Methods for Measuring Student Growth

White Paper

OCTOPUS

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What is Student Growth?

Student growth is how much academic progress a student has made between two points in time.

Here are some different methodologies and approaches we can take when it comes to measuring student growth.

1. Gain Score Model

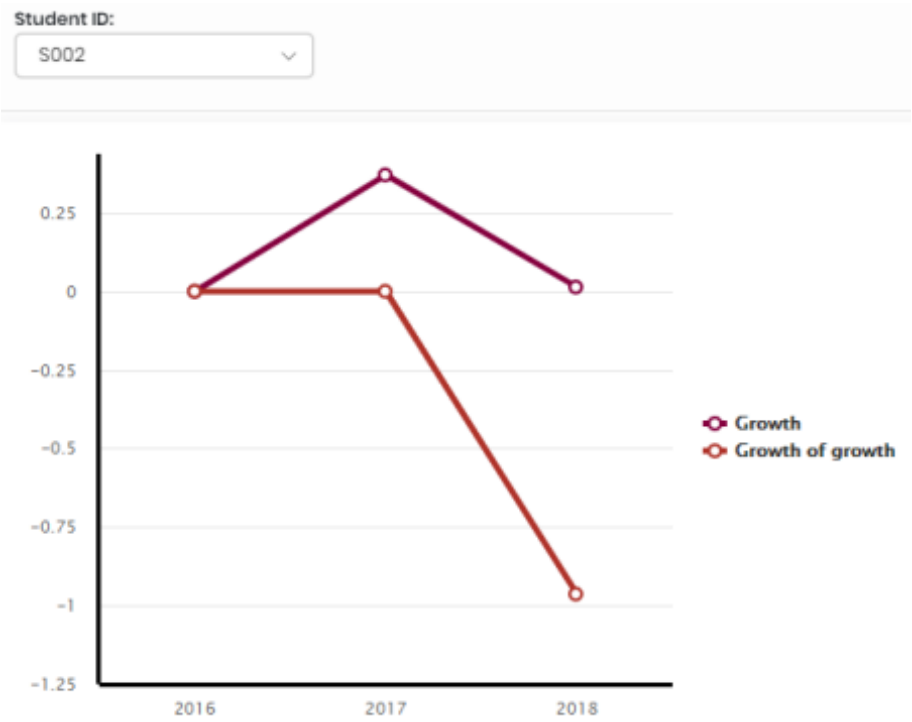
Measures year-to-year change by subtracting the prior year (initial) score from the current year (final) score. The gains for a teacher are averaged and compared to overall average gain for other teachers. It's quite easy to compute and can be used with local assessments. We've also had state accountability assessments use the gain-score model as well, and it's probably the most basic model available. The problem is that it doesn't account for initial achievement levels, it's just a basic calculation of change in score for student

$$\text{Gain score} = \frac{(\text{Current Year Score} - \text{Previous Year Score})}{\text{Previous Year Score}}$$

2. Growth of Growth

Measures the year-to-year growth change by subtracting the previous growth rate from current growth rate.

$$\text{Growth of Growth} = \frac{(\text{Current Growth Rate} - \text{Previous Growth Rate})}{\text{Previous Growth Rate Score}}$$



3. Student Growth Percentile Model (SGP)

SGPs are aggregated and normed relative to all students, with a statistic model developed to approximate how much a student should grow. SGP is based on different subgroups of students with different abilities and across different grade spans over time

The purpose of the SGP is to determine whether the amount of growth is enough

What Do Percentiles Mean?

