ACT Working Paper Series

Catching up to College and Career Readiness in Kentucky

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Catching Up to College and Career Readiness in Kentucky[1]

Abstract: This report focuses on the extent to which students who are academically far off track in fourth or eighth grade in Kentucky catch up by eighth or eleventh grade. We studied three recent cohorts of Kentucky students whose eighth-grade ACT Explore® scores were more than one standard deviation below the ACT Explore benchmark scores associated with being on track. We found that 5% or fewer of the students who were far off track in eighth grade attained the ACT College Readiness Benchmarks® by the spring of eleventh grade. We did a similar analysis for two cohorts of students beginning in fourth grade, using scores on the Kentucky Core Content Tests in reading, mathematics, and science in grade four and ACT Explore scores in the same subjects in grade eight, and found that catching-up rates ranged from 7% in mathematics to 12% in science. We also found that students from at-risk groups—those who are low-income, African American, Hispanic, English language learners or in special education—have lower catching up rates than their more advantaged peers. These results are of special concern because a large percentage of students from those groups are far off track in fourth and eighth grade.

These findings should underscore the importance of policies and practices that focus on getting students off to a good start in the early grades. These practices are especially important for disadvantaged students. Ongoing research should identify practices that help to accomplish this goal, and state and local policy should support efforts to disseminate and implement those practices.

Keywords: academic preparation, achievement gaps, college and career readiness, early intervention, student growth

Introduction

In recent years educators and policymakers have set a goal that students graduate from high school ready for college and careers. However, as a nation we fall short of achieving this goal, particularly for disadvantaged students. In states where the highest percentages of students

[1] This study uses data maintained by the Kentucky Department of Education and is published with its permission.

took the ACT in 2012, for example, 45% of students in the two lowest family income categories[2] met ACT's national College Readiness Benchmarks in English, 21% in mathematics, 24% in reading, and 18% in science. In Kentucky, of 15,163 students from these two family income categories who took the ACT, 44% met the ACT benchmark in English, 17% in mathematics, 24% in reading, and 16% in science.[3]

A substantial body of research supports the idea that the path to college and career readiness begins in early childhood. Gaps in vocabulary development begin in very early childhood (Hart & Risley, 1995), and students entering kindergarten from disadvantaged backgrounds tend to lag behind their more advantaged peers in vocabulary and overall oral language development (Farkas & Beron, 2004; Dunham, Farkas, Hammer, Tomblin, & Catts, 2007) as well as in early reading and mathematics skills and background knowledge (West, Denton, & Germino-Hausken, 2000). In turn, early reading and mathematics skills and background knowledge predict student success in the later grades (Duncan, Claessens, Huston, Pagani, Engel, Sexton, Dowsett, Magnuson, Klebanov, Feinstein, Brooks-Gunn, Duckworth, & Japel, 2007; Claessens & Engel, 2013; Grissmer, Grimm, Aiyer, Murrah, & Steele, 2010; Geary, 2011). With these findings in mind, recent ACT reports have focused on the importance of getting students off to a good start in preschool and the early elementary grades (Sawyer, 2008; Sawyer & Gibson, 2012; ACT, 2012c; Dougherty, 2013).

Learning gaps that emerge early are likely to widen over time because of "Matthew effects," whereby those who start out ahead are at a relative advantage in acquiring new

[2] These two income categories together consist of students with a self-reported family income of less than $36,000 a year.

[3] These statistics are based on the updated benchmarks of 22 in reading and 23 in science calculated in Allen (2013). The states with the highest percentages of students taking the ACT were Colorado, Illinois, Kentucky, Michigan, North Dakota, Tennessee, and Wyoming. The data file contained the most recent ACT scores of students who were twelfth graders in 2012; ACT scores for students who did not take the ACT in twelfth grade came from earlier grades and years.

knowledge (Stanovich, 1986). These effects can occur because students who already know about a topic often find it easier to learn new information on the same topic (Willingham, 2006), and because prior exposure to knowledge can motivate students to learn more (Durik & Matarazzo, 2009; Maltese & Tai, 2010). In addition, in order to catch up, students who are academically off track must grow faster than students ahead of them. The lagging students must do double duty, catching up on content that they missed earlier while mastering newly taught curriculum. Students who are already on track do not carry this extra burden.

This report follows up on the analysis in a recent ACT research report (Dougherty & Fleming, 2012). We used the recently updated ACT College Readiness Benchmarks (Allen, 2013) as a measure of high school students' academic preparation for two- and four-year colleges and other postsecondary training programs leading to skilled careers (ACT, 2006). These benchmarks identify the ACT scores associated with a 50% probability of earning a B or higher, or a 75% chance of earning a C or higher, in entry-level college courses corresponding to the ACT subject tested (Allen & Sconing, 2005). We used the corresponding ACT Explore College Readiness Benchmarks as indicators of whether eighth grade students are on track to meet the ACT benchmarks. The report focused on students who start out far off track—scoring more than one standard deviation below the ACT Explore Benchmark in eighth grade in a given subject, or more than one standard deviation below the fourth-grade state test score associated with a 50% probability of reaching the ACT Explore Benchmark in eighth grade.

The next section discusses the methodology of our study. The two following sections look at results for students catching up in Grades 8-11 and Grades 4-8. Subsections of the report examine the percentage of far-off-track students from different demographic groups who reached the benchmarks four years later and how far short of the benchmarks the other students fell.

Finally, the conclusion discusses implications of our findings for how educators and policymakers should think about intervention and accountability requirements.

Methodology

Students in the Analysis

Grades 8-11. For the analysis of students catching up in high school, we used data from three cohorts of Kentucky students who took the ACT Explore test in Grade 8 in the 2006-07, 2007-08, or 2008-09 school years and the ACT in Grade 11 three and a half years later (Table 1). This analysis was possible in Kentucky because state education officials provided student-level enrollment, state test, ACT Explore, and ACT data from the state's longitudinal data system that could be matched across datasets and years using the state student ID. This made it possible to link the ACT Explore and ACT results to state enrollment and academic achievement test data, and to disaggregate ACT Explore and ACT results based on state-provided student demographic information.

The data used for the longitudinal study contained about 68% of the population of eighth grade tested students in Kentucky.[4] This percentage is relatively high since Kentucky administers ACT Explore and the ACT statewide. As expected, the students in the longitudinal cohorts in the study—representing students who stayed in school, followed a normal grade progression, remained in the state, and took both ACT Explore and the ACT—had lower percentages of students from typically at-risk groups than did the general population of eighth grade students. For example, students in the study were less likely to be low-income, African American, or in special education (Table 2).[5] This means that any difficulty that students in the study had

[4] From Table 2, the 95,342 Kentucky cohort students were about 68% of the total eighth grade tested population of 140,827 students from the cohorts' eighth grade years. The database did not include twelfth grade ACT scores from Kentucky students retaking the test as high school seniors.

[5] In Table 2, the demographic characteristics of each student was taken from the eighth grade data, so that comparison between longitudinal and eighth grade snapshot cohorts use the same information on each student. Moving from left to right, students in each column of Table 2 are a subset of those in the previous column.

catching up would likely be amplified in the general student population, thus lending greater weight to the findings of this study about the difficulties experienced by far off track students.

Table 1

Kentucky Grades 8-11 Student Cohorts

Student Cohort	School Year Taking ACT Explore	School Year Taking the ACT	Grade Taking the ACT	Number of Students*
2007-2010	2006-07	2009-10	11	30,575
2008-2011	2007-08	2010-11	11	30,755
2009-2012	2008-09	2011-12	11	34,012
Total (3 cohorts)				**95,342**

* 1% of students in these cohorts with incomplete demographic records were dropped from the analysis.

Table 2

Demographics of Kentucky 8th Grade Students 2006-07, 2007-08, and 2008-09 School Years

	Total 8th grade tested student population*	8th graders taking ACT Explore	8th grade ACT Explore takers in longitudinal cohorts
Number of students*	140,827	128,511	95,342
Percent low-income	50	49	43
Percent African American	10	10	9
Percent Hispanic	2	2	2
Percent English language learners	1	1	1
Percent special education	12	11	9

* Students from the Kentucky Core Competency Test (KCCT) databases for the three school years. 1% of students with incomplete demographic records were dropped from the analysis.

Grades 4-8. For students in upper elementary and middle school, we used data from two cohorts of Kentucky students who took the Kentucky Core Competency Test (KCCT) in reading, mathematics, and/or science in Grade 4 in the 2006-07 or 2007-08 school years and ACT Explore in Grade 8 four years later (Table 3). The students in the longitudinal cohorts—who followed a normal grade progression, stayed in the state, and took the ACT Explore test in eighth grade—were similar demographically to the overall population of all fourth grade tested students (Table 4). Differences in the percentages of African American, Hispanic, English language learner, and special education students between the longitudinal cohort and the general student population were small, showing up only in the first decimal place (not shown in Table 4).

Table 3

Kentucky Grades 4-8 Student Cohorts

Student Cohort	School Year Taking 4th Grade Test	School Year Taking ACT Explore	Grade Taking ACT Explore	Number of Students*
2007-2011	2006-07	2010-11	8	35,205
2008-2012	2007-08	2011-12	8	39,368
Total (2 cohorts)				**74,573**

* 1.9% of students in these cohorts with incomplete demographic records were dropped from the analysis.

Table 4

Demographics of Kentucky 4th Grade Students
2006-07 and 2007-08 School Years

	total 4th grade enrollment*	tested 4th graders	tested 4th graders in longitudinal cohorts
Number of students	n/a	87,169	74,573
Percent low-income	n/a	52	51
Percent African American	n/a	10	10
Percent Hispanic	n/a	2	2
Percent English language learners	n/a	2	2
Percent special education	n/a	13	13

* The enrollment data provided by Kentucky begins with the 2008-09 school year. The second column of this table, KCCT-tested students, is analogous to the first column of Table 2.

Disaggregation of Students into Demographic Groups

Grades 8-12 and 4-8. In addition to looking at all tested students, we disaggregated the students in the longitudinal cohorts and the ACT Explore tested population as a whole into 19 additional subgroup categories, making 20 categories altogether. The first set of eight categories consists of:

1. All students
2. Low-income students
3. Non-low-income students
4. African American students
5. Hispanic students

6. Other students[6]
7. English language learners
8. Special education students[7]

An additional set of 12 mutually exclusive categories disaggregates students by income, ethnicity, and gender:

9. Low-income African American males
10. Low-income African American females
11. Low-income Hispanic males
12. Low-income Hispanic females
13. Other low-income males
14. Other low-income females
15. Non-low-income African American males
16. Non-low-income African American females
17. Non-low-income Hispanic males
18. Non-low-income Hispanic females
19. Other non-low-income males
20. Other non-Low-Income females

To keep the number of statistics in the paper to a manageable size, this report focuses on the first eight categories. However, information on students disaggregated by income, ethnicity, and gender (Categories 9 through 20) is available in the Appendix.

[6] The "Other" category consists of individuals who are neither African American nor Hispanic. In Kentucky, the great majority of those students are White. The three ethnic categories (4-6) are mutually exclusive, as are the two income categories (2 and 3).

[7] In addition, we looked at results for the following additional four categories not reported on in this paper: Hispanic English language learners, non-Hispanic English language learners, non-English language learners, and students not in special education.

Division of Students into Academic Preparation Groups

Grades 8-12. We classified eighth grade students into three academic preparation groups in each of four subject areas (English, mathematics, reading, and science) based on their performance on ACT Explore in these areas:

- "On-Track" students met the College Readiness Benchmark score on ACT Explore (Table 5) in the subject.[8]
- "Off-Track" students missed the Benchmark by one standard deviation or less.
- "Far-Off-Track" students scored more than a full standard deviation below the Benchmark.[9]

For example, a score of 16 or better in ACT Explore Reading indicated that a student was On Track; Off Track students scored from 13 to 15, while students scoring 12 or below were classified as Far Off Track. Similarly, Table 6 shows the ACT scores indicating that a student is On Track (meeting the ACT College Readiness Benchmark), Off Track, or Far Off Track. These benchmarks, first set in 2005, were updated in 2013 based on more recent data linking students' ACT scores to their grades in credit-bearing first-year college courses (Allen, 2013; Allen & Sconing, 2005). In the update, the English and mathematics benchmarks remained the same, while the ACT benchmark in reading changed from 21 to 22 and in science from 24 to 23. Similarly, the eighth grade ACT Explore benchmark changed from 15 to 16 in reading and 20 to 18 in science. We used these updated benchmarks for all years of data in this report.

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[8] Readers should note that reaching the College Readiness Benchmark on ACT Explore in the eighth grade does not imply that the student is college-ready in eighth grade, only that he or she is on track to being college ready on the ACT by eleventh or twelfth grade.

[9] Standard deviations were chosen as the yardstick because they provide a common metric across different grades and tests. A one-standard deviation difference in scores is quite large: in reading and mathematics, it is roughly the difference between scoring at the Basic and Proficient levels on the National Assessment of Educational Progress (NAEP), or between the 16th and the 50th percentiles on a norm-referenced standardized test. The size of a standard deviation on ACT Explore (based on national data) was 4.2 points in English, 3.5 in mathematics, 3.9 in reading, and 3.3 in science. Standard deviations on the ACT were 6.4 points in English, 5.3 in mathematics, 6.2 in reading, and 5.1 in science.

Table 5

Student Academic Preparation Levels on ACT Explore (Grade 8)

Academic Preparation Level	English	Mathematics	Reading	Science
On Track Met or exceeded the College Readiness Benchmark	13 or above	17 or above	16 or above	18 or above
Off Track No more than one standard deviation below the Benchmark	9 - 12	14 - 16	13 - 15	15 - 17
Far Off Track More than one standard deviation below the Benchmark	8 or below	13 or below	12 or below	14 or below

Table 6

Student Academic Preparation Levels on the ACT

Academic Preparation Level	English	Mathematics	Reading	Science
On Track Met or exceeded the College Readiness Benchmark	18 or above	22 or above	22 or above	23 or above
Off Track No more than one standard deviation below the Benchmark	12 - 17	17 - 21	16 - 21	18 - 22
Far Off Track More than one standard deviation below the Benchmark	11 or below	16 or below	15 or below	17 or below

In ACT Explore English, few students scored at the Far Off Track level of 8 or below. Thus, we focused our analysis of Far Off Track students in the other three subjects.

