

# Investigating Comparability in Response to Georgia Senate Bill 211

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Nathan Dadey & Joseph Martineau



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## Overall Executive Summary

In response to Georgia Senate Bill 211, this report investigates whether two nationally recognized high school assessments, the Redesigned SAT (rSAT) and ACT:

- provide data that are comparable to the current Georgia Milestones End of Course (EOC) assessments,
- are valid and reliable for all subgroups, and
- provide differentiation between schools' performances as required by the Georgia's State Plan for the Every Student Succeeds Act.

This report identifies similarities and dissimilarities in policies and procedures pertaining to the administration, accommodation, and scoring of the EOC, rSAT and ACT assessments. Compared to the EOC assessments, the rSAT and ACT have shorter testing times, less flexible administration options and far fewer allowable accommodations for students with disabilities and English language learners. Of the fifty-one standard accommodations on the EOC assessments for students with disabilities, sixteen (or 31%) are not explicitly listed as available on the rSAT and twenty-three (or 43%) are not explicitly listed as available on the ACT. In addition, five (or 10%) of the standard EOC accommodations were specifically prohibited on rSAT and four (or 8%) were specifically prohibited on ACT. Similarly, of the fifteen standard accommodations for the EOC assessments provided for English language learners, three (or 20%) are listed as allowable supports on the rSAT and four (or 25%) on the ACT. These differences in accommodations ultimately mean that many students eligible for accommodations may have to choose between receiving the accommodations usually afforded on the EOC assessments (resulting in a score that cannot be used for college admissions), or taking the rSAT or ACT without those accommodations (potentially obstructing the students' ability to demonstrate their knowledge, skills and abilities).

This report also defines and examines linking relationships between the assessments and finds considerable and meaningful differences between the two nationally recognized high school assessments and the EOC assessments<sup>1</sup>. Specifically, approximately half of the students within the available data had their achievement level classifications correctly identified based on concordances from the rSAT or ACT scores. At the scale score level, a typical student's EOC assessment score differs by approximately 35 to 65 scale score points<sup>2</sup>, which translates into standardized differences of 0.60 to 1.12. At the school level, a typical school's score on the Content Mastery component of Georgia's redesigned College and Career Ready Performance Index (CCRPI) differs by approximately 6 to 7 points, which translates into a standardized difference of 0.30. These results suggest that the scores from the EOC assessments investigated and those of the rSAT and ACT should not be treated as comparable and therefore not treated as interchangeable.

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<sup>1</sup> This report investigates seven EOC assessments: two literature and composition assessments - Ninth Grade Literature and Composition, American Literature and Composition; four mathematics assessments - Coordinate Algebra, Algebra I, Analytic Geometry, and Geometry; and one science assessment – Biology.

<sup>2</sup> Based on root mean squared differences between the EOC assessment scores and those scores produced from the rSAT or ACT concordances.

## Introduction

In response to the increased flexibility<sup>3</sup> permitted under the Every Student Succeeds Act (ESSA) of 2015, Georgia Senate Bill 211 directs the Georgia State Board of Education to

“Conduct a comparability study to determine and establish the concordance of nationally recognized academic assessments, including, but not limited to, the SAT, ACT, and ACCUPLACER with alignment to state content standards in grades nine through 12. Such comparability study shall also determine whether the nationally recognized high school academic assessment provides data that are comparable to current End of Course assessments and valid and reliable for all subgroups and whether the assessment provides differentiation between schools' performances as required by the state accountability plan.”

Paraphrased, the bill requires investigation into whether:

- (a) The content of specific nationally recognized high school assessments are aligned to Georgia state content standards in specified grades,
- (b) Concordance relationships can be successfully established between the scores of the Georgia Milestones End of Course (EOC) Assessments and those from the selected nationally recognized high school assessments,
- (c) The interpretations of the nationally recognized high school assessments are as valid and reliable for all subgroups as they are for the general population, and
- (d) Performance on a nationally recognized high school assessment, aggregated to the school level, differentiates among schools.