Percentiles express the percentage of students that fall below a certain score

99th Percentile

99% of students with a similar achievement history scored lower

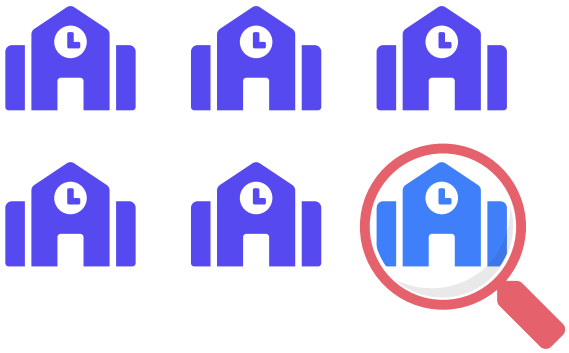
50th Percentile

50% of students with a similar achievement history scored lower

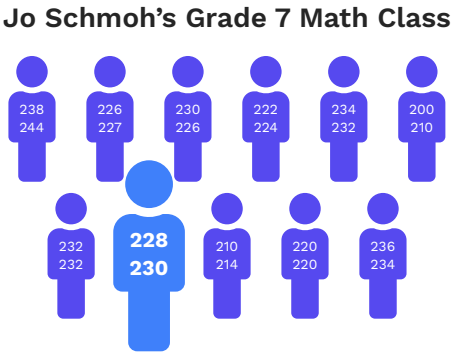
1st Percentile

1% of students with a similar achievement history scored lower

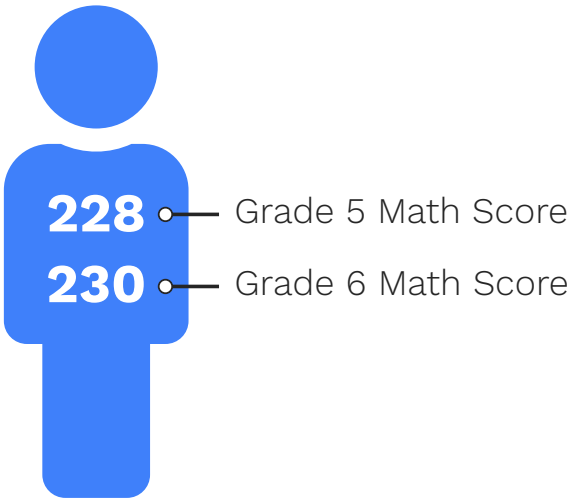
With this method we are able to evaluate NAPALN, Edu test, PAT scores.



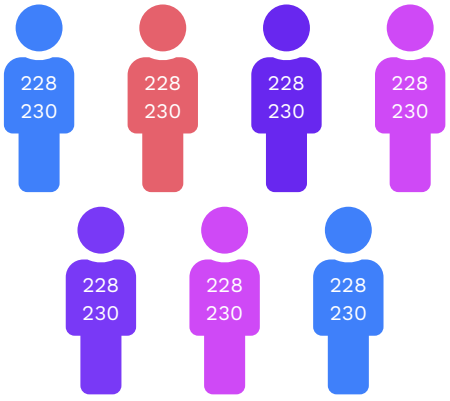
Ex-Students for example a district a school a grade or a classroom the SGP measures growth by comparing a student's mathematics score from one year to next. Let's look at one school in a particular state.



Within that school focus on one class. Joe schmo's 7th grade math class. Each student in this class has math scores from the previous two years grades. Grades 5&6.

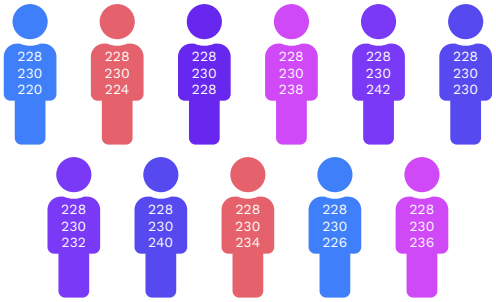


Let's select one student in the class



Look again at all the schools in state and find the students who have the same maths score history as Joe Schmoe student.