Grades 4-8. Similarly, we classified fourth grade students in the two Kentucky cohorts as On Track, Off Track, and Far Off Track based on their scores on the Kentucky Core Competency Tests.[10] This classification was based on a direct link between students' fourth grade KCCT scores in reading, mathematics, and science and their eighth grade ACT Explore scores in the same subjects. This was done by using logistic regression to identify the fourth grade KCCT score in each subject associated with a 50% or better probability of meeting or exceeding the eighth grade benchmark on ACT Explore in the corresponding subject.[11] Data from both cohorts was combined for this analysis. This led to the identification of the fourth grade academic preparation levels shown in Table 7.[12]

[10] In the 2011-12 school year, the KCCT tests in grades 3-8 were replaced by the Kentucky Performance Rating for Educational Progress (K-PREP) tests. The first group of fourth graders taking K-PREP will be eighth graders in the 2015-16 school year.

[11] Students were classified into two categories based on whether they did or did not meet the ACT Explore benchmark in a subject, and a logistic regression model such as the one described in Allen (2013) was used to assess the probability of meeting the ACT Explore benchmark in the subject as a function of the student's fourth grade KCCT score in the same subject.

[12] These preparation levels are slightly different from those identified using different years' data or a different linking methodology, e.g., the methodology used in ACT (2012d). Most of the difference between the On Track reading target shown in Table 7 below and on page 3 of ACT (2012d) is due to the use of the updated ACT Explore reading benchmark. Once that is taken into account, the On Track targets differ by one KCCT scale score point (about .05 standard deviation) in reading and two KCCT scale score points (about .09 standard deviation) in mathematics. This small difference is due to the use of different years of data (fourth grade in the 2009-10 school year in the earlier publication, versus fourth grade in the 2006-07 and 2007-08 school years in this paper) and a different linking methodology (direct links from fourth to eighth grade in this paper, versus direct links from seventh to eighth grade and statistical moderation from seventh grade down to fourth grade in the earlier publication).

Table 7

Student Academic Preparation Levels on the Grade 4 Kentucky State Test

Academic preparation level	Reading	Mathematics	Science
On Track			
Met or exceeded the College and Career Readiness Target	468 or above	466 or above	465 or above
Off Track			
No more than one standard deviation below the Target	449 - 467	445 - 465	447 - 464
Far Off Track			
More than one standard deviation below the Target	448 or below	444 or below	446 or below

Classification of Far-Off-Track Students Based on their Amount of Catching Up

Grades 8-11. For each Far Off Track student in a given subject, we calculated the difference between the student's ACT Explore score and the ACT Explore College Readiness Benchmark in that subject. For example, consider a hypothetical student with a score of 10 on the ACT Explore reading test. This student has a *scale score gap* of -6 relative to the ACT Explore Benchmark score of 16.[13] (The gap is negative to emphasize that the student falls short of the Benchmark.) If the same student scores 16 on the ACT, the student's scale score gap is -6 relative to the ACT Reading Benchmark of 22, the same as the student's scale score gap on ACT

[13] "Scale scores" are the familiar ACT Explore and ACT scores reported on a scale from 1 to 25 and 1 to 36, respectively. They are distinguished from "raw scores" which represent the percentage of test items correct, and other forms of score reporting such as stanines, percentile ranks, and grade equivalents that are used on norm-referenced tests.

Explore. An ACT reading score of 19, on the other hand, would constitute a gap of -3, and the student would have closed half of the ACT Explore score gap. A student scoring at or above the Benchmark on the ACT would have closed all of the gap.

Score gaps can also be measured in standard deviation units. In that case, we refer to them as *z-score gaps*. The definitions of Off Track and Far Off Track students in Tables 5-7 are based on z-score gaps. For example, our hypothetical student with an ACT Explore reading score of 10 has a z-score gap of about –1.54 (= –6/3.9, where 3.9 is the standard deviation of ACT Explore reading scores). This places the student in the Far Off Track group, as the student scores more than one standard deviation below the Benchmark. If the same student scores 16 on the ACT, the scale score gap is unchanged but the z-score gap narrows to –.97 (= –6/6.2, where 6.2 is the standard deviation of ACT reading scores), and the student is counted in the Off Track group. Z-score gaps adjust for the wider dispersion of student scores on the ACT than on ACT Explore. Analogously, a 15-pound weight gap is a larger share of typical weight differences among 5-year-olds than it is among 30-year-olds, so a five-year-old who is 15 pounds overweight might be considered to be "more overweight" than a 15-pounds-overweight 30-year-old. This may be small consolation to the 30-year-old who must still make the effort to lose 15 pounds. So both score gaps and z-score gaps are useful measures of how far students fall short of On Track benchmarks.

Using score gaps as the metric, we classified students who scored Far Off Track on a given subject on ACT Explore into four *scale score growth categories* based on how much they closed their scale score gaps in the same subject when they took the ACT (Table 8). Likewise, we divided those students into four *z-score growth categories* based on how close they came to reaching the ACT Benchmarks (Table 9).

Table 8

ACT Explore-ACT Scale Score Growth Categories for Far Off Track Students

Category 1	"Reached Benchmark": the student closed the entire ACT Explore scale score gap by scoring at or above the ACT College Readiness Benchmark.
Category 2	"Closed half or more of gap": the student's ACT Explore scale score gap narrowed by half or more on the ACT.[14]
Category 3	"Closed gap by less than half": the student's ACT Explore scale score gap narrowed on the ACT, but by less than half.
Category 4	"No gap closing": the student's ACT Explore scale score gap stayed the same or widened on the ACT.

Table 9

ACT Explore-ACT z-Score Growth Categories for Far Off Track Students Based on the Change in the Student's Academic Performance Level

Category 1	"Reached Benchmark": the student moved from Far Off Track on ACT Explore to scoring at or above the ACT College Readiness Benchmark.
Category 2	"Reached top half of Off Track level": the student moved from Far Off Track to scoring in the top half of the Off Track performance level on the ACT.[15]
Category 3	"Reached bottom half of Off Track level": the student moved from Far Off Track to scoring in the bottom half of the Off Track performance level on the ACT.
Category 4	"Stayed Far Off Track": the student scored in the Far Off Track category on the ACT.

[14] This is a less stringent criterion that proposed in ACT (2009), which suggested that Off-Track students be expected to close half the point gap between ACT Explore and PLAN and half of the gap again between PLAN and the ACT, or three-quarters of the gap altogether between ACT Explore and the ACT.

[15] The ACT scores required to reach this category are 15 in English, 20 in mathematics, 19 in reading, and 21 in science.

To see how students are placed in these categories, consider our far-off-track eighth-grade student with an ACT Explore reading score of 10, representing a scale score gap of -6 and a z-score gap of -1.54 relative to the Explore reading benchmark of 16. If the student later scores at or above the College Readiness Benchmark of 22 on the ACT reading test, that student attains Category 1 on both growth metrics. To reach Category 2 on scale score growth, the student must score 19-21 on the ACT, reducing the scale score gap relative to the Benchmark to 3 points or less. To reach Category 2 on z-score growth, the student must score no more than one-half standard deviation below 22, also a score of 19-21. (A half standard deviation in ACT reading is 6.2/2 = 3.1 points.) For Category 3 on scale score growth, the student must score 17 or 18 on the ACT; a score of 16 or below would fail to narrow the 6-point gap relative to the Benchmark, thus leaving the student in Category 4. In comparison, an ACT score of 16-18 places the student in Category 3 on z-score growth, since the borderline between Category 3 and 4—one standard deviation below the Benchmark—falls between an ACT score of 15 and 16.[16]

Scale score growth measures between two tests depend on the tests having a common vertical scale, as is the case for ACT Explore and the ACT. Z-score growth measures can be used even if no such scale exists, as long as the subject matter of the two tests is similar enough for the concept of "growth" to be meaningful.

Because the scores of any predefined group of students contains an error component that is positive on average for students chosen from near the top of the score distribution and negative on average for students chosen from near the bottom, all averages of groups of students *chosen based on their prior performance* tend to move back toward the average of all students. Using a sports analogy, a group of baseball players chosen for the highest batting averages in the first six

[16] Note that the z-score categories only depend on the student's ending point, whereas the scale score categories also depend on how far behind the Far-Off-Track student starts.

weeks of the season will probably bat at a lower average for the rest of the season, even if they continue to bat well above the average for all players (Campbell & Kenny, 1999). This *regression effect* tends to reduce the expected future growth of On Track students and increase the expected future growth of Far Off Track students.[17] Possibly offsetting this regression effect are Matthew effects, which give an advantage to the students with better prior academic preparation.[18]

Scale scores but not z-scores can be used to look for Matthew effects, as z-scores "adjust out" the increased spread of scores over time, including any divergence of groups of students that might be attributable to Matthew effects. Z-score measures do not, on the other hand, remove regression effects. Therefore any z-score measure will always show the top students declining and the bottom students improving, even if their scale scores diverge. Thus, it is not sufficient just to see if Far Off Track students' z-scores improve, but whether they improve enough to bring them close to the Benchmarks. That is the reason for emphasizing the student's ending point when looking at z-scores.

The academic preparation level measures (Far Off Track, Off Track, and On Track) and growth category measures used in this report are subject-specific. A student might be Far Off Track in ACT Explore reading and/or achieve little growth in that subject between ACT Explore

[17] In eighth grade, the cut scores for being On Track (shown in Table 5) were slightly below the Kentucky ACT Explore score mean of 13.9 in English but above the Kentucky means of 14.6 in mathematics, 14.0 in reading, and 16.0 in science. Thus any On Track score was above the state average in three of the four subjects.

[18] Faster growth of groups of previously higher performing students than of groups of lower performing students is highly suggestive of Matthew effects. In fact, because of regression to the mean, the *same* growth by groups of previously higher performing students could be suggestive of these effects. On the other hand, the fact that individual scores diverge over time is not in itself proof of Matthew effects, as individual scores will spread out over time even if current period score growth is uncorrelated with growth or performance levels in prior periods – think of the spreading out of an ink blot even if all movement of ink molecules is random and unrelated to prior position or movement. Note also that growth comparisons of student groups that begin at different levels depend on the assumption that the score scale has equal-interval properties – that is, growth from 10 to 15 has the same meaning as growth from 20 to 25.

and the ACT, but perform very well in ACT Explore mathematics and/or achieve strong mathematics growth between ACT Explore and the ACT.

Grades 4-8. We used students' Kentucky Core Competency Test scores in reading, mathematics, and science in Grade 4 and the ACT Explore scores in reading, mathematics, and science in Grade 8 as our endpoints for student growth. As the KCCT and ACT Explore tests were not scored on a common vertical scale, no scale score growth measure exists between the two sets of tests.[19] However, academic performance levels and growth measure can be calculated based on the number of standard deviations that students scored below the On Track measure on each test. Thus, fourth grade Far Off Track students were classified into the four z-score growth categories shown in Table 9 based on the performance level they reached on ACT Explore in eighth grade.

Because z-score growth measures were available at both levels (grades 4-8 and 8-11), we focus on those measures in the main body of this report. Appendix A contains a discussion of scale score growth by Kentucky students in grades 8-11.

Results

Closing Academic Preparation Gaps in High School

What Percentage of Students Were Far Off Track in 8th Grade?

Table 10 shows the percentage of ACT Explore eighth grade test-takers in Kentucky who were Far Off Track in the 2006-07, 2007-08, and 2008-09 school years, the starting years for the students in the three cohorts in this study. Between 29 and 38 percent of students in the overall population were Far Off Track in 2006-07, 2007-08, and 2008-09 (top row of Table 10), depending on the subject tested. These percentages were higher for students in at-risk student

[19] For example, while the ACT Explore is scored on a scale from 1 to 25 in each subject, the 2008 fourth grade KCCT scale scores ranged from 400 to 480 in each subject.

groups, as can be seen from the remaining rows. For example, roughly 44, 49, and 39 percent of low-income students were Far Off Track in mathematics, reading, and science, respectively.

Table 10

Percentage of Kentucky ACT Explore Tested 8th Grade Students Who Were Far Off Track 2006-07, 2007-08, and 2008-09 School Years

			Percentage of 8th graders who were Far Off Track		
Group	Category	Number of students	Mathematics	Reading	Science
1	All students	128,511	32	38	29
2	Low-income	62,651	44	49	39
3	Non-low-income	65,860	21	27	20
4	African American	12,291	52	57	43
5	Hispanic	2,360	42	48	36
6	Other[20]	113,860	30	36	28
7	English language learners	966	61	71	51
8	Special education	14,437	70	67	61

As Table 11 shows, the percentages of Far Off Track students were lower for students in the longitudinal cohorts—who stayed in school, made normal progress through the grades,

[20] As mentioned in an earlier footnote, the "Other" category consists of students who are neither African American nor Hispanic. Thus, the sum of the number of students in the African American, Hispanic, and Other categories equals the total number of students in the top row. Likewise, the number of low-income and non-low-income students adds up to the number in the top row.

remained in the state, and took the ACT college readiness assessment in grade 11. Not only were the students in these cohorts less likely to be from at-risk groups (Table 2), but the longitudinal cohort students from at-risk groups were less likely than others in their demographic groups to be Far Off Track.[21]

Table 11

Percentage of Kentucky ACT Explore Tested 8th Grade Students Who Were Far Off Track Students in Longitudinal Cohorts, 2006-07, 2007-08, and 2008-09 School Years

			Percentage of 8th graders who were Far Off Track		
Group	Category	Number of students	Mathematics	Reading	Science
1	All students	95,342	26	33	24
2	Low-income	41,003	37	43	32
3	Non-low-income	54,339	18	25	17
4	African American	8,160	46	51	37
5	Hispanic	1,457	35	41	29
6	Other	85,725	24	31	22
7	English language learners	532	55	65	45
8	Special education	8,969	66	62	56

[21] For example, the percentages of Far Off Track students among the eighth grade low-income students *not* in the longitudinal cohorts were 57%, 61%, and 51% in mathematics, reading, and science, respectively.

What Percentage of Far Off Track 8th Graders Reached College Readiness Benchmarks by 11th Grade?

Based on an analysis of the Kentucky longitudinal cohorts, few Far Off Track eighth grade students reached the ACT College Readiness Benchmarks by the spring of eleventh grade. Only about 1% of Far Off Track eighth graders met the ACT Benchmark in mathematics, 5% in reading, and 3% in science (Figure 1).[22] Success rates for Off Track students were higher: 13% in mathematics, 25% in reading, and 14% in science. By contrast, the majority of On Track eighth graders met the ACT Benchmarks in Grade 11.