This two-section report addresses requirements (b) to (d) above for the Redesigned SAT (rSAT) and the ACT<sup>4</sup> in relation to seven EOC assessments: two literature and composition assessments - Ninth Grade Literature and Composition, American Literature and Composition; four mathematics assessments - Coordinate Algebra, Algebra I, Analytic Geometry, and Geometry; and one science assessment – Biology.

The first section of this report is a review of all available documentation on key factors that impact the comparability of scores between the EOC assessments and the rSAT and ACT. These key factors include administration, accommodations and scoring. The second section of this report presents the results of a concordance study between the EOC assessments and the rSAT and ACT. Taken together, these two sections provide detailed evidence about the degree to which the results of the rSAT and ACT meet the requirements outlined above. The third and final section summarizes the results, overviews the limitations of the entire study and provides recommendations. These results and the recommendations drawn from them are, however, not meant to be used in isolation. Instead, they are meant to be used in conjunction with an alignment study or studies to come to an overall determination of score comparability between the EOC assessments and the rSAT and ACT assessments.

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<sup>3</sup> Specifically ESSA section 1111(b)(2)(H) allows a state to permit a local education agency (LEA) to administer a locally-selected, nationally recognized assessment in lieu of the state test at the high school level, *if* that assessment has been approved for such use by the state.

<sup>4</sup> The ACCUPLACER assessment, another nationally recognized high school assessment specified in Senate Bill 211, is not considered here as it has been previously investigated in relation to the EOC assessments.

# Section 1

## Audit of Administration, Accommodation, and Scoring Procedures

### Executive Summary

We examined the available documentation relevant to the administration, accommodation, and scoring procedures of the Redesigned SAT (rSAT), ACT and the Georgia Milestones End of Course (EOC) assessments. This qualitative comparison identified some important differences between the EOC assessments and the two nationally-recognized high school assessments. The differences identified are:

- The EOC assessments have been administered online since 2004, whereas both the rSAT and ACT have only recently been administered online. Technical difficulties in online assessment are more likely in the first few administrations of the program (see Martineau et al., 2015).
- The time allotted for test taking is shorter on both the rSAT and ACT compared to EOC, meaning that fewer students may be able to complete the rSAT or ACT than complete EOC tests. Item completion rate data bear this out. Extrapolating from the item completion rate data, given approximately 125,000 students per grade level in Georgia, if every high school were to administer the ACT, this amounts to approximately 10,100 more students unable to complete the mathematics test and 4,100 unable to complete the ELA test. For the rSAT those numbers are approximately 32,000 in mathematics and 3,600 in ELA. Therefore the scores provided by the rSAT and ACT are indicative of the ability to respond both quickly and correctly. This does not appear to be the case for the EOC assessments – although there are time limits for the EOC assessments, nearly all students complete nearly all the EOC items.
- Flexibility in scheduling differs by assessment program, as does the number of days allotted for testing. The rSAT and ACT require all subject tests to be completed on the same day, whereas testing time can be spread across two days for each EOC assessment. In addition, the College Board, the provider of rSAT, and ACT specify a single calendar day for all schools to administer the rSAT or ACT. In contrast, the schools may choose the administration date within a state specified window for the EOC assessments.
- The EOC assessments have a considerably wider array of item types in comparison to the rSAT and ACT. A greater number of item types generally, but not necessarily, makes it possible to directly assess a broader range of skills. The degree to which this is the case for the rSAT and ACT, if at all, should become clear in separate alignment studies.
- Local staff roles are similar across programs with one exception: for the EOC assessments there are official roles for district personnel. The lack of an official role for district personnel in ACT or rSAT testing could disrupt existing roles and activities, but could also be addressed with some planning.
- Overall, the EOC assessments have stricter requirements for who may perform duties associated with testing. However, the rSAT and ACT have more restrictive policies around potential conflicts of interest.
- There are considerable differences in how accommodations are handled across programs. In particular, the rSAT and ACT have far fewer accommodations identified as allowable for students with disabilities and English language learners. Those students who usually receive an accommodation not allowed on the rSAT or ACT must decide, with the support of their parents and educators, whether to receive that accommodation and not receive a college-reportable score, or to forgo the accommodation and receive a college-reportable score.