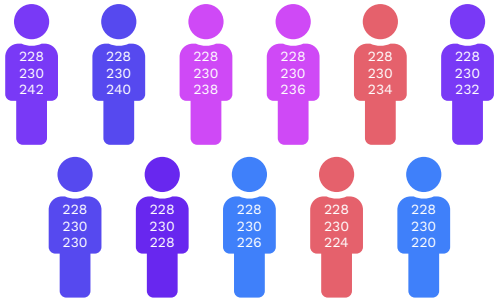
MA Students “like” Jo’s Student



These students are test score peers. Note that these are not peers based on any demographic characteristics. Students whose previous test scores are the same may be very different demographically.

Each student takes the math test this year in grade 7 and receives a score. In this example each score is different. Some go up some go down and some stay the same.

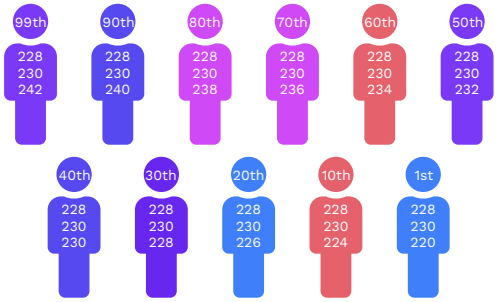
MA Students “like” Jo’s Student



The students are ranked ordered by the amount of improvement in their grade 7 scores compared to the previous two years.

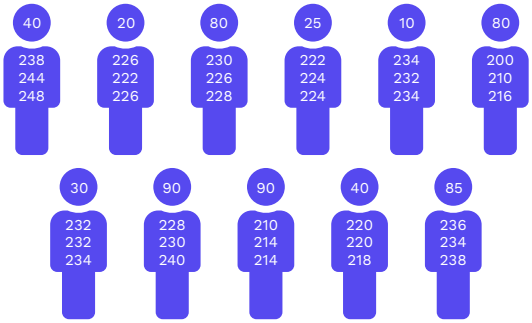
Joe Schmoe student had the second largest improvement

MA Students “like” Jo’s Student



Each student is assigned a percentile score. The student from Joe schmo’s class in the 90th percentile his score this year went up from 232-240 improvement that was as good as or better than 90% of his test score peers. The percentile become each student SGP score.

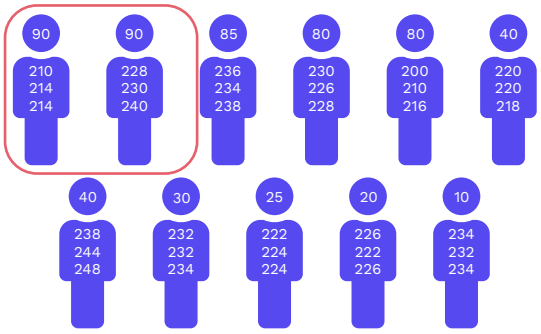
Jo Schmoh’s Grade 7 Math Class



In Joe schmo’s class each student now has a SGP based on how well each did compared to the students in the corresponding statewide test score cohort.

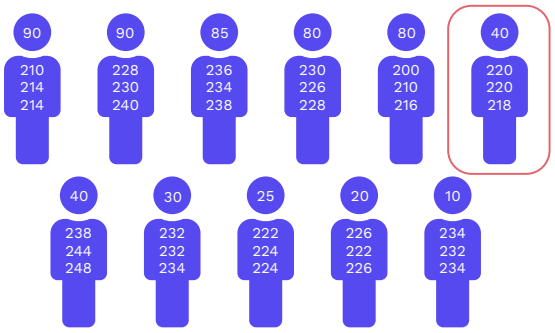
The students in the class are ranked according to their SGP score.

Jo Schmoh's Grade 7 Math Class



Students with very different scores can have the same SGP the student we have followed has an SGP of 90 another student also has an SGP of 90but that students score did not change this year and the score is much lower to 14 compared to 240 but within that students statewide peer group only 10% of the students had higher scores this year.

Jo Schmoh's Grade 7 Math Class



The SGP for Joe's class or for school grade or district identify the middle student in the group in this example that student as an SGP of 40. That student's score the median for the class becomes the classroom SGP.