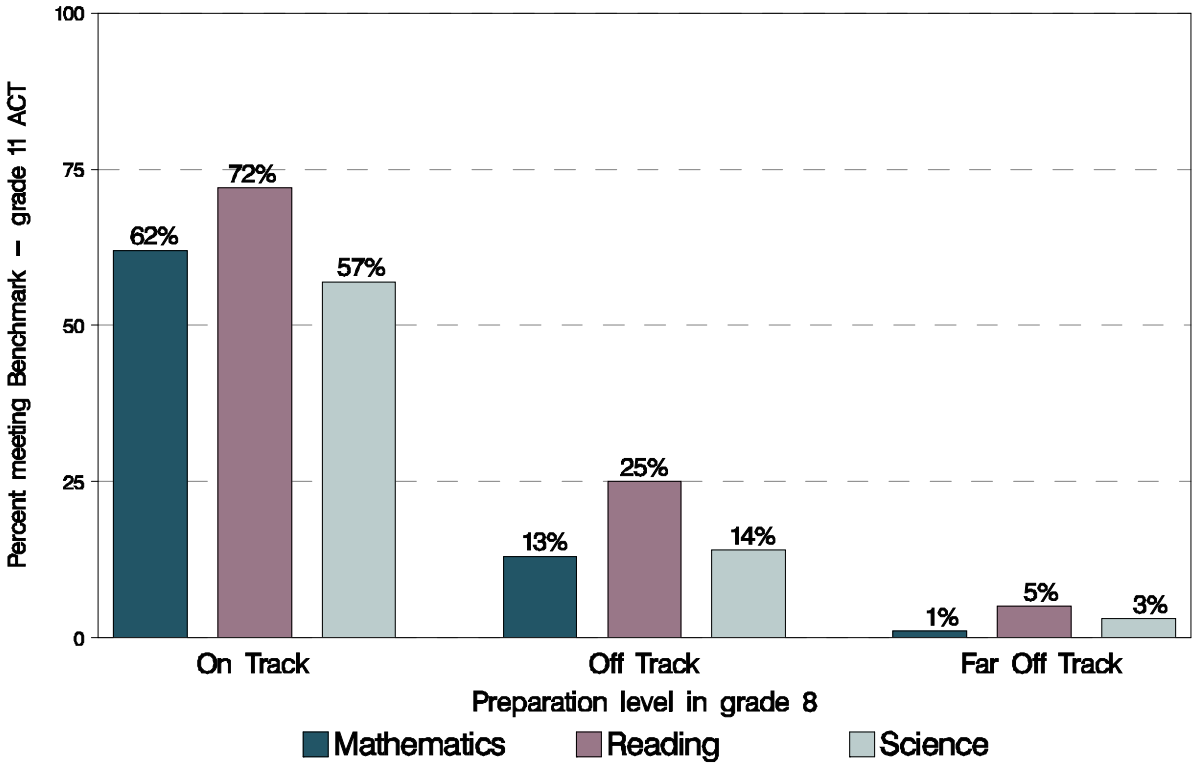

Figure 1. Percent of Kentucky students meeting the ACT College Readiness Benchmarks in grade 11, given their eighth grade ACT Explore performance

[22] Results for English are not included in this chart because, as noted earlier, few students scored at the Far Off Track level of 8 or below on the ACT Explore English exam.

How Did the Percentage of Far Off Track 8th Graders Reaching Benchmarks by 11th Grade Vary Across Student Demographic Groups?

Figure 2 shows how the percentages of Far Off Track eighth grade students reaching College Readiness Benchmarks by eleventh grade varied between low-income and non-low-income students. Figure 3 provides the same information by student ethnic category, and Figure 4 provides this information for English language learner and special education students.[23] These charts show that Far Off Track students from at-risk groups such as low-income students, minority students, English language learners, and special education students reached the Benchmarks at lower rates than did their less at-risk counterparts. This is a matter of concern given that students from these groups were more likely to be Far Off Track in the first place (Tables 10 and 11).

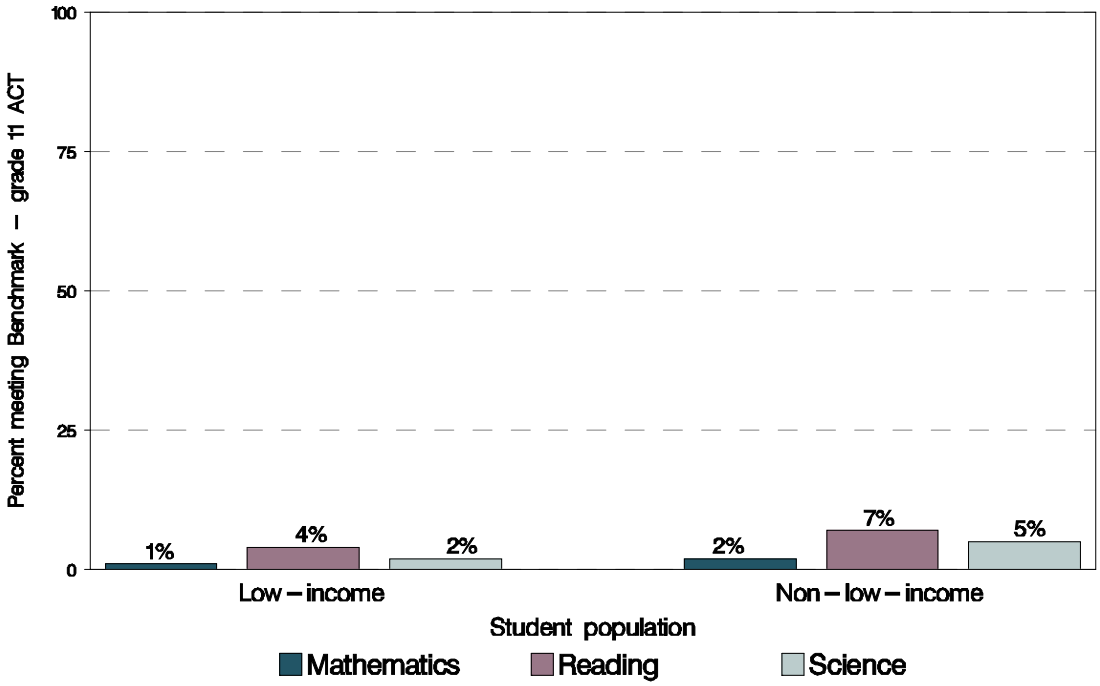

Figure 2. Percent of Far Off Track eighth grade students meeting College Readiness Benchmarks on the ACT in grade 11, by student income category.

[23] The large amount of white space in these charts is deliberate, intended to emphasize the low rate of catching up of Far Off Track students from all demographic categories.

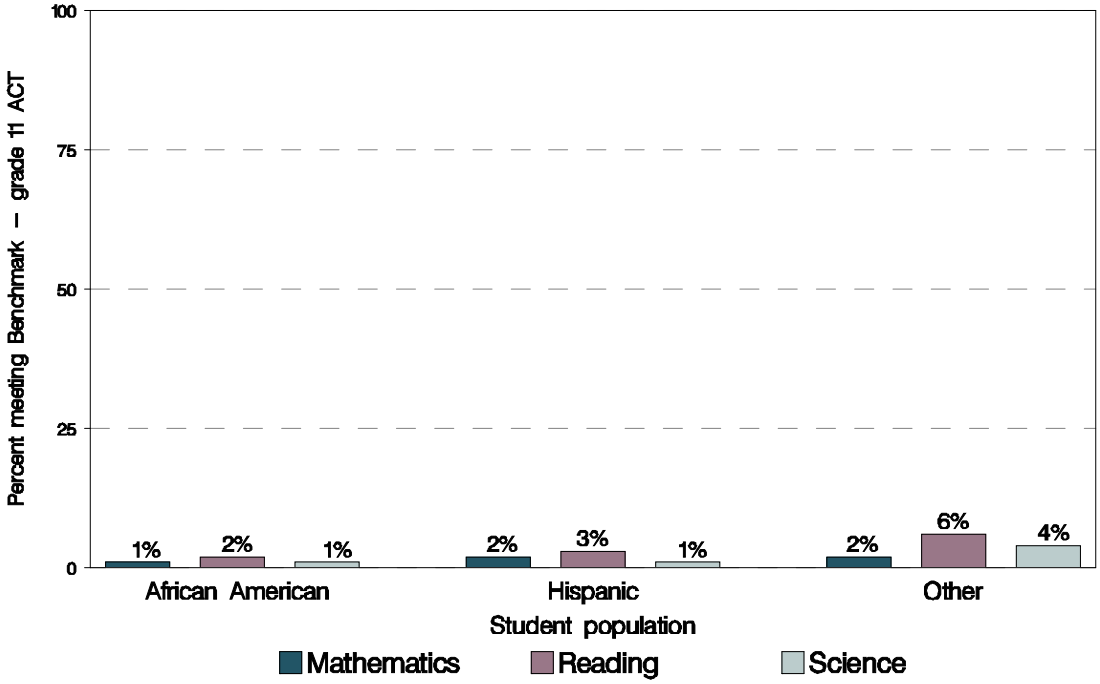

Figure 3. Percent of Far Off Track eighth grade students meeting College Readiness Benchmarks on the ACT in grade 11, by student ethnic category.

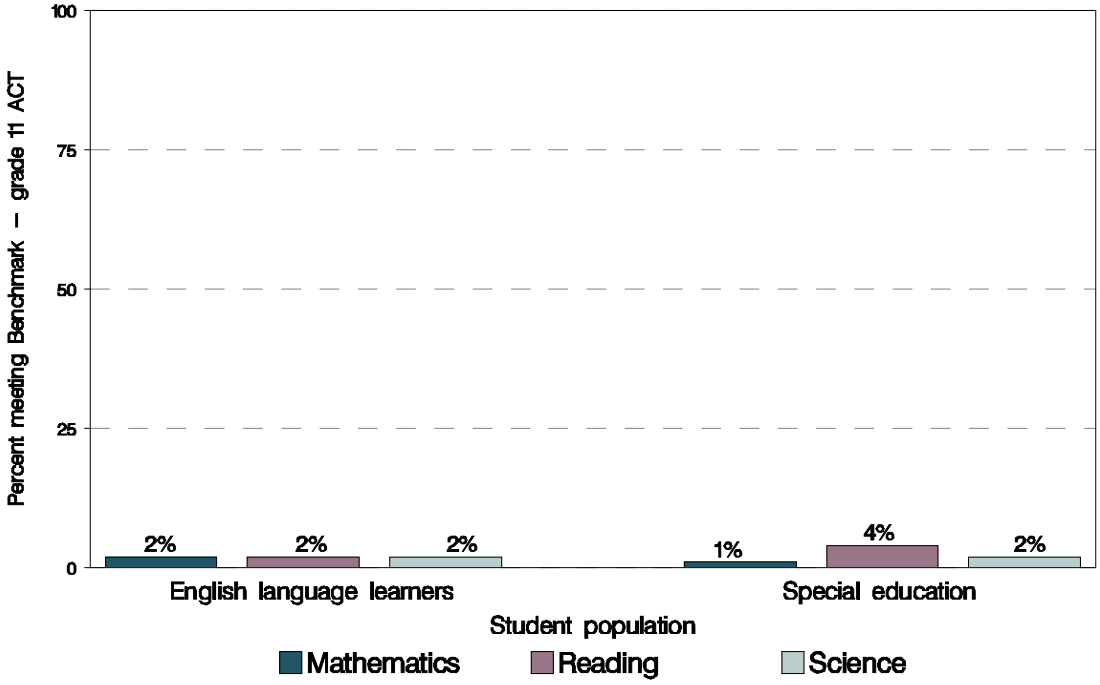

Figure 4. Percent of Far Off Track eighth grade students meeting College Readiness Benchmarks on the ACT in grade 11, for English language learners and special education students.

How Much Growth Towards College Readiness Benchmarks Did Far Off Track Students Achieve in High School?

To address this question, we disaggregated students into the z-score growth categories described in Table 9. We examined how many Far Off Track students either reached or moved up close to the Benchmark, as represented by the top two z-score growth categories. These students are shown in the first and second bar segments in Figures 5-8. (The "Reached Benchmark" category in these charts shows the same statistics as in Figures 1-4.) For example, the overall percentage of Far Off Track students in the top two z-score growth categories (reaching the Benchmark or moving to no more than a half standard deviation below it) was 3% in mathematics, 17% in reading, and 9% in science (Figure 5).[24] For low-income students, the corresponding totals were 2% in mathematics, 13% in reading, and 6% in science (Figure 6).

It is also useful to look at the percentage of Far Off Track students who remained Far Off Track, represented by the lowest growth category in Table 9 and the last bar segment in Figures 5-8. For low-income students, these percentages were 86% in mathematics, 66% in reading, and 73% in science (Figure 6). African American students, English language learners, and special education students were the most at-risk groups based on the percentage of students staying Far Off Track in high school: 87, 70, and 76 percent of African American students remained Far Off Track in mathematics, reading, and science, respectively (Figure 7), while the corresponding statistics for English language learners were 87, 75, and 78 percent, and for special education students, 92, 77, and 80 percent (Figure 8).[25]

[24] Rounding may cause totals in the charts to differ from 100% and subtotals to differ from those reported in the text. For example, in science in Figure 9, 3.32% of students in the first category and 5.34% in the second category add up to 8.66% in the two categories combined.

[25] As discussed in the methodology section, score metrics based on z-scores cannot be used to examine Matthew effects, as dividing by the standard deviation removes the effect of increasing variance in test scores over time.

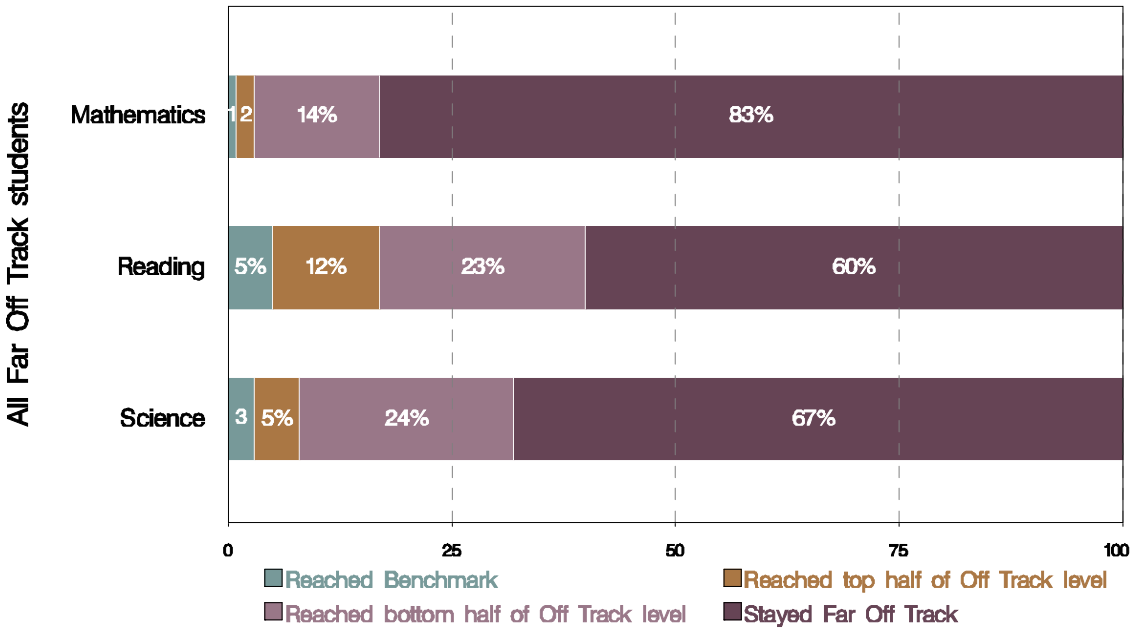

Figure 5. Percent of Kentucky Far Off Track students changing academic preparation levels in grades 8-11, by subject.

