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Interpreting and Measuring Lexile® Growth with Achieve3000 Literacy

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About Achieve3000 Literacy

Achieve3000 Literacy is a digital literacy solution that is designed to support learning growth for students in grades 2-12. Based on decades of scientific research, this proven learning platform differentiates instruction to 12 levels in English and 8 in Spanish to reach all students at their level, accelerating learning, improving high-stakes test scores, and driving college and career readiness.

This powerful solution also extends teachers' reach without adding to their workloads or time demands. By combining embedded assessment, differentiated instruction, regular skills practice, and targeted scaffolds in a single program, Achieve3000 Literacy empowers educators to increase their students' reading gains surely and steadily, level by level.

A Guide to Interpreting Lexile Growth

This paper provides a brief introduction to interpreting growth in reading ability with Achieve3000 Literacy. This paper begins with an overview of the patented technology that powers the measurement of student ability in Achieve3000 Literacy using the Lexile measure. Next, the paper describes how to track and interpret Lexile growth using three key reports available within the Achieve3000 Literacy platform. Third, the paper describes how student growth can be interpreted through the lens of grade-level norms, both cross-sectional and longitudinal. Finally, the paper points to other resources that may be helpful to readers who wish to learn more. After reading this paper, readers should be able to better understand the available resources within and outside of Achieve3000 Literacy that will help build competence and confidence for interpreting reading growth.
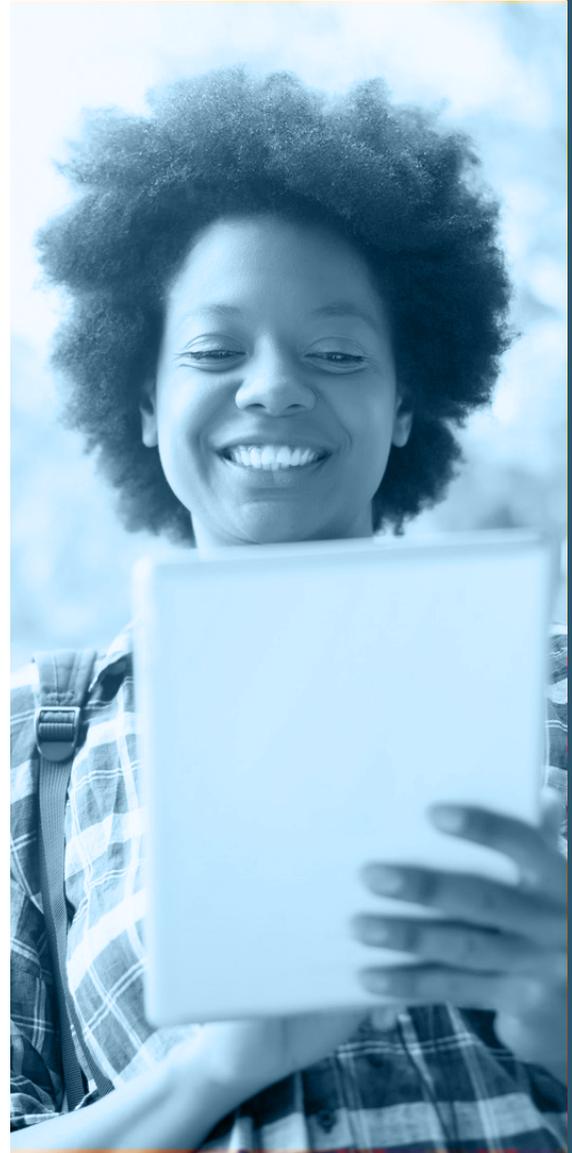
Achieve3000 Literacy: An Effective Way to Measure Growth in Reading Ability

Students in the United States are frequently assessed to determine their progress toward educational benchmarks. While the Every Student Succeeds Act (ESSA) of 2015 reduced the federal role in education accountability decisions, all states must still establish student performance goals and hold schools accountable for student achievement in reading, math, and science. However, these annual summative assessments are intended primarily for institutional accountability and occur too infrequently to provide useful feedback to educators. Educators, parents, and students have discovered the value of more frequent feedback available through educational technology designed to collect, compile, and analyze data related to students' educational progress.

