The Added-Value Growth Model

A Value-Added Model that Adds Value to Student Proficiency Levels

ASA Subcommittee Recommendations:

Recommendation 1: 2023 School Report Cards shall report both the existing norm-referenced student growth model and the proposed Added-Value Growth Model. Points and Ratings for schools shall be calculated using the same model and method described in the SY 2021-22 Accountability Manual. Added-Value Growth Model metrics shall be defined in the SY 2022-23 Accountability Manual without associated Points or Ratings and shall appear on Report Cards for informational purposes only.

Recommendation 2: EOC Staff shall analyze SY 2021-22 accountability data, seeking input from SCDE and select stakeholders, to further explore the Added-Value Growth Model scoring methods currently under consideration. EOC Staff shall make a final recommendation to EOC members for a scoring system to be published in the SY 2023-24 Accountability Manual.

Recommendation 3: EOC Staff, in collaboration with SCDE, will produce Added-Value Growth Model scores based on SY 2022-23 accountability data to disseminate to school and district leaders for their reference in preparation for full transition to the proposed model in the SY 2023-24 Accountability Manual.

Recommendation 4: 2024 School Report Cards shall report Added-Value Growth Model metrics and shall use those metrics to calculate Points and Ratings. The previously used norm-referenced growth model shall no longer be reported on these or subsequent report cards.

The state of South Carolina currently uses a norm-referenced value-added model to compare achievement gains of students enrolled at a given school to those of similar students statewide who have similar prior achievement. The current model, provided by Education Analytics, analyzes matched current and prior year test scores for all students to estimate the amount of growth that is associated with prior achievement and with various student demographic attributes (such as poverty status, English learner status, disability status, or racial/ethnic identity) to determine the degree to which students enrolled at a given school perform better or worse than the statewide average for similar students.

In this way, the scores expected for each individual student are based on the scores observed for all other students in the state who took the same test in that same year. Schools whose students systematically perform better than similar students with similar prior achievement have higher value-added scores, while schools whose students systematically score worse than similar students have lower scores. Norm-referenced value-added scores cannot be projected or predicted in advance of testing since these scores are determined in comparison to the other tests taken at the same time and not in comparison to a predefined set of fixed criteria.

One criticism of commonly used value-added models is that, regardless of how well or poorly all students perform on the academic achievement test used in the model, about half of all students will demonstrate better than average growth and about half will demonstrate below-average growth. If the declared goal of the South Carolina accountability system is to improve educational outcomes for all students, then the norm-referenced nature of the current model seems to run counter to that goal. For example, if all students were to demonstrate extraordinary growth one year and were all to exceed expectations on the SCREADY, then growth that year would still be higher than average for about half of those students. Thus, students with below-average growth would still count negatively toward their schools' evaluation, even though they exceeded expectations.

By contrast, the educational disruptions caused by the COVID-19 pandemic negatively impacted student learning statewide (see EOC, 2021). Although achievement testing, ratings, and value-added growth estimates were suspended during the pandemic, analyses of interim and benchmark assessment data from the same time suggested that average

student growth statewide would have been unacceptably low if it had been measured, with more than seven out of ten students statewide expected to fall short of grade level expectations. In this case, a substantial number of students could have counted positively toward their schools' evaluations, even though their progress was insufficient to meet expectations or maintain current achievement levels. If the goal of the accountability system is to improve outcomes for all students, then that system should report it accurately when all students do poorly and properly recognize schools when all students do well. The current growth model does neither.

This paper explores the implications of norm-referenced growth models on student achievement in grades 3 through 8 and proposes an empirically derived, criterion-referenced growth model as a possible alternative. The first section presents some exploratory analyses of historical achievement data to understand the nature and magnitude of average learning gains and their implications for student achievement. The second section describes the proposed Added-Value Growth Model including the results of some simulations run with historical achievement data. The third section explores the implications of the proposed model for instruction, including possible applications with interim and benchmark assessments that could provide meaningful feedback on student progress toward meeting added-value growth targets. Finally, the paper closes with recommendations for adoption and implementation of the proposed model.

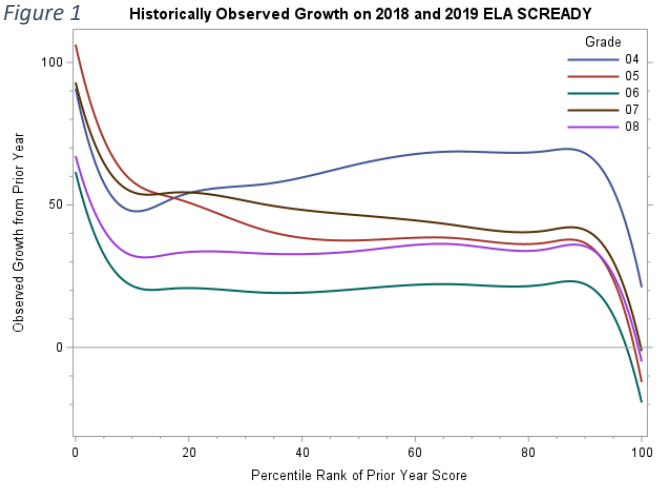
Historical Growth Data

Determining Expected Gains

Because the SCREADY achievement test uses a common vertical scale across grade levels, year over year changes in scores can be compared to determine the mean growth for each test at each point in the score distribution by grade level. We analyzed historical records that included 344,877 students with a score for the ELA SCREADY and 345,914 students with scores for the Mathematics SCREADY taken in 2017, another 352,375 students with scores for the ELA SCREADY and 352,491 students with scores for the Mathematics SCREADY taken in 2018, and 355,693 students with scores for the ELA SCREADY and 356,110 students with scores for the Mathematics SCREADY taken in 2019. We then matched records for students who tested in both 2017 and 2018 as well as those who tested in both 2018 and 2019, dropping records without a match.

