



COLORADO DEPARTMENT OF EDUCATION

201 East Colfax Avenue • Denver, Colorado 80203-1799
303.866.6600 • www.cde.state.co.us

Dwight D. Jones
Commissioner of Education

Robert K. Hammond
Deputy Commissioner

Kenneth R. Turner
Deputy Commissioner

January 6, 2009

The Honorable Margaret Spellings
U.S. Secretary of Education
U.S. Department of Education
400 Maryland Ave., SW
Washington, D.C. 20202-6132

Dear Secretary Spellings:

The Colorado Department of Education appreciates the opportunity to revise our growth proposal based on feedback from the peer reviewers. We understand that by making these revisions, our growth proposal will be fully approved.

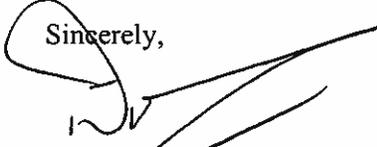
Attached you will find the revised proposal, which includes the following changes requested by the peer reviewers:

- The proposed growth targets (Annual Measureable Objectives) have been revised to be equal with the achievement targets.
- The impact of the growth proposal has been re-calculated based on these revised targets.

The Colorado Department of Education also provides an assurance to the U.S. Department of Education that it will share data as needed from the implementation of the growth model with the Department.

Thank you again for recognizing the importance of student growth to standard as an integral part of educational accountability. If you have any further questions, please do not hesitate to contact us.

Sincerely,



Dwight D. Jones
Commissioner of Education

cc. Kerri Briggs
Patrick Rooney
Richard Wenning
Patrick Chapman

**THE COLORADO GROWTH MODEL:
HIGHER EXPECTATIONS FOR ALL STUDENTS**

Submitted by Dwight D. Jones, Commissioner of Education

Colorado Department of Education

Additional evidence and description submitted November 12, 2008

Revised on December 27, 2008 in accordance with peer review comments

Note: The additional evidence is organized according to the requests for additional information from Assistant Secretary Briggs' October 15th letter. The requests from Assistant Secretary Briggs are presented below in *italics*, followed by response from the Colorado Department of Education presented in regular font. Additional revisions made on December 27, 2008 in response to requests by the peer reviewers are also indicated.

Principle 1. Universal proficiency.

- *Has the state proposed technically and educationally sound criteria for "growth targets" for school's and subgroups? (Principle 1.2)*
 - *Has the state adequately described the rules and procedures for establishing and calculating "growth targets?" (Principles 1.2.2)*
 - *Please provide greater detail regarding the calculation of the individual growth percentiles, how the percentiles are used to determine whether the student has met sufficient growth, and how the percentiles are then used to create school- and district-level accountability determinations. Please provide several concrete examples, including the particular steps for calculating individual student growth and school-level accountability determinations.*

Individual growth percentile calculations

We urge the peers and USED to review the "Colorado Growth Model Tutorial," submitted as Attachment 1 in our original proposal, and included as part of Appendix A of this document, as a way to walk through several examples of how the growth percentile methodology is used to judge whether or not students have met their growth targets. Additional details and examples regarding the calculation of individual growth percentiles are presented in Appendix A.

School and district accountability

Aggregating the individual growth percentile results for school and district accountability purposes is really quite simple. Each student is evaluated to determine whether or not they have met their particular growth target. The total number of students meeting their growth targets in a subgroup, school, and/or district comprises the numerator, while the total number of eligible students in the subgroup, school, and/or district comprises the denominator. The resulting percentage of students meeting their growth targets is compared to the Growth AMO. If the percentage of students meeting their growth targets meets or exceeds the Growth AMO, then the subgroup, school, and/or district meets the AYP target.

- *Has the state proposed a technically and educationally sound method of making annual judgments about school performance using growth? (Principle 1.3)*
 - *Has the state adequately described how annual accountability determinations will incorporate student growth? (Principle 1.3.1)*
 - *Please elaborate on how and why Colorado calculated the annual growth targets as described on page 14 and presented in Table 1 on page 15. In elaborating, discuss in greater detail than currently provided the rationale for "setting the initial growth AMO at the '60th percentile' school."*

At the request of the peer reviewers, CDE adjusted the growth targets from its original proposal to be equal to the achievement AMOs. In order to make AYP, a district, school, or disaggregated group will need to have at least the percentage of students indicated in the table below score proficient on the state assessment or make adequate growth (or make safe harbor or matched safe harbor).

Reading Achievement and Growth AMOs

	Elementary	Middle	High
2009-2010	88.46%	86.81%	89.83%
2011-2013	94.23%	93.41%	94.92%
2014	100%	100%	100%

Math Achievement and Growth AMOs

	Elementary	Middle	High
2009-2010	89.09%	79.75%	73.50%
2011-2013	94.54%	89.88%	86.75%
2014	100%	100%	100%

- *Please provide the timeframe for data presented in Tables 2-6 on pages 16-20, respectively. What years of student achievement were used in calculating student and school growth to determine whether growth-to-standard criteria were met and for what year were these criteria applied?*

The 2008 results were the basis for the growth analyses presented in our original proposal. The growth percentile methodology incorporates all available prior scores into the growth calculations, so the results presented in Tables 2-6 in original proposal included 2008 CSAP data and at least 2007 data, but for many students 2006, 2005, and 2004 data could have been included in the analyses as well. Growth determinations were based on the growth between 2007 and 2008 data for students who are not currently proficient to become so within 3 years or by 10th grade, and for students who are already proficient to remain proficient over the next three years, or through 10th grade.

- *While informative, Table 3 and Tables 4-6 provide data regarding the impact of the proposed growth model on the number and percent of schools meeting AYP for different content areas. (Table 3 presents these data for reading and Tables 4-6 for math.) Please provide a series of tables that include this*

information for the same content area (i.e., present Table 3 for math or Tables 4-6 for reading). In addition, please narrate the information in tables depicting number and percent of schools meeting Adequate Yearly Progress (AYP) by performance, safe harbor, and growth to confirm the data presented in the tables.

(The following section was updated on December 27, 2008 based on the results of equalizing the achievement and growth AMOs.)

We have constructed a set of tables for reading and math, re-created with the new growth targets in tables 4b – 9b below. We present a detailed narration of Table 4b as an example of how the peers should read Tables 4-6 in the original proposal and Tables 4b-9b in this additional submission. This data analysis has been conducted on the schools overall (the total population), not on the disaggregated groups.

As seen in Table 4b, 206 schools did not meet performance (status) targets in elementary reading, while 832 did. Of the 206 schools not meeting performance targets, 123 schools did not meet safe harbor, while 83 were able to meet safe harbor requirements. Thirty-two (32) schools of the 123 not meeting safe harbor were able to meet AYP requirements through the use of matched safe harbor, while 83 did not. Only one (1) of 32 schools that did not meet safe harbor—but met matched safe harbor—was able to meet the growth target. The 83 schools that did not meet performance targets but met safe harbor were run through the matched safe harbor and growth calculations to examine the relative effects of the different metrics. Forty-six (46) of these 83 schools would also have met matched safe harbor, none of which would have met the growth criterion. Similarly, not a single school that did not meet matched safe harbor requirements would have met growth requirements.

Moving to the 832 elementary schools that met the reading targets, we see that 384 would have made matched safe harbor, while 335 schools would not have done so (113 schools were not eligible for this analysis). Further, 178 of the 832 that met their initial performance targets also would have met the growth criterion.

In summary, 179 of 1,041 elementary schools would have met growth targets, but only one (1) of the 206 schools not meeting performance (status) targets would have met growth targets, all of which would have made AYP either through safe harbor or matched safe harbor. Again, the analyses presented in these tables are for the school as a whole, and do not include data on all of the disaggregated groups.

Table 4b. The number/percent of schools meeting performance, growth (with the same targets as performance), and safe harbor targets for elementary reading (whole school results only).

Elementary Level Reading

Met performance target	Met safe harbor	Met matched safe harbor	Met AMO growth target			Total
			did not meet target	Met target	NA	
NA	NA	NA	3			3
			100.0%			
NO	NO	NA	6		1	7
			85.7%		14.3%	
		NO	84			84
			100.0%			
		YES	31	1		32
			96.9%	3.1%		
		total	121	1	1	123
			98.4%	0.8%	0.8%	
	YES	NA	2			2
			100.0%			
		NO	35			35
			100.0%			
		YES	46			46
			100.0%			
total	83			83		
	100.0%					
YES	NA	70	43		113	
		61.9%	38.1%			
	NO	295	40		335	
		88.1%	11.9%			
	YES	289	95		384	
		75.3%	24.7%			
	total	654	178		832	
		78.6%	21.4%			

Table 5b. The number/percent of schools meeting performance, growth (with the same targets as performance), and safe harbor targets for middle school reading (whole school results only).

Middle Level Reading

Met performance target	Met safe harbor	Met matched safe harbor	Met AMO growth target		Total	
			did not meet target	met target		
NA	NA	NA	13		13	
			100.0%			
NO	NO	NA	11	1	12	
			91.7%	8.3%		
		NO	32		32	
			100.0%			
		YES	17		17	
			100.0%			
	total	60	1	61		
		98.4%	1.6%			
	YES	YES	NO	4		4
				100.0%		
			YES	15		15
		100.0%				
total		19		19		
		100.0%				
YES	NA	NA	34	28	62	
			54.8%	45.2%		
		NO	175	23	198	
			88.4%	11.6%		
		YES	114	47	161	
			70.8%	29.2%		
		total	323	98	421	
			76.7%	23.3%		

Table 6b. The number/percent of schools meeting performance, growth (with the same targets as performance), and safe harbor targets for high school reading (whole school results only).

High Level Reading

Met performance target	Met safe harbor	Met matched safe harbor	Met AMO growth target		Total	
			did not meet target	met target		
NA	NA	NA	17		17	
			100.0%			
NO	NA	NA	1		1	
			100.0%			
		NO		1		1
				100.0%		
		total		1	1	2
				50.0%	50.0%	
	NO	NA	NA	16		16
				100.0%		
		NO	NO	24		24
				100.0%		
		YES	YES	12		12
				100.0%		
		total	total	52		52
				100.0%		
	YES	NO	NA	1		1
				100.0%		
NO			NO	5		5
				100.0%		
YES		YES	3		3	
			100.0%			
total		total	9		9	
			100.0%			
YES	NA	NA	36	46	82	
			43.9%	56.1%		
		NO	NO	129	22	151
				85.4%	14.6%	
		YES	YES	76	32	108
				70.4%	29.6%	
		total	total	241	100	341
				70.7%	29.3%	

Table 7b. The number/percent of schools meeting performance, growth (with the same targets as performance), and safe harbor targets for elementary math (whole school results only).

Elementary Level Math

Met performance target	Met safe harbor	Met matched safe harbor	Met AMO growth target			Total
			did not meet target	met target	NA	
NA	NA	NA	5			5
			100.0%			
NO	NO	NA	8			8
			100.0%			
		NO	76			76
			100.0%			
		YES	18			18
			100.0%			
		total	102			102
			100.0%			
	YES	NA	3			3
			100.0%			
		NO	24			24
			100.0%			
		YES	18			18
			100.0%			
total	45			45		
	100.0%					
YES	NA	NA	136	12		148
			91.9%	8.1%		
		NO	497	3	1	501
			99.2%	0.6%	0.2%	
		YES	234	7		241
			97.1%	2.9%		
		total	867	22	1	890
			97.4%	2.5%	0.1%	

Table 8b. The number/percent of schools meeting performance, growth (with the same targets as performance), and safe harbor targets for middle level math (whole school results only).

Middle Level Math

Met performance target	Met safe harbor	Met matched safe harbor	Met AMO growth target		Total
			did not meet target	met target	
NA	NA	NA	12		12
			100.0%		
NO	NA	NO	1		1
			100.0%		
	NO	NA	15		15
			100.0%		
		NO	87		87
			100.0%		
		102		102	
	100.0%				
	YES	NA	1		1
			100.0%		
		NO	9		9
			100.0%		
	10		10		
100.0%					
YES	NA	39	15	54	
		72.2%	27.8%		
	NO	307	6	313	
		98.1%	1.9%		
	YES	15	7	22	
		68.2%	31.8%		
		361	28	389	
	92.8%	7.2%			

Table 9b. The number/percent of schools meeting performance, growth (with the same targets as performance), and safe harbor targets for high level math (whole school results only).

High Level Math

Met performance target	Met safe harbor	Met matched safe harbor	Met AMO growth target		Total	
			did not meet target	met target		
NA	NA	NA	17		17	
			100.0%			
NO	NA	NA	2		2	
			100.0%			
		NO	3		3	
			100.0%			
		total	5		5	
			100.0%			
	NO	NA	23		23	
			100.0%			
		NO	98		98	
			100.0%			
	total	121		121		
		100.0%				
	YES	YES	NA	6		6
				100.0%		
			NO	19		19
				100.0%		
YES		1		1		
		100.0%				
total	26		26			
	100.0%					
YES	NA	NA	21	8	29	
			72.4%	27.6%		
		NO	162	30	192	
			84.4%	15.6%		
		YES	20	11	31	
			64.5%	35.5%		
		total	203	49	252	
			80.6%	19.4%		

Finally, CDE replicated the analyses described above for each disaggregated group for both math and reading to determine the overall effect of incorporating the growth model into Colorado’s AYP determinations. No additional schools would have made AYP by virtue of growth determinations. This is further evidence that Colorado has adopted rigorous growth standards.

Although incorporating growth model results may have no immediate impact on AYP determinations given the current statutory target of 100 percent of students reaching proficiency by 2014, our purpose is not to “try to get more schools off the AYP hook.”

Rather, CDE is concerned with ensuring that Colorado’s educational accountability system focuses attention on maximizing every child’s progress toward ambitious standards. To make sure that our accountability system supports learning, we believe it is desirable to provide a common understanding of how individual students and groups of students progress from year to year toward state standards based on where each student begins. To close the achievement gaps that plague our education system, we must eliminate gaps in how children are growing academically and ensure that our neediest students grow faster — more than a year’s growth in a year’s time — so that they catch up.

- *Please clarify use of the three-year trajectory in determining whether or not students, subgroups, and schools have met growth targets. How will the growth be compounded to create a three-year trajectory? Will students' first year growth trajectory be used in annual school accountability determinations? What is the utility of the second and third year growth trajectories for purpose of calculating annual school accountability determinations?*

Appendix A includes a visual presentation (tutorial) that depicts how the one, two and three-year growth percentile projections/trajectories are used to evaluate whether students and, by aggregation, subgroups and schools have met the growth targets. As noted above, subgroup, school, and district determinations are simply a function of counting the number of students that have met their individual growth targets in a given year. Therefore, we focus on describing individual student growth determinations.

It will be helpful to use the fictional student portrayed on pages 26-30 of Appendix A to address this question. As seen on page 30 in Appendix A, this student would need to grow at the 89th percentile consecutively for 2 years or at the 77th growth percentile for each of three consecutive years in order to reach the NCLB proficient level. By definition, if the student’s growth percentile exceeds the minimum of the 1st, 2nd, and 3rd year growth targets, their growth in the most recent year puts them on track to reach the NCLB proficient level within 3 years. As seen, on page 30, this student grew at the 61st percentile after year 1 (2008), which was not enough to reach NCLB proficient in 1 year and less both the 89th and 77th percentile 2 and 3 year targets. Therefore, this student will count in the denominator, but not the numerator when calculating the percentage of students in the subgroup, school, and district meeting the growth targets for 2008.

Now, it is relatively easy to see from this tutorial, after accounting for the student’s 61st percentile growth in the first year, that even if this student grew at the 77th percentile in years 2 (2009) and 3 (2010), he/she would still fall short of the NCLB-proficient target. While the achievement target and three-year time frame does not change, the required growth percentile needed to achieve this target will be adjusted each year to incorporate

the most recent assessment data. Therefore, the student's recalculated two-year (because one year has already passed) growth percentile target will likely have to exceed the 80th percentile. In 2009, CDE will determine if the student met this growth percentile and this determination will be incorporated into subgroup, school, and district AYP calculations as just described for 2008.

Principle 2. Establishing appropriate growth model targets at the student level

- *Has the state proposed a technically and educationally sound method of depicting annual student growth in relation to growth targets? (Principle 2.1)*
 - *Has the state adequately described a sound method of determining student growth over time? (Principle 2.1.1)*
 - *Please provide further detail regarding if and when each student's growth percentile trajectory is recalculated annually based on the "most recent results from statewide analyses," p.24) and explain in detail the implication of this in determining student growth over time. Specifically, how does this impact the use of the three-year trajectory?*

The Colorado Department of Education addresses this question above and in Appendix A.

- *Please describe Colorado's plans to evaluate the growth model and its impact on student/school/subgroup achievement of or growth toward 100 percent proficiency by 20 14. For example, how will the evaluation be independent, what questions will the evaluation address, what analyses will be employed to answer the evaluation questions, and over what period of time will the evaluation be conducted?*

CDE already has begun to evaluate the Colorado Growth Model, and plans to continue these efforts. Even before the Model was adopted by the State Board of Education, CDE compared the results of the Colorado Growth Model and the Cumulative Effects Model. The following table shows strong correlations among the 2007 CEM Effects and Median Growth Percentiles.

Grade	Reading	Writing	Math
5	.872	.903	.920
6	.855	.901	.929
7	.862	.898	.836
8	.774	.844	.726
9	.604	.838	.833
10	.810	.910	.866

CDE is embarking on future evaluations of the Colorado Growth Model. Our IES Grant Application proposes to evaluate programs using both the Colorado Growth Model and a Hierarchical Linear Model (HLM) model. If approved for the grant, CDE will be able to compare the outcomes of both measures for a variety of programs. This would enable CDE to further evaluate the Colorado Growth Model.

With regard to evaluating the Colorado Growth Model's impact on AYP, CDE will analyze AYP results in order to identify districts, schools and disaggregated groups that made AYP as a result of growth. We will monitor those schools and districts to analyze what they are doing that yields such results, and ensure that their practices are truly impressive

Additionally, the Colorado Growth Model has been in the public domain since inception. It is required by law to be an open source model, and CDE has been putting a great deal of effort into presenting the model and methodology to a full range of Colorado and national stakeholders

Related to this last point, CDE is committed to ensuring that the results of the Colorado Growth Model are used to drive school improvement actions. The extensive and sophisticated reporting structure is evidence of this commitment. Further, CDE is launching a comprehensive professional development program to ensure that Colorado stakeholders understand and can use the growth model results to improve educational programs. Therefore, any validity evaluation needs to include studies of the utility of the growth model and results. CDE is currently planning to incorporate data collection opportunities into professional development offering to gain a better understanding of the consequential aspects of the Colorado Growth Model.

Principle 4. Inclusion of all students.

- *Does the state's growth model address the inclusion of all students, subgroups, and schools appropriately? (Principle 4.1)*
 - *Does the state's growth model address the inclusion of all students appropriately? (Principle 4.1.1)*
 - *Please clarify how Colorado will attribute growth model data for AYP purposes when a student moves from one school to another or one district to another.*
 - *Provide scenarios to illustrate this attribution.*

The Colorado Growth Model along with Colorado's highly reliable unique student identifier is able to track student performance over many years and across school and district boundaries to ensure that students are included to the full extent possible in growth model calculations and determinations. The inclusion of students in the growth model interacts with Colorado's full academic year (FAY) criterion.

Colorado has a USED-approved definition of FAY that requires a student to be in the school from the previous CSAP administration in order to be included in school accountability determinations. Therefore, except in rare cases, students meeting the FAY definition will also have the necessary two scores in order to be included in the Colorado Growth Model (except for 3rd graders). This definition is modified when students transition between elementary and middle school and between middle and high school such that students need to have been in the district during the previous CSAP

administration and in the school on or before October 1st in order to meet FAY requirements for the middle or high school.