Achieve3000 operates on two fundamental premises: a) literacy unlocks student achievement, and b) differentiated instruction is the key to improving literacy. The Achieve3000 platform provides the only cloud-based, differentiated instructional solutions designed to reach a school or district's entire student population as well as adult learners. For students using Achieve3000, reading ability is enhanced through a series of literacy solutions, each designed for a particular portion of the developmental continuum. Smarty Ants® builds foundational reading skills for students in PreK-2; Achieve3000 Literacy accelerates literacy growth for grades 2-12, and Actively Learn supports deeper learning in science, social studies, and ELA for grades 3-12. These solutions have been designed to closely align with state standards to coordinate students' literacy growth with the content-area knowledge they need to succeed in school and prepare for college and careers. Details about each of the solutions are available at www.achieve3000.com.

Achieve3000 Literacy is powered by the LevelSet™ assessment tool and a proprietary software engine, which distributes assignments to an entire class, yet tailors them according to each individual student's reading level. The two main purposes of the Achieve3000 Literacy reading assessments are to provide an initial, baseline measurement of student reading comprehension and to iteratively measure growth in reading comprehension throughout the school year. In this way, reading materials are always matched to the student's just-right reading ability. To meet these goals, a developmental scale must be used to report the results. Achieve3000 Literacy uses the Lexile Framework for Reading, a scientific approach to measuring both reading ability and text complexity of reading materials, to power its assessments and reports. Importantly, the assessments provide accurate feedback on a student's developing reading ability, helping measure progress and forecast future performance.

One of the key advantages of Achieve3000 Literacy is the built-in capability to measure the same individuals repeatedly. Thus, Achieve3000 Literacy is ideally suited to providing educators with a deeper understanding of how their students are developing and progressing in reading ability over time.

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The Lexile® Framework for Reading

The Lexile Framework for Reading, developed by MetaMetrics®, is a unique resource for accurately matching readers with text. Unlike other measurement systems, it evaluates reading ability based on actual assessments, rather than generalized age or grade levels. The true power of the Lexile Framework for Reading is its ability to measure both a person's reading ability and the complexity of a text (e.g., a book or magazine article) on a single developmental scale. The Lexile measure is shown as a numeral with an "L" after it—880L means 880 Lexile.

A student's Lexile measure is obtained from a reading test or program. For example, a student who receives an 880L on an end-of-grade reading test is an 880 Lexile reader. Higher Lexile measures represent higher levels of reading ability. A Lexile measure can range from below 200L for emergent readers to above 1600L for advanced readers. Readers who score below 0L receive a BR for Beginning Reader. In some cases, a BR code for readers is followed by a numeral and L (e.g., BR150L). A Lexile reader measure of BR150L indicates that the Lexile measure of the reader is 150 units below 0L.

The Lexile Framework for Reading is based on more than 20 years of research funded by the National Institute of Child Health and Human Development. Its distinct approach to measuring readers and texts has resulted in adoptions by departments of education in nearly half the states and school districts in all 50 states. Tens of millions of students worldwide now receive a Lexile measure that helps them select targeted text from the more than 100 million articles, books, and websites available, as major book retailers, test companies, and text publishers utilize Lexile measures. The Common Core State Standards for English Language Arts cite Lexile measures as key indicators of text complexity and provide recommended Lexile bands for reading comprehension development by grade level to ensure students are on track for college and career text demands.

Today, the Lexile Framework for Reading is recognized as the most widely used reading metric. It is a powerful tool for connecting learners of all ages with materials at the right level of challenge and monitoring their progress toward goals and standards. You can find out more about the Lexile Framework for Reading at www.Lexile.com.

Bayesian Approach to Lexile Scoring

Achieve3000 Literacy uses the LevelSet assessment tool and a proprietary software engine to determine student reading ability on an ongoing basis. This system produces repeated measures of students' reading abilities as they learn. For students with sufficient reading abilities, Achieve3000 Literacy uses a Bayesian scoring algorithm to provide continually updated measures and monitor progress in reading development. The Bayesian approach uses prior scores to refine each new estimate of achievement to improve the accuracy of measurement as students learn. In this way, Achieve3000 Literacy uses multiple measures over time to improve the assessment of reading ability, which in turn improves the ability to match students with appropriate texts.