We can modify this method as per below;

We can create a separate baskets based on score range

Ex- NAPALN, Edu-Test, PAT

0-100

101-200

201-300

301-400

.

.

901-1000

And take the average of relevant ranges. Based on that average we can compare students by state with their relevant baskets. Then we can assign percentiles.

4. Effect Size Approach

Effect size is a simple way of quantifying the difference between two groups that has many advantages over the use of typical tests of statistical significance alone (e.g., t-test). It should be easy to calculate and understand, and it can be used with any outcome in education (or other disciplines).

One of the most commonly used scenarios for effect size is to determine the efficacy of an intervention or educational practice relative to a comparison group or approach. Not only does the effect size indicate if an intervention would work, but it also predicts how much impact to expect in a range of scenarios.

The goal of the effect size is to provide a measure of "the size of the effect" from the intervention rather than pure statistical significance, which tends to get confounded with effect size and sample size. The term "meta-analysis[1]," which is one of the most useful ways of using effect size; it's the process of synthesizing research results into a single effect size estimate. When the research has been replicated, the different effect size results from each study can be combined to give an overall best estimate of the size of the effect.

The calculation of the effect size is actually quite simple and is the standardized mean difference between the two groups. It can be expressed as an equation:

$$\textbf{Effect Size} = \frac{\textbf{[Mean of Experimental Group] — [Mean of Control Group]}}{\textbf{Standarn Deviation}}$$

NB - Based on a particular grade
We can assign previous marks for control group, and assign current marks for experimental group

Effect size scores are equal to "Z-scores" of a normal distribution and thus, have the same possible range of scores. Effect size scores will typically range about **-2.0 to +2.0**, but could range from +/- infinity as the normal curve never touches the baseline. In theory, you could have many standard deviations above or below the average. Generally, effect sizes will range from -0.5 to +1.75 in most educational contexts.

[1] Examination of data from a number of independent studies of the same subject, in order to determine overall trends.

A basic method for interpreting the effect size:

0.20 As “small,”

0.50 As “medium,”

0.80 As “large.”

Ever since, these values have been widely cited as the standard for assessing the magnitude of the effects found in intervention research.