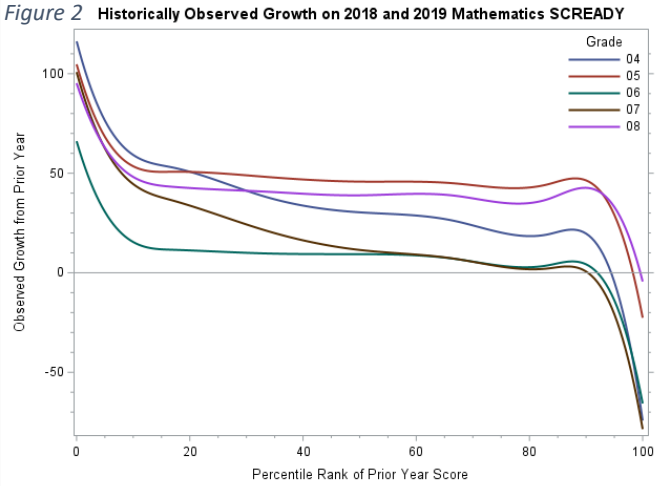
Students must be continuously enrolled at the same school from the 45th day to the 160th day of the school year with no break in enrollment to be included in the Student Progress indicator for accountability that year. Thus, we removed records for students who were not continuously enrolled for the second year of each matched data set. Since no such requirement exists for continuous enrollment during the prior school year, no additional records were dropped for non-continuous enrollment. Because we were interested in identifying general historical trends for student growth from year to year rather than trends for a specific year, we combined these data sets to produce a single data set for the ELA SCREADY (containing 531,483 records) and a separate data set for the Mathematics SCREADY (containing 532,578 records). Both data sets contained scores from students continuously enrolled for the "current" year (i.e., tests taken in the spring of either 2018 or 2019) matched with scores from the prior year (i.e., the spring of either 2017 or 2018).

Figure 1 **Historically Observed Growth on 2018 and 2019 ELA SCREADY**



Analyses of historical achievement growth data indicates that, on average, South Carolina students gain about 40 vertical scale score (VSS) points (*M* = 41.0, *Mdn* = 40.0, *SD* = 58.2) on the ELA SCREADY and 29 VSS points (*M* = 28.7, *Mdn* = 29.0, *SD* = 63.2) on the Mathematics SCREADY, regardless of current grade level and prior year score. However, as demonstrated by Figures 1 and 2 (to right and next page), mean growth from

Figure 2 **Historically Observed Growth on 2018 and 2019 Mathematics SCREADY**



year to year is meaningfully different by grade level and depends on the student's position on the prior year score distribution. Specifically, students scoring at or below the fifth percentile of their grade-level peers typically exhibit much higher gains in a single year than students who score above the tenth percentile. Similarly, at the top of most score distributions, average growth becomes negative.

Since observed growth varies at each point along the score distribution, we further analyzed these growth data to determine not only typical gains for similarly scoring students, but progressively better than average gains as well. For these analyses, students were grouped together by grade level according to their prior year SCREADY score, rounded down to the nearest ten. For example, any sixth grade student who scored from 520 to 529 on the fifth grade ELA SCREADY in the data set would be analyzed together to determine growth expectations for that test, grade level, and prior achievement. Specifically, observed learning gains for the 50th, 55th, 60th, 65th, 70th, 75th, and 80th percentiles of single-year growth were estimated at each point in the distribution of prior-year scores and graphed in SAS using PROC SGPLOT with PBSPLINE to smooth the curves. Estimates were recorded for expected gains at each percentile rank of growth at each point on the score distribution for each test and grade level.

Applying Expected Gains

To determine the implications of historically observed expected gains, we considered the score trajectory of hypothetical students who are members of the Average family. For example, with a vertical scale score (VSS) of 314, Ashley Average scored the median historically-observed score in the Does Not Meet achievement level on the 3rd grade ELA SCREADY. Historically, students who scored from 310 to 319 on the ELA test in grade 3 demonstrated median achievement gains of 46 vertical scale points, giving Ashley a score of 360 on the 4th grade test. Students who scored from 360 to 369 on the ELA test in grade 4 demonstrated median achievement gains of 54 points, giving Ashley a score of 414 in grade 5. Ashley's score continues to progress in the same way, increasing by the median gains for students with a similar score on the prior year test until she ultimately scores 511 on the 8th grade ELA test, which is still in the Does Not Meet achievement level.

Table 1

Progression of ELA Scores for Hypothetical Average Students Making Median Gains from Grades 3 through 8

	3rd Grade		4th Grade		5th Grade		6th Grade		7th Grade		8th Grade	
Student	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**
Adam A.	579	Exceeds	642	Exceeds	671	Exceeds	690	Exceeds	729	Exceeds	762	Exceeds
Annie A.	494	Meets	565	Meets	604	Meets	629	Meets	671	Meets	708	Meets
Alberto A.	408	Appr	468	Appr	507	Appr	528	Appr	576	Appr	611	Appr
Ashley A.	314	DNM	360	DNM	414	DNM	432	DNM	483	DNM	511	DNM

Note: ELA = English language arts. DNM = Does Not Meet. Appr = Approaches. Score progression assumes that students made gains equivalent to the median observed for students with similar prior scores for that test and grade on historical SCREADY tests taken in 2017, 2018, and 2019.

The other members of the Average family similarly demonstrated the median observed score of their respective achievement levels on the initial 3rd grade ELA SCREADY test. Like Ashley, these students also demonstrated median historically observed gains for students with similar prior year scores from year to year from grade 3 through grade 8, leading each of them to the final scores shown in Table 1. We then repeated this same process for the Mathematics SCREADY, again with each member of the Average family demonstrating the historical median score for their respective

achievement levels in 3rd grade and demonstrating median growth for similarly-scoring students each year until 8th grade. The results of the progression of Mathematics SCREADY scores are shown in Table 2.