Once an ability estimate has been obtained from an administration of LevelSet and/or multiple-choice activities associated with lessons, that information serves as the basis for predicting achievement expected to occur over a short period of time. However, when a substantial amount of time will pass before the next assessment (e.g., forecasting to the end-of-year assessment), an allowance must be made for growth that is likely to occur between the most recent Lexile measure and the Lexile measure likely to be received at the end of the year. This allowance is estimated using a statistical model that determines the expected growth as a function of the elapsed time between the two administrations.

MetaMetrics developed the growth rate model based on an analysis of longitudinal data for reading and mathematics across grades 1-12 for more than 100,000 students. This research found that younger students grow at a faster rate than older students, but that the growth was mostly linear within a school year; that is to say, students in any given grade made about the same amount of growth each month. The forecasting model is robust when the assessment dates fall within a school year.

The accuracy of the forecast improves as a student takes the recommended LevelSet assessments or completes multiple-choice activities, both because of the availability of more prior data to estimate the student's ability level and the shorter time that will elapse between the administration of the most recent assessment and the administration of the end-of-year assessment.

Forecasts of expected Lexile growth derived from MetaMetrics's growth model are available to educators through reports. In addition, Achieve3000 uses the same growth model to determine the expected Lexile growth between any two points in time within a school year and includes such information in custom reports provided to educators. To determine if students are achieving desired Lexile growth, expected Lexile growth is often compared to actual Lexile growth.

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# Tracking and Interpreting Growth with Achieve3000 Literacy

Three key reports in Achieve3000 Literacy are helpful for examining forecasted expected Lexile growth and for tracking student progress towards proficiency targets: the *How has Lexile reading measure performance changed over time?* report; the *How likely are my students to be on track for College and Career when the high-stakes test is administered?* report; and the *How are my students likely to perform on the state test?* report.

Expected Lexile Growth

Figure 1 shows an example of the *How has Lexile reading measure performance changed over time?* report. The report displays the monthly Lexile measure for students up to the current period. The "Growth" column shows the amount of Lexile growth from the LevelSet pre-test to the most recent monthly Lexile measure. The "Initial Expected Post-Test Score" shows the forecasted Lexile post-test score based on a student's LevelSet pre-test measure, and the "Current Expected Post-Test Score" shows the forecasted Lexile post-test score based on a student's most recent Lexile measure. If the latter is larger than the former, the student has experienced accelerated growth—that is, growth above what was expected. An additional feature of this report is the "college and career readiness" icon that appears next to the name of students who have met the criteria for being on track for college and career readiness.

It is important to note that all forecasts have uncertainty associated with them. As a general rule, about two-thirds of the time a student's actual post-test Lexile measure will fall within +/-110L of the initial forecasted Lexile measure and +/-95L of the mid-year forecasted Lexile measure.