- In terms of accommodations for students with disabilities:
  - For the EOC assessments, any accommodation listed as standard will be automatically approved for use if specified on an individual education plan (IEP). For both the rSAT and ACT, documentation indicates that the listing of an accommodation on an IEP will be considered in determining whether to approve a requested accommodation, but ACT and the College Board reserve the right to reject any requested accommodation.
  - Of the fifty-one standard accommodations for EOC, twenty-three (or 43%) are not explicitly listed as available on the ACT, and sixteen (or 31%) are not explicitly listed as available on the rSAT. This does not mean that either ACT or the College Board will decline requests for those accommodations – however, it does imply that there is a greater likelihood that these accommodations will be rejected than those explicitly listed as approvable. As noted previously, students may still receive such accommodations on the ACT or rSAT if the request is declined, but the resulting score will not be reportable to colleges.
  - Of the fifty-one standard accommodations for EOC, four (or 8%) are specifically prohibited on ACT, and five (or 10%) are specifically prohibited on rSAT.
  - Finally, some of the accommodations listed as approvable on the rSAT and ACT are specifically prohibited on EOC assessments. There are four such accommodations for the ACT and three for the rSAT.
- The differences in allowable accommodations for English learners (ELs) are even more pronounced than those for students with disabilities. A few EOC standard accommodations are listed as allowable supports on the ACT or rSAT and could, if approved, result in college-reportable scores. The remaining accommodations are not allowed.
- The essays students complete on the EOC, rSAT, and ACT tests differ in some important ways, specifically in terms of:
  - The scores reported for each essay – a single score for the ACT essay and the EOC narrative essay, and scores for each rubric category for the rSAT essay and the EOC informational and argumentative essays,
  - The number of essays completed – three for the EOC, one for the rSAT and ACT,
  - The type of essay – argumentative for ACT; text-dependent analysis for rSAT; and informational, narrative, and argumentative for EOC, and
  - The detail provided regarding the reliability and validity of the essay scores:
    - The EOC documentation provides highly detailed information about scoring, training, and monitoring protocols, as well as about rater performance, reliability, and validity checks,
    - The ACT documentation provides a short narrative description of scoring protocols as well information on rater agreement, and
    - The SAT documentation provides a detailed narrative description of scoring protocols.

## Introduction

This section involves the review of all available documentation on the Georgia Milestones End of Course, rSAT and ACT assessments, with an emphasis on factors key in determining the comparability of scores. This section is organized around multiple key factors: availability of online assessment, timing and scheduling, item types, local staff roles and requirements, accommodations for students with disabilities, accommodations for English learners, essay scoring for English language arts (ELA), and precision of measurement along the continuum of achievement.

### Availability of Online Assessment

Georgia high school assessments have been available for online administration since 2004 and online administration has become the norm for the EOC assessments. In 2015, 2016, and 2017, approximately 71, 91, and 97 percent of assessments were administered online, respectively (see source document<sup>5</sup> AG in [Appendix A](#)). In contrast, the College Board and ACT are just beginning to administer rSAT and ACT online on a small scale. Online administration is not yet widely available for the ACT or rSAT.

Little documentation is available from either the College Board or the ACT online administration and it is unclear when online administration will become generally available. Given issues with the rollout of online administrations in the past (e.g., large scale interruptions), districts that plan to administer the rSAT and ACT online will need to develop a plan to handle unintended interruptions. The State already has plans for responding to interruptions that take place for EOC, which could serve as a model (the State's plans were included in the assessment peer review submission to the U.S. Department of Education).

In addition, students accustomed to taking assessments online may find the transition to paper and pencil to be difficult. However, it is unclear to what degree of difficulty a transition to paper and pencil testing may cause, especially if high school teachers still administer classroom tests via paper and pencil.