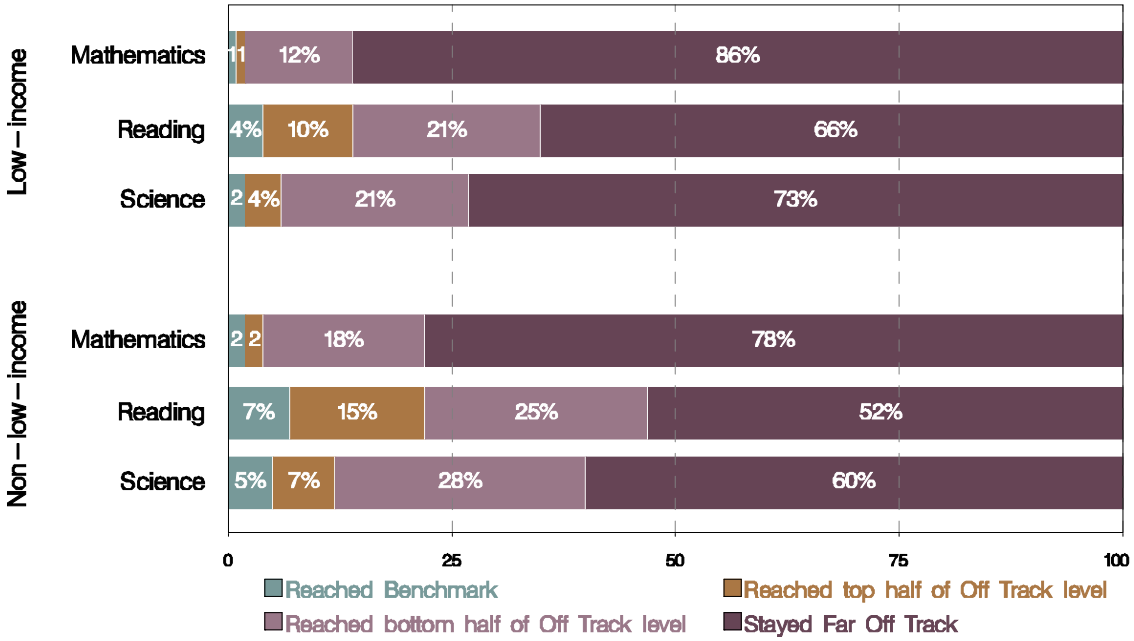

Figure 6. Percent of Kentucky Far Off Track students changing academic preparation levels in grades 8-11, by subject and income.

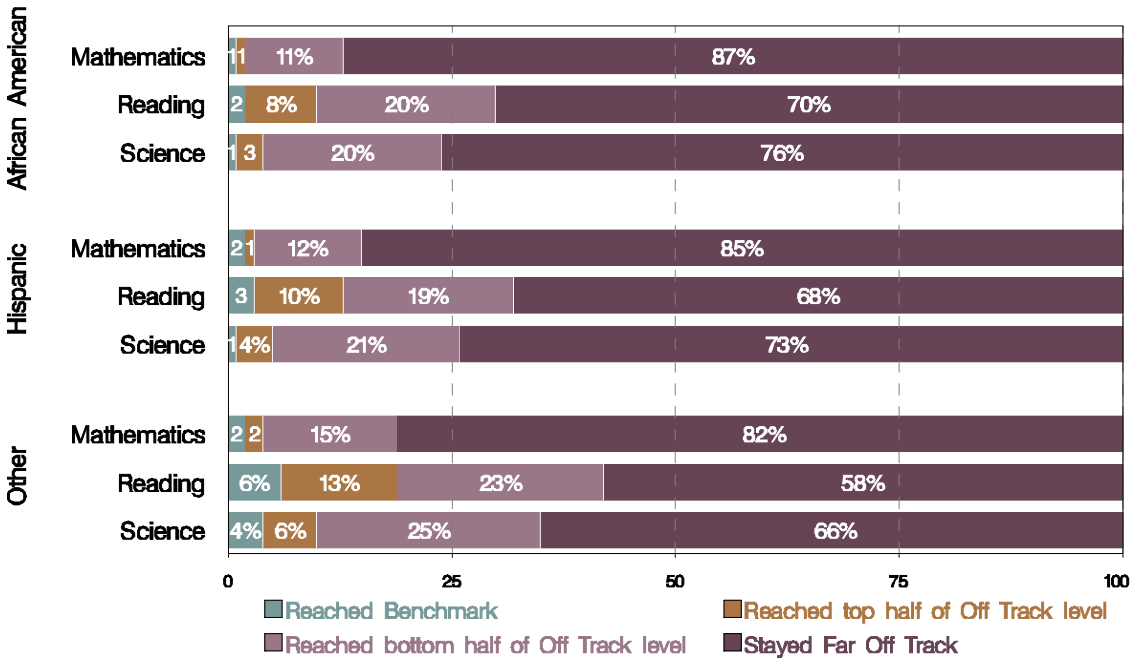

Figure 7. Percent of Kentucky Far Off Track students changing academic preparation levels in grades 8-11, by subject and ethnicity.

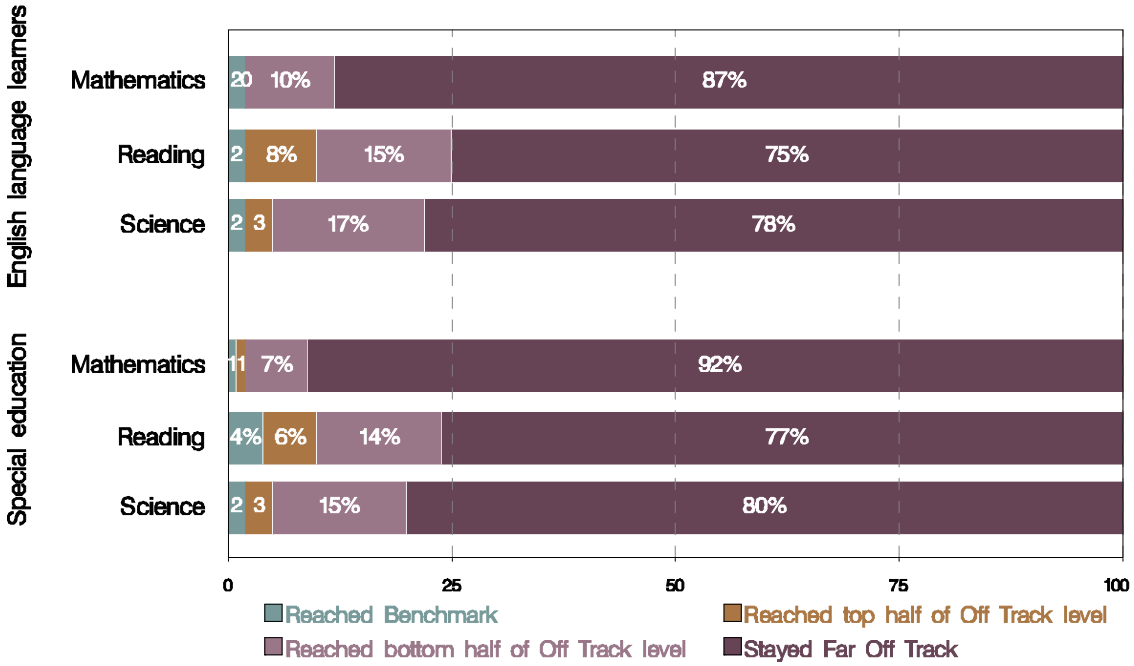

Figure 8. Percent of Kentucky Far Off Track English language learners and special education students changing academic preparation levels in grades 8-11, by subject.

Closing Academic Preparation Gaps Between Grades 4 and 8

What Percentage of Students Were Far Off Track in 4th Grade?

Table 12 shows the percentage of fourth grade KCCT test-takers in Kentucky who were Far Off Track in the 2006-07 and 2007-08 school years, the starting years for the students in the two Grades 4-8 cohorts in this study. 39, 42 and 44 percent of students were Far Off Track in mathematics, reading, and science, respectively (top row of Table 12). These percentages were higher for students in at-risk student groups, as can be seen from the remaining rows. Students in the longitudinal cohorts (Table 13) were Far Off Track at the same or lower rates. However, the difference between the performance of all tested students and the subset of students in longitudinal cohorts was less in grades 4-8 than in high school, as shown by comparing the differences between Tables 12 and 13 with those between Tables 10 and 11. This could result from greater attrition of worse prepared students from the high school cohorts. For example, the 74,573 students in the "All Students" group in Table 13 represent 86% of the 86,936 fourth grade students in Table 12, whereas the 95,342 students in the corresponding group in Table 11 represent 74% of the 128,511 eighth grade students in Table 10. In addition, cohort attrition may be more closely related to academic performance in high school (e.g., students drop out, are retained in grade) than in the middle grades.

Table 12

Percentage of Kentucky Tested 4th Grade Students Who Were Far Off Track 2006-07 and 2007-08 School Years

			Percentage of 4th graders who were Far Off Track		
Group	Category	Number of students	Mathematics	Reading	Science
1	All students	86,936	39	42	44
2	Low-income	45,582	51	52	55
3	Non-low-income	41,354	27	30	32
4	African American	9,086	61	63	69
5	Hispanic	2,304	49	50	58
6	Other	75,546	37	39	40
7	English language learners	1,502	57	61	69
8	Special education	11,640	60	59	61

Table 13

Percentage of Kentucky Tested 4th Grade Students Who Were Far Off Track Students in Longitudinal Cohorts, 2006-07 and 2007-08 School Years

			Percentage of 4th graders who were Far Off Track		
Group	Category	Number of students	Mathematics	Reading	Science
1	All students	74,573	38	41	43
2	Low-income	38,148	49	51	53
3	Non-low-income	36,425	26	30	31
4	African American	7,397	60	62	68
5	Hispanic	1,715	46	49	56
6	Other	65,461	35	38	39
7	English language learners	1,059	56	60	69
8	Special education	9,560	59	58	60

What Percentage of Far Off Track 4th Graders Were On Track by 8th Grade?

For the Kentucky longitudinal cohorts in the study, 7, 8, and 12 percent of Far Off Track fourth graders reached the ACT Explore College Readiness Benchmarks by eighth grade in mathematics, reading, and science, respectively (Figure 9). Success rates for Off Track students were higher: 32, 36, and 37 percent in those three subjects. As was the case in high school, the majority of On Track fourth graders were still on track four years later.

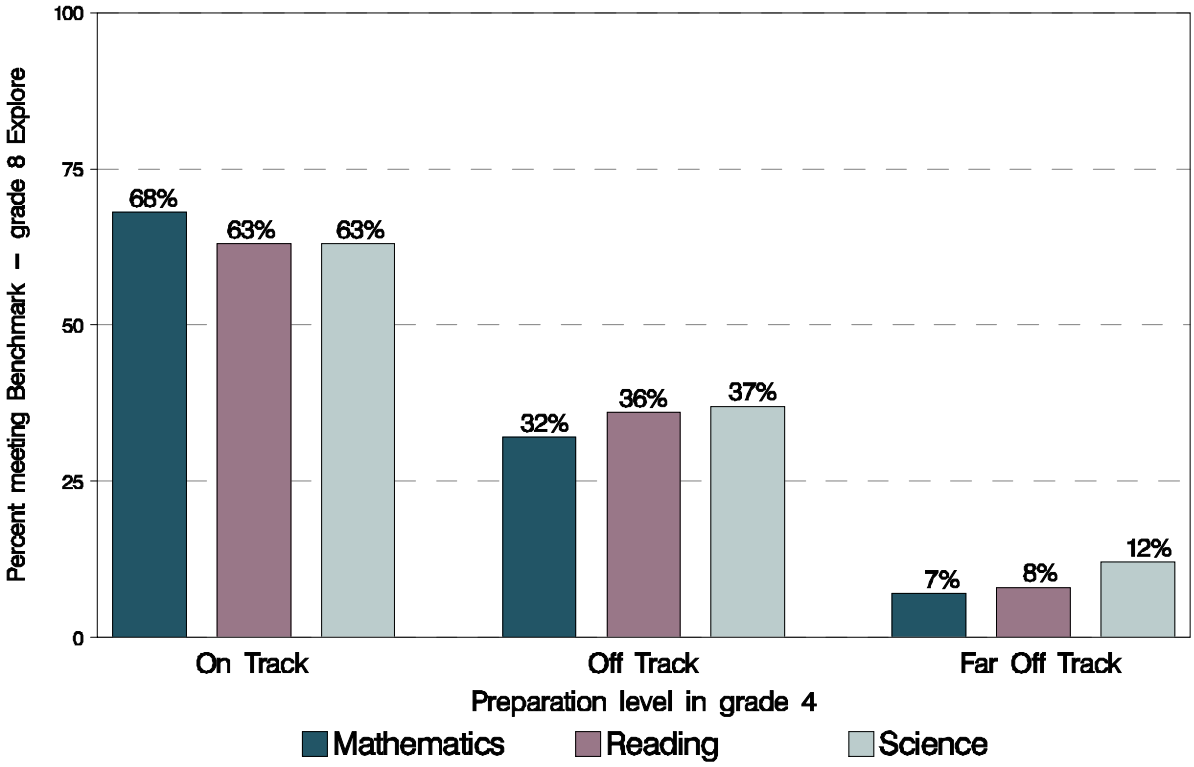

Figure 9. Percentage of Kentucky students meeting the ACT College Readiness Benchmarks on Grade 8 ACT Explore, given their fourth grade KCCT performance.