Figure 1 Report: How has Lexile reading measure performance changed over time?
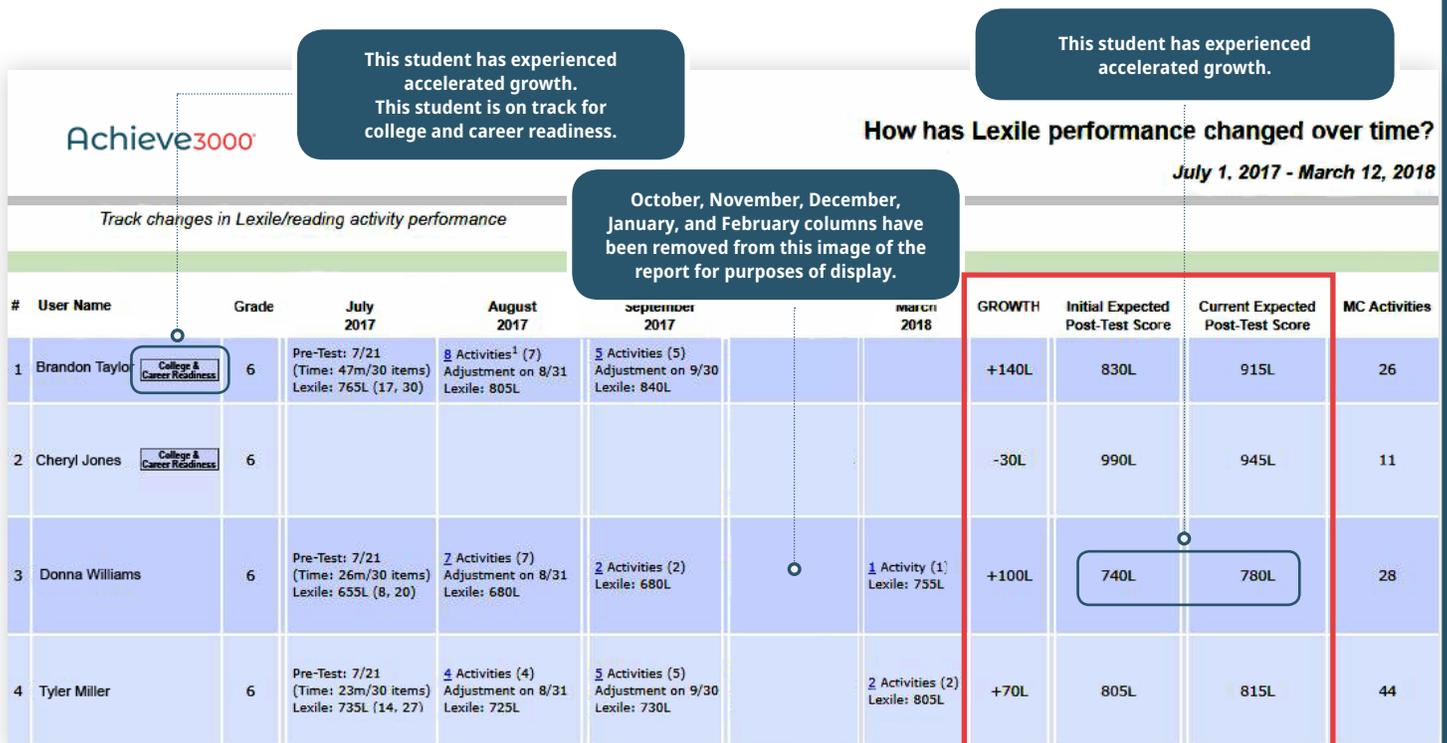
College and Career Readiness

Figure 2 shows an example of the *How likely are my students to be on track for College and Career when the high-stakes state test is administered?* report. The "Current Readiness" column compares a student's current Lexile measures to Achieve3000's college and career readiness proficiency ranges (presented in Table 1 below). Students with current Lexile measures classified as "Falls Far Below" or "Approaches" are considered "Not On Track" to be ready for the reading demands of college and the workforce by the end of high school. Students with current Lexile measures classified as "Meets" or "Exceeds" are considered "On Track" for college and career readiness targets.

Additionally, the "Forecasted Readiness" column provides a forecast of a student's likely readiness at the time of the high-stakes state assessment. Using the current Lexile measure and a proprietary forecasting algorithm from MetaMetrics, the Forecasted Readiness section shows the probability that a student's Lexile measures will fall into each of the four readiness categories at the time of the state assessment.