Table 2

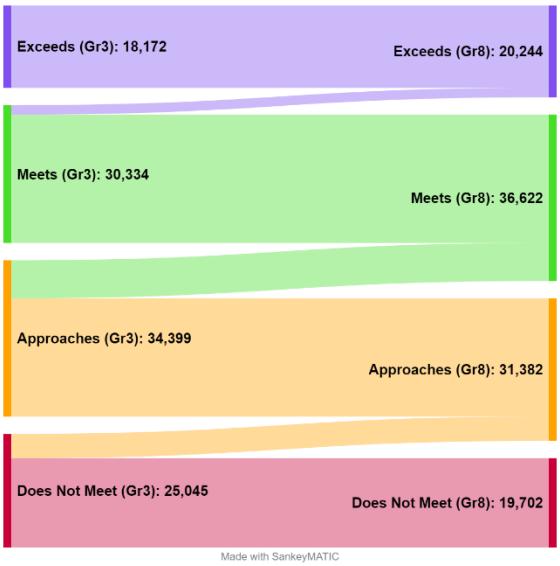
Progression of Mathematics Scores for Hypothetical Average Students Making Median Gains from Grades 3 through 8

	3rd Grade		4th Grade		5th Grade		6th Grade		7th Grade		8th Grade	
Student	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**	**VSS**	**Level**
Adam A.	596	Exceeds	609	Exceeds	650	Exceeds	650	Exceeds	650	Exceeds	685	Exceeds
Annie A.	488	Meets	514	Meets	558	Meets	565	Meets	**571**	**Appr**	**609**	**Appr**
Alberto A.	402	Appr	438	Appr	484	Appr	492	Appr	509	Appr	547	Appr
Ashley A.	319	DNM	379	DNM	431	DNM	438	DNM	472	DNM	511	DNM

Note: DNM = Does Not Meet. Appr = Approaches. Score progression assumes that students made gains equivalent to the median observed for students with similar prior scores for that test and grade on historical SCREADY tests taken in 2017, 2018, and 2019. Note that median annual achievement gains led Annie Average to drop from the Meets achievement level to Approaches in 7th and 8th grade.

By these analyses, median growth is insufficient to improve the academic achievement of any of the students in the Average family. In fact, median growth on the Mathematics SCREADY led Annie to fall below grade level expectations in 7th and 8th grade. The children in the Average family, although an interesting thought experiment, do not give us a clear sense of how median year to year growth might affect the distribution of achievement levels among students in South Carolina schools. Thus, we used the same method of projecting median growth for all students who took a 3rd grade SCREADY test in either 2017 or 2018 (n = 107,950 for ELA and n = 108,164 for Mathematics) to determine their final achievement levels at the end of 8th grade.

Figure 3 - ELA Achievement Progression (Median Growth)

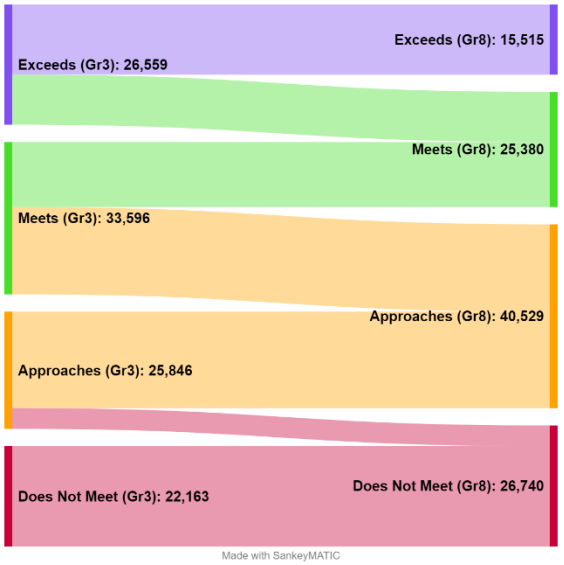


Applying historically observed median growth from grade 3 through grade 8 for the ELA SCREADY leads to the achievement level changes shown in Figure 3. Median growth leads 85% of students to maintain the same achievement level that they demonstrated in the 3rd grade. Only 15% of all students tested move to a higher achievement level under median growth, and only 14% of students who had not met the standard in grade 3 (8,360 students statewide) were able to reach proficiency by the end of grade 8.

For the Mathematics SCREADY (see Figure 4), no students improve their achievement level from grade 3 through grade 8 with median growth. In fact, 32% of all students in the state fall to a lower achievement level and 32% of all students who had demonstrated proficiency in 3rd grade fall below expectations by the end of 8th grade.

If typical growth generally does not lead students reach proficiency in ELA and leads to a general decline in achievement in Mathematics, then it raises the question whether better-than-typical growth is sufficient to move students who have not met expectations in grade 3 to proficiency by the end of 8th grade. We sought to discern *how much* better than typical must achievement gains be to reach proficiency by grade 8.

Figure 4 - Math Achievement Progression (Median Growth)



To answer this question, we applied year to year achievement gains to the same sample of historically observed 3rd grade SCREADY scores at each percentile rank for which growth estimates had been generated. Table 3 (on the next page) displays the number and proportion of students who initially scored at each achievement level on the 3rd grade test, as well as the number and proportion of students who would score at each proficiency level after five years of steady achievement gains at the indicated percentile rank. For simplicity, results are only shown for growth at the 50th, 60th, 70th, and 80th percentile ranks, although analyses were also conducted with growth estimates at the 55th, 65, and 75th percentiles as well.