How Did the Percentage of Far Off Track 4th Graders Getting On Track by 8th Grade Vary Across Student Demographic Groups?

Figure 10 shows how the percentages of Far Off Track fourth grade students getting on track by the eighth grade ACT Explore varied between low-income and non-low-income students. Figure 11 provides the same information by student ethnic category, and Figure 12 provides this information for English language learners and special education students. These charts show that Far Off Track students from at-risk groups caught up at lower rates than did their less at-risk counterparts. Students from these groups were also more likely to be Far Off Track in the first place, as shown in Tables 12 and 13.[26]

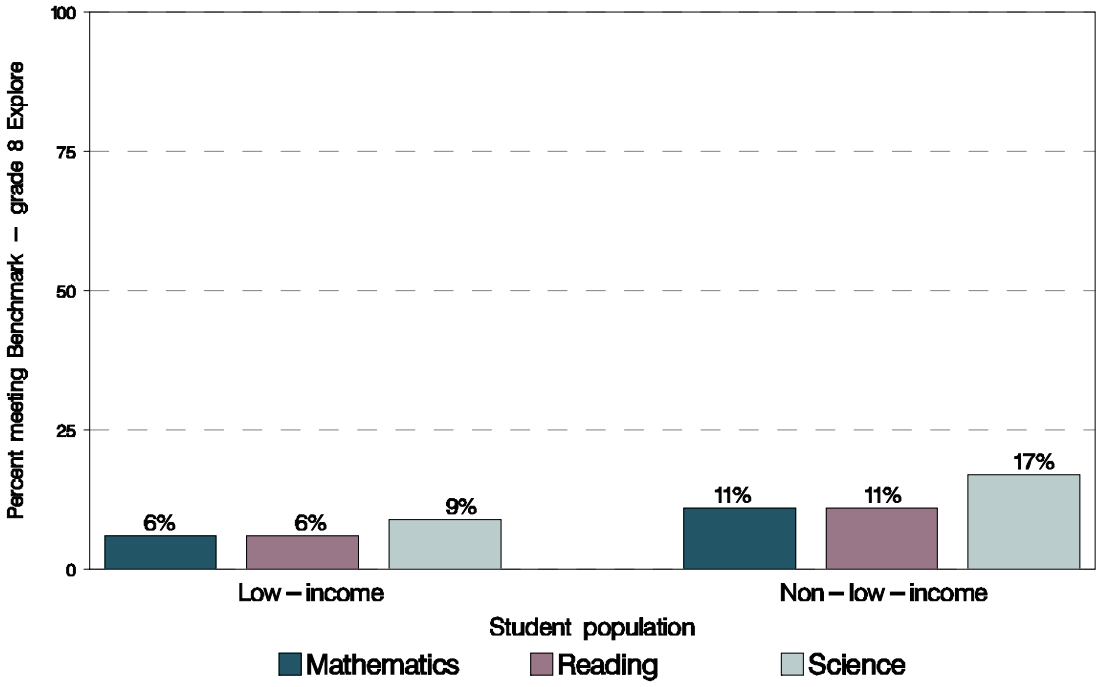

Figure 10. Percentage of Far Off Track fourth grade students reaching the ACT Explore 8th grade Benchmarks, by student income category.

[26] Results for other disaggregated student categories are available in the Appendix.

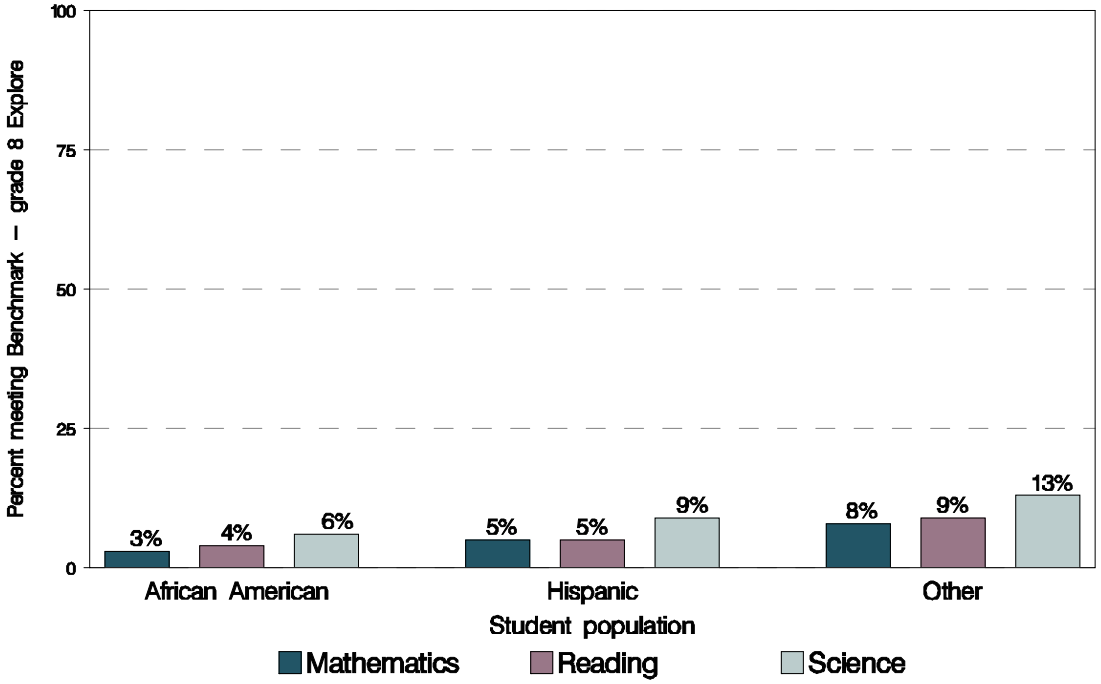

Figure 11. Percentage of Far Off Track fourth grade students reaching the ACT Explore 8th grade Benchmarks, by student ethnic category.

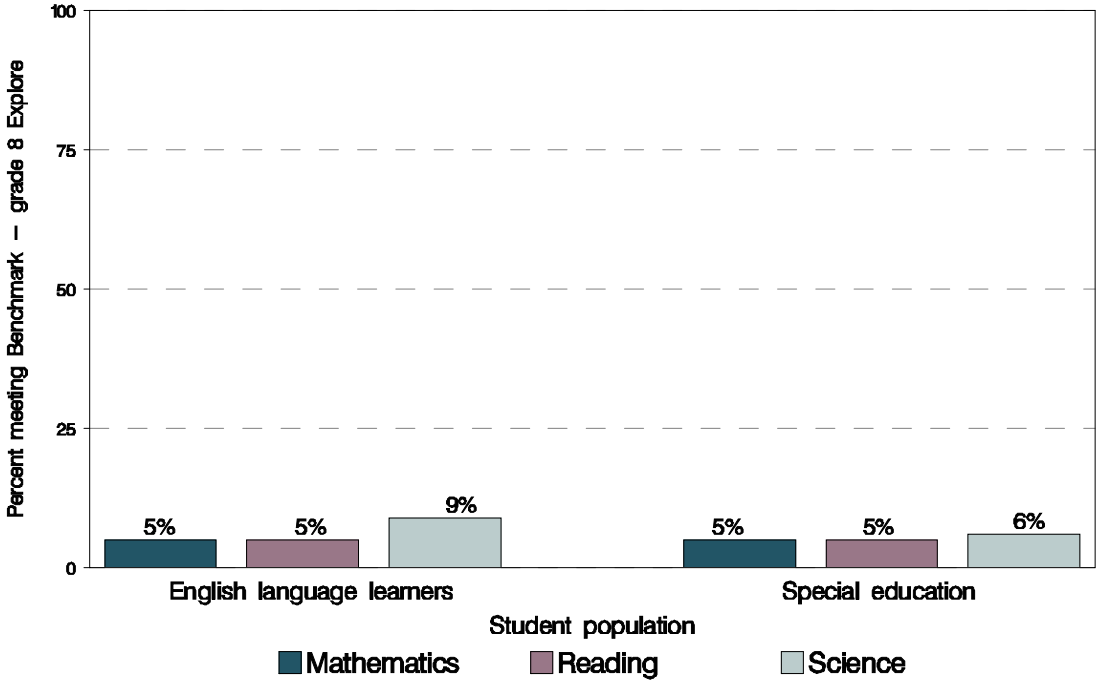

Figure 12. Percentage of Far Off Track fourth grade students reaching the ACT Explore 8th grade Benchmarks, for English language learners and special education students.

How Much Growth Towards 8th Grade Benchmarks Did Far Off Track Students Achieve between Grades 4 and 8?

Using the growth categories in Table 9, we examined the percentage of Far Off Track students who either reached the Benchmark or moved up into the top half of the Off Track category, indicating that they were getting close to the Benchmark (Figures 13-16). (The "reached benchmark" category in these charts reports the same statistics as in Figures 9-12.) The overall percentage of Far Off Track students in the top two growth categories was 18% in mathematics, 15% in reading, and 27% in science (Figure 13). For low-income students, the corresponding totals in those three subjects were 15, 13, and 22 percent (Figure 14).[27]

It is also useful to look at the percentage of Far Off Track students who remained Far Off Track, represented by the last bar segment in Figures 13-16. For low-income students, these percentages were 49% in mathematics, 62% in reading, and 47% in science (Figure 14). African American and special education students were the most at-risk groups based on the percentage of students staying Far Off Track in grades 4-8: 58, 70, and 53 percent of African American students remained Far Off Track in mathematics, reading, and science, respectively (Figure 15), while the corresponding statistics for special education students were 64, 70, and 61 percent (Figure 16).

[27] See footnote 24 about rounding.

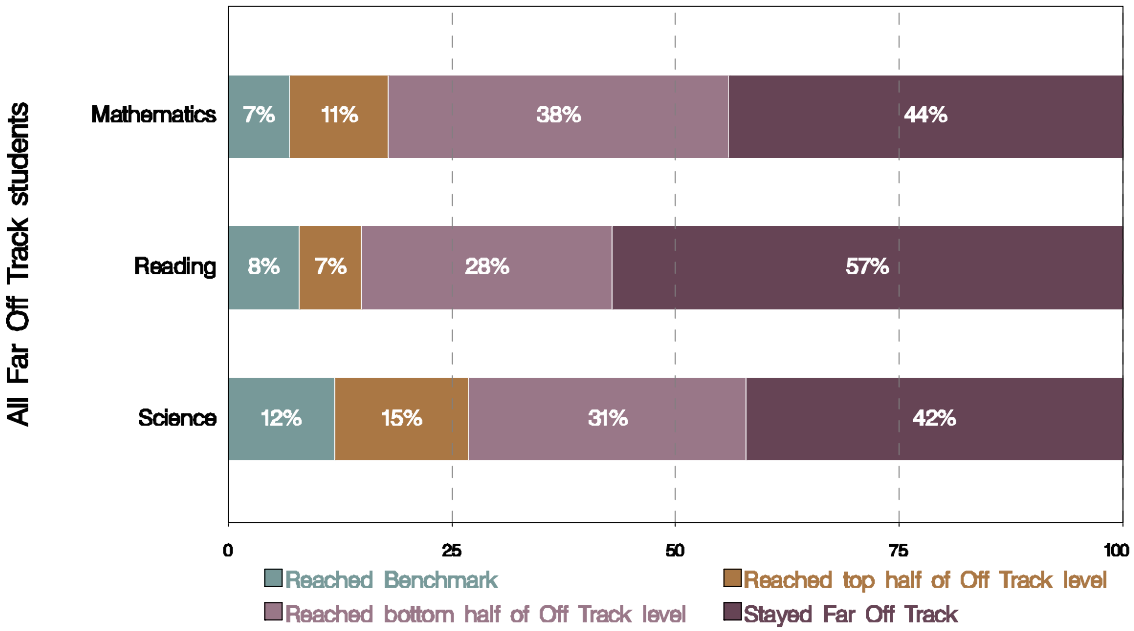

Figure 13. Percent of Kentucky Far Off Track students changing academic preparation levels between Grades 4 and 8, by subject.

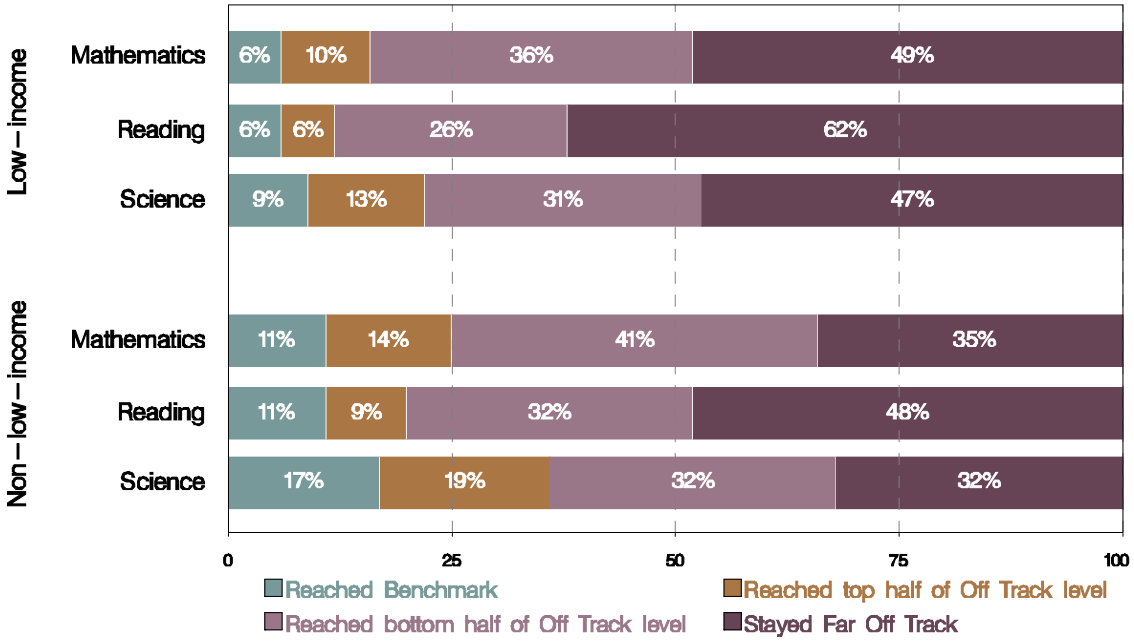

Figure 14. Percent of Kentucky Far Off Track students changing academic preparation levels between Grades 4 and 8, by subject and income.