As noted earlier, the Colorado Growth Model incorporates all prior score information into the calculation of student growth results. Therefore, as long as the student meets FAY requirements in his/her current school, the growth model results will be based on all valid prior CSAP scores no matter where in the state they came from. Basically, due to the definitions above, all CSAP test takers (except 3rd graders) that are included in AYP performance calculations will be included in the growth calculations.

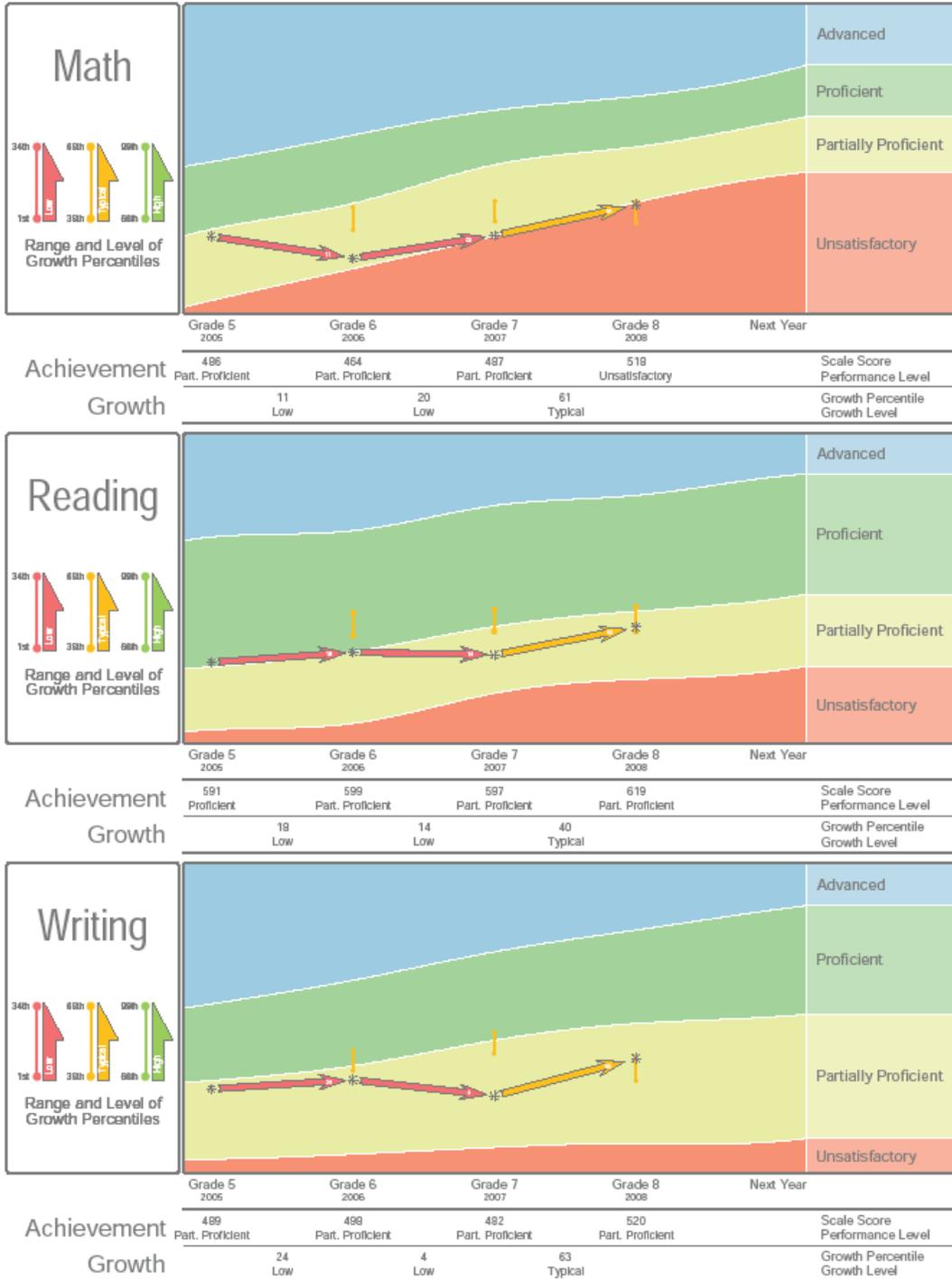
Principle 5. State assessment system and methodology.

- *How will the State report individual student growth to parents? (Principal 5.2)*
 - *How will an individual student's academic status be reported to his or her parents in any given year? What information will be provided about academic growth to parents and in what format will this be provided? Will the student's status compared to the State's academic achievement standards also be reported? (Principle 5.2.1)*
 - *Please discuss in greater detail, and, if available, provide examples, of how student growth will be reported to parents.*

CDE is developing a plan to ensure that parents have access to their student's growth data. Some initial reports are currently in place and CDE is developing future reports and processes. Currently, all districts have received student level data that include each student's growth percentile, and the amount of growth necessary for them to reach or maintain specific proficiency levels. CDE is consulting with districts on how to give school administrators and teachers the skills to share this information informatively and productively with parents.

We are currently designing student-level reports to share with students and their parents (see below). Although these reports are in their initial design phases, we are working with stakeholders to get feedback on the information contained in and the format of the reports. We also are working with stakeholders on the best methods for reporting this information to parents. CDE has created a wiki to collect feedback and run discussions with our district "beta testers."

CDE plans to deliver parent reports to districts and schools, so that teachers can share them with students and their parents. We believe that conversations related to these reports among students, parents and teachers will be an important catalyst for student academic improvement. Additionally, we are exploring the possibilities of creating a secure parent portal for viewing the growth results online.



Glossary of Colorado Growth Model Terminology

Following is a glossary of some key terms used in the Colorado Growth Model proposal. We only defined the few terms that are likely to be unfamiliar to peers and other readers of this proposal.

Achievement Target: This simply refers to the growth target established for each student in standards-based terms (i.e., achievement levels). For students scoring in the unsatisfactory level, the achievement target would be the partially proficient (NCLB proficient) level in three years or by 10th grade, whichever comes first. For students already scoring at the proficient level, their achievement target is to maintain their current achievement level.

Growth-to-Standard Criteria: These criteria are the rules by which we judge whether the growth observed for each student is sufficient for school accountability purposes. Essentially, these criteria translate the growth trajectories produced through the growth percentile methodology into standards-based determination. After considerable deliberation, Colorado has established the following criteria for determining whether or not students have met their growth targets.

A student will meet his/her growth target if:

- The student is unsatisfactory and on track to be NCLB-proficient within 3 years or by 10th grade, whichever comes first,
- The student is NCLB-proficient and is on track to maintain NCLB-proficient for the upcoming 3 years or by 10th grade, whichever is first,
- The student is Colorado-proficient and is on track to maintain Colorado-proficient for the upcoming 3 years or by 10th grade, whichever is first, or
- The student is advanced and is on track to maintain Colorado-proficient for the upcoming 3 years or by 10th grade, whichever is first.

Percentile Growth Projection: Also referred to as the **percentile growth trajectory**. Using the results from the calculation of student growth percentiles, 297 growth trajectories (99 percentiles x 3 forecasts of future (1, 2, and 3 year)) are calculated for each student assuming consecutive 1st through 99th percentile growth rate. These individualized percentile trajectories are compared to the cut-scores associated with achievement targets allowing the articulation of growth-to-standard targets in the percentile metric. The Colorado Growth Model uses the percentile growth projections/trajectories to determine whether the growth demonstrated by a student puts them on track to reach their individual achievement targets. Percent growth projections/trajectories are calculated annually following calculation of student growth percentiles for each student.

Student Growth Percentile: A Student Growth Percentile defines how much relative growth a student made. The **Colorado Growth Model** serves as a way for educators to understand how much growth a student makes from one year to the next relative to students with the same achievement history. The model produces a student growth percentile, much like children's height and weight percentiles that pediatricians share with parents. If a student grew as well or better than 60 percent of her academic peers,

she would have a growth percentile of 60. Individual Student Growth percentiles are categorized as **“low” (1 to 34)**, **“typical” (35 to 65)**, or **“high” (66-99)**. Student growth percentiles are calculated annually, comparing student progress against students in their grade by subject cohort.

APPENDIX A: Individual Growth Percentile Calculations

Please provide greater detail regarding the calculation of the individual growth percentiles, how the percentiles are used to determine whether the student has met sufficient growth, and how the percentiles are then used to create school- and district-level accountability determinations. Please provide several concrete examples, including the particular steps for calculating individual student growth and school-level accountability determinations.

Calculation of Student Growth Percentiles

Calculation of an individual student's growth percentile is based upon the estimation of the distribution of current student scores taking account of (i.e., conditioning upon) *all* prior student scores. Once this conditional distribution is established, a student's growth percentile quantifies the percentile rank of the student's current score within their conditional distribution. To provide an illustration, consider the four panels of Figure 1 that depict what a student growth percentile represents considering a simple situation in which students having only two consecutive achievement test scores (e.g., 4th graders in Colorado). In general, student growth percentiles are based not just upon two consecutive achievement test scores but on all prior consecutive test scores.

Upper Left Panel Considering all pairs of scores for all students in grade cohort in the state yields a bivariate (two variable) distribution.

Upper Right Panel Taking account of prior achievement (i.e., conditioning upon prior achievement) fixes a the value of the 2005 scale score (in this case at 600) and is represented by the red slice taken out of the bivariate distribution.

Lower Left Panel Conditioning upon prior achievement defines a *conditional distribution* which represents the distribution of outcomes on the 2006 test assuming a 2005 score of 600—indicated as a solid red curve.

Lower Right Panel The conditional distribution provides the context within which a student's 2006 achievement can be understood normatively. Students with 2006 achievement in the upper tail of the conditional distribution have demonstrated high rates of growth relative to their academic peers whereas those students with achievement in the lower tail of the distribution have demonstrated low rates of growth. Students with current achievement in the middle of the distribution could be described as demonstrating typical growth.

The fourth panel of Figure 1 shows the student scoring approximately 650 on the 2006 test. Within the conditional distribution, the value of 650 lies at approximately the 70th percentile. Thus the student's growth from 600 in 2005 to 650 in 2006 met or exceeded that of approximately 70 percent of students starting from the same place. This 50 point increase is above average. As such, the percentile result reflects the likelihood of such an outcome given the student's prior achievement. In the sense that the student growth percentile translates to

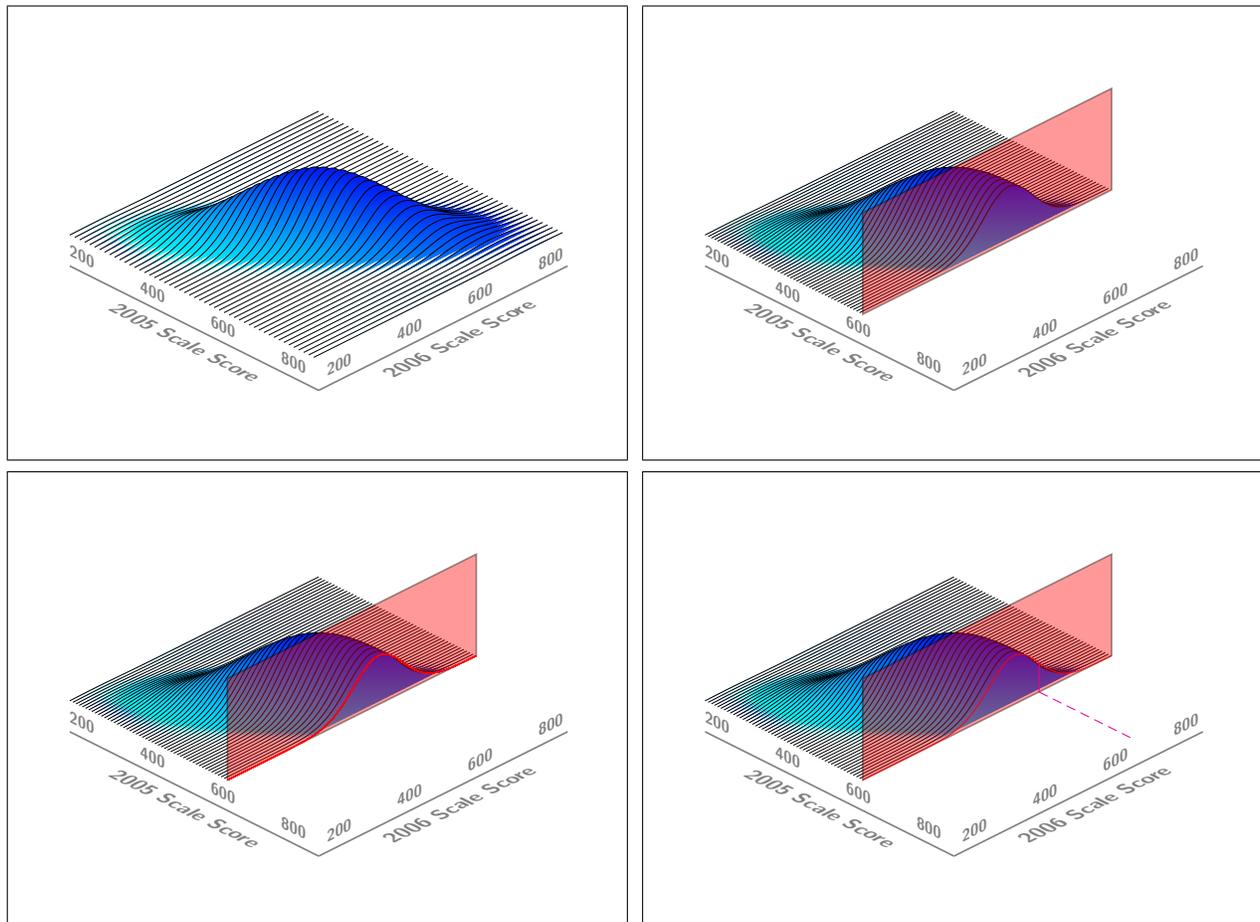


Figure 1: Figures depicting the distribution associated with 2005 and 2006 student scale scores together with the conditional distribution and associated growth percentile

the probability of such an outcome occurring (i.e., rarity), it is possible to compare the progress of individuals not beginning at the same starting point. However, occurrences being equally rare does not necessarily imply that they are equally “good”. Qualifying student growth percentiles as “(in)adequate”, “good”, or as satisfying “a year’s growth” is a standard setting procedure requiring external criteria (e.g., growth relative to state performance standards) combined with the wisdom and judgments of stakeholders.

It is important to understand some specifics of how the student growth percentile is actually calculated. These calculations are used subsequently to establish how much growth it will take for each student to reach their achievement targets as established in the Colorado growth model proposal.

Analysis

Quantile regression is used to establish curvi-linear functional relationships between the cohort’s prior scores and the cohort’s current scores. Specifically, for each grade by subject cohort, quantile regression is used to establish 100 (1 for each percentile) curvi-linear functional relationships between the students grade 3, grade 4, grade 5, and grade 6 prior scores and their

grade 7 scores.¹ The result of these 100 separate analyses is a single coefficient matrix that can be employed as a look-up table relating prior student achievement to current achievement for each percentile. Using the coefficient matrix, one can plug in *any* grade 3, 4, 5, and 6 prior score combination to the functional relationship to get the percentile cutpoints for grade 7 conditional achievement distribution associated with that prior score combination. These cutpoints are the percentiles of the conditional distribution associated with the individual's prior achievement

Consider a student with the following reading scores:

Grade 3/2004	Grade4/2005	Grade 5/2006	Grade 6/2007	Grade 7/2008
519	518	587	589	601

Table 1: Scale scores for a hypothetical student across 5 years in reading

Using the coefficient matrix derived from the quantile regression analyses based upon grade 3, 4, 5, and 6 scores as independent variables and the grade 7 score as the dependent variable together with this student's vector of grade 3, 4, 5, and 6 grade scores provides the scale score percentile cutpoints associated with the grade 7 conditional distribution for these prior scores.

1st	2nd	3rd	...	10th	...	25th	...	50th	51st	...	75th	...	90th	...	99th
514.8	534.9	543.9	...	566.9	...	584.8	...	600.5	601.3	...	616.9	...	630.1	...	653.8

Table 2: Percentile cutscores for grade 7 reading based upon the grade 3, 4, 5, and 6 reading scores given in Table 1

The percentile cutscores for 7th grade reading in Table 2 is used with the the student's *actual* grade 7 reading score to establish their growth percentile. In this case, the student's grade 7 score of 601 lies above the 50th percentile cut and below the 51st percentile cut, yielding a growth percentile of 50. Thus, the progress demonstrated by this student between grade 6 and grade 7 exceeded that of 50 percent of their academic peers—those students with the same achievement history. The Colorado Growth Model designates growth percentiles between 35 and 65 as being *typical*. Using Table 2, another student with the exact same grade 3, 4, 5, and 6 prior scores but with a grade 7 score of 530, would have a growth percentile of 1, which is designated as *low*.

This example provides the basis for beginning to understand how growth percentiles in the Colorado Growth Model are used to determine whether a student's growth is *(in)adequate*. Suppose that in grade 6 a 1 year (i.e., 7th grade) achievement goal/target of proficiency was established for the student. This target corresponds to a scale score of 619 in grade 7 reading. Based upon the results of the growth percentile analysis, this one year target corresponds to 78th percentile growth. Their growth, obviously, is less than this and the student has not met this individualized growth standard.

¹For the mathematical details underlying the use of quantile regression in calculating student growth percentiles, see the appendix *Student Growth Percentile and Percentile Growth Trajectory Calculation* supplied with the October 15th application.

Building upon this simple example involving only a 1 year achievement target translated into a growth standard, in the next section we demonstrate how multi-year growth standards are established based upon pre-established achievement targets/goals. That is, by defining a future (e.g., a 3 year) achievement target for each student, we show how growth percentile analyses can be used to quantify what level of growth, expressed as a per/year growth percentile, is required by the student to reach their achievement target. Unique to the Colorado Growth Model is the ability to stipulate *both* what the growth standard is as well as how much the student actually grew in a metric that is informative to stakeholders.

Growth Sufficiency using Growth Percentiles

Establishing growth sufficiency thresholds for each student requires pre-established achievement targets for each student against which growth can be assessed (i.e., growth-to-standard). For the Colorado Growth Model, these achievement targets are

- Unsatisfactory students are expected to be NCLB proficient (Colorado partially proficient) within 3 years following the establishment of the achievement target or by grade 10, whichever comes sooner.
- NCLB proficient students are expected to remain NCLB proficient for at least the next 3 years following the establishment of the achievement target or by grade 10, whichever comes sooner.
- Colorado proficient students are expected to remain Colorado proficient for at least the next 3 years following the establishment of the achievement target or by grade 10, whichever comes sooner.
- Advanced students are expected to remain at or above Colorado proficient for at least the next 3 years following the establishment of the achievement target or by grade 10, whichever comes sooner.