The findings displayed in Table 3 suggest that, for the students demonstrating the lowest initial achievement in 3rd grade to meet or exceed the grade level standard by the end of 8th grade, they must make annual achievement gains that are as high or higher than were observed for 80% of similar students in the historical data set. Although growth at the 80th percentile of gains ensure that all students meet the standard within five years, goals set at this level are onerous and it may not be necessary to set goals this high for all students, particularly those who have already met or exceeded the grade level standard. Thus, a system of progressive targets for annual achievement gains may best support the goals of the South Carolina accountability system. We explored several possible methods with which to determine individual student achievement growth targets, desiring a system that would both move students to achieve proficiency by 8th grade and guarantee that all students either maintain or improve the achievement level they demonstrated on the 3rd grade SCREADY. The features of the system which best meets the needs of South Carolina are described in the next section.

Table 3

Number and Proportion of Students Scoring at the Different Achievement Levels on the 8th Grade SCREADY after Demonstrating Five Years of Consistent Achievement Growth at Various Percentile Ranks

	Initial (Grade 3)		After PR50 Gains		After PR60 Gains		After PR70 Gains		After PR80 Gains	
Achievement Level	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
					ELA SCREADY					
Exceeds	18,172	(16.8%)	20,244	(18.8%)	46,241	(42.8%)	72,213	(66.9%)	97,696	(90.5%)
Meets	30,334	(28.1%)	36,622	(33.9%)	31,981	(29.6%)	26,130	(24.2%)	10,254	(9.5%)
Meets or Exceeds	**48,506**	**(44.9%)**	**56,866**	**(52.7%)**	**78,222**	**(72.5%)**	**98,343**	**(91.1%)**	**107,950**	**(100.0%)**
Approaches	34,399	(31.9%)	31,382	(29.1%)	29,575	(27.4%)	9,603	(8.9%)	—	(0.0%)
Does Not Meet	25,045	(23.2%)	19,702	(18.3%)	153	(0.1%)	—	(0.0%)	—	(0.0%)
Not Met	**59,444**	**(55.1%)**	**51,084**	**(47.3%)**	**29,728**	**(27.5%)**	**9,603**	**(8.9%)**	—	**(0.0%)**
					Mathematics SCREADY					
Exceeds	26,559	(24.6%)	15,515	(14.3%)	39,180	(36.2%)	71,309	(65.9%)	97,617	(94.0%)
Meets	33,596	(31.1%)	25,380	(23.5%)	32,129	(29.7%)	25,806	(23.9%)	6,209	(6.0%)
Meets or Exceeds	**60,155**	**(55.6%)**	**40,895**	**(37.8%)**	**71,309**	**(65.9%)**	**97,115**	**(89.8%)**	**103,826**	**(100.0%)**
Approaches	25,846	(23.9%)	40,529	(37.5%)	36,855	(34.1%)	11,049	(10.2%)	—	(0.0%)
Does Not Meet	22,163	(20.5%)	26,740	(24.7%)	0	(0.0%)	—	(0.0%)	—	(0.0%)
Not Met	**48,009**	**(44.4%)**	**67,269**	**(62.2%)**	**36,855**	**(34.1%)**	**11,049**	**(10.2%)**	—	**(0.0%)**

Note: PR50 = 50th percentile rank. PR60 = 60th percentile rank. PR70 = 70th percentile rank. PR80 = 80th percentile rank. Initial scores were taken from students in South Carolina who took the 3rd grade SCREADY either in 2017 or 2018. Score progression assumes that students made gains through 8th grade equivalent to those at the indicated percentile rank observed for students with similar prior scores for that test and grade on historical SCREADY tests taken in 2017, 2018, and 2019.

The Proposed Added-Value Growth Model

Setting Individual Student Growth Targets

We propose using a criterion-referenced value-added model, the Added-Value Growth Model, to measure student progress in the SC accountability system. Under the proposed model, each student in grades 4 through 8 will have two individualized target scores for each of the SCREADY assessments that they will take that year based upon their prior year SCREADY scores. The first growth target shall be a median annual target (MAT), which shall be set to the median level of growth observed for students with similar scores on the prior year test. Any student who meets or exceeds their MAT will earn at least one point for their school in the accountability model. Near the top of the distribution for prior achievement, when historically observed median growth becomes negative, MATs shall be set to 0 so that all students are always expected to earn the same VSS or higher than the previous year.

The second growth target shall be an added-value target (AVT), which is a target set progressively according to prior year achievement levels based on the analyses described in the previous section. The historically-observed percentile ranks of gains upon which AVTs are set are shown in Table 4. Any student who meets or exceeds their individual AVT will earn additional points for their school in the accountability model, with more points awarded for more ambitious targets.

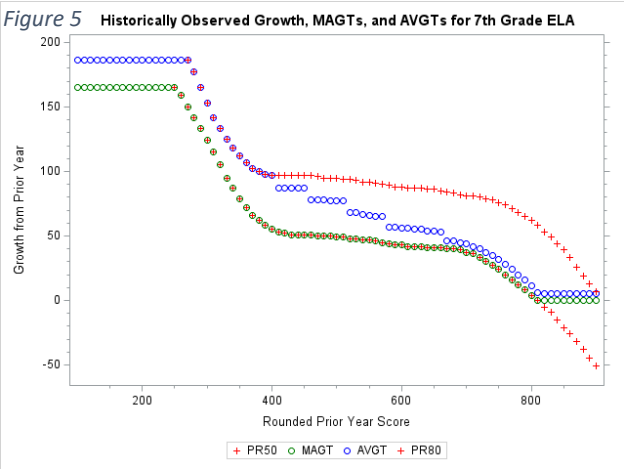
Table 4

Percentile Ranks Used to Set Added-Value Targets (AVTs) for Growth at Various Prior Achievement Levels