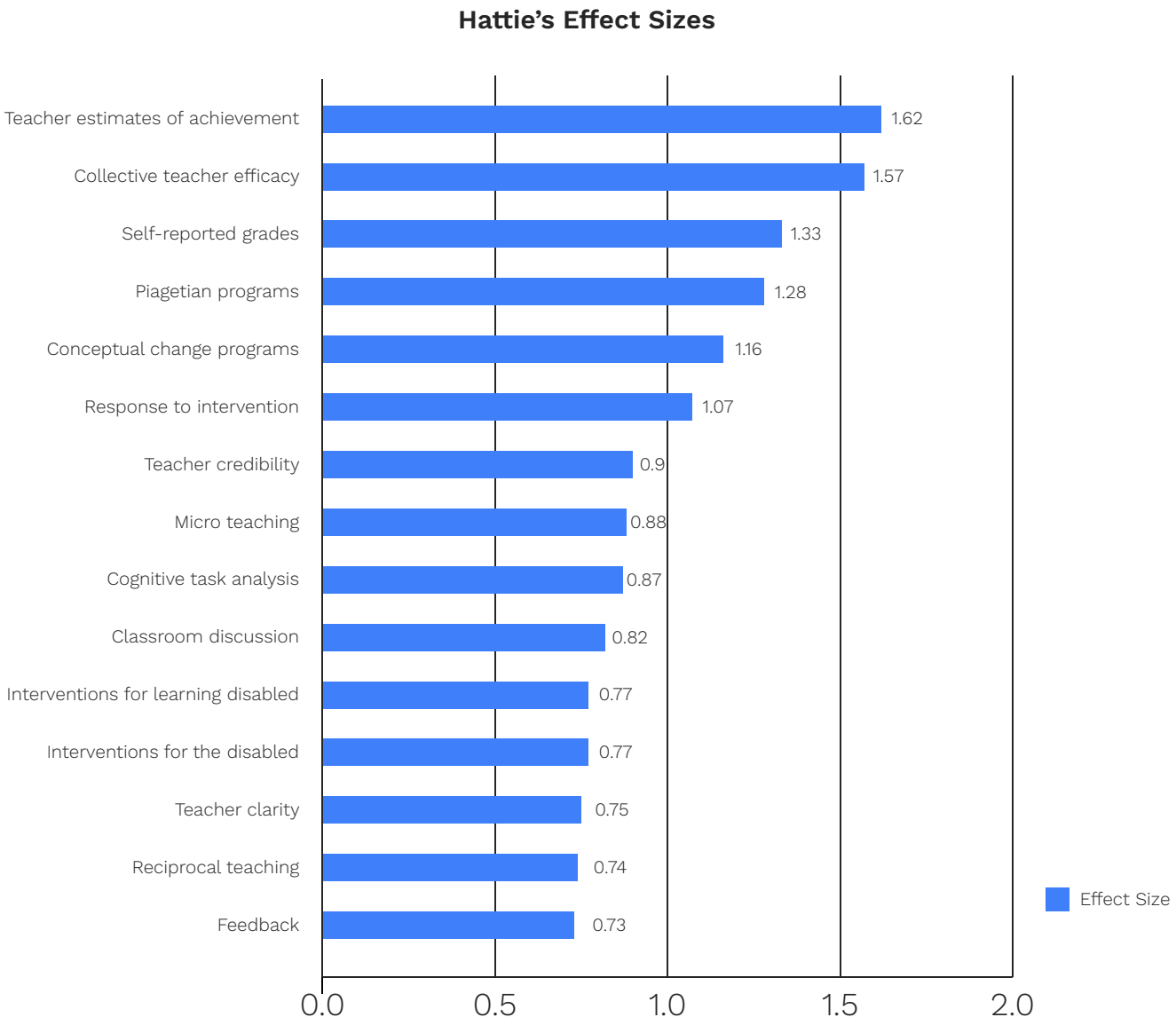
Many people consider effect sizes of

- +0.3 or less to indicate a small impact on outcomes,
- +0.4 to +0.6 to represent moderate treatment effects and
- +0.70 or greater to indicate highly effective treatments.

Certainly, we can deduce that the higher the effect size is, the greater the expected magnitude of the effect will be on student outcomes. (For example, an effect size of 0.7 means that the score of the average student in the intervention group is 0.7 standard deviations higher than the average student in the “control group,” and hence exceeds the scores of 69% of the similar group of students that did not receive the intervention.)

Example:

Tying this statistical discourse to the classroom, Hattie published his latest meta-analyses and reported the interventions and educational practices that are most effective (based on meta-analyses of 1200 studies). The following chart displays all effect sizes larger than.



From these results, we can determine, for example, that response-to-invention systems produced a 1.07 standard deviation greater impact on student outcomes (higher test scores) than districts not implementing RtI approaches.

Furthermore, Hattie has identified what he terms the “Super Factors” on student outcomes:

- **Teacher estimates of achievement (d = 1.62).**

  Unfortunately, this reflects the accuracy of a teacher’s knowledge of their students and not “teacher expectations.” Therefore, this is not a factor teachers can use to boost student achievement.

- **Collective teacher efficacy (d = 1.57).**

  This factor involves helping all teachers on the staff to understand that the way they do their work on a day-to-day basis has a significant impact on student performance. This also means that teachers should not use distal factors such as home life, socio-economic status, and motivation as reasons for poor achievement. In other words, great teachers will often try to make a difference despite these inhibitory factors.

- **Self-reported grades (d = 1.33).**

  This factor reflects the fact that students are quite aware and capable of anticipating their grades before even receiving their report cards. But this is not something teachers can truly use to boost performance.