### Timing and Scheduling

Table 1.1 shows a comparison of the timing and scheduling characteristics of the three programs. Table 1 includes the amount of time allotted for test taking, the number of days on which testing may occur, the rates of test completion, and flexibility in scheduling test dates.

The *amount of time allotted for test administration* is considerably longer for EOC (120-170 minutes and 190-240 minutes for mathematics and ELA, respectively) than for either ACT (60 and 120 minutes) or rSAT (80 and 150 minutes). These differences may result in fewer students completing the assessments on rSAT and ACT, but because all three tests are of different lengths, this is an empirical question. To answer this question, we analyzed item-completion data provided for EOC to compare the three programs.

The *rate at which students completed their entire tests* also differed considerably across programs. Because ACT and the College Board calculate test completion differently, we developed two measures for EOC to be as similar as

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<sup>5</sup> Since we often cite multiple documents to support our conclusions, we have created a letter code for each document. These codes and the corresponding documents are provided in [Appendix A](#).



possible to those reported by ACT and the College Board. ACT reported the percent of students who responded to all five of the last five items. To create as similar a metric as possible for EOC, we computed the completion rates for the last five items and took the minimum. The College Board reported the percent of students who responded to the last item. We used the same metric for EOC. For all three programs, the results provided are averages across test forms. Detailed item completion rates for EOC are provided in [Appendix B](#).

For mathematics, the results showed that for the calculator-allowed sections, completion rates were higher for EOC (an average of 99%) than for ACT (an average of 91%), as well as for EOC (an average of 99%) than for rSAT (an average of 77%). For the non-calculator sections, completion rates were higher for EOC (an average of 99%) than for rSAT (an average of 70%). Note that there is not a non-calculator section of the ACT mathematics test.

For ELA, the results showed that for the reading/vocabulary sections, completion rates were higher for EOC (an average of 99%) than for ACT (an average of 94%), as well as for EOC (an average of 99%) compared to rSAT (an average of 95%). For the writing/language/English sections, completion rates were higher for EOC (an average of 95%) than for ACT (an average of 92%), as well as for EOC (an average of 99%) compared to rSAT (an average of 96%).

Given approximately 125,000 students per grade level in Georgia, if every high school were to administer the ACT, this amounts to approximately 10,100 more students unable to complete the mathematics test and 4,100 unable to complete the ELA test. For the rSAT those numbers are approximately 32,000 in mathematics and 3,600 in ELA. The scores provided by the rSAT and ACT intentionally include ability to respond both quickly and correctly. This does not appear to be the case for EOC.

The *number of days allowed for testing* also differs across programs, with the rSAT and ACT requiring all subject area tests to be completed on a single day (with the sole exception of students receiving extended time accommodations), whereas for EOC each subject area test may be spread out over up to two days as based on the discretion of the school or district.

Finally, *flexibility in scheduling* also differs across programs. For EOC, schools and districts may schedule testing within a window of allowable dates. For the rSAT and ACT, all students (at all schools) must take the complete test on a single day with a single backup day for students who missed the initial testing day. The sole exception is that for students with an extended time accommodation, a window of days is also allowed.

Table 1.1. *Time allotted for testing, completion rates, and flexibility in scheduling administration for EOC, ACT, and rSAT.*