Current Grade Level:	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade
Exceeds					
Prior ELA score range:	540 – 825	593 – 850	653 – 875	668 – 900	705 – 925
Prior Math score range:	544 – 825	563 – 850	622 – 875	628 – 900	650 – 925
AV growth target based on historical percentile:	**55**				
Meets					
Prior ELA score range:	452 – 539	509 – 592	558 – 652	576 – 667	615 – 704
Prior Math score range:	438 – 543	482 – 562	536 – 621	543 – 627	578 – 649
AV growth target based on historical percentile:	**60**				
Approaches 2					
Prior ELA score range:	408 – 451	464 – 508	504 – 557	516 – 575	562 – 614
Prior Math score range:	402 – 437	441 – 481	490 – 535	498 – 542	531 – 577
AV growth target based on historical percentile:	**65**				
Approaches 1					
Prior ELA score range:	359 – 407	419 – 463	450 – 503	455 – 515	512 – 561
Prior Math score range:	360 – 401	402 – 440	448 – 489	454 – 497	488 – 530
AV growth target based on historical percentile:	**70**				
Does Not Meet 2					
Prior ELA score range:	314 – 358	356 – 418	405 – 449	412 – 454	462 – 511
Prior Math score range:	313 – 359	366 – 401	411 – 447	414 – 453	451 – 487
AV growth target based on historical percentile:	**75**				
Does Not Meet 1					
Prior ELA score range:	100 – 313	100 – 355	100 – 404	100 – 411	100 – 461
Prior Math score range:	100 – 312	100 – 365	100 – 410	100 – 413	100 – 450
AV growth target based on historical percentile:	**80**				

AVTs shall be set for students whose prior year SCREADY score falls in the Exceeds achievement level based on historically observed growth at the 55th percentile rank among similarly scoring students. At the top of the score distribution for prior achievement, when historically observed growth at the 55th percentile becomes negative, AVTs shall be set to 5 so that all students are expected to improve on the VSS earned in the prior year. The 55th percentile is used for the Exceeds achievement level because this is the minimum level of historically-observed growth at which all students who performed at the Exceeds level in 3rd grade maintained that achievement level through the end of 8th grade. AVTs for students with prior achievement at the Meets level shall be based on 60th percentile growth because this is the level of historical growth at which all students at the Meets level in grade 3 maintained or improved that level through grade 8.

For students who have not met grade level expectations, the Approaches and Does Not Meet achievement levels have each been split at the median historically-observed score for that level to allow for a smoother progression of growth targets. Students whose prior year score falls in the lower half of the Does Not Meet achievement level ("Does Not Meet 1"; DNM1) have AVTs based on 80th percentile of observed gains. Students in the upper half ("Does Not Meet 2"; DNM2), have AVTs based on 75th percentile gains. Students in "Approaches 1" (Appr1) have AVTs based on the 70th percentile and



students in "Approaches 2" (Appr2) have AVTs based on the 65th percentile. Near the floor of the score distribution, there were points at which the sample of historical scores was too small to accurately estimate median and 80th percentile growth for DNM1. In these cases, growth targets at the lowest historical score for which growth could be estimated are also used as the targets for scores from the minimum score of 100 to that score. Figure 5 shows the historically observed gains at the 50th and 80th percentile (PR50 and PR80) plotted as red plusses with MATs and AVTs plotted as green and blue circles, respectively, for the 7th grade ELA SCREADY to illustrate how growth targets are set for the Added-Value Growth Model.

To find an individual student's target score for the SCREADY, round down their prior-year VSS (whether ELA or Mathematics) to the nearest multiple of 10 and find that score in the gray, center column of Table 5. For the ELA SCREADY, track left on that row to the student's current grade level to find growth targets for this year's test. Follow the same procedure for the Mathematics SCREADY but track right to the current grade level to find growth targets for this year's test. The minimum VSS point gains that are needed to meet the MAT goal are shown in the unshaded column and gains needed to meet the AVT goal are shown in the shaded column. To find the target scores for the student for this year's test, add the number of points shown to their prior year VSS for that test. An example is given in the next paragraph.

Table 5

Median-Annual Growth Target (MAT) and Added-Value Growth Target (AVT) Lookup Table (continued on next page)

Growth Targets for ELA SCREADY										Prior Year Score (round down)	Growth Targets for Mathematics SCREADY									
Grade 4		Grade 5		Grade 6		Grade 7		Grade 8			Grade 4		Grade 5		Grade 6		Grade 7		Grade 8	
MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT		MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT
211	347	205	289	187	190	165	186	269	144	100	251	283	265	279	322	187	299	302	334	194
202	347	206	286	187	190	165	186	269	144	110	242	276	260	273	334	187	299	302	327	194
193	309	206	281	187	190	165	186	269	144	120	233	268	254	266	344	187	296	302	318	194
183	275	205	274	187	190	165	186	269	144	130	223	258	246	260	351	187	292	302	309	194
172	246	204	267	187	190	165	186	269	144	140	212	246	239	253	352	187	287	302	301	194
161	216	201	259	187	190	165	186	269	144	150	200	233	232	245	348	187	281	302	291	194
151	193	196	248	187	190	165	186	269	144	160	190	222	222	238	341	187	274	302	281	194
141	174	191	239	187	190	165	186	269	144	170	179	210	214	232	330	187	266	302	271	194
130	161	184	228	187	190	165	186	269	144	180	167	197	206	226	316	187	257	302	260	194
119	151	175	215	187	190	165	186	261	144	190	156	184	196	218	300	187	248	302	252	194
109	141	166	203	187	190	165	186	251	144	200	146	173	187	211	281	187	236	302	241	194
100	132	157	192	187	190	165	186	238	144	210	137	163	178	204	261	187	225	302	230	194
90	126	145	179	173	190	165	186	228	144	220	126	153	167	197	236	187	214	302	219	194
82	120	135	169	156	190	165	186	217	144	230	117	144	158	188	215	187	202	302	209	194
75	114	126	159	141	190	165	186	205	144	240	109	136	149	179	194	187	191	279	200	194
67	109	115	148	127	173	165	186	195	144	250	99	128	138	170	174	179	179	253	190	194
60	104	106	139	114	155	159	186	184	144	260	90	120	130	163	155	168	168	229	181	194
55	102	98	132	102	139	150	186	172	144	270	84	115	121	155	137	156	157	207	172	194
52	100	90	123	91	124	142	177	162	144	280	77	110	111	145	121	144	146	188	164	194
49	98	83	118	81	111	133	165	152	144	290	71	105	103	136	107	135	136	171	157	194
47	98	77	112	72	102	124	153	140	144	300	65	101	95	129	94	125	126	157	150	194
46	99	72	107	64	94	115	142	130	144	310	60	98	86	122	81	116	117	145	142	184
46	87	67	104	56	88	105	133	121	144	320	56	88	79	114	71	107	108	135	135	171
47	89	63	101	49	82	95	125	109	137	330	52	85	73	108	62	97	99	126	127	160
49	91	60	99	42	77	87	118	100	128	340	49	83	66	102	53	88	91	118	120	150
50	93	57	97	36	73	79	112	91	120	350	46	81	61	98	45	81	82	111	111	140
52	85	54	86	31	69	72	107	81	112	360	44	72	56	95	38	75	74	104	105	131
54	87	51	84	27	66	66	102	73	105	370	41	70	52	84	31	69	67	98	96	123
56	90	49	83	24	65	62	100	66	97	380	39	68	50	82	24	63	60	91	87	116