While the numbers are not guarantees of future performance, the readiness category with the highest probability appears in bold, suggesting a student's Lexile performance is most likely to fall in that category when the state assessment is administered. It is important to keep in mind that this is a dynamic report and will change over time as students' Lexile measures change. Educators can use this information to see how students are progressing toward college and career readiness performance expectations as their state assessment nears, and in turn use this information to make instructional decisions.
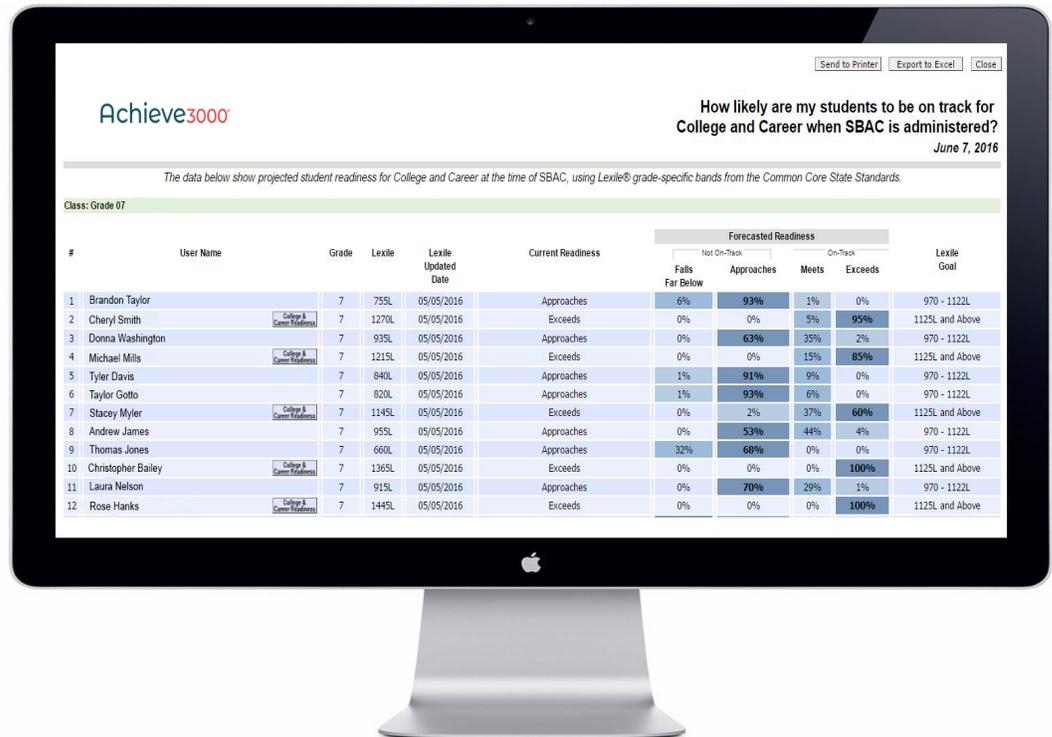

Figure 2 Report: How likely are my students to be on track for college and career when the high-stakes state test is administered?

Achieve3000 Literacy uses four proficiency ranges in each grade (see Table 1) to identify each learner's level of college and career readiness (MetaMetrics, Inc. & Achieve3000, Inc., 2016). Students who are in the two "Not On Track" categories are not meeting the college and career readiness targets for their grade level and are not expected to reach the 1300L level by the end of high school without significant intervention and acceleration. Students in the two "On Track" categories are meeting grade-level targets and can be expected to read at or above 1300L by the time they graduate if they continue to achieve expected or greater growth every year.

**Table 1** - College and Career Readiness Proficiency Ranges

	Not on Track		On Track	
Grade	**Falls Far Below**	**Approaches**	**Meets**	**Exceeds**
1	BR115 and Below	BR110 to 185L	190L—530L	535L and Above
2	150L and Below	155L—415L	420L—650L	655L and Above
3	265L and Below	270L—515L	520L—820L	825L and Above
4	385L and Below	390L—735L	740L—940L	945L and Above
5	500L and Below	505L—825L	830L—1010L	1015L and Above
6	555L and Below	560L—920L	925L—1070L	1075L and Above
7	625L and Below	630L—965L	970L—1120L	1125L and Above
8	660L and Below	665L—1005L	1010L—1185L	1190L and Above
9	775L and Below	780L—1045L	1050L—1260L	1265L and Above
10	830L and Below	835L—1075L	1080L—1335L	1340L and Above
11/12	950L and Below	955L—1180L	1185L—1385L	1390L and Above

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State Test Proficiency

Figure 3 shows an example of the *How are my students likely to perform on the high-stakes state test?* report. This report is available to schools in states where MetaMetrics has linked the state-mandated summative assessment with the Lexile Framework. The report shows how students are likely to perform on their state assessment based on their current Lexile levels as shown in the "Lexile" column. At the beginning of the school year, this Lexile is based on the LevelSet Pre-Test measure. As the year goes on, students' Lexile measures are adjusted based on their performance in the Achieve3000 Literacy program and this report is adjusted, as well. The report shows the date of the last Lexile adjustment, a student's current Lexile measure, and the probability of scoring in each proficiency level by the time the state assessment is administered.