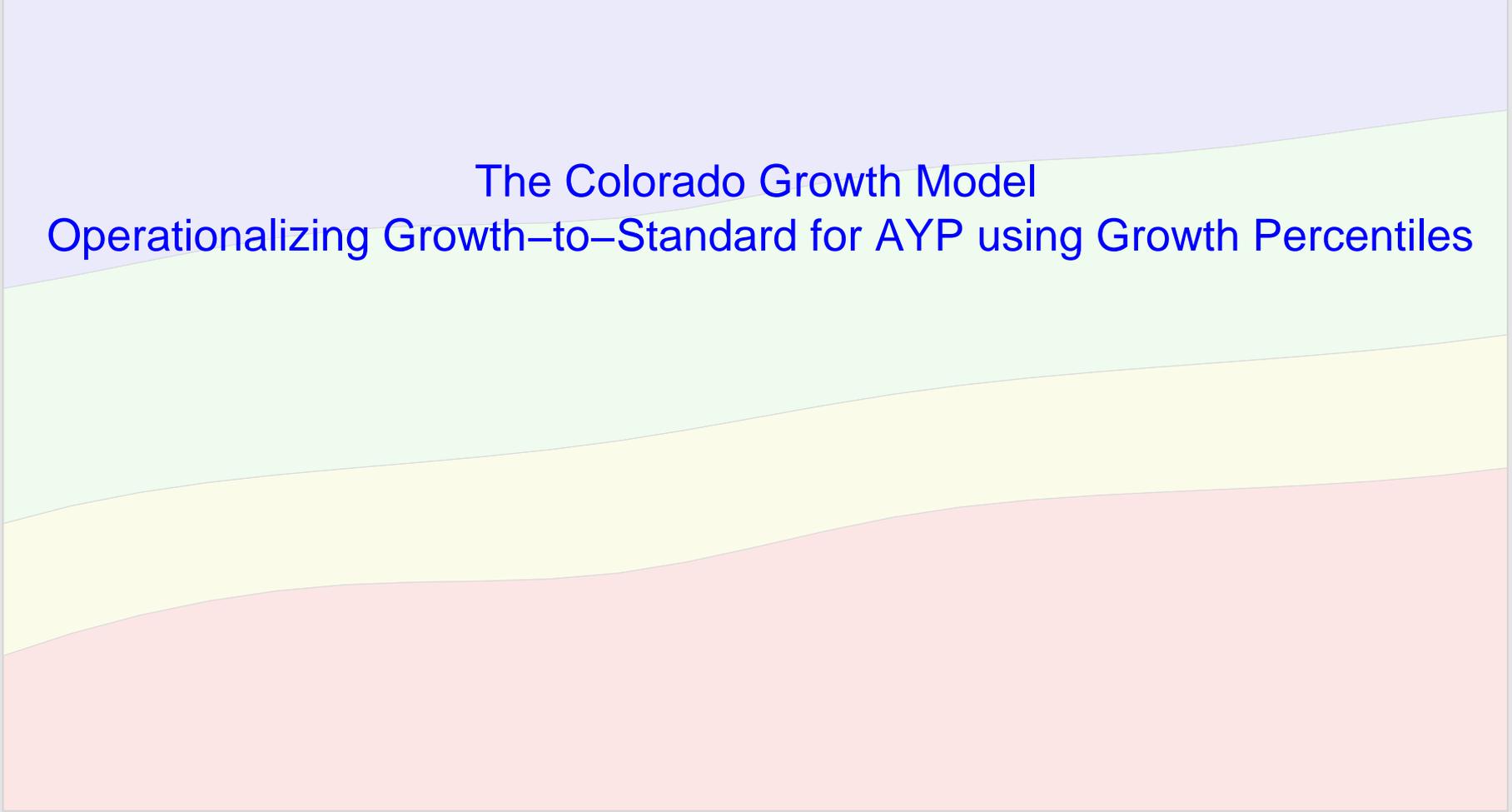
It is important to note that the achievement targets and time-frame are fixed. However, depending upon the student's interim rates of growth, their growth targets can be adjusted to reflect what is required for the student to reach their fixed achievement target. For example, a 3rd grade unsatisfactory student in reading (with an achievement target of NCLB proficient in reading by the 6th grade) might demonstrate sizable growth between 3rd and 4th grade and still remain unsatisfactory. They now have 2 years to reach NCLB proficient and the growth necessary to reach that fixed achievement goal should be recalculated to reflect their progress from the most recent year.

Slide Show Tutorial

To better motivate the discussion of the calculation of multi-year growth targets, the following slides demonstrate how the achievement goals/targets, once established, are used to make individual determinations of growth adequacy. The slides assume a situation in which, beginning in August 2007, 3 year Colorado Growth Model achievement targets are established for each student.

The Colorado Growth Model

Operationalizing Growth-to-Standard for AYP using Growth Percentiles



Grade 4/2005

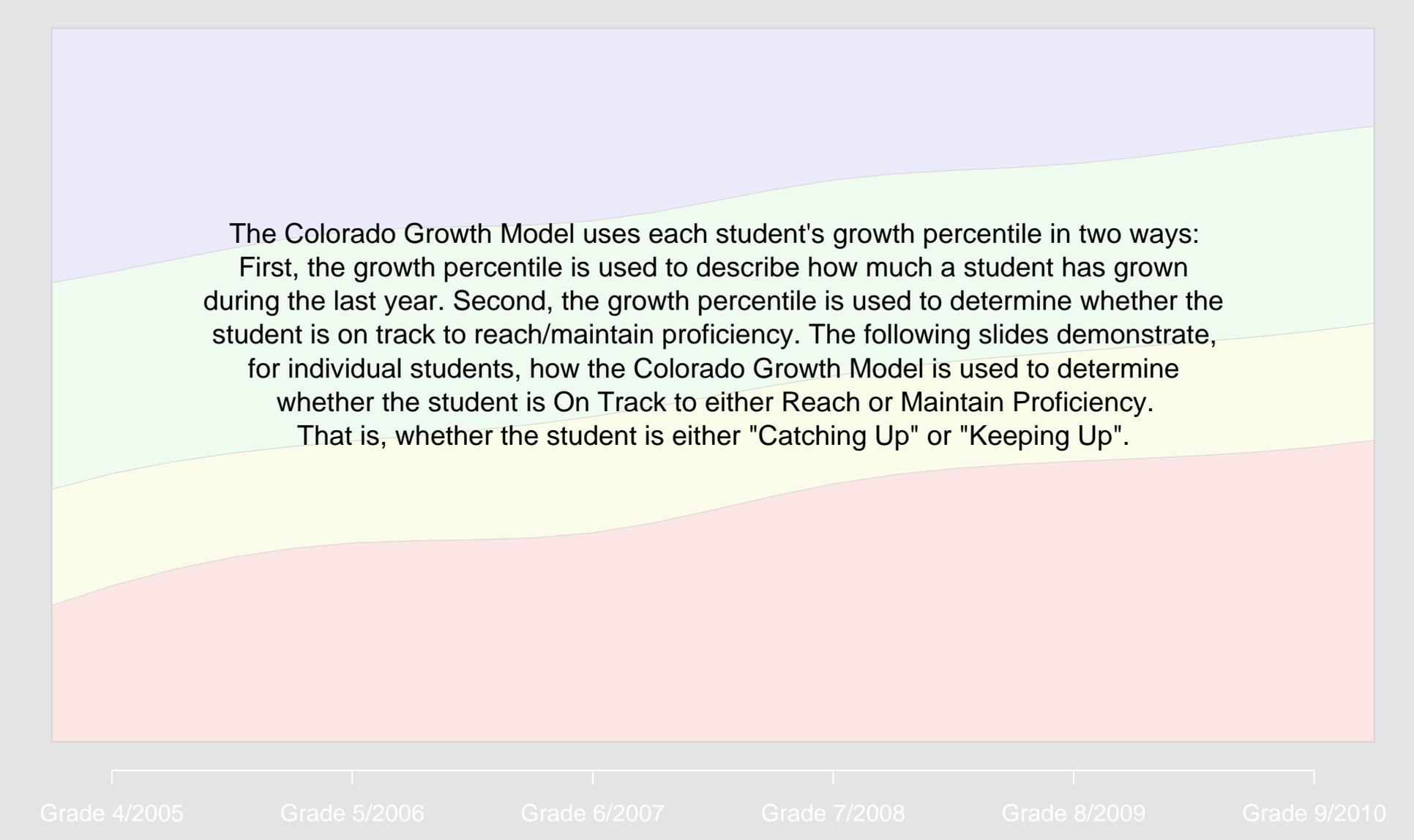
Grade 5/2006

Grade 6/2007

Grade 7/2008

Grade 8/2009

Grade 9/2010



The Colorado Growth Model uses each student's growth percentile in two ways:
First, the growth percentile is used to describe how much a student has grown during the last year. Second, the growth percentile is used to determine whether the student is on track to reach/maintain proficiency. The following slides demonstrate, for individual students, how the Colorado Growth Model is used to determine whether the student is On Track to either Reach or Maintain Proficiency. That is, whether the student is either "Catching Up" or "Keeping Up".

Grade 4/2005

Grade 5/2006

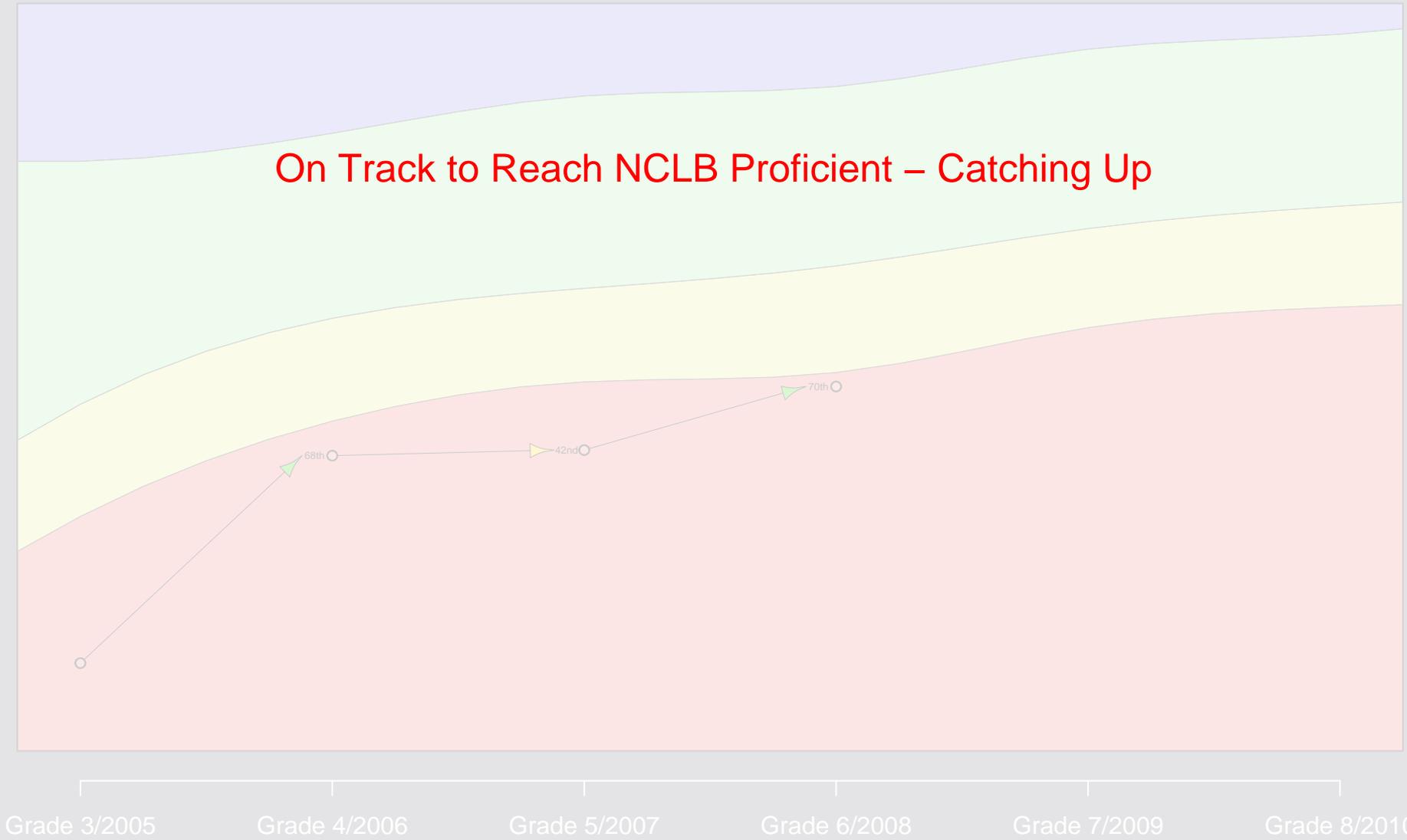
Grade 6/2007

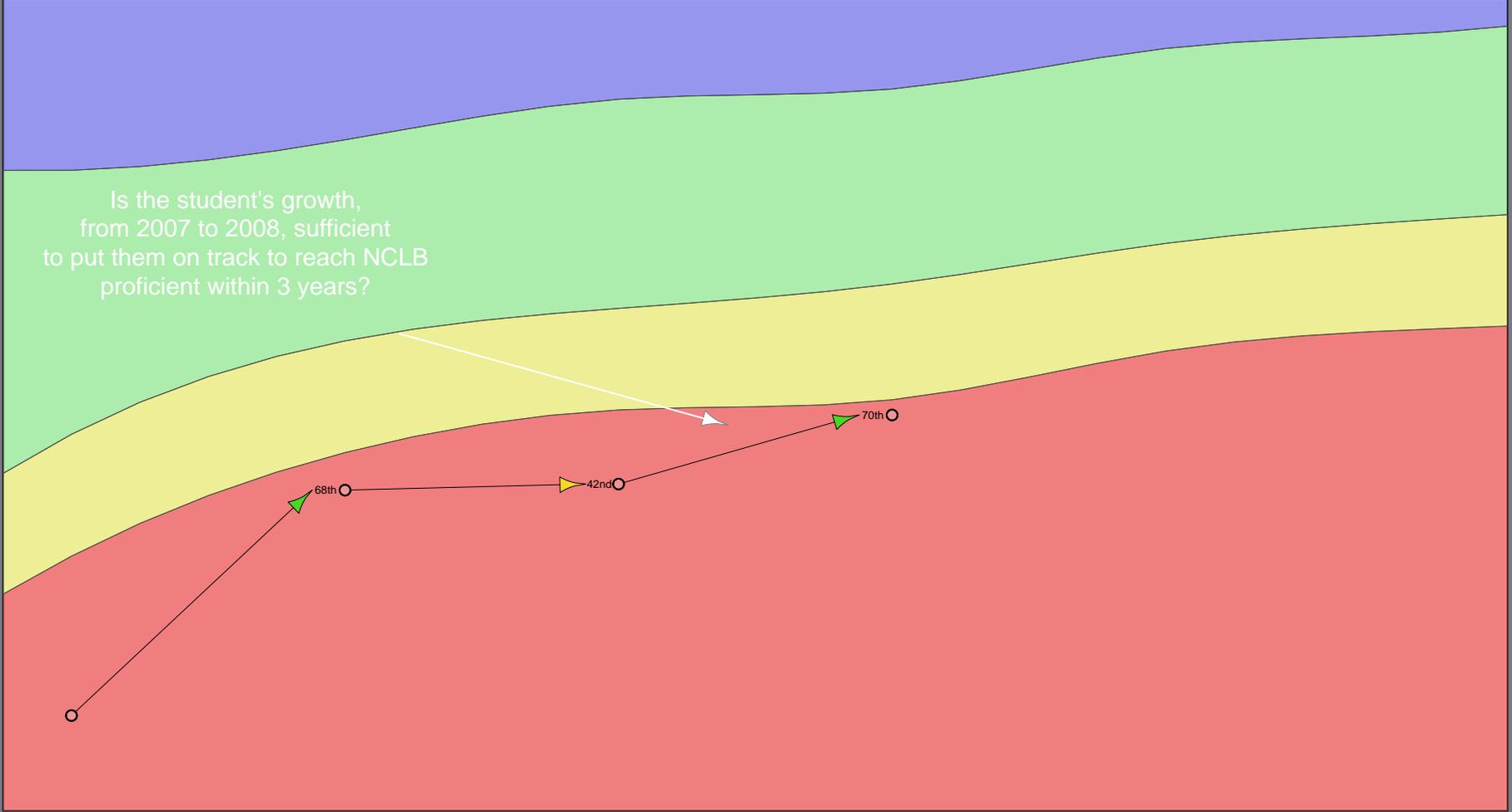
Grade 7/2008

Grade 8/2009

Grade 9/2010

On Track to Reach NCLB Proficient – Catching Up





Grade 3/2005

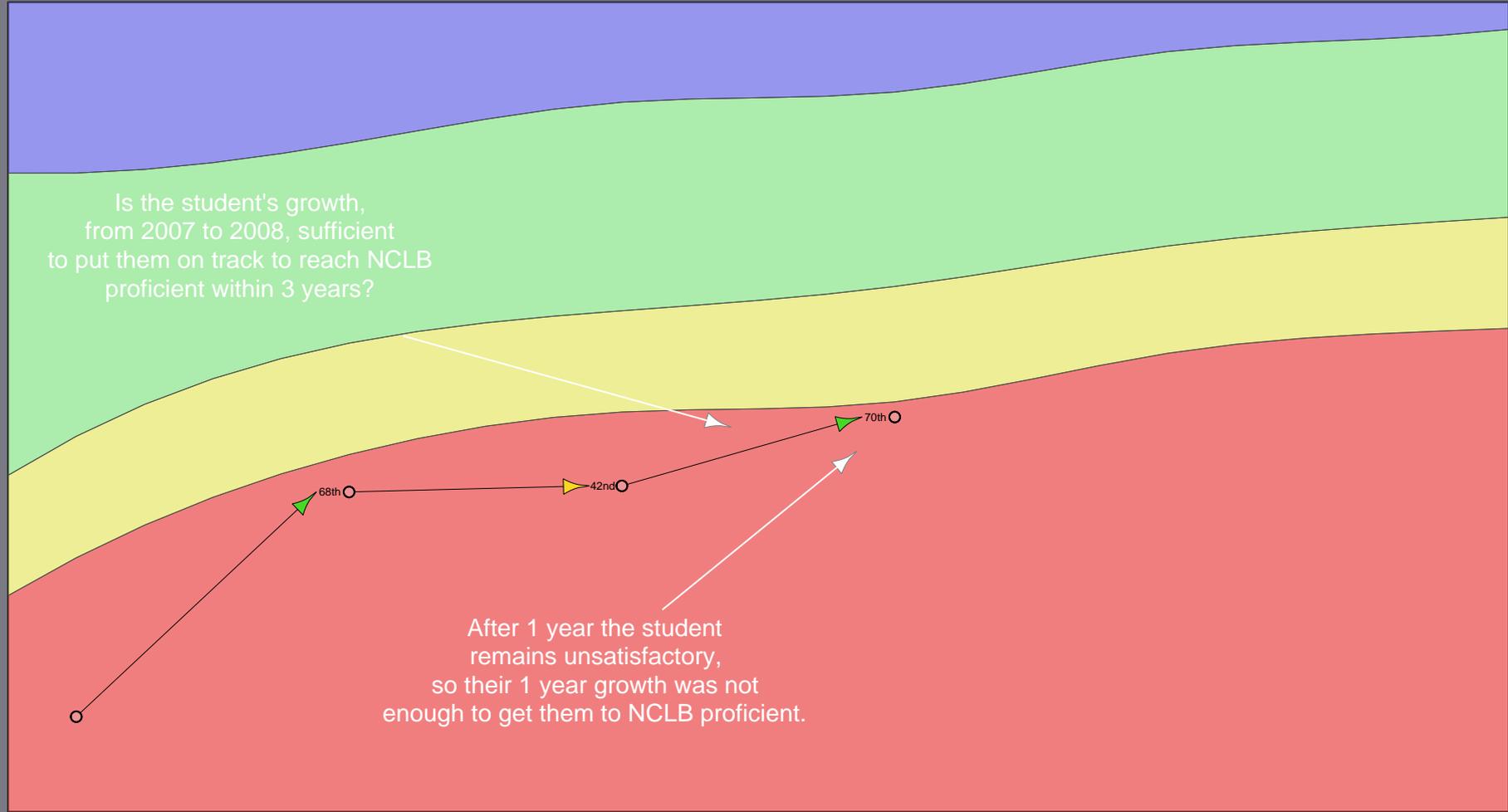
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Grade 3/2005