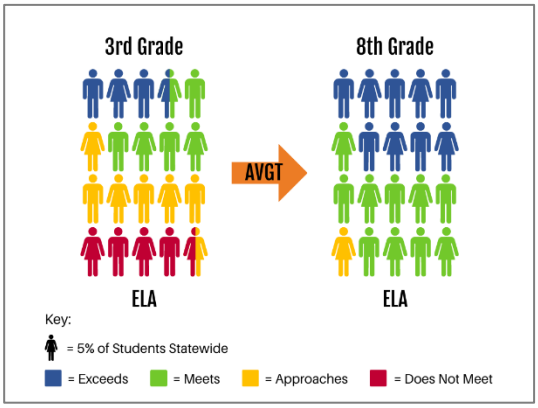
Growth Targets for ELA SCREADY										Prior Year Score (round down)	Growth Targets for Mathematics SCREADY									
Grade 4		Grade 5		Grade 6		Grade 7		Grade 8			Grade 4		Grade 5		Grade 6		Grade 7		Grade 8	
MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT		MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT	MAT	AVT
58	91	47	82	21	64	58	98	57	91	390	38	67	48	82	19	59	54	85	78	108
60	93	45	81	19	64	55	97	51	86	400	36	66	47	82	15	57	48	80	70	102
62	86	43	80	18	54	53	87	45	81	410	34	56	46	74	11	45	43	68	64	96
64	87	42	70	17	54	52	87	39	77	420	33	55	46	74	9	44	38	63	57	92
65	89	40	70	17	55	51	87	35	74	430	32	54	46	75	7	44	34	59	51	88
66	90	40	69	17	56	51	87	32	73	440	30	46	46	75	7	44	30	56	46	85
68	91	39	69	17	47	51	87	30	72	450	29	45	45	67	6	36	27	54	43	83
69	83	39	68	18	48	51	78	29	73	460	28	44	45	67	6	37	24	46	40	73
70	84	38	60	19	49	50	78	28	64	470	27	43	45	67	7	38	21	44	39	72
70	84	38	60	19	50	50	78	28	65	480	26	42	45	67	7	39	19	42	38	73
71	84	39	60	20	51	50	77	29	67	490	25	41	44	59	8	32	17	40	38	65
71	84	39	60	21	52	49	77	30	69	500	24	40	44	59	8	32	15	32	38	66
70	84	39	53	22	44	49	77	31	70	510	24	39	44	59	8	32	13	30	38	66
70	84	39	53	23	44	48	68	31	62	520	23	38	43	58	8	32	11	29	38	66
69	83	40	53	23	45	48	68	32	63	530	22	37	43	58	8	32	9	28	38	59
68	75	40	53	24	45	47	67	33	63	540	21	36	43	58	7	23	8	27	38	59
67	74	40	53	24	46	47	66	34	63	550	20	29	43	59	7	22	7	20	38	59
65	72	39	53	25	39	46	65	34	63	560	18	28	43	59	6	21	6	19	38	59
63	70	39	52	25	39	45	65	35	56	570	16	27	42	51	5	21	5	18	38	59
61	68	38	52	25	39	44	57	36	57	580	15	26	42	51	5	20	4	17	37	51
59	66	37	51	25	39	43	57	36	57	590	13	24	42	50	4	20	3	16	37	51
56	63	36	43	25	38	43	56	37	58	600	10	22	41	50	3	20	3	16	37	51
52	60	35	42	25	38	42	56	37	58	610	7	20	40	49	3	20	2	15	36	51
49	57	33	40	24	38	42	55	38	51	620	4	18	39	49	2	20	2	15	36	50
45	53	32	39	24	37	42	55	38	51	630	1	15	38	48	1	11	1	7	36	50
40	48	29	37	23	36	41	54	38	51	640	0	11	37	46	1	10	1	7	36	50
35	43	27	34	21	35	41	54	38	51	650	0	7	36	45	0	9	0	6	35	43
30	38	24	32	20	27	41	53	38	51	660	0	5	34	43	0	8	0	5	35	43
24	33	20	28	19	25	40	46	37	50	670	0	5	32	41	0	6	0	5	35	42
18	27	17	24	17	23	40	46	37	50	680	0	5	30	38	0	5	0	5	34	42
11	21	13	20	15	21	39	45	36	49	690	0	5	27	36	0	5	0	5	34	42
5	16	7	15	12	19	37	44	35	48	700	0	5	24	33	0	5	0	5	33	41
0	10	3	10	10	17	36	42	34	41	710	0	5	22	30	0	5	0	5	32	41
0	5	0	5	7	14	33	40	33	39	720	0	5	19	27	0	5	0	5	32	40
0	5	0	5	4	11	30	37	31	38	730	0	5	15	23	0	5	0	5	31	40
0	5	0	5	0	8	27	35	30	37	740	0	5	12	20	0	5	0	5	30	39
0	5	0	5	0	5	24	32	28	34	750	0	5	9	16	0	5	0	5	29	38
0	5	0	5	0	5	20	28	26	32	760	0	5	4	11	0	5	0	5	27	37
0	5	0	5	0	5	16	24	23	30	770	0	5	0	6	0	5	0	5	25	36
0	5	0	5	0	5	12	20	20	26	780	0	5	0	5	0	5	0	5	23	34
0	5	0	5	0	5	8	16	16	23	790	0	5	0	5	0	5	0	5	21	32
0	5	0	5	0	5	4	11	13	20	800	0	5	0	5	0	5	0	5	19	29
0	5	0	5	0	5	0	6	8	15	810	0	5	0	5	0	5	0	5	16	26
0	5	0	5	0	5	0	5	3	11	820	0	5	0	5	0	5	0	5	13	23
		0	5	0	5	0	5	0	7	830			0	5	0	5	0	5	9	19
		0	5	0	5	0	5	0	5	840			0	5	0	5	0	5	6	14
		0	5	0	5	0	5	0	5	850			0	5	0	5	0	5	2	11
				0	5	0	5	0	5	860					0	5	0	5	0	6
				0	5	0	5	0	5	870					0	5	0	5	0	5
						0	5	0	5	880							0	5	0	5
						0	5	0	5	890							0	5	0	5
						0	5	0	5	900							0	5	0	5
								0	5	910									0	5
								0	5	920									0	5