The report also provides the Lexile ranges corresponding to the state proficiency levels. This information has great potential for setting goals for students. The difference between the lower bound of the desired proficiency level and a student's current Lexile measure is the gap that the student needs to strive to close. This gap is defined by the number of Lexile points needed to attain a performance goal by the time the state assessment is administered. The report can be run multiple times throughout the school year to see if the gap is narrowing.

Figure 3 report: How are my students likely to perform on SBAC assessment?
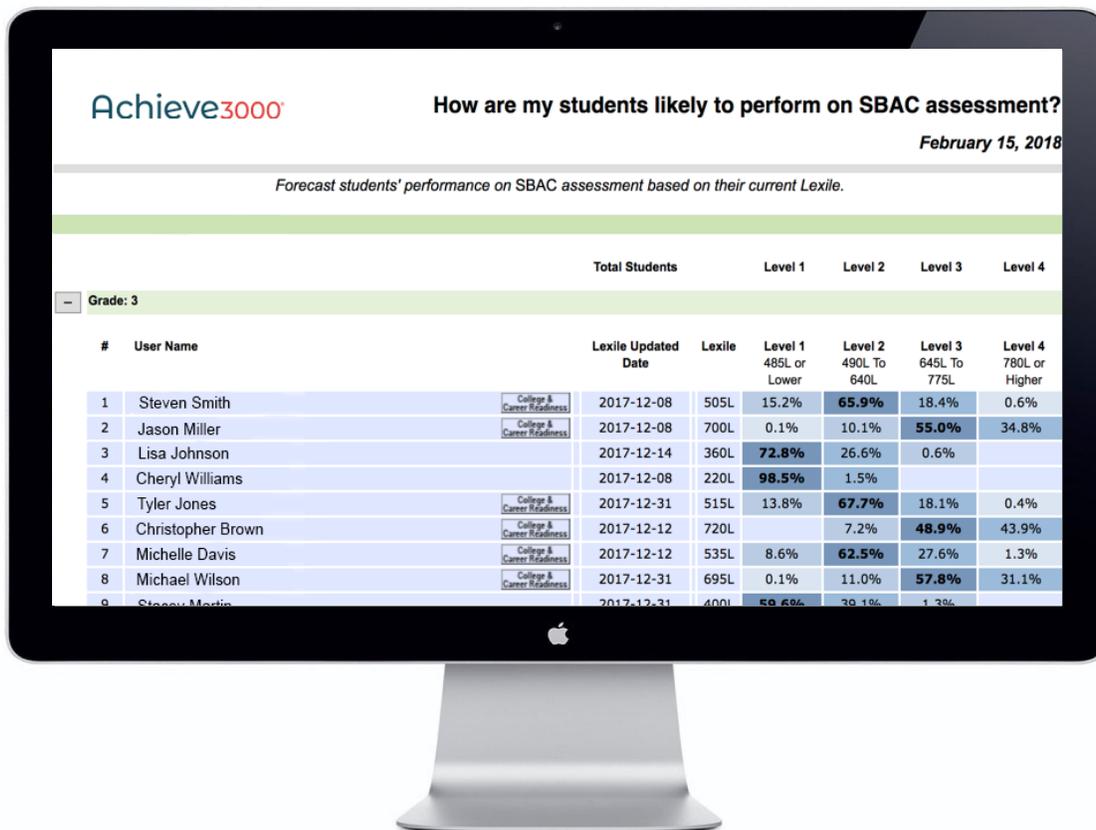
Using Grade-Level Norms to Interpret Growth

While the growth forecasts provided in Achieve3000 Literacy are robust and are based on each student's Lexile level rather than grade level, educators often want to evaluate a student's progress against grade-level expectations. Grade-level norms provide such a benchmark. This section provides an overview of grade-level norms and two types of norms that can be helpful to educators.