- **Piagetian levels (d = 1.28).**

  This is another super factor of which teachers have no influence. Students who were assessed as being at a higher Piagetian level than other students perform better at school. The research does not suggest that trying to boost students’ Piagetian levels has any effect.

- **Conceptual change programs (d = 1.16).**

  This research refers to the type of textbook used by secondary science students. While some textbooks simply introduce new concepts, conceptual change textbooks simultaneously introduce concepts and discuss relevant and common misconceptions. These misconceptions can hinder deeper levels of learning. While the current research is limited to science textbooks in secondary school, it’s reasonable to predict that when teachers apply this same idea to introduce any new concept in their classroom, it could have a similar impact.

Response to Intervention (d = 1.07).

There's plenty of commercial literature and material to help schools use RtI or Multi-Tier System of Supports (MTSS). RtI involves screening students to see who is at-risk, deciding whether supporting intervention will be given in class or out of class, using research-based teaching strategies within the chosen intervention setting, closely monitoring the progress, and adjusting the strategies being used when enough progress is not being made. While the program is designed for at-risk students, the underlying principles are the same as advocated by Hattie as being applicable for all students.

Reference

1 Student Growth Percentile Model (SGP)

- Massachusetts Teachers Association
- https://massteacher.org/employment-and-licensure/educator-evaluation

2 Effect size approach

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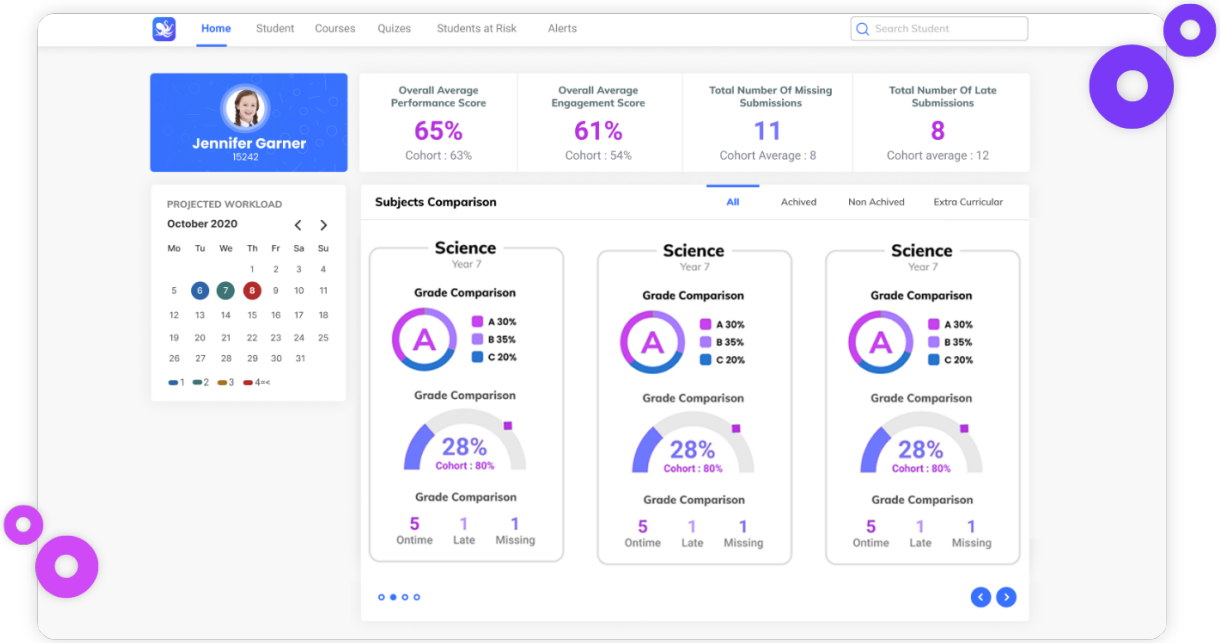

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