Note that, because MATs and AVTs are assigned based on rounded-down scores, all students whose prior year scores round down to the same score are assigned the same target gains, even if the rounded score falls into a different achievement level than the student's unrounded score. For example, imagine that Anna is in 5th grade and scored 419 on

the ELA SCREADY last year. Anna's score falls within the Appr1 range (for which growth targets are typically set to 70th percentile gains). However, since the rounded score of 410 falls within the DNM2 range, Anna's growth target is based on 75th percentile gains. Table 5 indicates that MAT = 43 and AVT = 80 for Anna. Thus, if Anna scores 462 or higher (i.e., her prior year score of 419 plus her MAT of 43) on the ELA SCREADY in 5th grade, she will earn at least one point for her school in the accountability system. If Anna scores 499 or higher (i.e., 419 + 80) on the 5th grade ELA test, she will earn additional points for meeting her AVT. Although the exact scoring structure will be determined after an additional year of data has been collected and analyzed, several scoring systems have been tested using historical data and will be discussed in general terms in the next section.

Applying the Added-Value Growth Model

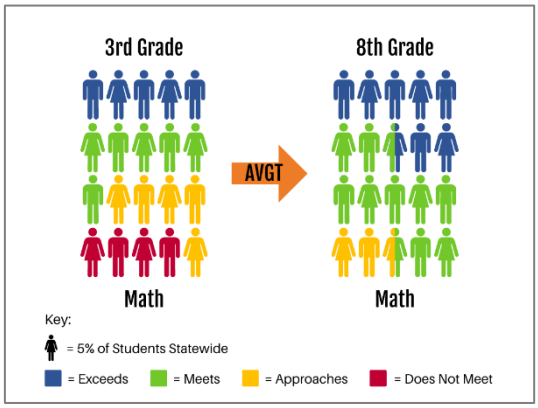
Figure 6 - Achievement Levels in ELA under AVTs



As a first test of how effectively the proposed model moves students to grade-level proficiency, we applied its growth targets to the same sample of historical 3rd grade SCREADY scores analyzed in the previous sections. For each of the 107,950 3rd grade ELA scores and each of the 108,164 3rd grade Mathematics scores, we assumed that the students in question exactly met the expected achievement gains described by the AVTs shown in Table 5 when they took the 4th grade tests. We then used that predicted score to generate the AVTs for the 5th grade test, and so on each year to determine the students' final achievement level at the end of 8th grade. On the 8th grade ELA test, after five years of consistently meeting AVTs, 44% of students would score at the Exceeds level, 51% at the Meets level, and only 5% at the Approaches level (see Figure 6). On the Mathematics test, 36% would score at the Exceeds level, 51% at the Meets level, and only 13% at the Approaches level (see Figure 7). After consistently meeting AVTs, the students whose achievement remains below grade level expectations all started at the DNM1 achievement level in grade 3, scored at the Appr2 level in grade 8, and had scores within 13 points of Meets for ELA and within 26 points of Meets for Mathematics.

As a second test, we applied the proposed model to generate estimated Ratings Points and Ratings for schools using available historical data. This approach allowed us to compare estimated scores that schools would have received under the Added-Value Growth Model in 2018 and 2019 to the scores that schools received under the norm-referenced growth model that was in use at the time. We also tested estimated scores for relationships with known school characteristics. Note that we are not yet recommending a specific scoring system for the Added-Value Growth Model until after the scoring systems currently being considered can be tested against an additional year of collected growth data. However, all scoring systems tested met the following criteria:

Figure 7 - Achievement Levels in Math under AVTs



(a) Students whose SCREADY scores fall short of their individualized MATs earn zero Indicator Points for their school.
(b) Students who meet or exceed their MATs earn at least one Indicator Point for their school.
(c) Students who meet or exceed their AVTs earn substantially more Indicator Points for their school.
(d) Students whose AVTs are based on higher percentile gains earn more Indicator Points for meeting those targets than students with AVTs based on lower percentile gains.