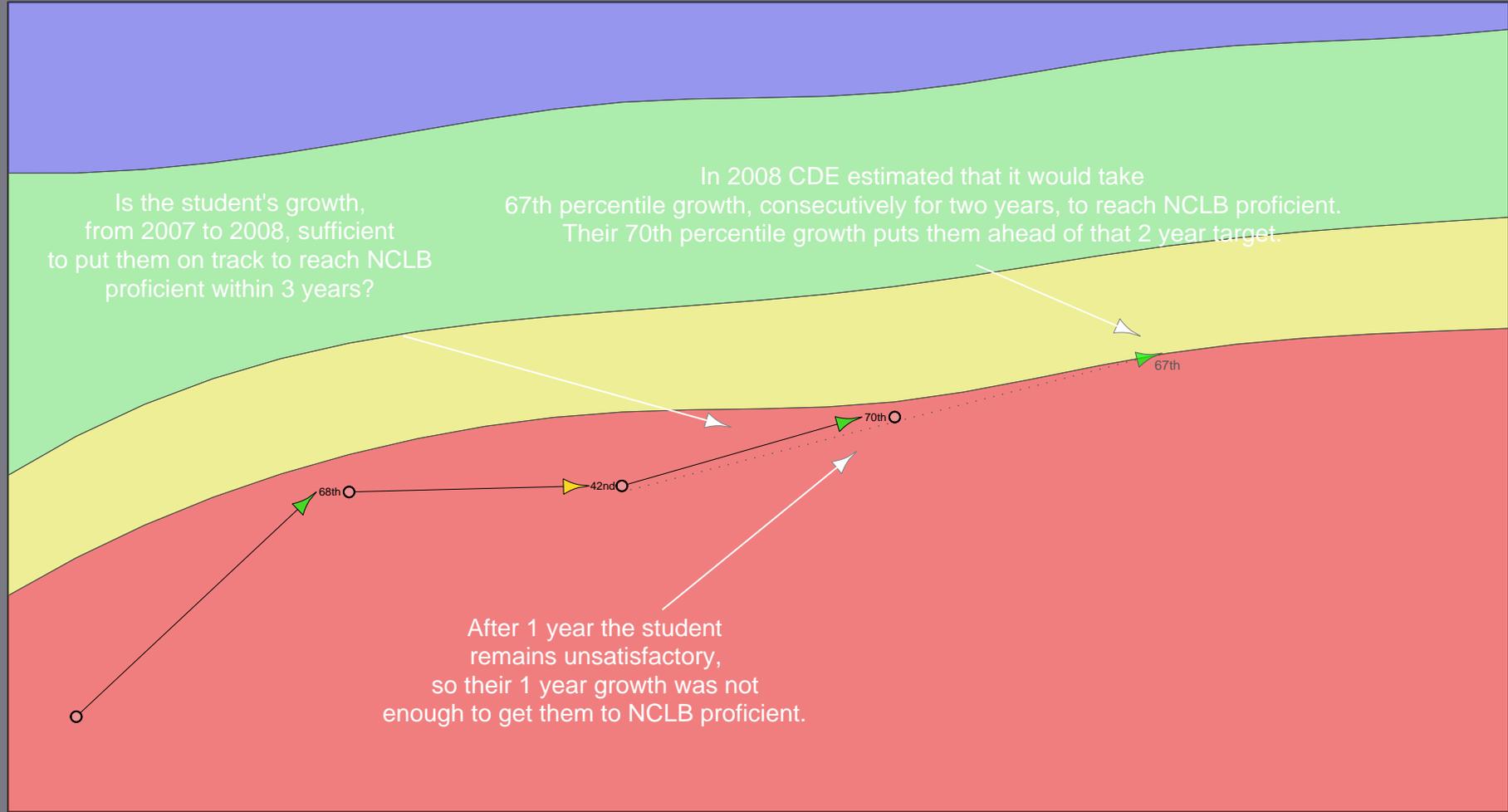
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Grade 3/2005

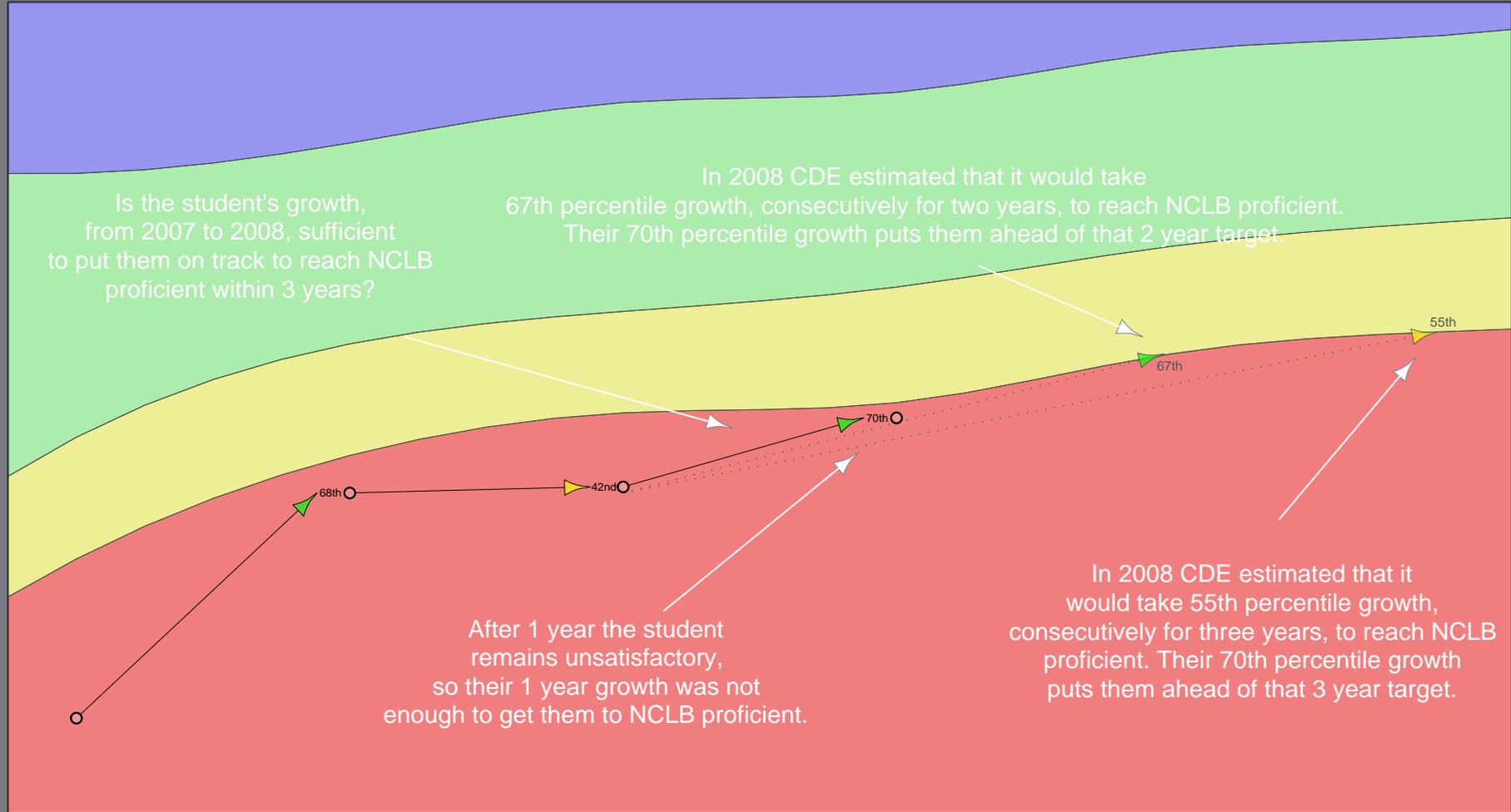
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Is the student's growth, from 2007 to 2008, sufficient to put them on track to reach NCLB proficient within 3 years?

In 2008 CDE estimated that it would take 67th percentile growth, consecutively for two years, to reach NCLB proficient. Their 70th percentile growth puts them ahead of that 2 year target.

After 1 year the student remains unsatisfactory, so their 1 year growth was not enough to get them to NCLB proficient.

In 2008 CDE estimated that it would take 55th percentile growth, consecutively for three years, to reach NCLB proficient. Their 70th percentile growth puts them ahead of that 3 year target.

Grade 3/2005

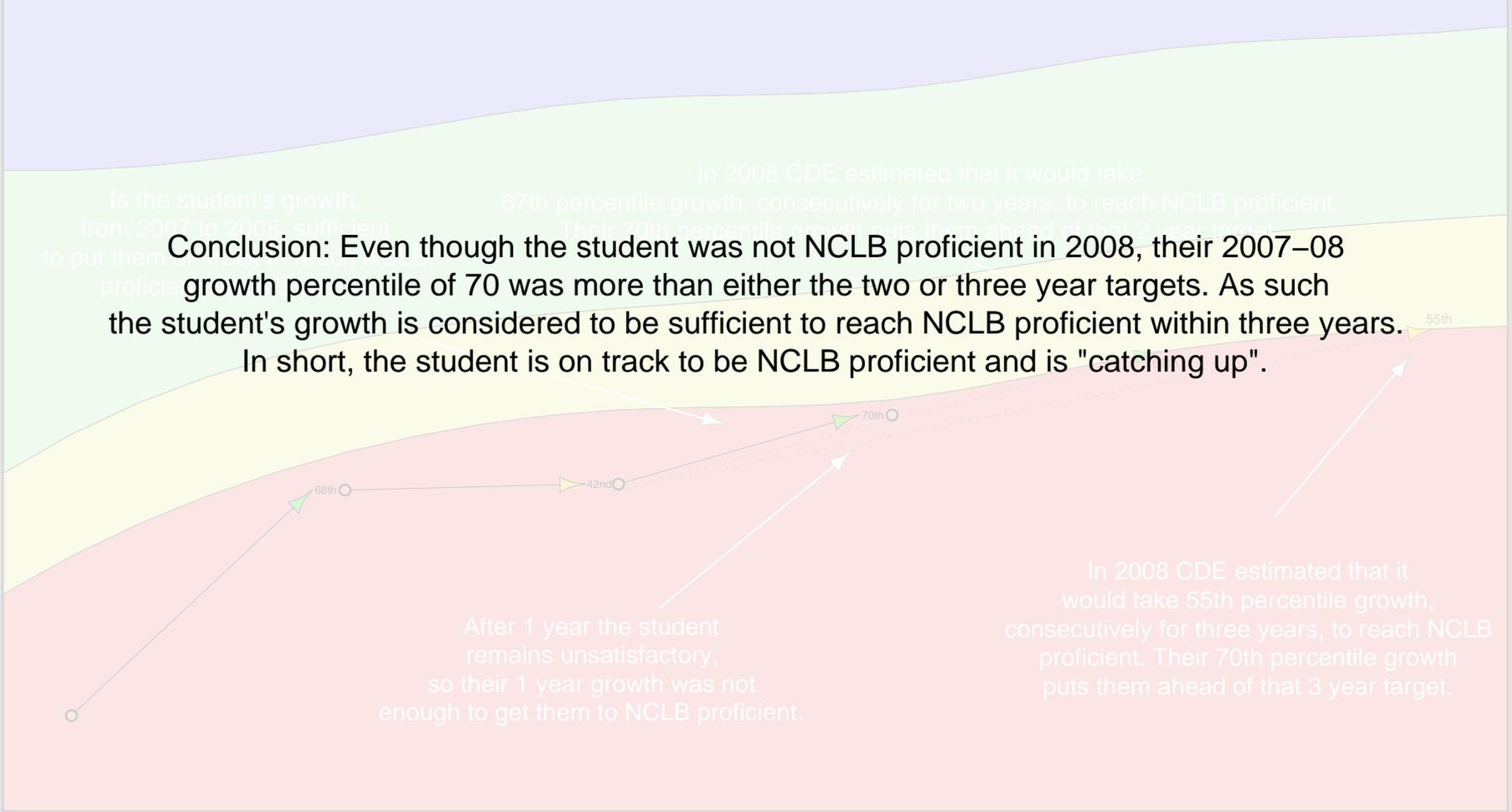
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Grade 3/2005

Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010

Conclusion: Even though the student was not NCLB proficient in 2008, their 2007–08 growth percentile of 70 was more than either the two or three year targets. As such the student's growth is considered to be sufficient to reach NCLB proficient within three years. In short, the student is on track to be NCLB proficient and is "catching up".

After 1 year the student remains unsatisfactory, so their 1 year growth was not enough to get them to NCLB proficient.

In 2008 CDE estimated that it would take 55th percentile growth, consecutively for three years, to reach NCLB proficient. Their 70th percentile growth puts them ahead of that 3 year target.

In 2008 CDE estimated that it would take 67th percentile growth, consecutively for two years, to reach NCLB proficient. Their 70th percentile growth puts them ahead of that 2 year target.

Is the student's growth, from 2007 to 2008, sufficient to put them on track to reach NCLB proficient?

Not On Track to Reach NCLB Proficient – Not Catching Up

Grade 3/2005 Grade 4/2006 Grade 5/2007 Grade 6/2008 Grade 7/2009 Grade 8/2010

○

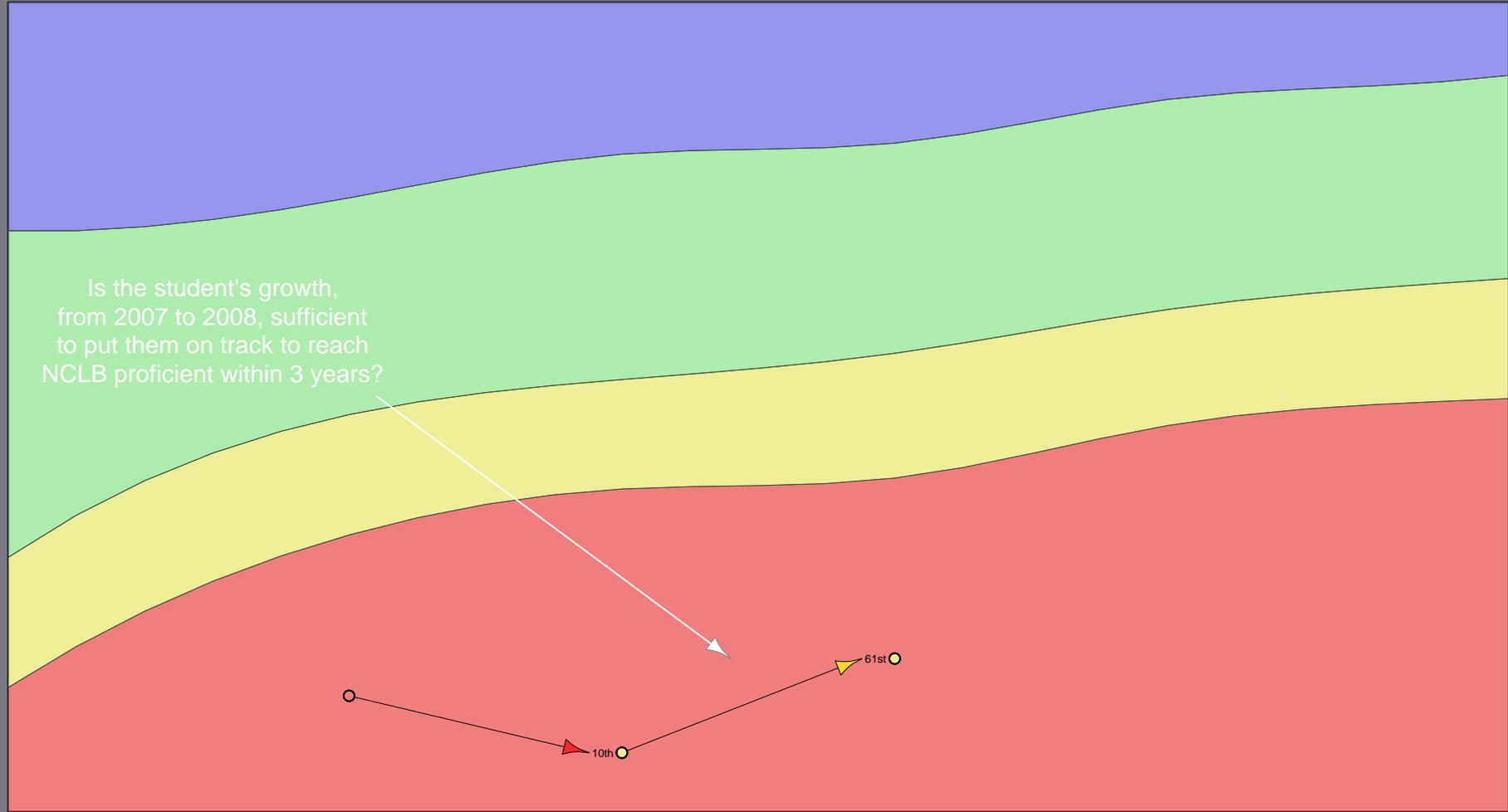
▶

10th

▶

61st

○



Grade 3/2005

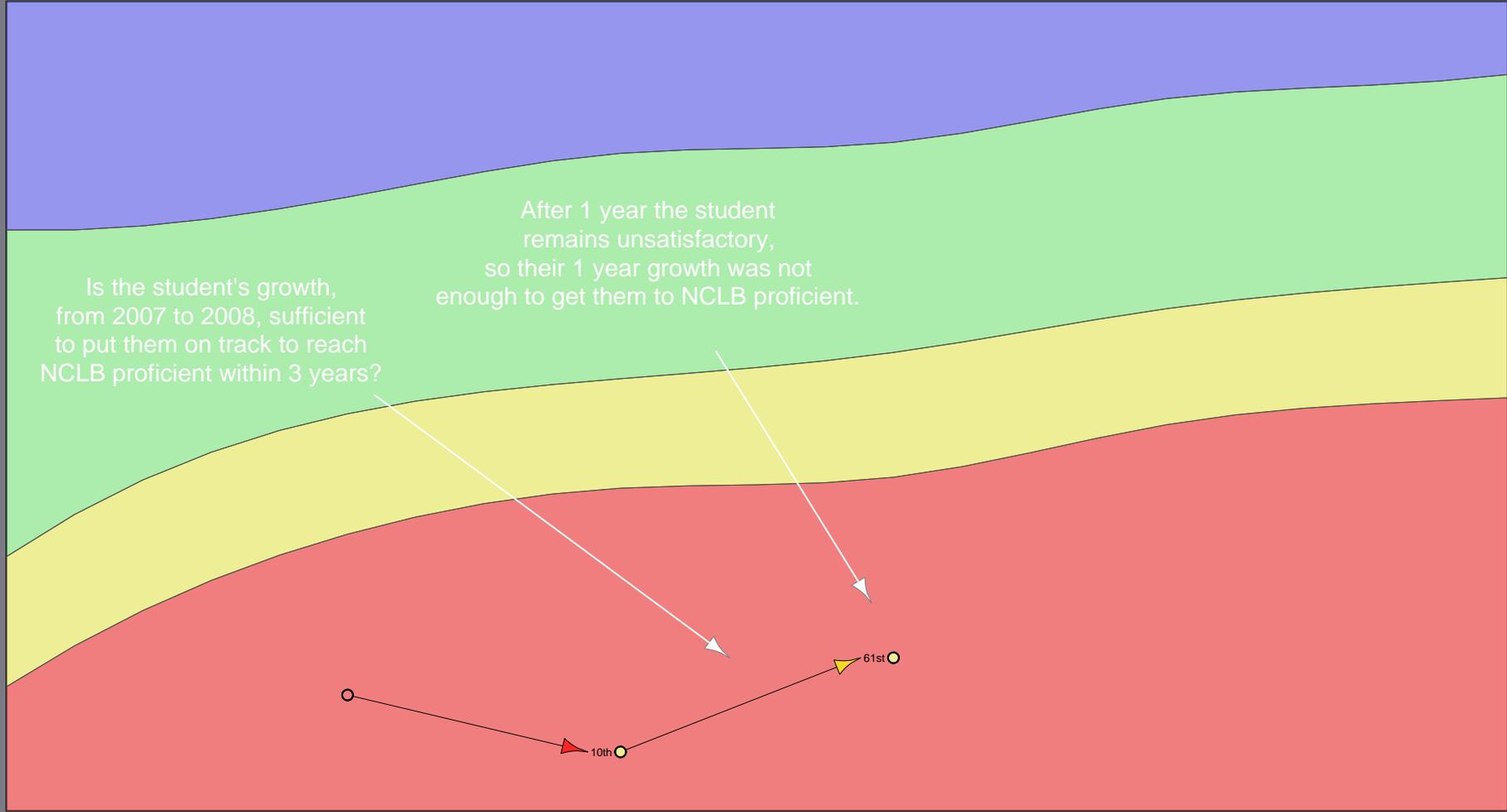
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Is the student's growth, from 2007 to 2008, sufficient to put them on track to reach NCLB proficient within 3 years?