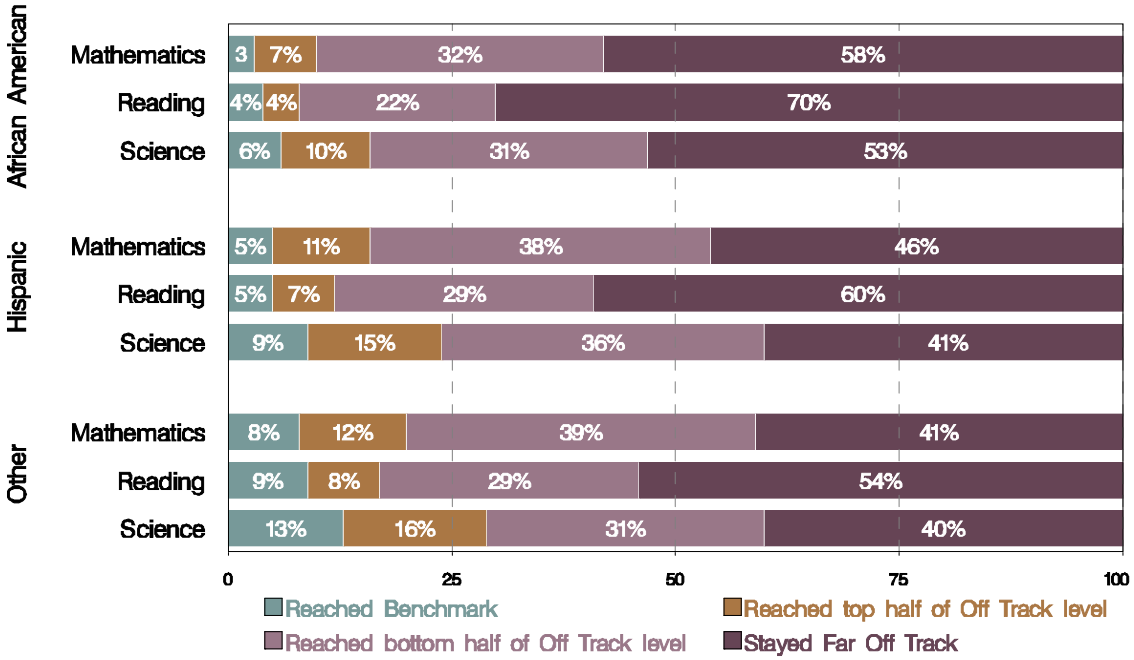

Figure 15. Percent of Kentucky Far Off Track students changing academic preparation levels between Grades 4 and 8, by subject and ethnicity.

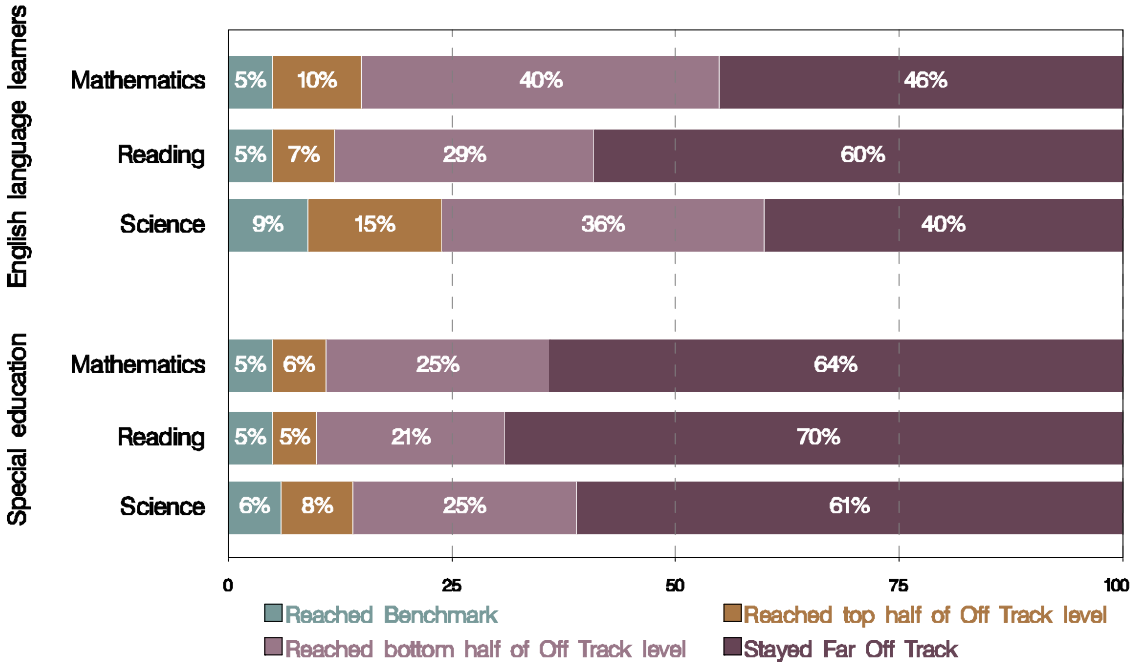

Figure 16. Percent of Kentucky Far Off Track English language learners and special education students changing academic preparation levels between Grades 4 and 8, by subject.

How Did Growth by Far Off Track Students in the Middle Grades Compare with Growth by Far Off Track Students in High School?

Growth comparisons between grades 4-8 and 8-11 can be difficult to make because of differences in selection effects between the two levels. These selection effects ought to favor growth by students in high school cohorts, as attrition is greater in high school.[28] Attrition is likely to remove a disproportionate share of less prepared and slower growing students, who are more likely to drop out, be retained in grade, and not take the ACT.

A second issue complicating comparisons between grades 4-8 and 8-11 is differences in the content alignment of the fourth grade KCCT tests with the eighth grade ACT Explore, compared with the alignment of ACT Explore with the ACT. Differences in content tested reduce the correlation between the results from earlier and later tests, increasing regression effects (Campbell & Kenny, 1999).[29] Thus, lower alignment of the grades 4 and 8 tests would produce more "growth" between grades 4 and 8 for the students who are farthest off track, compared with the growth shown by similar students between grades 8 and 11 on more highly aligned tests. This effect is likely to work in the opposite direction from selection effects, favoring growth in the middle grades over high school.[30]

With these caveats, Tables 14 and 15 compare the percentage of students from each group who made it into the top two performance levels by the end of the period (grade 8 for fourth graders or grade 11 for eighth graders), summarizing information from Figures 5-8 and

[28] The greater selectivity of the high school cohorts can be seen by comparing the size of the cohorts with the total number of tested students in Tables 2 and 4. Also, in grade 8 the students in longitudinal cohorts did better relative to all tested students (Table 11 vs. Table 10) than was the case in grade 4 (Tables 13 vs. Table 12).

[29] A longer time interval between earlier and later tests would also tend to reduce the correlation between the scores. However, because the fourth and eleventh grade tests were given in the spring and the eighth grade test in the fall, the average time intervals between the two sets of tests were not very different: three years and four months for grades 4-8, versus three years and six months for grades 8-11.

[30] Correlations between grade 4 KCCT and grade 8 ACT Explore scores were lower than between grade 8 ACT Explore and grade 11 ACT scores: for the former, correlations in mathematics, reading, and science were .608, .570, and .518, respectively, versus .704, .708, and .636 between grades 8 and 11.

Figures 13-16. In addition, these tables provide information on how far below the On Track level each group of students started out on average, measured in standard deviation units. This information is shown in the columns labeled "average distance below benchmark in grade 4 (or 8)."

In mathematics, the students in the grades 4-8 cohorts started out roughly the same distance behind as did students in the grades 8-11 cohorts, but in general were more successful at making it into the top two levels by the end of the cohort period. For example, African American students in the grades 4-8 cohorts started out an average of 1.87 standard deviations below On Track performance levels in fourth grade; their counterparts in the grades 8-11 cohorts started out about 1.86 standard deviations behind (Table 14). Yet 10% of African American students were able to transition into the top two performance levels in the middle grades, versus 2% in high school. This provides some evidence that it may be easier for students to catch up in mathematics in the middle grades than in high school.

In reading, students caught up at similar rates in grades 4-8, even though they started out farther behind (Table 15). An ordinary least squares regression of z-score growth versus initial scores provides evidence that Kentucky Far Off Track students who were equally far behind in reading did more catching up in the middle grades than in high school.[31] In science, students started out farther behind in grades 4-8 but caught up at higher rates than in grades 8-11 (Table 16), a result also supported by regression analysis.[32] However, the correlation between students'

[31] For example, a student who started out 1.5 standard deviations below the On Track level in fourth grade reading was predicted to move .72 standard deviations closer to the Benchmark between fourth and eighth grade, while a student in a similar position in eighth grade was predicted to move only.29 standard deviations closer to the Benchmark between grades 8 and 11. Similar results obtained when score change per year was used as the metric to allow for differences in students' time to grow.

[32] For example, a student who started out 1.5 standard deviations below the On Track level in fourth grade science was predicted to move .65 standard deviations closer to the Benchmark between fourth and eighth grade, while a student in a similar position in eighth grade was predicted to move only .10 standard deviations closer to the Benchmark between grades 8 and 11.

fourth and eighth grade science scores was relatively low, a likely indication of low content alignment between the two tests.[33] In general, differences in content alignment between the fourth grade state test and ACT Explore, as compared with the alignment of ACT Explore with the ACT, are likely to be an important issue affecting comparisons in all three subjects. Therefore, further evidence is needed to determine whether catching students up in each subject is easier in the middle grades than in high school, and whether current efforts to remediate students in middle school are more effective than similar efforts in high school.

[33] In support of our hypothesis of relatively low content alignment between the fourth and eighth grade science tests, the correlation between students' fourth and eighth grade science scores (.518) was lower than that between their fourth grade science scores and their eighth grade mathematics and reading scores (.533 and .524, respectively).

Table 14

*Percent of Kentucky Far Off Track Students Reaching the Top Two **Mathematics** Performance Levels: Grades 4-8 versus Grades 8-11*

	Grades 4-8			Grades 8-11		
Category	Number of Far Off Track students	Average distance below benchmark in grade 4	Percent in top two growth categories	Number of Far Off Track students	Average distance below benchmark in grade 8	Percent in top two growth categories
All students	28,387	-1.73	18%	24,967	-1.79	3%
Low-income	18,780	-1.79	15%	15,137	-1.83	2%
Non-low-income	9,607	-1.63	24%	9,830	-1.73	4%
African American	4,404	-1.87	10%	3,728	-1.86	2%
Hispanic	794	-1.77	16%	508	-1.79	3%
Other	23,189	-1.71	20%	20,731	-1.78	3%
English language learners	591	-1.84	15%	293	-1.93	3%
Special education	5,643	-2.01	11%	5,880	-2.10	2%

Table 15

*Percent of Kentucky Far Off Track Students Reaching the Top Two **Reading** Performance Levels: Grades 4-8 versus Grades 8-11*

	Grades 4-8			Grades 8-11		
Category	Number of Far Off Track students	Average distance below benchmark in grade 4	Percent in top two growth categories	Number of Far Off Track students	Average distance below benchmark in grade 8	Percent in top two growth categories
All students	30,281	-1.80	15%	30,995	-1.34	17%
Low-income	19,444	-1.86	13%	17,576	-1.36	13%
Non-low-income	10,837	-1.68	20%	13,419	-1.31	23%
African American	4,565	-1.99	8%	4,162	-1.38	10%
Hispanic	844	-1.81	12%	592	-1.34	13%
Other	24,872	-1.76	17%	26,241	-1.33	19%
English language learners	640	-1.86	12%	345	-1.38	10%
Special education	5,528	-1.96	9%	5,554	-1.41	10%

Table 16

*Percent of Kentucky Far Off Track Students Reaching the Top Two **Science** Performance Levels: Grades 4-8 versus Grades 8-11*

	Grades 4-8			Grades 8-11		
Category	number of Far Off Track students	Average distance below benchmark in grade 4	Percent in top two growth categories	Number of Far Off Track students	Average distance below benchmark in grade 8	Percent in top two growth categories
All students	31,716	-1.72	27%	22,602	-1.59	9%
Low-income	20,386	-1.80	22%	13,179	-1.62	6%
Non-low-income	11,330	-1.59	36%	9,423	-1.56	12%
African American	5,043	-1.96	16%	3,015	-1.63	4%
Hispanic	958	-1.80	24%	428	-1.55	5%
Other	25,715	-1.67	29%	19,159	-1.58	9%
English language learners	729	-1.88	24%	239	-1.62	5%
Special education	5,738	-1.97	14%	4,986	-1.74	5%

Conclusion

The results in this study on the difficulty of catching up Far Off Track students are consistent with previous research findings (Sawyer, 2008; ACT, 2008, 2012c; Dougherty, 2010;

Dougherty & Fleming, 2012; Sawyer & Gibson, 2012). This study extends those findings to demographic subgroups such as low-income students, African Americans, Hispanics, English language learners, and special education students. When more states provide the necessary data, research on students catching up by demographic subgroups in those states will be possible.[34]

These results support a general finding that it is difficult for students who are far behind to get on track in middle or high school. While *over*estimating the difficulty of catching up might encourage educators and policymakers to give up on students, *under*estimating the difficulty might lead educators to choose strategies and interventions that are too little and too late. For their part, policymakers who think that catching students up is easier than it actually is may reduce funding for educational programs. They may also hold schools to accountability targets that are not attainable over the period in question, creating strong incentives for leaders at various levels in the system to seek to artificially inflate test scores.

The high percentage of students who are below college and career readiness achievement targets at all grade levels—and the difficulty of catching them up—should also lead educators and policymakers to focus on the importance of early learning and to emphasize prevention over remediation (ACT, 2012c). These prevention strategies may include: changing the regular academic program to give every student access to a content- and vocabulary-rich curriculum beginning in the early years (Willingham, 2009; Common Core State Standards Initiative, 2010; ACT, 2012a; Dougherty, 2013); strengthening the early reading and mathematics program in preschool through third grade; and implementing programs and strategies that improve students' attendance and academic behaviors (Diamond, Barnett, Thomas, & Munro, 2007a, 2007b;

[34] For example, the Arkansas Department of Education provided similar data, making possible a research report on students catching up in that state (Dougherty, Hiserote, & Shaw, 2014, in press). Dougherty & Fleming (2012) examined the percentages of Far Off Track students who caught up in four multi-state student cohorts in grades 8-12 and two statewide Arkansas cohorts in grades 4-8.

Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011; Sawyer & Gibson, 2012). Efforts to close academic preparation gaps should begin as early as possible, be more intensive, and take as long as necessary. Even if starting earlier does not reduce the amount of time it takes for students to catch up, starting earlier gives them more time to catch up.

