the beginning, meaning that the student would be falling behind. A goal ROI between the 50th and 85th percentiles will be labeled *Closes the Gap* because it will raise the student’s score-level percentile. Finally, a goal ROI above the 85th percentile will be labeled *Ambitious* to signal to the user that such a rate of improvement is relatively rare.

**Group ROIs**

As previously mentioned, the ROI values that have always been shown in the right-hand column of AIMSweb national or local norm tables are *group ROIs* rather than ROI growth norms for individual students. Group ROIs describe how fast various percentile points in the group’s distribution of scores have changed over the fall–winter or fall–spring period. For example, the ROI shown on the row for the 75th percentile indicates how much the 75th percentile point increased over the time interval. If the 75th percentile was at a raw score of 25 in the fall and 43 in the spring, then that part of the score distribution had an ROI of (43 – 25) ÷ 36, which is equal to 0.50 raw-score points per week. These group ROI values should not be used for interpreting the rate of improvement of individual students. In particular, it would be incorrect to infer that a student whose initial score was at the 75th percentile would have, on average, an ROI equal to the group ROI shown on the 75th percentile row of a raw-score norm table. Rather, group ROIs describe how fast various levels of the norm group improved and have particular value for shedding light on how a local norm group has responded to instruction over the semester or year.
Development

The ROI growth norms are based on the large, representative AIMSweb national norm sample that was assembled in 2011. A detailed description of the sample can be found on the Downloads tab of the AIMSweb system. Briefly, the sample included an average of 16,000 students at each grade and screening period for the AIMSweb measures shown in Table 1.

Table 1. Measures and Grade Levels/Seasons for ROI Growth Norms

<table>
<thead>
<tr>
<th>Measure</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Curriculum-Based Measurement (R–CBM) Maze</td>
<td>Grade 1 (Winter)</td>
<td>Grade 8</td>
</tr>
<tr>
<td>Test of Early Literacy (TEL):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Letter Naming Fluency (LNF)</td>
<td>Kindergarten (Fall)</td>
<td>Grade 1 (Fall)</td>
</tr>
<tr>
<td>Letter Sound Fluency (LSF)</td>
<td>Kindergarten (Winter)</td>
<td>Grade 1 (Fall)</td>
</tr>
<tr>
<td>Phoneme Segmentation Fluency (PSF)</td>
<td>Kindergarten (Winter)</td>
<td>Grade 1 (Winter)</td>
</tr>
<tr>
<td>Nonsense Word Fluency (NWF)</td>
<td>Kindergarten (Winter)</td>
<td>Grade 1 (Spring)</td>
</tr>
<tr>
<td>Spelling</td>
<td>Grade 1</td>
<td>Grade 8</td>
</tr>
<tr>
<td>Written Expression (Correct Writing Sequences)</td>
<td>Grade 1</td>
<td>Grade 8</td>
</tr>
<tr>
<td>Math Computation (M–COMP)</td>
<td>Grade 1</td>
<td>Grade 8</td>
</tr>
<tr>
<td>Math Concepts &amp; Applications (M–CAP)</td>
<td>Grade 2</td>
<td>Grade 8</td>
</tr>
<tr>
<td>Test of Early Numeracy (TEN):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral Counting (OCM)</td>
<td>Kindergarten (Fall)</td>
<td>Grade 1 (Spring)</td>
</tr>
<tr>
<td>Number Identification (NIM)</td>
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<td>Grade 1 (Spring)</td>
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<tr>
<td>Missing Number (MNM)</td>
<td>Kindergarten (Fall)</td>
<td>Grade 1 (Spring)</td>
</tr>
<tr>
<td>Quantity Discrimination (QDM)</td>
<td>Kindergarten (Fall)</td>
<td>Grade 1 (Spring)</td>
</tr>
</tbody>
</table>

The students came from schools around the country that used AIMSweb for universal screening during the 2009–2010 school year, with data from a school being used only if at least 95% of enrolled students at that grade had taken the measure. With only a few exceptions, the sample included only students who had screening scores for all three periods of the school year. The sample for each AIMSweb measure at each grade closely resembles the national student population with respect to gender, ethnicity, and free/reduced lunch eligibility.

The first step in constructing the ROI growth norms was to subdivide the cases into five levels, according to respective percentile scores at the beginning of the time interval (fall screening for the fall–winter and fall–spring ROI norms, and winter screening for the winter–spring norms). Next, ROIs were computed for each student by dividing the difference between their beginning and ending raw scores by 36 (for fall–spring ROI growth norms) or 18 (for fall–winter and winter–spring ROI growth norms). Then, using the frequency distributions of the resulting ROIs, the mid-interval percentile value for each ROI value was calculated and rounded to the 10 ROI percentile values (5, 15, 25,...,95) shown in the final ROI growth norm tables. That is, an ROI percentile value of 5 represents all percentiles from 1 to 10, and so on.
Figure 3. AIMSweb R–CBM: Median ROI by grade, initial score level, and time interval

Figure 4. AIMSweb Reading Maze: Median ROI by grade, initial score level, and time interval
Figure 5. AIMSweb M–CAP: Median ROI by grade, initial score level, and time interval

Figure 6. AIMSweb M–COMP: Median ROI by grade, initial score level, and time interval
Figure 7. AIMSweb Written Expression (Correct Writing Sequences): Median ROI by grade, initial score level, and time interval

Figure 8. AIMSweb Spelling: Median ROI by grade, initial score level, and time interval
Note. In this graph, the green line represents the median ROI for only Grade 1 and the red line represents the median ROI for only Kindergarten.

**Figure 9. AIMSweb Test of Early Literacy: Median ROI by measure, grade, initial score level, and time interval**
Figure 10. AIMSweb Test of Early Numeracy: Median ROI by measure, grade, initial score level, and time interval