After 1 year the student remains unsatisfactory, so their 1 year growth was not enough to get them to NCLB proficient.

Grade 3/2005

Grade 4/2006

Grade 5/2007

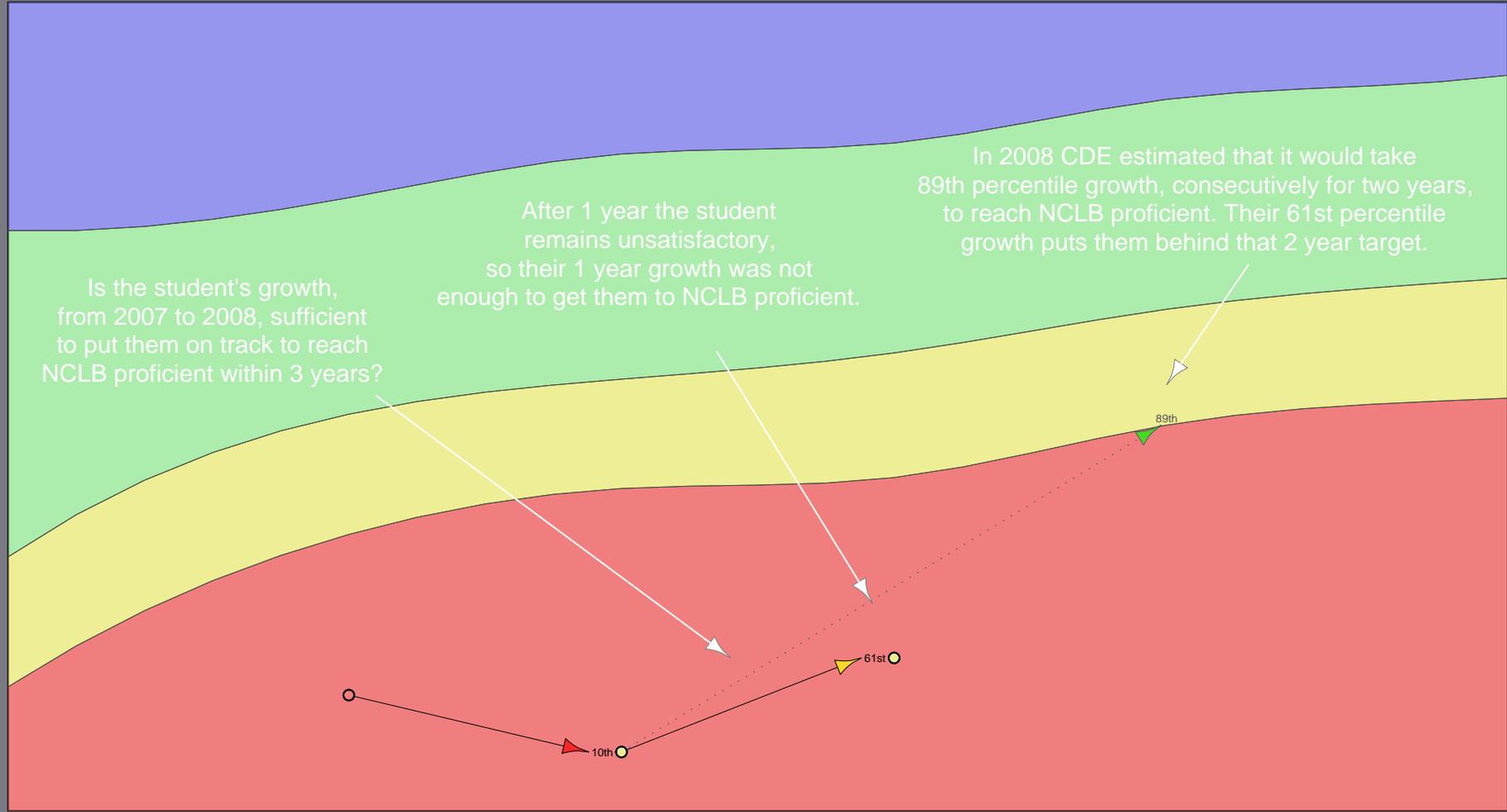
Grade 6/2008

Grade 7/2009

Grade 8/2010

10th

61st



Grade 3/2005

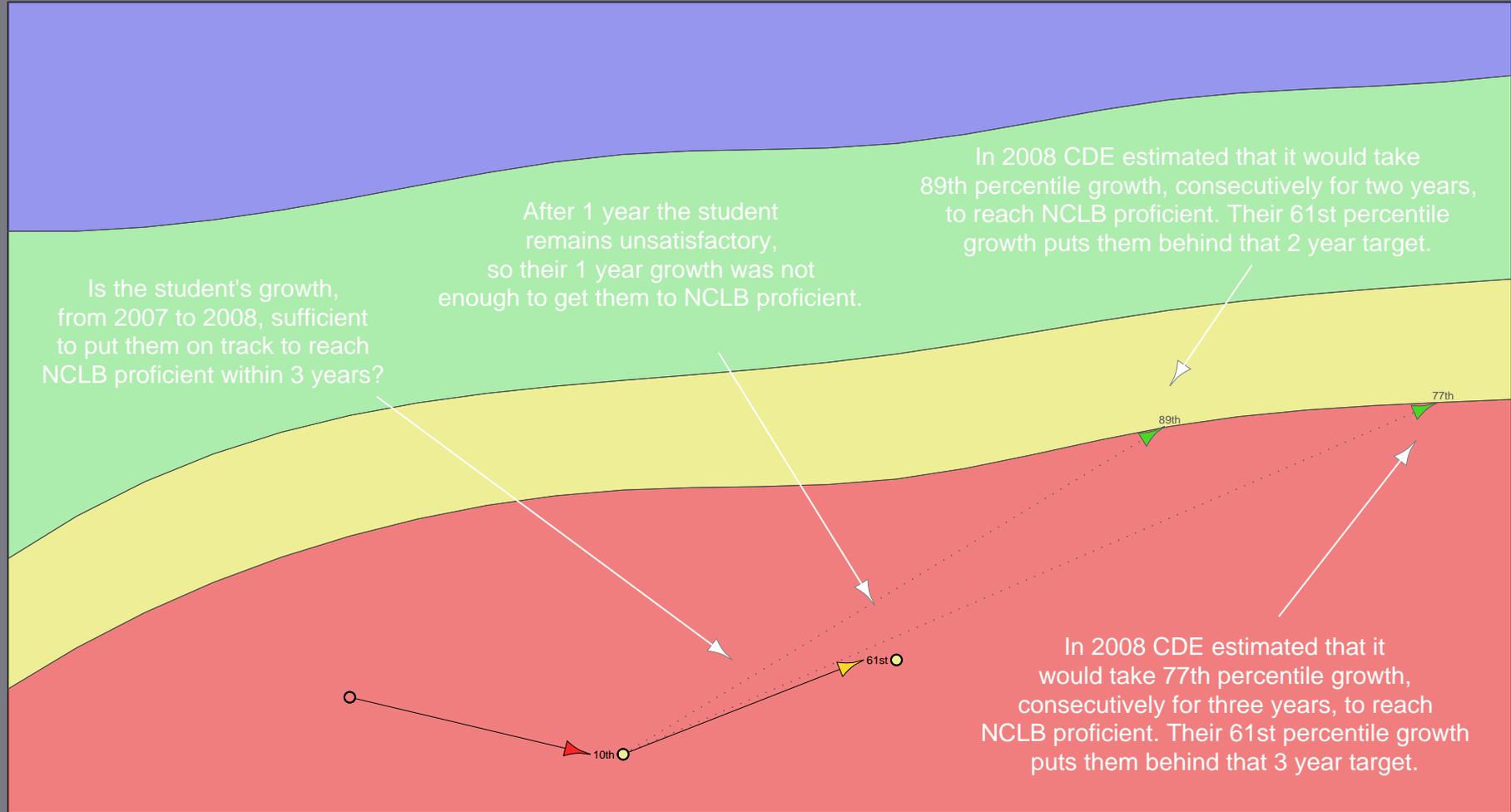
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Grade 3/2005

Grade 4/2006

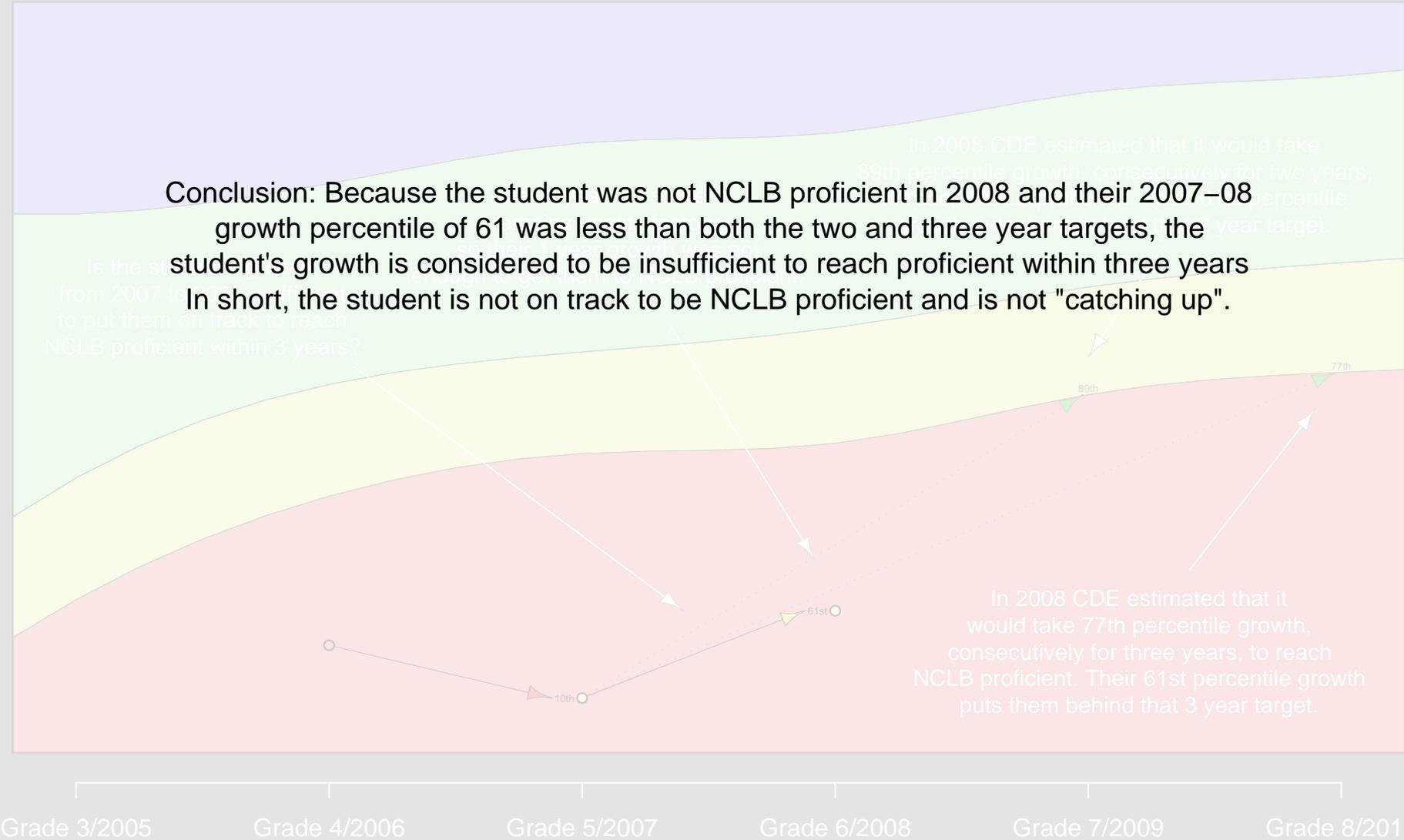
Grade 5/2007

Grade 6/2008

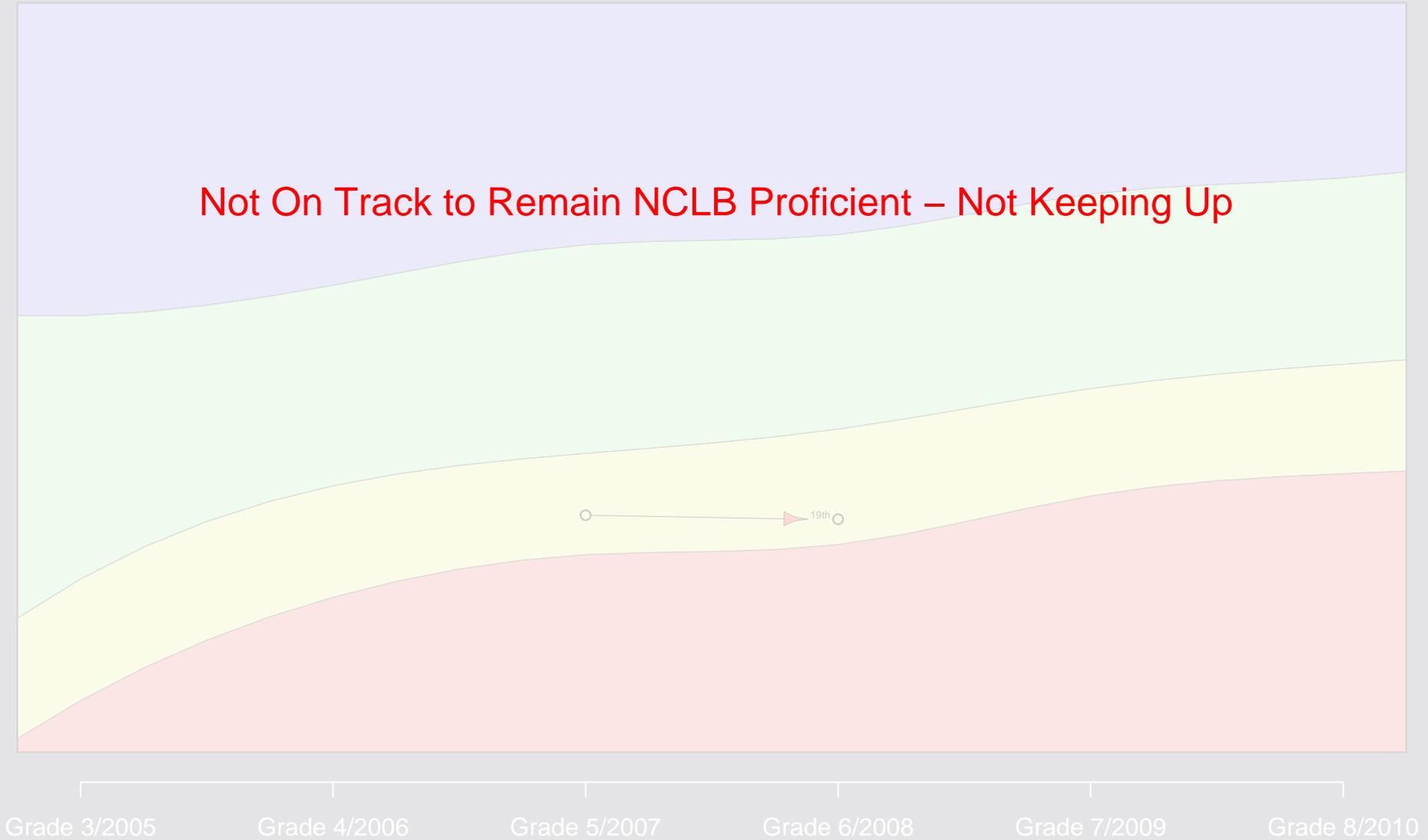
Grade 7/2009

Grade 8/2010

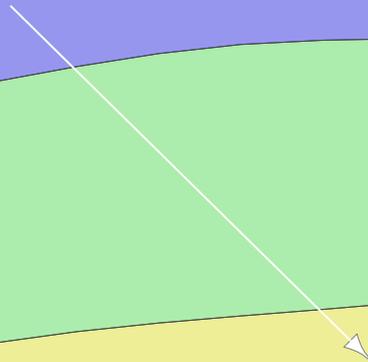
Conclusion: Because the student was not NCLB proficient in 2008 and their 2007–08 growth percentile of 61 was less than both the two and three year targets, the student's growth is considered to be insufficient to reach proficient within three years. In short, the student is not on track to be NCLB proficient and is not "catching up".



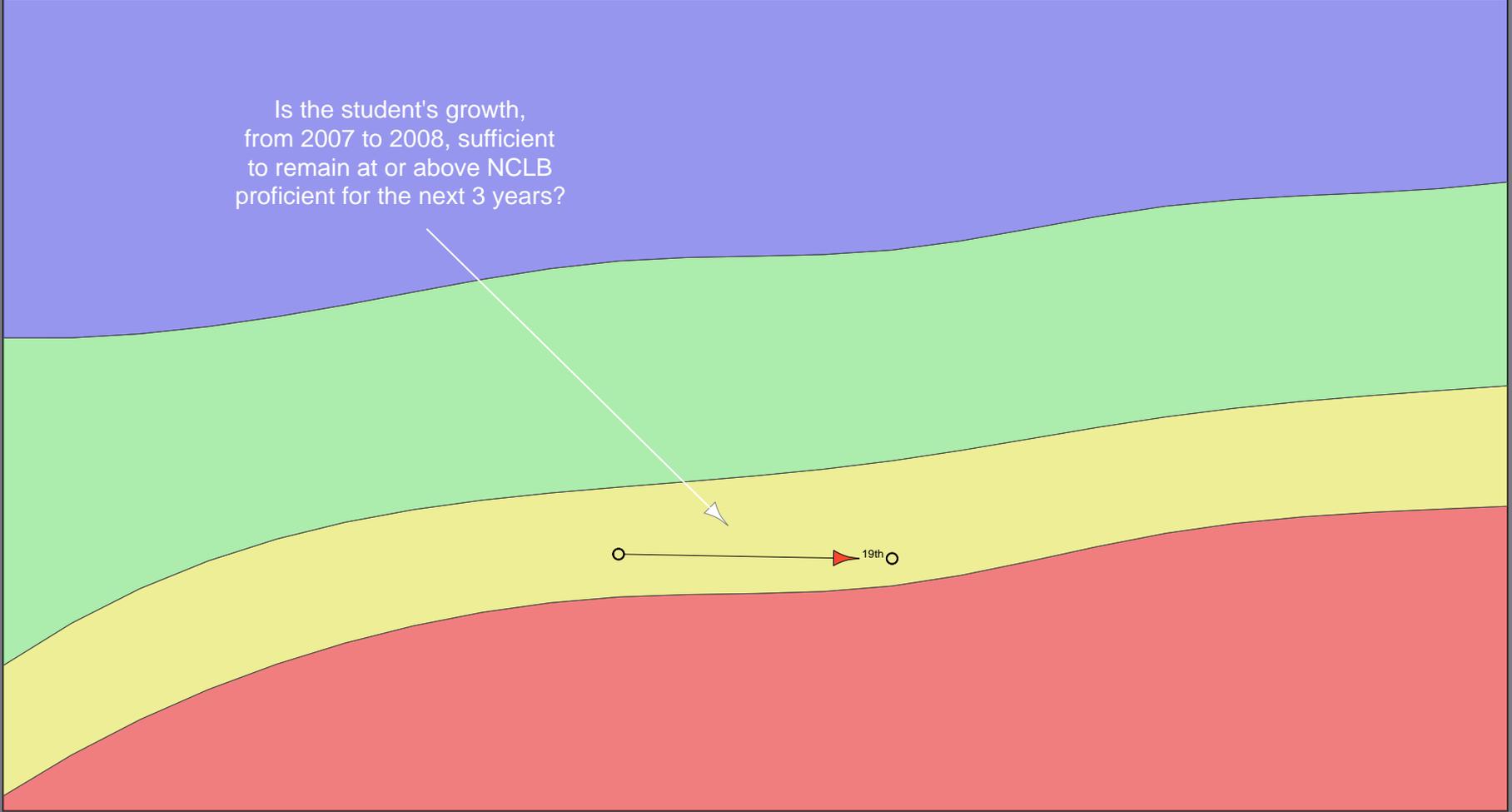
Not On Track to Remain NCLB Proficient – Not Keeping Up



Is the student's growth,
from 2007 to 2008, sufficient
to remain at or above NCLB
proficient for the next 3 years?