What Are Grade-Level Norms?

Norms are measures from a sample of students that are used as a reference. "The group of examinees used to construct the norms is typically considered to be a sample from a larger population" (Kolen, 2006, p. 180). When the larger population consists of students in a particular grade in school in a particular year, the norms are called grade-level norms. If a test is designed to be used across a series of grades, grade-level norms are prepared for each grade, separately. When the reference population of interest consists of students throughout the nation, the test-maker usually provides national norms by grade—that is, grade-level norms for a national sample of the students in each grade in school.

Cross-Sectional Norms

Grade-level norms are inherently cross-sectional in nature, as the norm group consists of students in particular grades who were all tested within the same time frame, such as within a two-week period at the beginning of May in a particular year. For example, suppose a test edition consists of 12 forms, one form designed for students in each of the grades 1-12. The norm group will consist of 12 different samples of students: a national sample of students in grade one, another (separate) national sample of students in grade two, and so on for each grade through grade 12.

Early in the 20th century, a well-known psychometrician suggested that it would be useful to determine whether a student maintains the same percentile rank in successive grade-level norms (Otis, 1922). It became common for educators to assume that the maintenance of percentile rank within successive grade-level norms could be taken as an indication of normal growth (Tallmadge & Wood, 1976). Consequently, maintenance of percentile rank in successive grade-level norms became one convenient definition of expected growth and this equal-percentile method came to be called the channel method for determining growth.

Table 2 below was constructed using the channel method and MetaMetrics' 2017 National Lexile Norms (MetaMetrics, 2016). The table displays the difference in grade-level performance between adjacent grades at two percentiles of the grade-level norms distribution; that is, the table presents spring-to-spring gains for typical (50th percentile) students and students at the 25th percentile in grades 2-11. An interested educator could use this table to determine the growth that may be expected by students in a given grade. Note that the values in this table are not the same as expected growth in the Achieve3000 program, because expected growth in the Achieve3000 program is based on a student's Lexile level, not their grade.

Table 2 - Annual Expected Lexile Gains, Metametrics 2017

Annual Expected Lexile Gains, Spring-To-Spring		
Grade	25Th Percentile Students	50Th Percentile Students
2	280L	260L
3	235L	220L
4	220L	205L
5	95L	100L
6	80L	80L
7	65L	65L
8	60L	60L
9	50L	50L
10	45L	45L
11/12	45L	45L

Longitudinal Norms

Longitudinal data are different from cross-sectional data. Longitudinal data consist of serial measures of the same individuals on successive occasions (e.g., across multiple grades). Collecting cross-sectional data is relatively convenient because one can collect the data from all 12 grades in a single year. But each grade consists of different students. It would take 12 years to collect longitudinal data on the same individuals across all 12 grades, and in that time some students would have moved, making it more difficult to collect their data. But longitudinal data represent the same students every year—a significant advantage when trying to understand growth, particularly the rate at which growth occurs over time.

The rate at which status changes per unit of time is the velocity of growth, or growth rate. The growth rate may itself change over time, as when children experience their pubertal growth spurts, or reading abilities may atrophy over the summer when students do not practice reading. When growth rate changes with time, it manifests as acceleration (or deceleration) of growth.

A growth velocity table for reading was created using longitudinal data of 101,610 North Carolina students using state assessment data (Williamson, 2016). The analysis included longitudinal data spanning grades 3-11, where assessments were administered once a year at the end of each grade. A growth model was derived from these data that allowed growth to be estimated as a function of time. The resulting grade-level estimates are displayed in Table 3. Values along the diagonal represent the expected gain for each year-to-year transition: grade 3 to grade 4, grade 4 to grade 5, and so on. These are the incremental yearly, spring-to-spring growth velocity norms. The other elements of the table display the amount of growth between every other possible pair of grades. This information is useful because it captures longer-term growth expectations, spanning multiple grades.

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To use Table 3 to interpret growth, an educator would find the value along the diagonal that corresponds to the grade of interest. For example, a fourth-grade teacher would locate the value at the intersection of the row for grade 3 and the column for grade 4. The value is 139L, and it describes the expectation for average reading growth between the end of grade 3 and the end of grade 4—that is, the fourth-grade year. Similarly, a fifth-grade teacher would locate the value at the intersection of the row for grade 4 and the column for grade 5 and find that the average growth expected of fifth graders is 122L.