In addition to criteria (a) through (d), some scoring systems were tested in which a portion of the additional Indicator Points available for meeting AVTs could be earned for gains that are higher than MATs, but which fall short of reaching the AVT. All scoring systems tested were designed to minimize the correlation between the criterion-referenced value-added score and the proportion of students in poverty served by the school. In addition, since Academic Achievement

and Student Growth are different but related constructs, scores generated by the proposed growth model are expected to correlate with Academic Achievement scores, but that correlation should not be too strong. Ideally, the magnitude of correlation between Added-Value Growth Model scores and both the school poverty index and Academic Achievement scores is expected to be less than 0.20. Finally, if the proposed criterion-referenced growth model is measuring the same or very similar construct of student achievement growth that the existing norm-referenced growth model measures, then scores generated by the proposed model should be strongly correlated with previously awarded Student Progress ratings. Most of the scoring systems tested met these performance criteria, and all tested scoring systems correlated with norm-referenced value-added scores at 0.80 or greater. These findings suggest that an additional year of data will allow us to select the most appropriate scoring system for use in the SC accountability system.

Student Growth Applied Beyond Accountability

One possible advantage of the proposed criterion-referenced value-added model and the method it uses to assign individual growth targets is that similar methods can be applied to interim and benchmark assessments used throughout the school year to appropriately measure a student's progress toward their AVT. For example, according to publicly released information about the Conditional Growth Percentile reported by NWEA's MAP assessments, this metric is calculated and reported in a manner that will allow it to be directly compared to the percentile ranks shown in Table 4 that were used to determine AVTs. In this way, MAP data could provide timely insight into whether students are making enough growth to meet their AVTs.

Providers of the other interim and benchmark assessment systems approved for use in South Carolina may already provide similar metrics or could be encouraged to add them to reporting systems that support the state's effort to promote student growth that adds value to proficiency levels. These kinds of applications could make the Added-Value Growth Model useful for instructional planning and progress monitoring and not just for the purposes of accountability. The South Carolina Department of Education has already begun exploring methods with which to leverage this model for instructional applications, and EOC Staff are committed to supporting such efforts in any way possible. We recommend continuing to explore how the features of this model can be used to inform teaching and instructional interventions.

A Value-Added Model that Meets the Needs of SC

Desiderata for a Growth Model

According to the Education Accountability Act of 1998, as last amended by Act 94 of 2017, its declared goal is to establish a performance-based accountability system to improve teaching and learning so that all students are equipped with a strong academic foundation and are prepared to meet the Profile of the South Carolina Graduate. The South Carolina accountability system has included a measure of student achievement growth for many years and has incorporated a value-added model since the 2017-18 school year. Including a measure of student growth is critically important to the goal of the accountability system.

Although the goal remains to ensure that all students meet or exceed grade level expectations each year, a student could arrive at a school far enough behind previous grade level expectations that getting them to proficiency in a single year would be a monumental and extremely difficult task. Our current norm-referenced value-added growth model encourages schools to ensure that such students demonstrate more gains than most other similar students in the state. Unfortunately, the analyses in this paper demonstrate that better than average growth is often insufficient to move students to proficiency. In these situations, it is in the interest of the State and all its residents to encourage schools to promote sufficient growth each year that students move closer to achieving grade level proficiency.

As EOC Staff began to explore a criterion-referenced value-added model to move students to proficiency, we identified eight desiderata (or desired attributes) for a model that would meet the state's needs. The desired growth model would:

Desiderata 1: Produce a specific, individualized growth target for each student based on that student's prior achievement.

Desiderata 2: Produce growth targets that, if met, would move all students toward proficiency and either maintain or improve all students' prior achievement levels.

Desiderata 3: Produce targets that can be understood by, calculated by, and communicated to all stakeholders.

Desiderata 4: Produce targets that are as rigorous as necessary to attain grade level proficiency, but do not unnecessarily inflate targets to avoid setting expectations that are seen as unreasonable or impossible.

Desiderata 5: Make it possible for all students and schools to perform well (or to perform poorly) against previously established criteria, independent of the performance of other students or schools.

Desiderata 6: Support a scoring system that can understood by and projected by school and district leaders.

Desiderata 7: Produce school scores that are as uncorrelated as possible with the proportion of pupils in poverty served by the school.

Desiderata 8: Produce scores that are minimally correlated with Academic Achievement scores.

ASA Subcommittee Recommendations

The Added-Value Growth Model described in this paper meets all eight of these desiderata. In addition, the proposed model has exciting implications for applications which support classroom instruction and instructional interventions at the school and district level. The proposed model is appropriate for an accountability system that promotes continuous improvement and supports improved outcomes for all students.

For these reasons, the ASA Subcommittee recommends adopting the Added-Value Growth Model to replace the current norm-referenced growth model for the Student Progress indicator in the South Carolina accountability system. Specifically, the following recommendations are made:

Recommendation 1: 2023 School Report Cards shall report both the existing norm-referenced student growth model and the proposed Added-Value Growth Model. Points and Ratings for schools shall be calculated using the same model and method described in the SY 2021-22 Accountability Manual. Added-Value Growth Model metrics shall be defined in the SY 2022-23 Accountability Manual without associated Points or Ratings and shall appear on Report Cards for informational purposes only.

Recommendation 2: EOC Staff shall analyze SY 2021-22 accountability data, seeking input from SCDE and select stakeholders, to further explore the Added-Value Growth Model scoring methods currently under consideration. EOC Staff shall make a final recommendation to EOC members for a scoring system to be published in the SY 2023-24 Accountability Manual.

Recommendation 3: EOC Staff, in collaboration with SCDE, will produce Added-Value Growth Model scores based on SY 2022-23 accountability data to disseminate to school and district leaders for their reference in preparation for full transition to the proposed model in the SY 2023-24 Accountability Manual.

Recommendation 4: 2024 School Report Cards shall report Added-Value Growth Model metrics and shall use those metrics to calculate Points and Ratings. The previously used norm-referenced growth model shall no longer be reported on these or subsequent report cards.