In addition, a database might be developed to learn more about how effective various programs and interventions are at helping students catch up—from how far behind and over what length of time (Dougherty, 2010). Key components of the database would include information on how far behind the students are at different points in time and on the nature, length and intensity of the interventions they receive. From this, it might be possible to identify combinations of curriculum, interventions, and time requirements that are sufficient to enable most off-track students to succeed.

These findings should also affect the requirements that accountability systems place on schools. For example, reasonable growth goals might be set based on student performance in more successful schools (ACT, 2009, 2012b), and goals for percentages of students reaching college and career readiness should take into account the students' starting points and the number of years the school has available to catch them up, as is done in value-added models. In general, policy and practice should be informed by data on the success of real students in actual schools.

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Appendix A

Narrowing of Scale Score Gaps in Grades 8-11

Because the ACT Explore and ACT tests are scored on a common scale, growth between those two tests can be measured in scale score points. Accordingly, we disaggregated students in the longitudinal grades 8-11 cohorts into the scale score categories described in Table 8. Figure 17 shows the percent of Far Off Track students in the three Kentucky high school cohorts falling into each of these categories. Figures 18, 19, and 20 provide the same information for student demographic groups based on income, ethnicity, and English language learner and special education status. (The "Reached Benchmark" category in these charts shows the same statistics as in Figures 1-4.)

As can be seen from these charts, the majority of Far Off Track students from all student groups did not narrow their ACT Explore scale score gaps on the ACT. For example, scale score gaps on the ACT remained the same on widened for 71% of students in mathematics, 76% in reading, and 74% in science (Figure 17). The percentage of Far Off Track students in the first two scale score growth categories (reaching the Benchmark or closing their scale score gaps by half or more) was 5% in mathematics, 13% in reading, and 11% in science (Figure 17). For low-income students, the corresponding totals were 4% in mathematics, 10% in reading, and 8% in science (Figure 18).[35] These results are broadly similar to those from the z-score analysis. All of this could indicate the presence of Matthew effects and the lack of sufficiently intensive and comprehensive interventions for these students in high school.

[35] Totals on the charts may differ from 100%, and subtotals on the charts from those reported in the text, due to rounding. For example, in mathematics in Figure 17, 1.4% of students in the first category and just under 3.5% of students in the second category add up to 4.9% in the two categories combined, rounding to 5%, even though the first two percentages rounded are 1% and 3%.

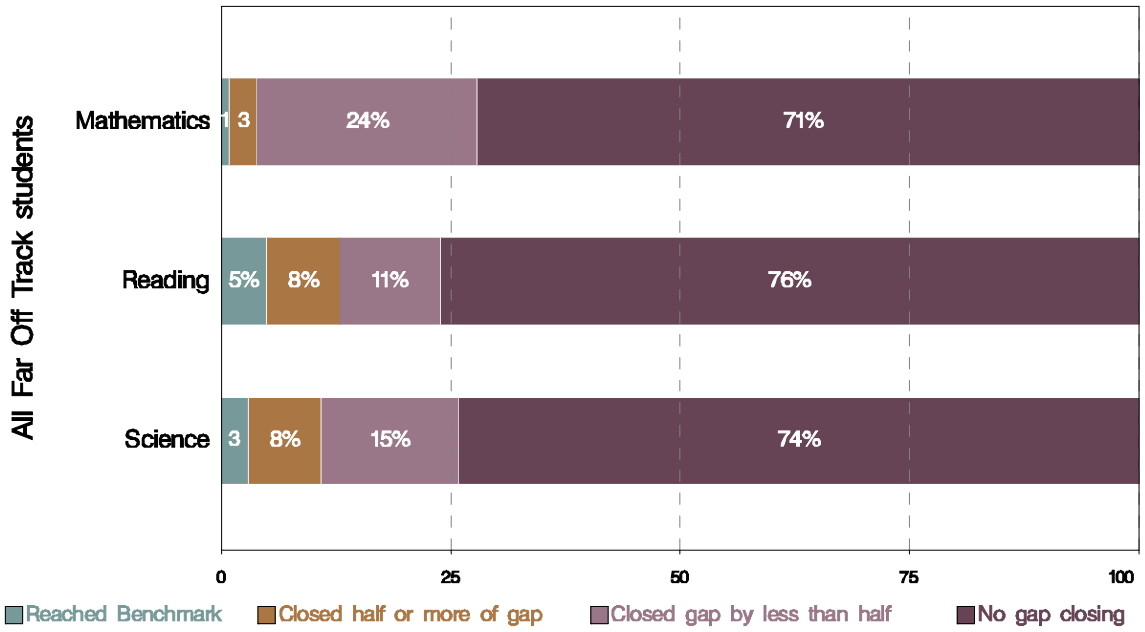

Figure 17. Percent of Kentucky Far Off Track students narrowing scale score gaps relative to the Benchmarks in grades 8-11, by subject.

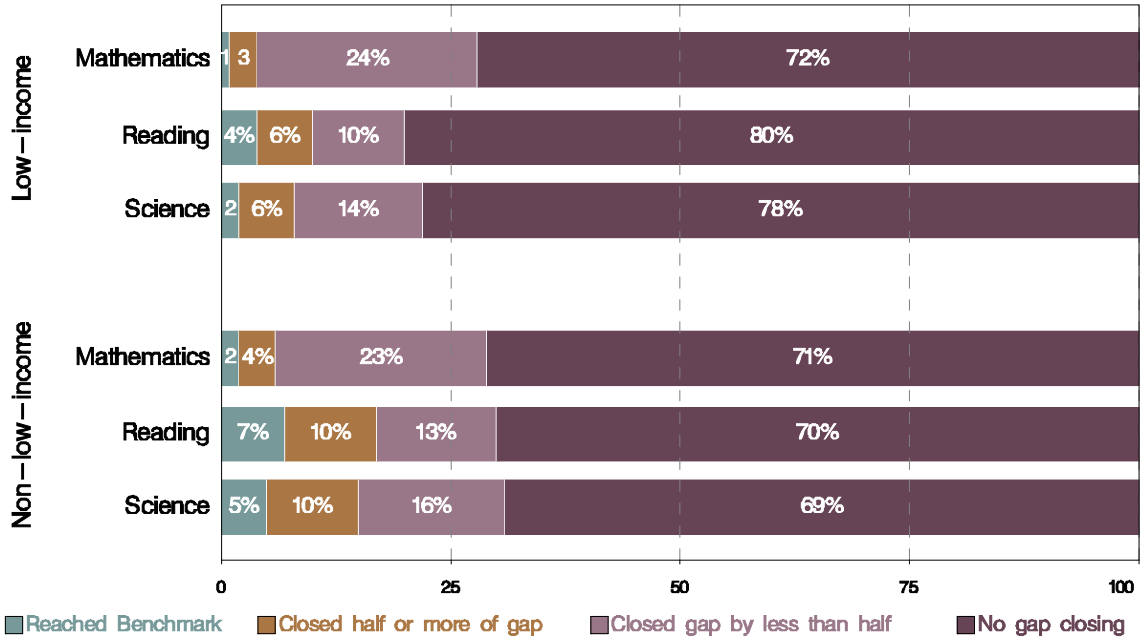

Figure 18. Percent of Kentucky Far Off Track students narrowing scale score gaps relative to the Benchmarks in grades 8-11, by subject and income.

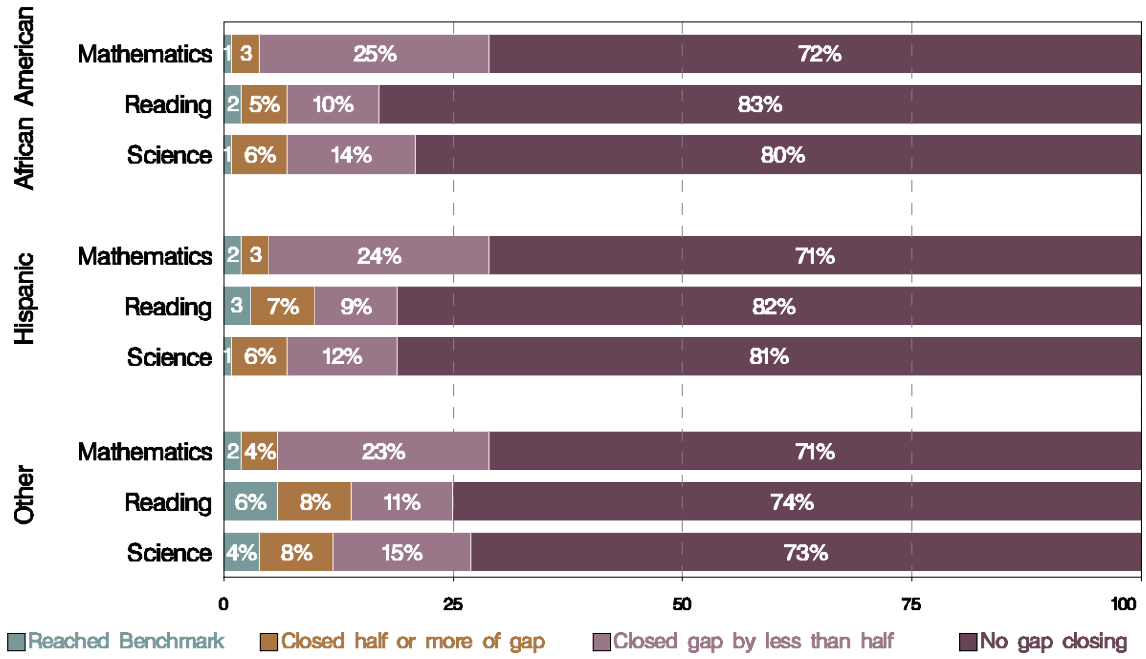

Figure 19. Percent of Kentucky Far Off Track students narrowing scale score gaps relative to the Benchmark in grades 8-11, by subject and ethnicity.

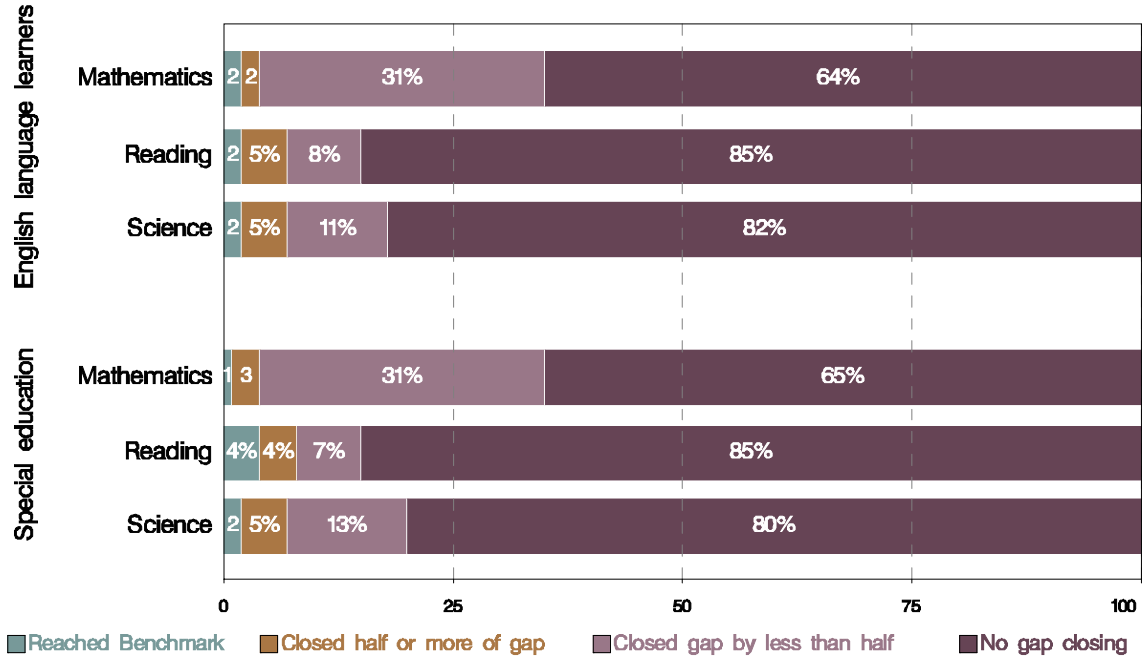

Figure 20. Percent of Kentucky Far Off Track English language learners and special education students narrowing scale score gaps relative to the Benchmark in grades 8-11.