Table 3 should be used with caution as the sample is from a single state and the demographic composition of the sample is unknown.

Table 3 - Incremental Velocity Norms for Average Reading Growth Denominated in Lexile Scale Units

Student Achievement Estimated From The Average Reading Growth Curve									
	664L	803L	925L	1029L	1116L	1185L	1237L	1271L	1288L
End of Grade	3	4	5	6	7	8	9	10	11
3		139L	261L	365L	452L	521L	573L	607L	624L
4			122L	226L	313L	382L	434L	468L	485L
5				104L	191L	260L	312L	346L	363L
6					87L	156L	208L	242L	259L
7						69L	121L	155L	172L
8							52L	86L	103L
9								34L	51L
10									17L

Note: The table is based on an average reading growth curve (ten waves of measurement) for North Carolina students (n=101,610), spanning grades 3-11 during the years 2002-2010. The fitted model is summarized by equation: $E(L|T) = 663.8 + 148.0\ T - 8.7\ T2$ where the time scale is centered at grade 3 (i.e., T = grade -3). Velocity increments for adjacent grades (i.e., spring-to-spring gains) are shown in the shaded diagonal.

Resources For Educators

For those who are interested in additional information, various resources are available to educators. Selected resources that relate to growth, assessment, and Achieve3000 solutions are briefly described below. There are many viewpoints about how best to conceptualize and measure student growth. The analysis of growth and related expectations for growth greatly depend on adopting an appropriate statistical model. Some statistical models are better able to capture salient aspects of growth. This makes it especially important for students, parents, and educators to have a clear understanding of student growth, how it is measured, and how growth expectations may be set in different contexts for different purposes. What is Expected Growth? (Williamson, 2006) explores such issues. Growth and growth models have been popular topics in educational accountability for at least a decade.

Castellano and Ho (2013) published A Practitioner's Guide to Growth Models to help educators understand several models that purport to address student growth and are currently implemented in various state accountability systems. Their guide gives ample evidence of a variety of approaches in current use, including student growth percentiles. LevelSet is an advanced, state-of-the-art assessment system designed specifically to interface with Achieve3000 Literacy solutions. For those who are interested in the technical aspects of its development and/or its psychometric properties, detailed information about LevelSet is available in a technical report, Achieve3000 LevelSet— Technical Guide (MetaMetrics, 2016). Extensive resources are available on the Achieve3000 website, including videos, whitepapers, webinars, literature about educational solutions, and networking opportunities for educators.

Conclusion

Achieve3000 Literacy provides powerful tools for forecasting future performance and tracking progress towards important academic goals. It uses repeated measures and the Lexile scale to provide ongoing insights into students' literacy development. Using a robust growth model developed by MetaMetrics that incorporates a Bayesian perspective on growth over time, Achieve3000 Literacy can forecast students' expected growth, providing educators the opportunity to shift instruction and help students accelerate their pace of growth. The Achieve3000 Literacy platform provides several reports to help educators set academic goals for students and track their progress towards these goals, whether they are based on college and career readiness or proficiency on summative assessments administered by states. To further aid educators, this paper provides grade-level norms, which are a common means of interpreting student achievement and can be used to establish growth expectations. However, because grade-level norms are cross-sectional in nature, it is better to use a longitudinal perspective as the basis for growth expectations. Williamson (2016) provides a growth velocity table that can be helpful in setting growth targets. With knowledge of the tools available in Achieve3000 Literacy and other resources provided in this paper, educators can be well equipped to help their students maximize their growth and achieve their goals.

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About Achieve3000

Achieve3000 delivers a comprehensive suite of digital solutions that significantly accelerate and deepen learning in literacy, math, science, social studies, and ELA. Using personalized and differentiated solutions, Achieve3000 enables educators to help all students achieve accelerated growth. For more than five million students in grades PreK-12, Achieve3000 improves high-stakes test performance and drives college and career readiness.

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