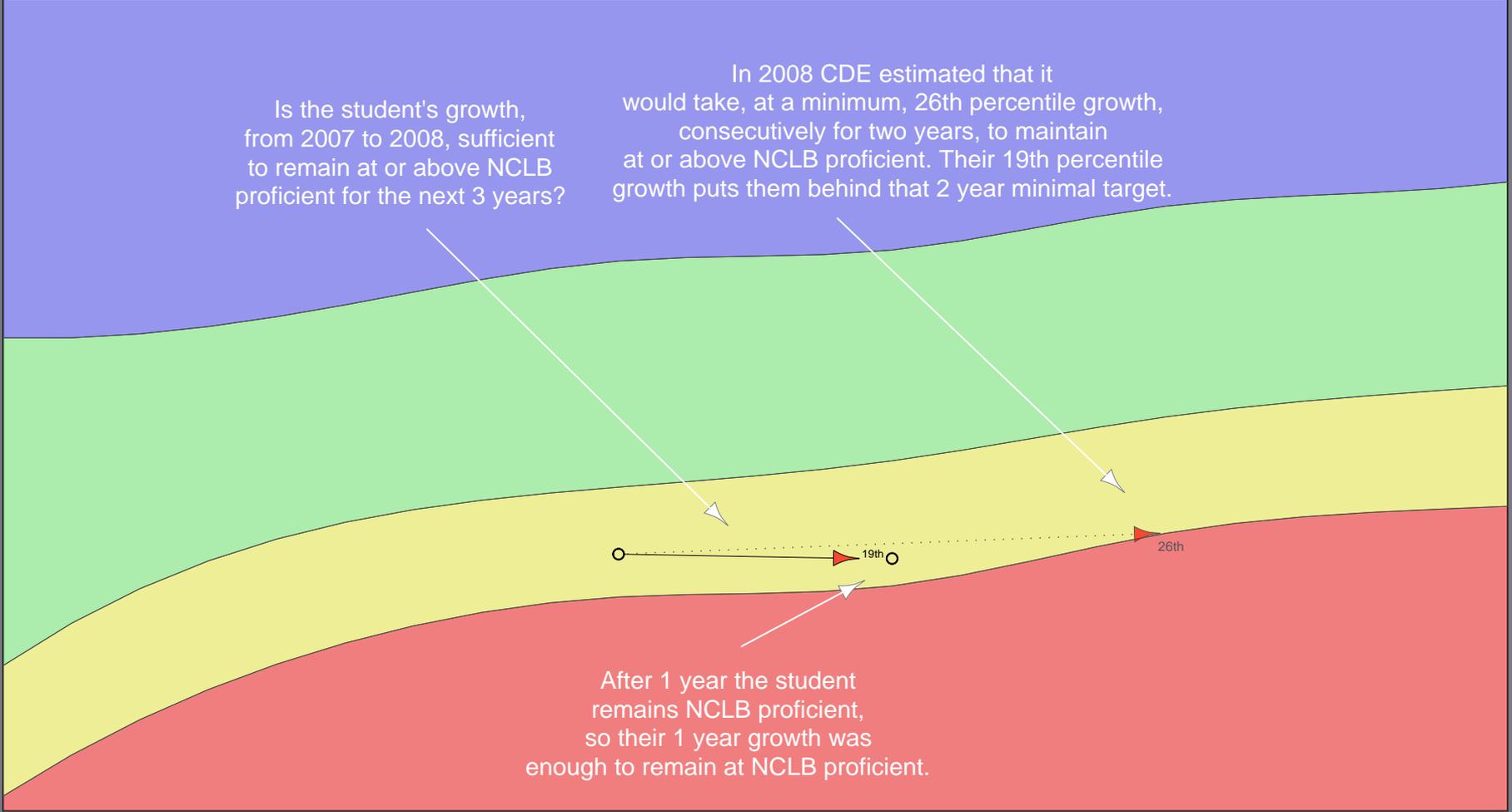
Grade 3/2005 Grade 4/2006 Grade 5/2007 Grade 6/2008 Grade 7/2009 Grade 8/2010



Is the student's growth,
from 2007 to 2008, sufficient
to remain at or above NCLB
proficient for the next 3 years?

After 1 year the student
remains NCLB proficient,
so their 1 year growth was
enough to remain at NCLB proficient.





Is the student's growth, from 2007 to 2008, sufficient to remain at or above NCLB proficient for the next 3 years?

In 2008 CDE estimated that it would take, at a minimum, 26th percentile growth, consecutively for two years, to maintain at or above NCLB proficient. Their 19th percentile growth puts them behind that 2 year minimal target.

After 1 year the student remains NCLB proficient, so their 1 year growth was enough to remain at NCLB proficient.

Grade 3/2005

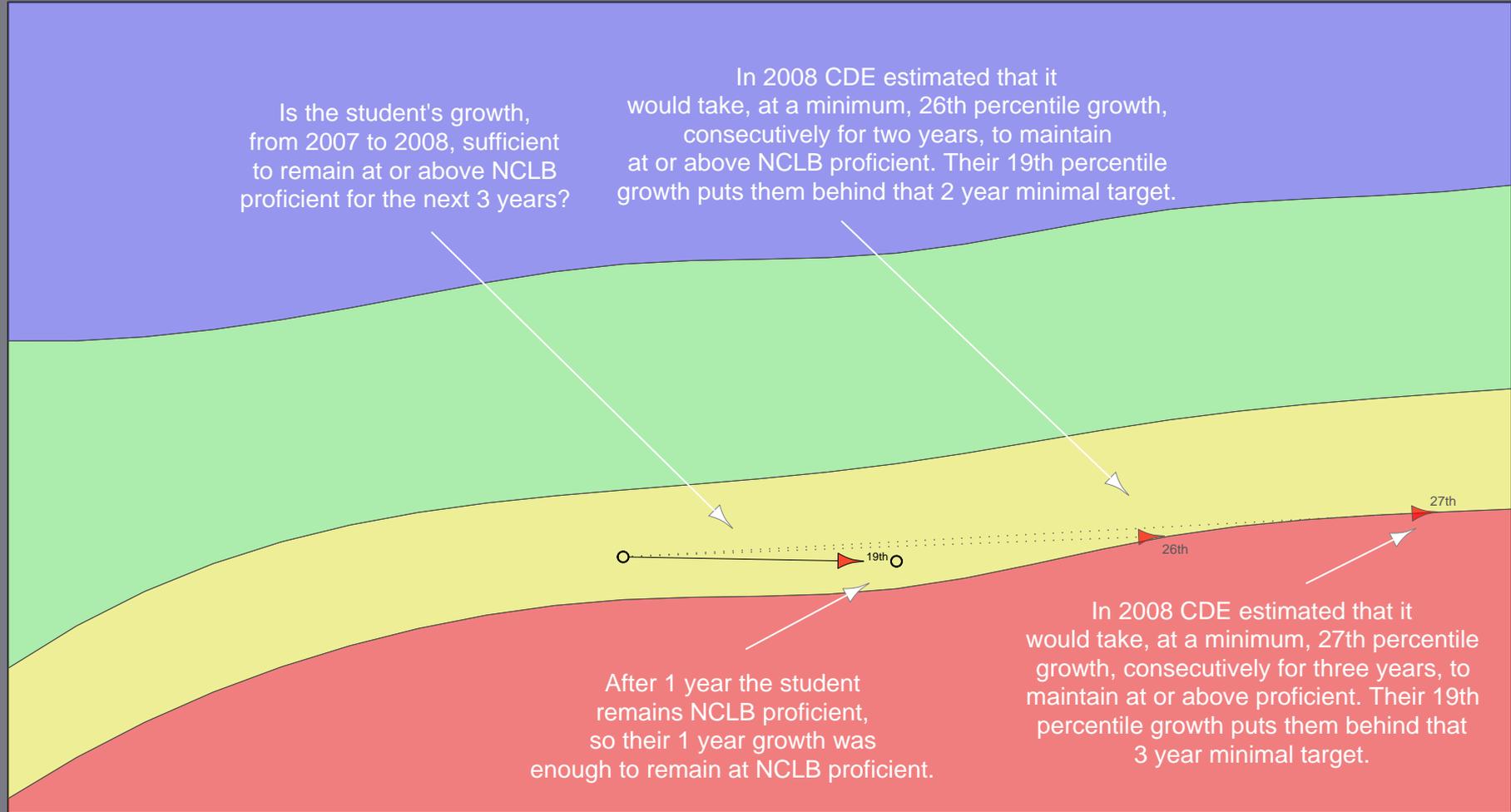
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Is the student's growth, from 2007 to 2008, sufficient to remain at or above NCLB proficient for the next 3 years?

In 2008 CDE estimated that it would take, at a minimum, 26th percentile growth, consecutively for two years, to maintain at or above NCLB proficient. Their 19th percentile growth puts them behind that 2 year minimal target.

19th

26th

27th

After 1 year the student remains NCLB proficient, so their 1 year growth was enough to remain at NCLB proficient.

In 2008 CDE estimated that it would take, at a minimum, 27th percentile growth, consecutively for three years, to maintain at or above proficient. Their 19th percentile growth puts them behind that 3 year minimal target.

Grade 3/2005

Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010

Is the student's growth, from 2007 to 2008, sufficient to remain at or above NCLB proficient for the next 3 years?

In 2008 CDE estimated that it would take, at a minimum, 26th percentile growth, consecutively for two years, to maintain at or above NCLB proficient. Their 19th percentile growth puts them behind that 2 year minimal target.

Conclusion: Even though the student was NCLB proficient in 2008, their 2007–08 growth percentile of 19 was less than both the two and three year minimum targets. As such, the student's growth is considered to be insufficient to remain NCLB proficient over the next three years. In short, the student is not on track to remain NCLB proficient and is not "keeping up".

After 1 year the student remains NCLB proficient, so their 1 year growth was enough to remain at NCLB proficient.

In 2008 CDE estimated that it would take, at a minimum, 27th percentile growth, consecutively for three years, to maintain at or above proficient. Their 19th percentile growth puts them behind that 3 year minimal target.

Grade 3/2005

Grade 4/2006

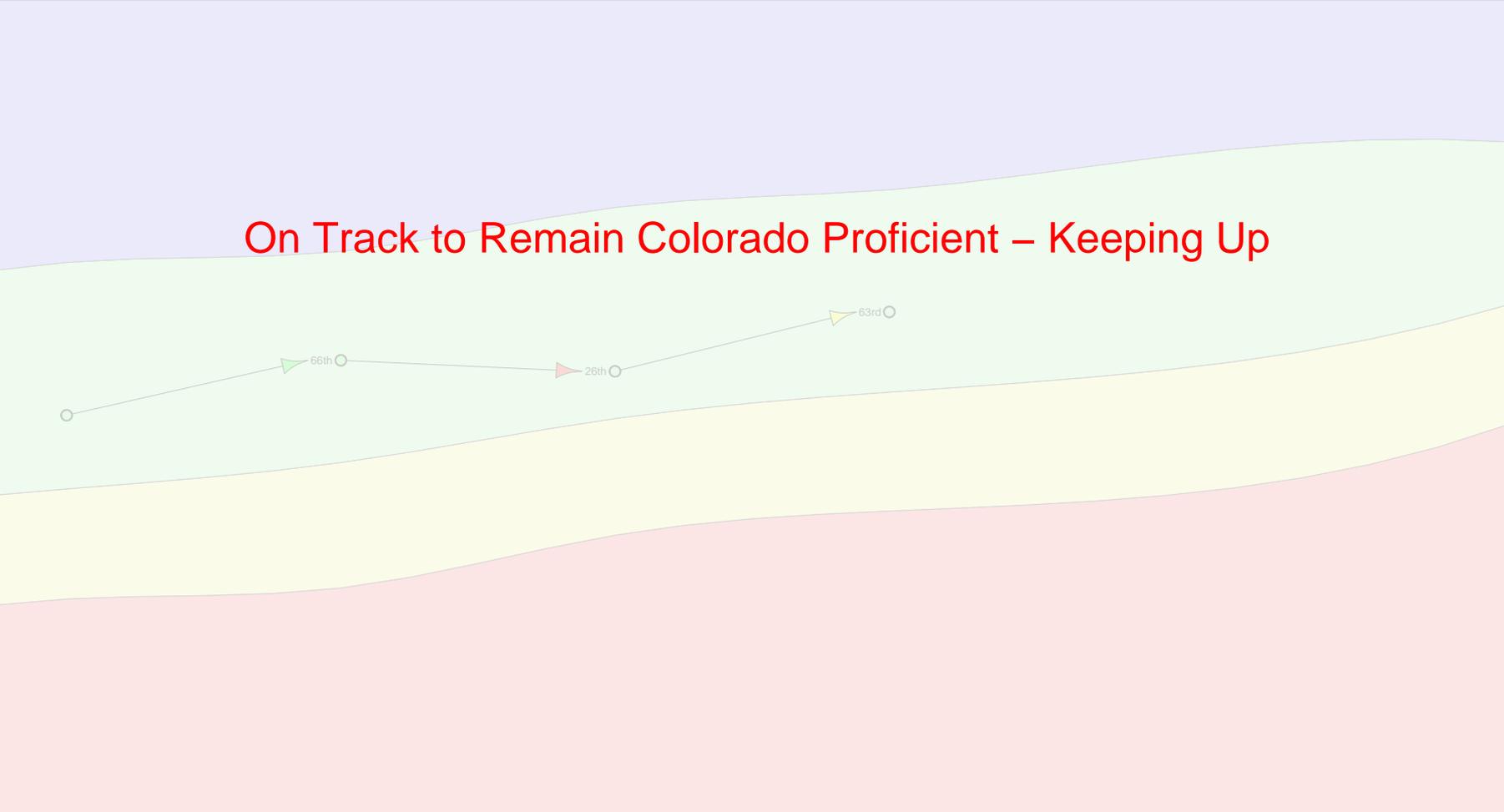
Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010

On Track to Remain Colorado Proficient – Keeping Up



Grade 5/2005

Grade 6/2006

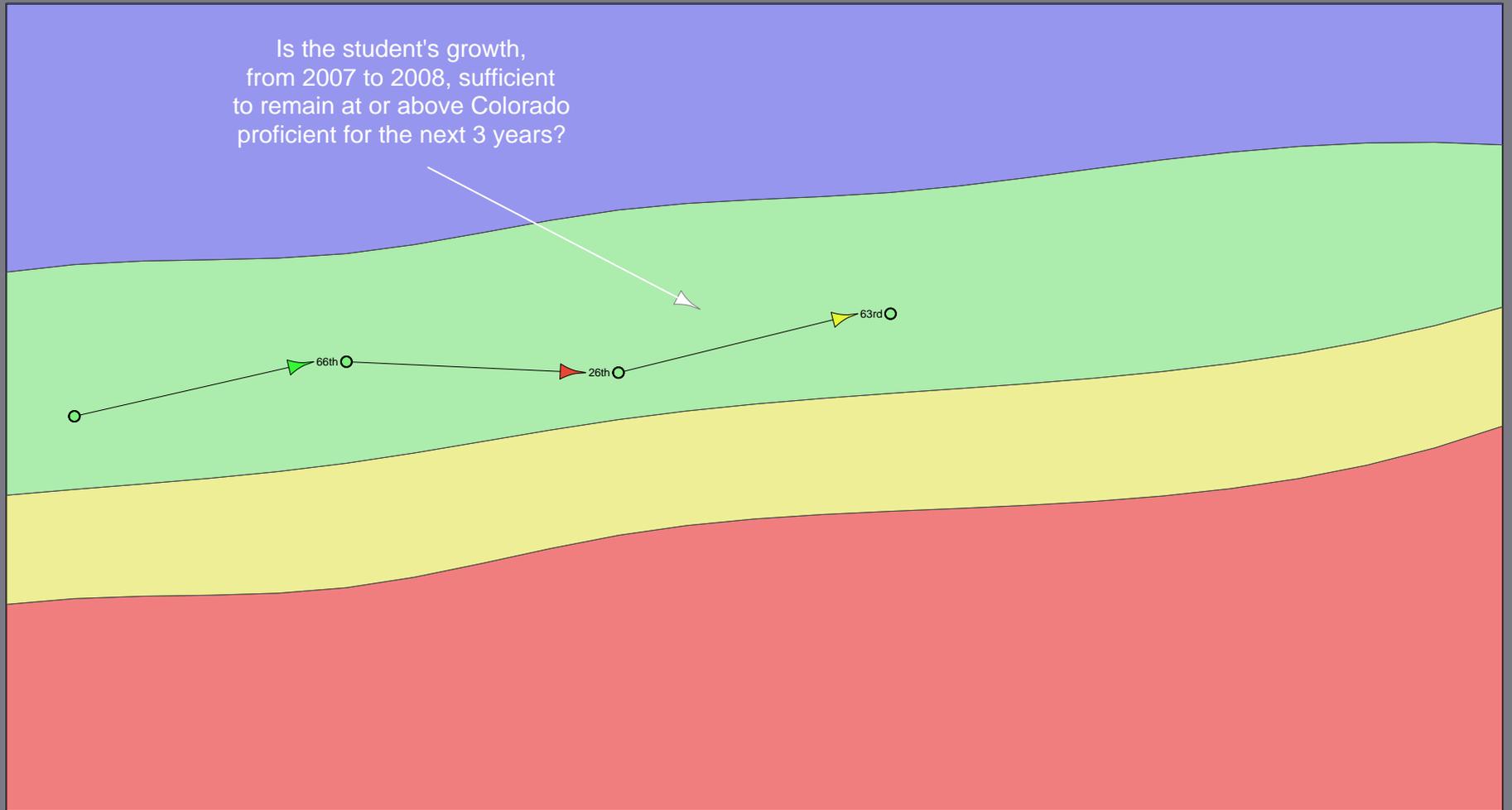
Grade 7/2007

Grade 8/2008

Grade 9/2009

Grade 10/2010

Is the student's growth,
from 2007 to 2008, sufficient
to remain at or above Colorado
proficient for the next 3 years?