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Appendix B

Results by Income, Ethnicity, and Gender

Table B1
*Percentage of **All Kentucky ACT Explore Tested Students** Who Were Far Off Track in 8th Grade, 2006-07, 2007-08, and 2008-09 School Years*

Group	Income	Ethnicity	Gender	Number of students	Percentage of 8th graders who were Far Off Track		
					Mathematics	Reading	Science
9	low-income	African American	male	4,568	59.7%	68.8%	53.7%
10			female	4,561	54.6%	54.6%	41.2%
11	low-income	Hispanic	male	963	47.4%	56.4%	42.8%
12			female	853	46.8%	48.9%	35.4%
13	low-income	Other	male	26,323	44.2%	53.0%	42.9%
14			female	25,383	38.2%	40.4%	31.5%
15	non-low-income	African American	male	1,596	40.4%	50.8%	37.4%
16			female	1,566	34.5%	35.0%	25.9%
17	non-low-income	Hispanic	male	271	25.8%	34.7%	25.8%
18			female	273	26.7%	27.8%	20.9%
19	non-low-income	Other	male	31,954	22.1%	31.6%	23.3%
20			female	30,200	18.1%	21.4%	15.5%

Table B2

*Percentage of Kentucky Students **in Longitudinal Cohorts** Who Were Far Off Track in 8th Grade 2006-07, 2007-08, and 2008-09 School Years*

					Percentage of 8th graders who were Far Off Track		
Group	Income	Ethnicity	Gender	Number of students	Mathematics	Reading	Science
9	low-income	African American	male	2,682	53.4%	63.8%	46.6%
10			female	3,079	48.5%	49.2%	35.4%
11	low-income	Hispanic	male	561	38.1%	47.1%	35.8%
12			female	526	39.2%	43.0%	28.3%
13	low-income	Other	male	16,628	36.3%	45.9%	35.5%
14			female	17,527	32.9%	35.5%	26.2%
15	non-low-income	African American	male	1,153	36.1%	47.1%	33.6%
16			female	1,246	31.0%	31.5%	23.1%
17	non-low-income	Hispanic	male	177	20.9%	28.8%	21.5%
18			female	193	26.4%	26.4%	20.7%
19	non-low-income	Other	male	25,878	18.5%	28.3%	20.0%
20			female	25,692	16.2%	19.7%	13.6%

Table B3

*Percent of Kentucky **Far Off Track** 8th Grade Students Meeting ACT College Readiness Benchmarks in Grade 11*

				Mathematics		Reading		Science	
Group	Income	Ethnicity	Gender	Number of Far Off Track students	Percent reaching benchmark	Number of Far Off Track students	Percent reaching benchmark	Number of Far Off Track students	Percent reaching benchmark
9	low-income	African American	male	1,433	0.5%	1,710	2.0%	1,250	1.4%
10			female	1,493	0.7%	1,516	1.7%	1,090	0.5%
11	low-income	Hispanic	male	214	2.8%	264	2.3%	201	1.0%
12			female	206	1.0%	226	2.2%	149	0.7%
13	low-income	Other	male	6,030	1.5%	7,637	4.3%	5,905	2.9%
14			female	5,761	0.8%	6,223	4.2%	4,584	1.7%
15	non-low-income	African American	male	416	1.0%	543	4.6%	387	1.8%
16			female	386	0.8%	393	3.8%	288	2.1%
17	non-low-income	Hispanic	male	37	0.0%	51	3.9%	38	2.6%
18			female	51	0.0%	51	3.9%	40	0.0%
19	non-low-income	Other	male	4,785	2.5%	7,330	7.6%	5,170	6.7%
20			female	4,155	1.3%	5,051	7.5%	3,500	3.3%

Table B4

*Percent of Kentucky Far Off Track Students in **Mathematics Scale Score Growth Categories** between Grades 8 and 11*

					Mathematics scale score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached benchmark or closed half or more of gap	(3) Closed gap by less than half	(4) No gap closing
9	low-income	African American	male	1,433	3.7%	29.0%	67.3%
10			female	1,493	2.5%	23.0%	74.5%
11	low-income	Hispanic	male	214	4.2%	22.9%	72.9%
12			female	206	4.9%	26.2%	68.9%
13	low-income	Other	male	6,030	5.2%	27.0%	67.8%
14			female	5,761	3.3%	20.5%	76.2%
15	non-low-income	African American	male	416	4.1%	24.3%	71.6%
16			female	386	3.4%	21.0%	75.6%
17	non-low-income	Hispanic	male	37	5.4%	24.3%	70.3%
18			female	51	5.9%	19.6%	74.5%
19	non-low-income	Other	male	4,785	7.9%	24.8%	67.2%
20			female	4,155	4.6%	20.6%	74.9%

Table B5
*Percent of Kentucky Far Off Track Students in **Reading Scale Score Growth Categories** between Grades 8 and 11*

					Reading scale score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached benchmark or closed half or more of gap	(3) Closed gap by less than half	(4) No gap closing
9	low-income	African American	male	1,710	6.3%	9.2%	84.6%
10			female	1,516	6.5%	8.6%	84.8%
11	low-income	Hispanic	male	264	8.7%	5.7%	85.6%
12			female	226	8.4%	10.6%	81.0%
13	low-income	Other	male	7,637	11.4%	9.5%	79.1%
14			female	6,223	10.8%	10.9%	78.3%
15	non-low-income	African American	male	543	12.5%	13.4%	74.0%
16			female	393	9.7%	9.9%	80.4%
17	non-low-income	Hispanic	male	51	13.7%	9.8%	76.5%
18			female	51	13.7%	17.6%	68.6%
19	non-low-income	Other	Male	7,330	17.2%	13.2%	69.6%
20			female	5,051	18.2%	12.6%	69.2%

Table B6
*Percent of Kentucky Far Off Track Students in **Science Scale Score Growth Categories** between Grades 8 and 11*

					Science scale score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached benchmark or closed half or more of gap	(3) Closed gap by less than half	(4) No gap closing
9	low-income	African American	Male	1,250	7.0%	15.1%	77.9%
10			female	1,090	4.1%	11.7%	84.2%
11	low-income	Hispanic	male	201	6.5%	12.9%	80.6%
12			female	149	6.0%	8.7%	85.2%
13	low-income	Other	male	5,905	9.2%	14.7%	76.1%
14			female	4,584	7.5%	14.4%	78.0%
15	non-low-income	African American	male	387	11.6%	15.0%	73.4%
16			female	288	10.1%	13.2%	76.7%
17	non-low-income	Hispanic	male	38	13.2%	15.8%	71.1%
18			female	40	7.5%	20.0%	72.5%
19	non-low-income	Other	male	5,170	17.4%	16.7%	65.8%
20			female	3,500	13.1%	15.4%	71.5%

Table B7
*Percent of Kentucky Far Off Track Students in **Mathematics z-Score Growth Categories** between Grades 8 and 11*

					Mathematics z-score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached or neared Benchmark level	(3) Reached bottom half of Off Track level	(4) Stayed Far Off Track
9	low-income	African American	male	1,433	1.4%	10.0%	88.6%
10			female	1,493	1.7%	10.3%	88.0%
11	low-income	Hispanic	male	214	4.2%	9.3%	86.4%
12			female	206	1.9%	14.6%	83.5%
13	low-income	Other	male	6,030	3.1%	13.2%	83.7%
14			female	5,761	2.0%	11.7%	86.3%
15	non-low-income	African American	male	416	2.4%	14.7%	82.9%
16			female	386	1.8%	16.1%	82.1%
17	non-low-income	Hispanic	male	37	0.0%	18.9%	81.1%
18			female	51	3.9%	11.8%	84.3%
19	non-low-income	Other	male	4,785	4.9%	18.5%	76.6%
20			female	4,155	3.1%	18.2%	78.7%

Table B8
*Percent of Kentucky Far Off Track Students in **Reading z-Score Growth Categories** between Grades 8 and 11*

					Reading z-score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached or neared Benchmark level	(3) Reached bottom half of Off Track level	(4) Stayed Far Off Track
9	low-income	African American	male	1,710	7.8%	19.0%	73.2%
10			female	1,516	9.6%	20.1%	70.4%
11	low-income	Hispanic	male	264	10.2%	15.5%	74.2%
12			female	226	11.9%	20.4%	67.7%
13	low-income	Other	male	7,637	14.2%	19.7%	66.0%
14			female	6,223	15.2%	23.2%	61.6%
15	non-low-income	African American	male	543	17.1%	20.6%	62.2%
16			female	393	13.5%	24.7%	61.8%
17	non-low-income	Hispanic	male	51	19.6%	21.6%	58.8%
18			female	51	23.5%	25.5%	51.0%
19	non-low-income	Other	male	7,330	22.2%	25.0%	52.8%
20			female	5,051	24.4%	25.8%	49.9%

Table B9
*Percent of Kentucky Far Off Track Students in **Science z-Score Growth Categories** between Grades 8 and 11*

Group	Income	Ethnicity	Gender	Number of students	Science z-score growth category (1) - (2) Reached or neared Benchmark level	(3) Reached bottom half of Off Track level	(4) Stayed Far Off Track
9	low-income	African American	male	1,250	4.1%	18.6%	77.4%
10			female	1,090	2.1%	19.6%	78.3%
11	low-income	Hispanic	male	201	4.0%	20.4%	75.6%
12			female	149	4.7%	22.8%	72.5%
13	low-income	Other	male	5,905	7.2%	21.5%	71.3%
14			female	4,584	5.8%	22.2%	72.0%
15	non-low-income	African American	male	387	8.3%	24.5%	67.2%
16			female	288	7.6%	22.9%	69.4%
17	non-low-income	Hispanic	male	38	10.5%	18.4%	71.1%
18			female	40	7.5%	25.0%	67.5%
19	non-low-income	Other	male	5,170	14.4%	27.6%	57.9%
20			female	3,500	10.6%	29.3%	60.1%

Table B10
*Percentage of **All Tested Kentucky Students** Who Were Far Off Track in 4th Grade Students Taking Kentucky Benchmark Exams, 2006-07 and 2007-08 School Years*

Group	Income	Ethnicity	Gender	Number of students	Percentage of 4th graders who were Far Off Track		
					Mathematics	Reading	Science
9	low-income	African American	male	3,613	65.9%	71.8%	72.9%
10			female	3,600	64.0%	61.2%	73.6%
11	low-income	Hispanic	male	974	51.3%	55.6%	58.3%
12			female	902	52.8%	49.7%	65.1%
13	low-income	Other	male	18,621	47.0%	53.4%	49.5%
14			female	17,872	48.4%	44.7%	51.8%
15	non-low-income	African American	male	952	44.8%	52.8%	54.3%
16			female	921	44.5%	42.2%	54.0%
17	non-low-income	Hispanic	male	218	32.4%	42.9%	41.1%
18			female	210	36.7%	31.4%	40.5%
19	non-low-income	Other	male	20,033	26.5%	34.9%	30.2%
20			female	19,020	25.9%	23.7%	31.2%

Table B11
*Percentage of **Kentucky Students in Longitudinal Cohorts** Who Were Far Off Track in 4th Grade Students Taking Kentucky Benchmark Exams, 2006-07 and 2007-08 School Years*

					Percentage of 4th graders who were Far Off Track		
Group	Income	Ethnicity	Gender	Number of students	Mathematics	Reading	Science
9	low-income	African American	male	2,928	64.6%	71.3%	71.7%
10			female	2,890	63.0%	60.2%	72.4%
11	low-income	Hispanic	male	742	48.8%	54.4%	56.1%
12			female	650	49.4%	48.6%	63.2%
13	low-income	Other	male	15,587	45.6%	52.3%	48.4%
14			female	15,351	47.4%	44.0%	51.0%
15	non-low-income	African American	male	798	44.5%	52.6%	54.8%
16			female	781	43.1%	40.5%	53.0%
17	non-low-income	Hispanic	male	180	33.3%	43.3%	40.0%
18			female	143	35.7%	32.2%	41.3%
19	non-low-income	Other	male	17,494	25.7%	34.3%	29.4%
20			female	17,029	25.3%	23.4%	30.5%

Table B12
*Percentage of Kentucky **Far off Track** 4th Grade Students Meeting College Readiness Benchmarks on 8th Grade ACT Explore*

				Mathematics		Reading		Science	
Group	Income	Ethnicity	Gender	Number of Far Off Track students	Percent reaching benchmark	Number of Far Off Track students	Percent reaching benchmark	Number of Far Off Track students	Percent reaching benchmark
1	low-income	African American	male	1,892	2.1%	2,089	3.3%	2,100	4.0%
2			female	1,820	3.1%	1,740	4.3%	2,092	7.1%
3	low-income	Hispanic	male	362	5.2%	404	3.5%	416	8.9%
4			female	321	4.0%	316	5.1%	411	8.8%
5	low-income	Other	male	7,114	6.9%	8,147	6.1%	7,543	8.2%
6			female	7,271	6.3%	6,748	8.5%	7,824	11.3%
7	non-low-income	African American	Male	355	6.5%	420	5.5%	437	9.2%
8			Female	337	4.5%	316	5.4%	414	9.7%
9	non-low-income	Hispanic	Male	60	8.3%	78	12.8%	72	12.5%
10			Female	51	3.9%	46	4.3%	59	6.8%
11	non-low-income	Other	Male	4,503	11.4%	5,996	11.0%	5,149	14.8%
12			Female	4,301	11.0%	3,981	12.8%	5,199	20.4%

Table B13
Kentucky Far Off Track 4th Grade Students
*Percentage in **Mathematics z-Score Growth Categories** between Grades 4 and 8*

					Mathematics z-score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached or neared Benchmark level	(3) Reached bottom half of Off Track level	(4) Stayed Far Off Track
9	low-income	African American	male	1,892	8.1%	28.4%	63.5%
10			female	1,820	9.8%	34.8%	55.4%
11	low-income	Hispanic	male	362	15.7%	34.0%	50.3%
12			female	321	15.6%	40.8%	43.6%
13	low-income	Other	male	7,114	16.6%	33.7%	49.7%
14			female	7,271	17.3%	40.5%	42.2%
15	non-low-income	African American	male	355	15.5%	31.5%	53.0%
16			female	337	15.7%	40.9%	43.3%
17	non-low-income	Hispanic	male	60	16.7%	36.7%	46.7%
18			female	51	13.7%	52.9%	33.3%
19	non-low-income	Other	male	4,503	23.9%	37.7%	38.4%
20			female	1,822	20.0%	47.4%	32.6%

Table B14
Kentucky Far Off Track 4th Grade Students
*Percentage in **Reading z-Score Growth Categories** between Grades 4 and 8*

					Science z-score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached or neared Benchmark level	(3) Reached bottom half of Off Track level	(4) Stayed Far Off Track
1	low-income	African American	Male	2,089	5.8%	15.9%	78.3%
2			female	1,740	10.2%	25.9%	63.9%
3	low-income	Hispanic	male	404	8.9%	26.0%	65.1%
4			female	316	13.0%	31.0%	56.0%
5	low-income	Other	male	8,147	11.5%	23.5%	65.0%
6			female	6,748	16.8%	30.6%	52.6%
7	non-low-income	African American	male	420	9.8%	25.0%	65.2%
8			female	316	12.7%	34.2%	53.2%
9	non-low-income	Hispanic	male	78	16.7%	28.2%	55.1%
10			female	46	19.6%	34.8%	45.7%
11	non-low-income	Other	male	5,996	19.1%	29.8%	51.0%
12			female	3,981	24.0%	34.9%	41.1%

Table B15
Kentucky Far Off Track 4th Grade Students
*Percentage in **Science z-Score Growth Categories** between Grades 4 and 8*

					Science z-score growth category		
Group	Income	Ethnicity	Gender	Number of students	(1) - (2) Reached or neared Benchmark level	(3) Reached bottom half of Off Track level	(4) Stayed Far Off Track
1	low-income	African American	Male	2,100	10.2%	27.0%	62.8%
2			female	2,092	18.7%	34.2%	47.1%
3	low-income	Hispanic	male	416	19.7%	33.7%	46.6%
4			female	411	26.3%	37.5%	36.3%
5	low-income	Other	male	7,543	19.1%	28.1%	52.8%
6			female	7,824	27.6%	33.4%	39.0%
7	non-low-income	African American	male	437	21.7%	30.2%	48.1%
8			female	414	30.2%	35.0%	34.8%
9	non-low-income	Hispanic	male	72	27.8%	34.7%	37.5%
10			female	59	28.8%	39.0%	32.2%
11	non-low-income	Other	male	5,149	31.0%	30.6%	38.4%
12			female	5,199	42.2%	33.1%	24.8%