Grade 5/2005

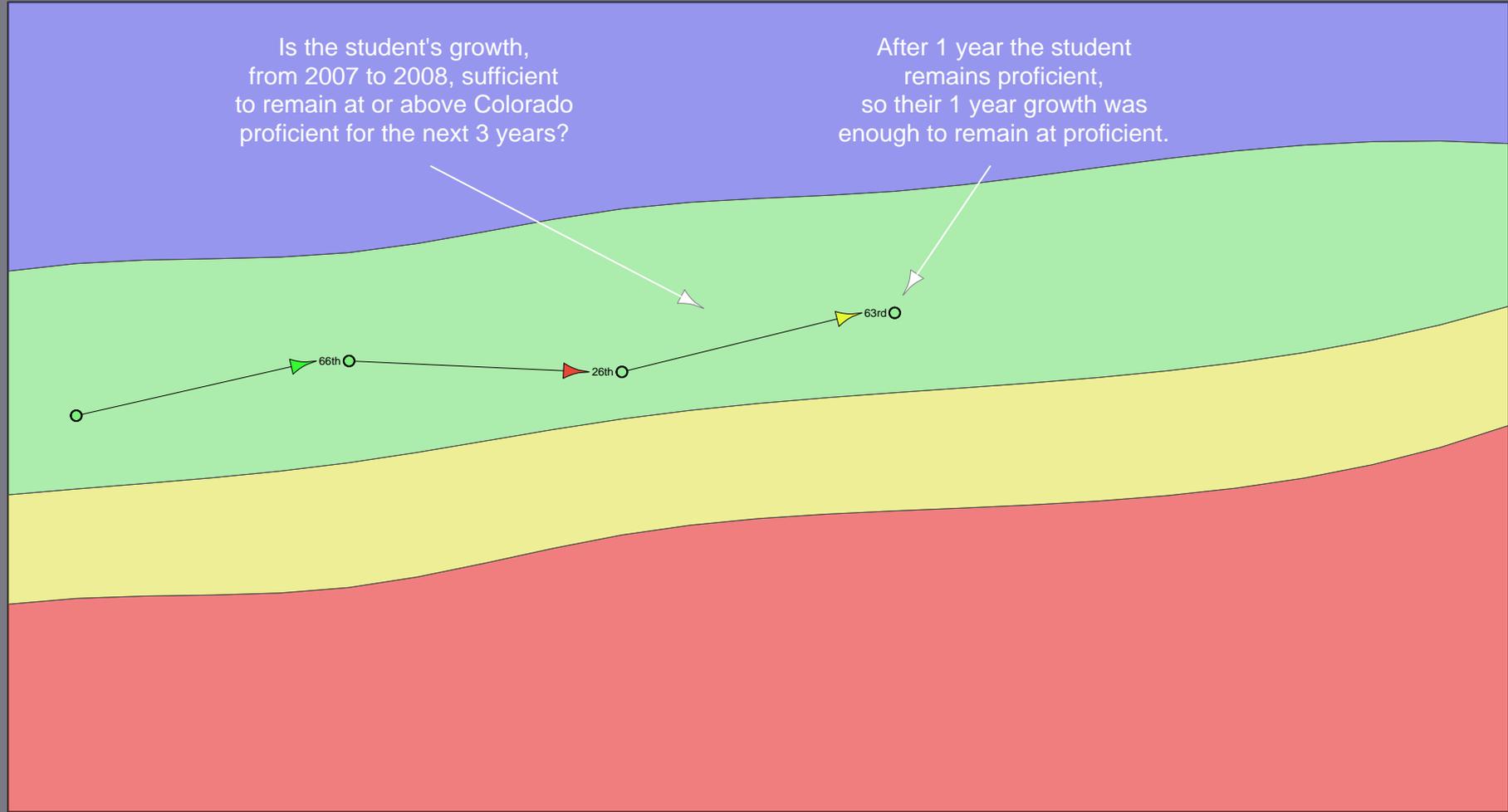
Grade 6/2006

Grade 7/2007

Grade 8/2008

Grade 9/2009

Grade 10/2010



Grade 5/2005

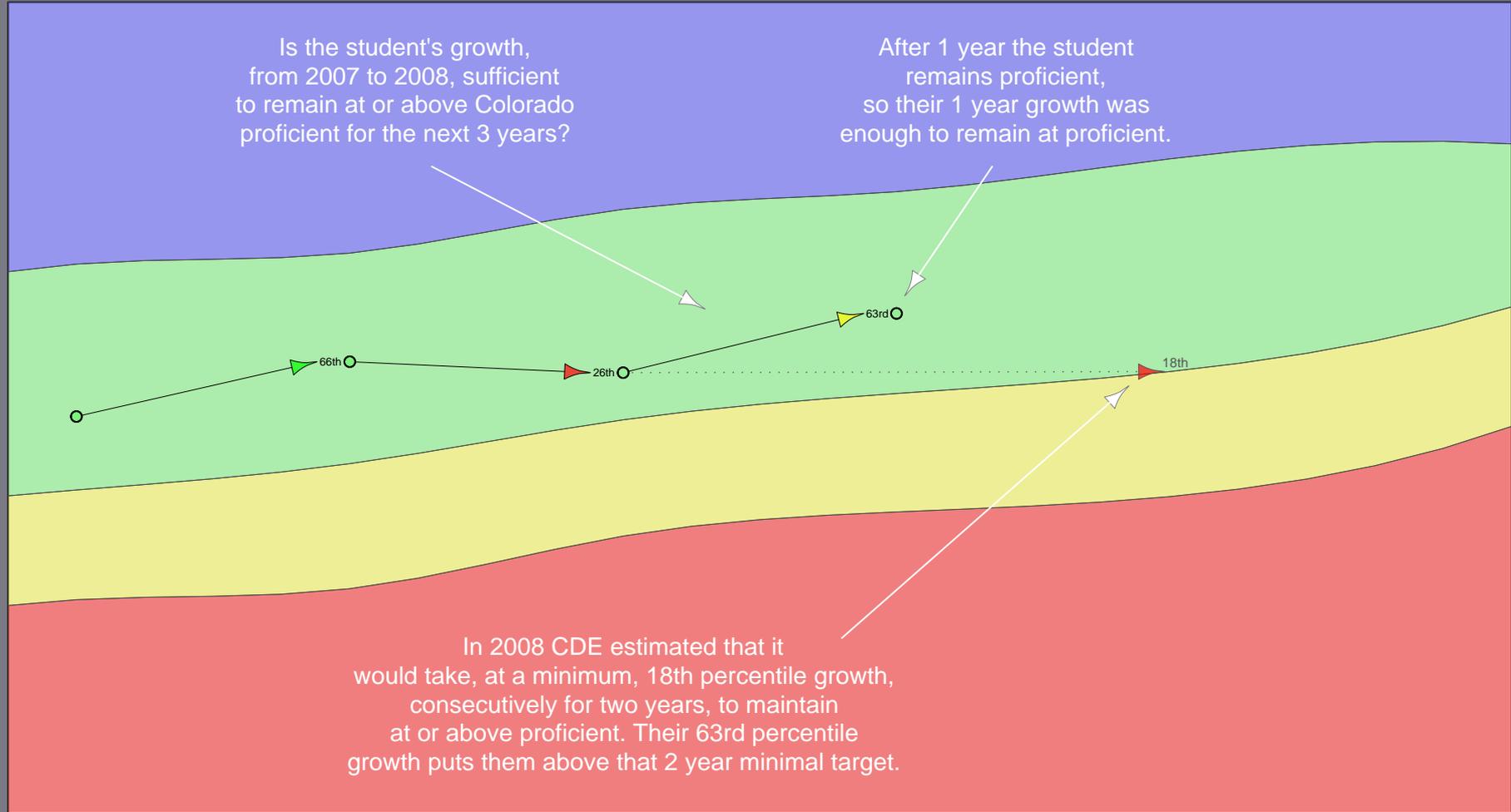
Grade 6/2006

Grade 7/2007

Grade 8/2008

Grade 9/2009

Grade 10/2010



Grade 5/2005

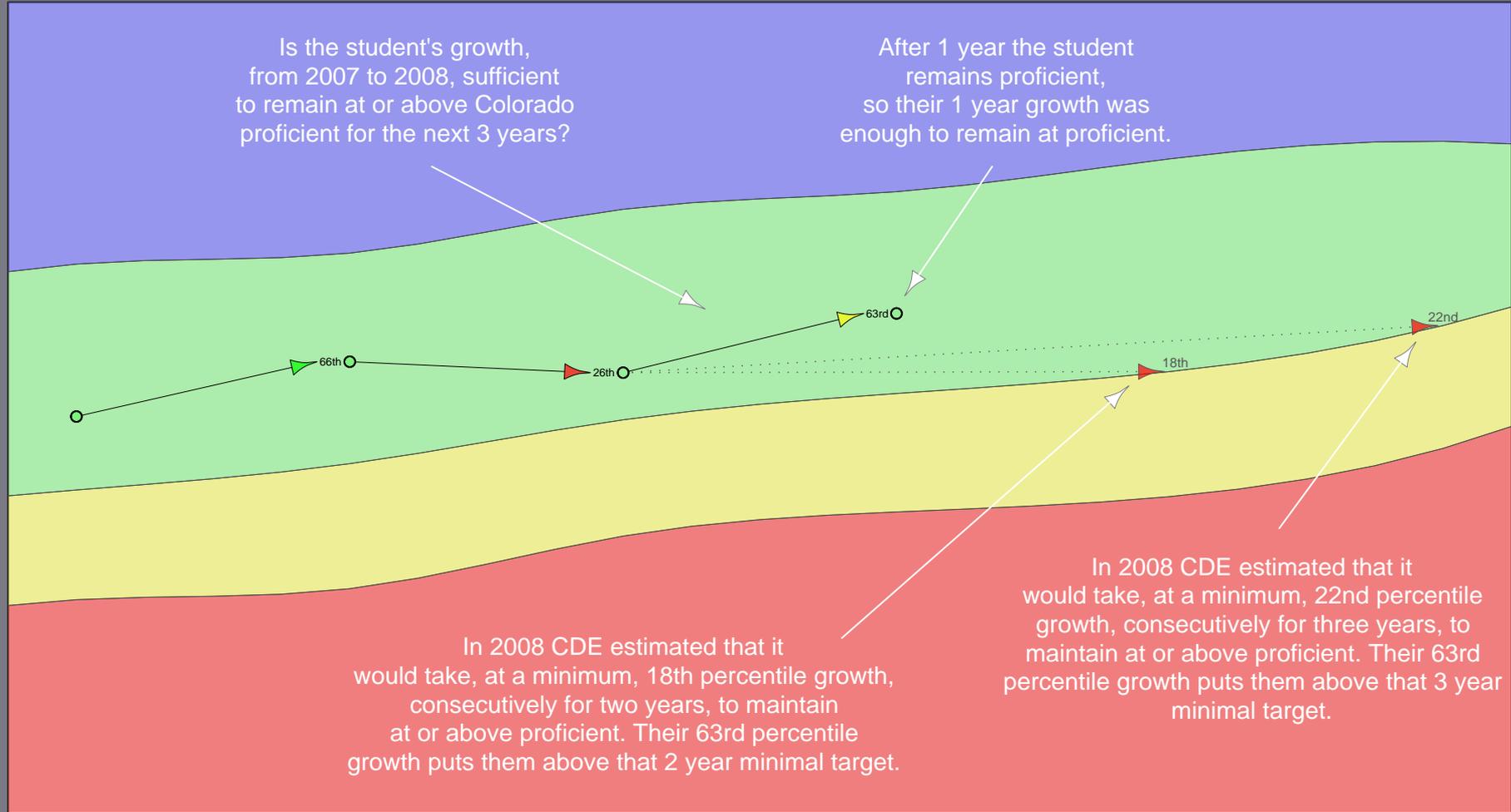
Grade 6/2006

Grade 7/2007

Grade 8/2008

Grade 9/2009

Grade 10/2010



Grade 5/2005

Grade 6/2006

Grade 7/2007

Grade 8/2008

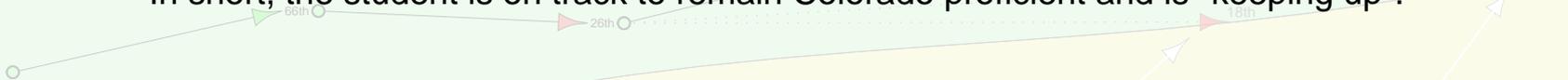
Grade 9/2009

Grade 10/2010

Is the student's growth, from 2007 to 2008, sufficient to remain at or above Colorado proficient for the next 3 years?

After 1 year the student remains proficient, so their 1 year growth was enough to remain at proficient.

Conclusion: Because the student was Colorado proficient in 2008 and their 2007–08 growth percentile of 63 was greater than both the two and three year minimum targets, the student's growth is considered to be sufficient to remain proficient during the next three years. In short, the student is on track to remain Colorado proficient and is "keeping up".



In 2008 CDE estimated that it would take, at a minimum, 18th percentile growth, consecutively for two years, to maintain at or above proficient. Their 63rd percentile growth puts them above that 2 year minimal target.

In 2008 CDE estimated that it would take, at a minimum, 22nd percentile growth, consecutively for three years, to maintain at or above proficient. Their 63rd percentile growth puts them above that 3 year minimal target.

Grade 5/2005

Grade 6/2006

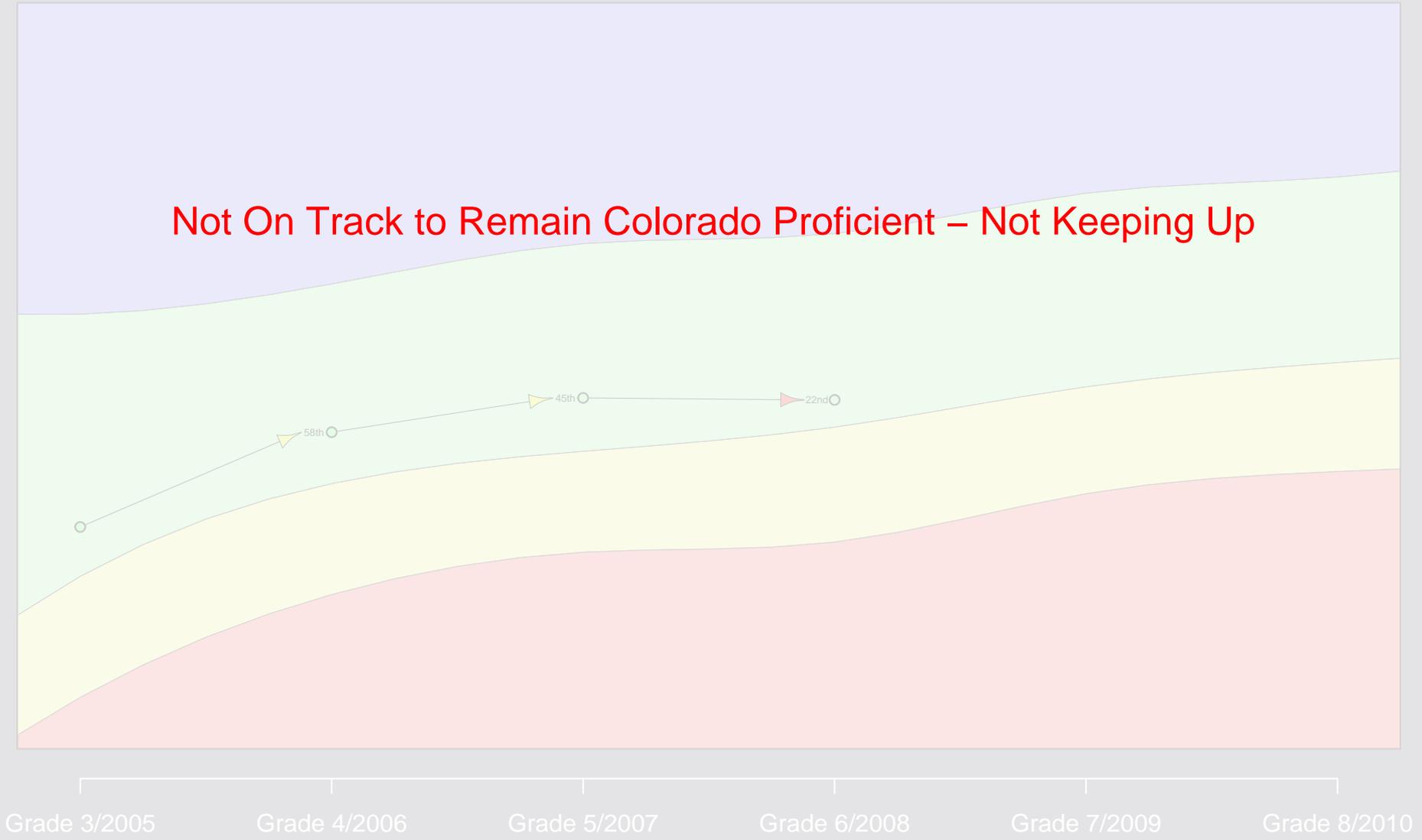
Grade 7/2007

Grade 8/2008

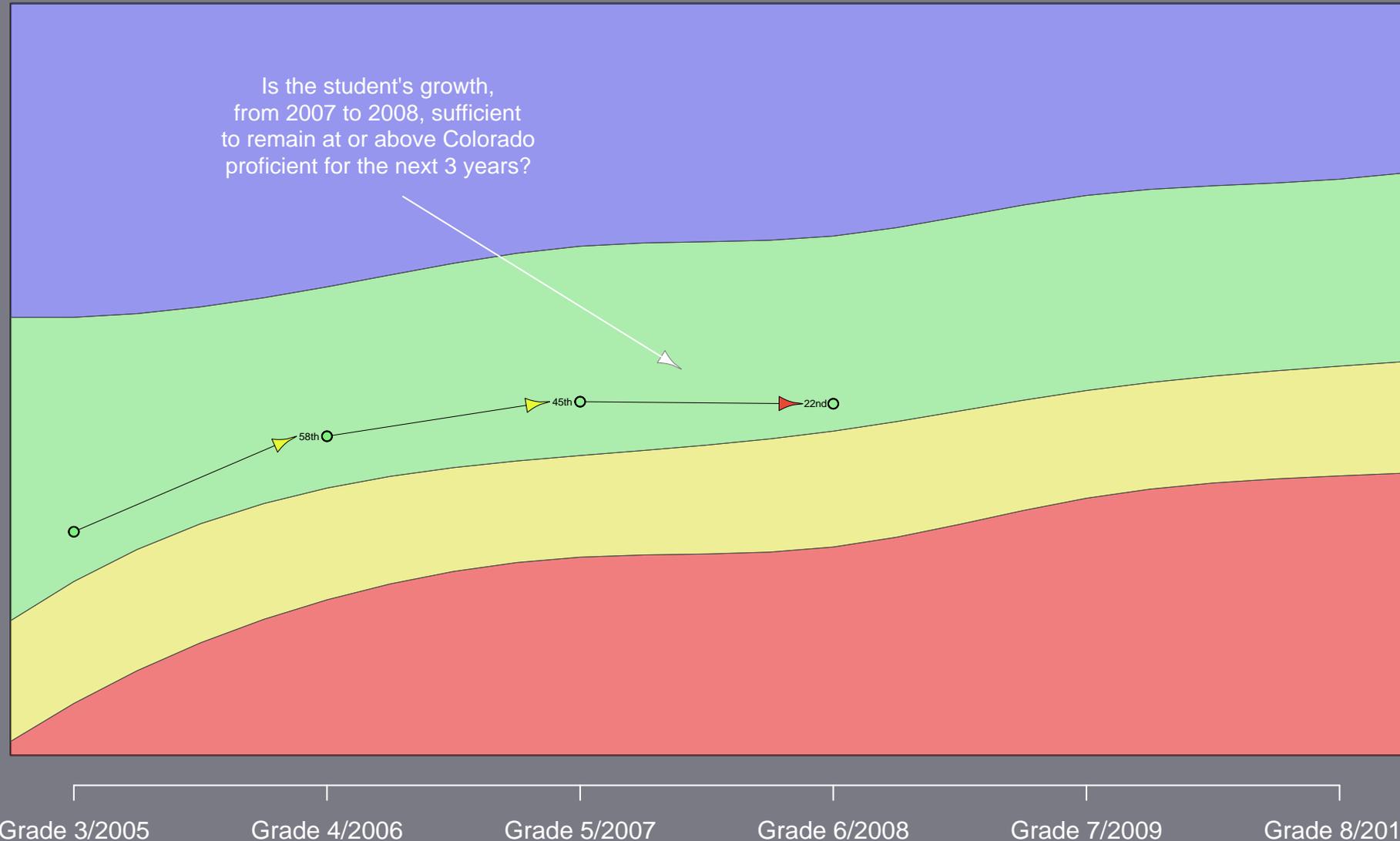
Grade 9/2009

Grade 10/2010

Not On Track to Remain Colorado Proficient – Not Keeping Up



Is the student's growth,
from 2007 to 2008, sufficient
to remain at or above Colorado
proficient for the next 3 years?



Grade 3/2005

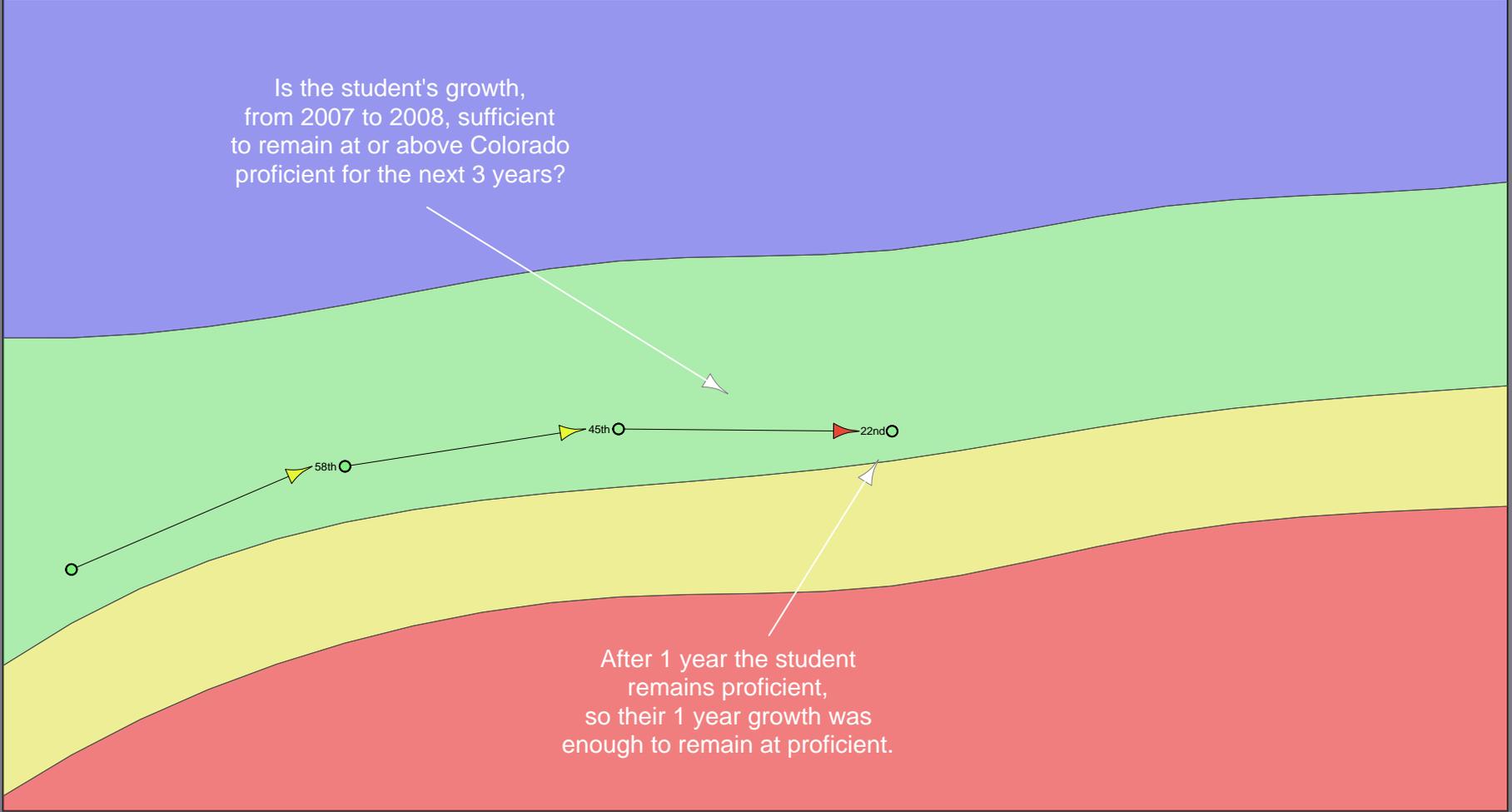
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Grade 3/2005

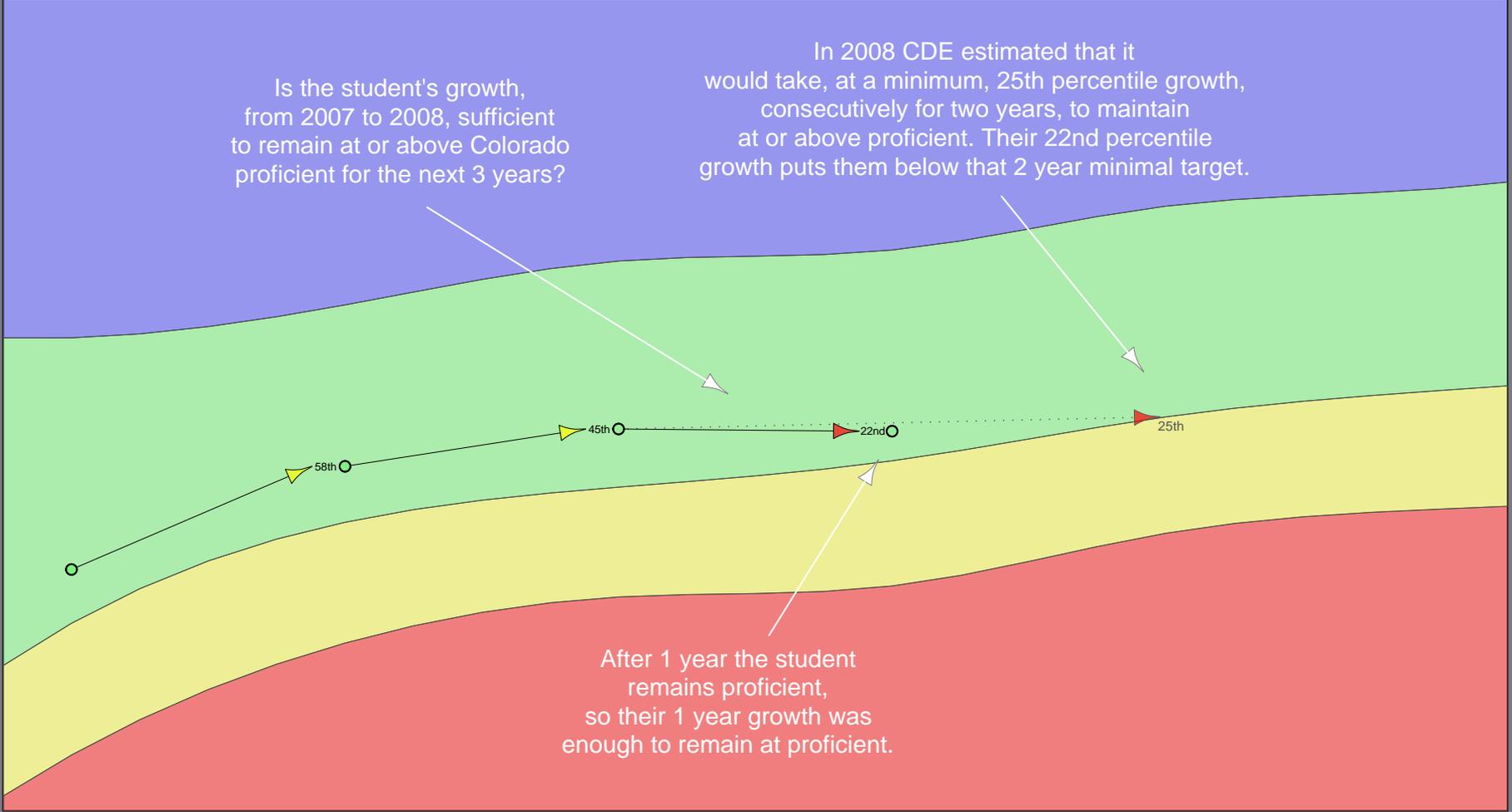
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Is the student's growth, from 2007 to 2008, sufficient to remain at or above Colorado proficient for the next 3 years?

In 2008 CDE estimated that it would take, at a minimum, 25th percentile growth, consecutively for two years, to maintain at or above proficient. Their 22nd percentile growth puts them below that 2 year minimal target.

After 1 year the student remains proficient, so their 1 year growth was enough to remain at proficient.

Grade 3/2005

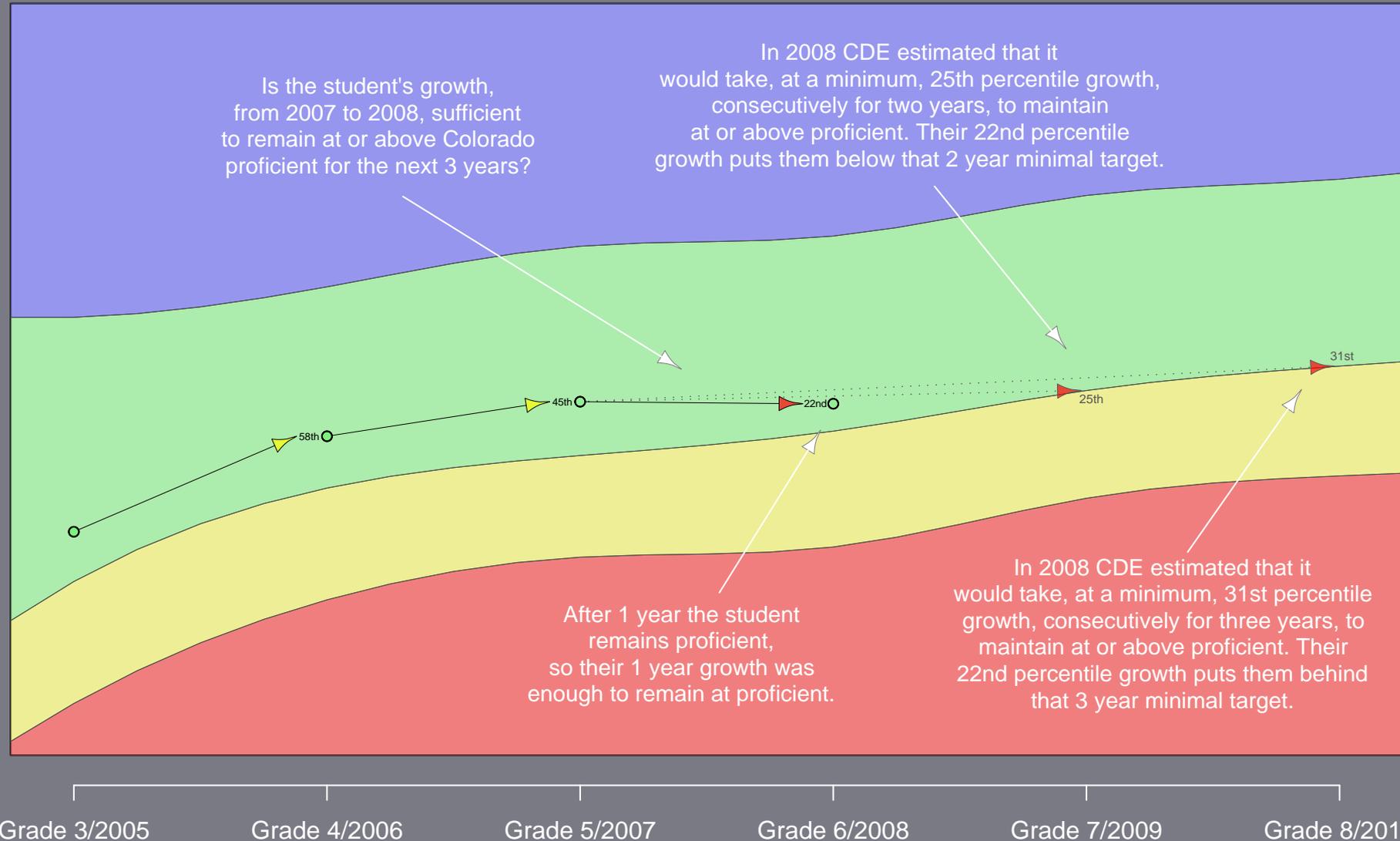
Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010



Is the student's growth, from 2007 to 2008, sufficient to remain at or above Colorado proficient for the next 3 years?

In 2008 CDE estimated that it would take, at a minimum, 25th percentile growth, consecutively for two years, to maintain at or above proficient. Their 22nd percentile growth puts them below that 2 year minimal target.

After 1 year the student remains proficient, so their 1 year growth was enough to remain at proficient.

In 2008 CDE estimated that it would take, at a minimum, 31st percentile growth, consecutively for three years, to maintain at or above proficient. Their 22nd percentile growth puts them behind that 3 year minimal target.

Grade 3/2005

Grade 4/2006

Grade 5/2007

Grade 6/2008

Grade 7/2009

Grade 8/2010

Is the student's growth, from 2007 to 2008, sufficient to remain at or above proficient for the next 3 years?

In 2008 CDE estimated that it would take, at a minimum, 25th percentile growth, consecutively for two years, to maintain at or above proficient. Their 22nd percentile growth puts them below that 2 year minimal target.

Conclusion: Even though the student was proficient in 2008, their 2007–08 growth percentile of 22 was less than both the two and three year minimum targets. As such, the student's growth is considered to be insufficient to remain Colorado proficient over the next three years. In short, the student is not on track to remain Colorado proficient and is not "keeping up".



After 1 year the student remains proficient, so their 1 year growth was enough to remain at proficient.

In 2008 CDE estimated that it would take, at a minimum, 31st percentile growth, consecutively for three years, to maintain at or above proficient. Their 22nd percentile growth puts them behind that 3 year minimal target.

Calculation of Growth Percentile Targets

As mentioned previously, the calculation of student growth percentiles across all grades and students results in the creation of numerous coefficient matrices that relate prior with current student achievement. These matrices constitute an annually updated statewide historical record of student progress. For the Colorado Growth Model, they are used to determine what level of percentile growth is necessary for each student to reach future achievement targets. In the calculation of student growth percentiles in 2008, the following coefficient matrices are produced:²

Grade 4 Using grade 3 prior achievement.

Grade 5 Using grade 4 and grades 3 & 4 prior achievement.

Grade 6 Using grade 5, grades 4 & 5, and grades 3, 4, & 5 prior achievement.

Grade 7 Using grade 6, grades 5 & 6, grades 4, 5, & 6, and grades 3, 4, 5, & 6 prior achievement.

Grade 8 Using grade 7, grades 6 & 7, grades 5, 6, & 7, grades 4, 5, 6, & 7 prior achievement, and grades 3, 4, 5, 6, & 7 prior achievement

Grade 9 Using grade 8, grades 7 & 8, grades 6, 7, & 8, grades 5, 6, 7, & 8 prior achievement, and grades 4, 5, 6, 7, & 8 prior achievement.

Grade 10 Using grade 9, grade 8 & 9, grades 7, 8, & 9, grades 6, 7, 8, & 9 prior achievement, and grades 5, 6, 7, 8, & 9 prior achievement

To describe how these numerous coefficient matrices are used together to produce 1, 2, and 3 year growth targets, consider, for example, a 2008 4th grade student in reading with 3rd and 4th grade CSAP reading scores of 450 (Unsatisfactory) and 500 (Unsatisfactory), respectively. The following are the steps that transpire over 3 years to determine whether this student is on track to reach NCLB proficient.

August 2007 Accountability clock begins requiring students to reach Colorado Growth Model achievement targets within 3 years or by grade 10. In particular, the unsatisfactory 3rd grade (in 2007) student under consideration is expected to be NCLB proficient by grade 6 in 2010.

August 2008 Employing the coefficient matrices derived in the calculation of 2008 student growth percentiles:

- First, the coefficient matrix relating grade 4 with grade 3 prior achievement is used to establish the percentile cuts (i.e., 1 year growth percentile projections/trajec-tories). If the student's actual 2008 growth percentile exceeds the percentile cut

²Note that because testing began in 2003 in Colorado, at present there is a maximum number of 5 consecutive prior achievement scores.

associated with NCLB proficient, then the student's one year growth is enough to reach NCLB proficient. Note, checking growth adequacy using 1 year achievement targets is equivalent to confirming whether the student reached their 1 year achievement target since the coefficient matrices used to produce the percentile cuts are based on current data.

- Next, the 2 year growth percentile projections/trajectories are calculated, from 2007 to 2009. The student's actual grade 3 scale score together with the 99 hypothetical 1 year growth percentile projections/trajectories derived in the previous step are plugged into the most recently derived coefficient matrix relating grade 5 with grade 3 & 4 prior achievement. This yields the percentile cuts (i.e., 2 year growth percentile projections/trajectories) for the student indicating what consecutive two-year 1st through 99th percentile growth (based upon the most recent student growth histories in the state) will lead to. Using the August 2007 achievement targets, 2 year growth sufficient to reach the target is determined and the student's growth percentile is compared to this target. If the student's growth percentile exceeds this target, then the student is deemed on track to reach NCLB proficient.
- Next, the 3 year growth percentile projections/trajectories are established. The student's actual grade 3 scale score together with the 99 hypothetical 1 and 2 year growth percentile projections/trajectories derived in the previous step are plugged into the coefficient matrix relating grade 6 with grade 3, 4, & 5 prior achievement. This yields the percentile cuts (i.e., 3 year growth percentile projections/trajectories) for each student indicating what consecutive three-year 1st through 99th percentile growth (based upon the most recent student growth histories in the state) will lead to in terms of future achievement. Using the August 2007 achievement targets, 3 year growth sufficient to reach the target is determined and the student's growth percentile is compared to this target. If the student's growth percentile exceeds this target then the student is deemed on track to reach NCLB proficient.

August 2009 Employing the coefficient matrices derived in the calculation of 2009 student growth percentiles:

- First, with the student now completing grade 5, the coefficient matrix relating grade 5 with grade 3, & 4 prior achievement is used to establish 99 percentile cuts (i.e., 1 year growth percentile projections/trajectories). If the student's actual 2009 growth percentile exceeds the cut associated with NCLB proficient, then the student's one year growth was enough to reach NCLB proficient. Note, this is equivalent to just checking whether the student reached NCLB proficient in 2009 since the coefficient matrices used to produce the 99 percentile cuts are based on 2009 data.
- Next, the student's grade 3 & 4 actual scores together with the 99 hypothetical 1 year growth percentile projections/trajectories derived in the previous step are plugged into the coefficient matrix relating grade 6 with grade 3, 4, & 5 prior achievement. This yields 99 percentile cuts (i.e., 2 year growth percentile projections/trajectories) for the student indicating what consecutive two-year 1st through 99th percentile growth (based upon the most recent student growth histories in the state) will lead to in terms of future achievement. Using the August 2007 ac-

countability achievement targets, 2 year growth sufficient to reach the target is determined and the student's growth percentile is compared to this target. If the student's growth percentile exceeds this target then the student is deemed on track to reach NCLB proficient.

- No three year targets are utilized because they exceed the time-frame initially established for the student to reach NCLB proficient.

August 2010 Employing the coefficient matrices derived in the calculation of 2010 student growth percentiles:

- Because 2010 is the terminal year of the 3 year time frame established for the student to reach NCLB proficient the student is deemed to have grown sufficiently if they have reached NCLB proficient.
- No two or three year targets are utilized because they exceed the accountability time-frame initially established for the student to reach NCLB proficient.

The complexity of the process just described is minimized by the open source software developed by Colorado to calculate student growth percentiles and percentile growth projections/trajectories. Every year, following the loading of the data into the Colorado Department of Education data warehouse, student growth percentiles and percentile growth trajectories are calculated for each student. Once calculated, these values can then be easily used to make the yes/no determinations about the adequacy of each student's growth relative to their fixed achievement targets. These yes/no determinations are then used in aggregate to determine whether schools have met their AYP targets.