			Assessment										Sources*	
			Mathematics					English Language Arts						
			EOC					Vendor		EOC		Vendor		
			Algebra I	Geometry	Coordinate Algebra	Analytic Geometry	Geometry	ACT	SAT	9th Grade Lit & Comp	American Lit & Comp	ACT		SAT
Number of minutes allotted for testing			120 – 170					60	80	190 – 240		120	150	A, B, C
Number of days allowed for testing		Up to 2 days per subject area	✓					-	-	✓		-	-	AC
		Exactly 1 day for all subject areas	-					✓	✓	-		✓	✓	
Item completion rates**	Reading / vocabulary section	Minimum response rate of last 5 items	-	-	-	-	-	-	99%	99%	-	-	V, AE	
		Responded to all of the last 5 items	-	-	-	-	-	-	-	-	94%	-		
		Responded to the last item	-	-	-	-	-	-	99%	99%	-	95%		
	Writing / language section	Minimum response rate of last 5 items	-	-	-	-	-	-	95%	94%	-	-		
		Responded to all of the last 5 items	-	-	-	-	-	-	-	-	92%	-		
		Responded to the last item	-	-	-	-	-	-	98%	99%	-	96%		
	Calculator section	Minimum response rate of last 5 items	99%	100%	99%	99%	-	-	-	-	-	-		
		Responded to all of the last 5 items	-	-	-	-	91%	-	-	-	-	-		
		Responded to the last item	99%	100%	99%	99%	-	77%	-	-	-	-		
	Non-calculator section	Minimum response rate of last 5 items	98%	99%	98%	99%	-	-	-	-	-	-		
Responded to all of the last 5 items		-	-	-	-	-	-	-	-	-	-			
Responded to the last item		98%	100%	99%	99%	-	70%	-	-	-	-			
Test date scheduling flexibility	All students on same day, with one backup day		-					✓	✓	-		✓	✓	AC
	A window of days for test administration		✓					-	-	✓		-	-	
	A window of days only for accommodated testing		-					✓	✓	-		✓	✓	

\* Source documents (the last column of the table) are identified in [Appendix A](#).

\*\* Averaged across forms for the rSAT and ACT assessments; averaged across courses and forms for EOC assessments.

## Item Types

The types of items available are an important indicator of the types of knowledge and skills students are intended to learn. Standards requiring more complex cognition (e.g., explaining, demonstrating, developing) are often assessed with constructed response items. The EOC assessments have a wider range of constructed response item types compared with the ACT or rSAT (see Table 1.2). However, availability of such item types does not guarantee that they directly measure higher-level skills; rather, their availability affords an *opportunity* to better assess more complex cognition. The extent to which that is the case is beyond the scope of this report.

Table 1.2. *Item types available on EOC, ACT, and rSAT.*

			Assessment			Sources*
			GM	Vendor		
			EOC	ACT	SAT	
Item Types	Selected Response	Multiple choice (1 correct answer)	✓	✓	✓	D, E, F, G
		Multiple selection (1+ correct answers)	✓	-	-	
	Constructed Response	Math only (SAT-specific)	-	-	✓	
		Short	✓	-	-	
		Mid-length	✓	-	-	
Extended	✓	✓	✓			

\* Source documents (the last column of the table) are identified in [Appendix A](#).

## Local Staff Roles and Requirements

Local staff roles for the three systems are similar, though they use different names for similar roles. These roles are shown in Table 1.3. One difference is that EOC includes roles for staff at all three levels (district, school, and room), whereas both the rSAT and ACT include roles at the school and room levels only. This difference may disrupt districts' existing procedures, should the ACT or rSAT be approved. Districts and the state would need to ensure current district responsibilities are accounted for in a new structure.

Table 1.3. *Local staff roles and requirements on EOC, ACT, and rSAT.*

			Assessment			Sources*
			GM	Vendor		
			EOC	ACT	SAT	
Required Local Roles	District-level	Test Coordinator	✓	-	-	A, B, R, S, T, U
		IT Coordinator	✓	-	-	
	School-level	Test Coordinator/Supervisor	✓	✓	✓	
		Backup Test Coordinator/Supervisor	-	✓	✓	
		Accommodations/SSD Coordinator	-	✓	✓	
		IT Support Staff	✓	-	-	
	Room-level	Roving/Hall Proctor	-	✓	✓	
		Examiner; Room/Associate Supervisor	✓	✓	✓	
		Proctor	✓	✓	✓	
Available Manuals & Resources by Role	District-level	Test Coordinator	✓	-	-	A, B, R, S, T, U
		IT Coordinator	✓	-	-	
	School-level	Test Coordinator/Supervisor	✓	✓	✓	
		Backup Test Coordinator/Supervisor	-	✓	✓	
		Accommodations/SSD Coordinator	-	✓	✓	
		IT Support Staff	✓	-	-	
	Room-level	Roving/Hall Proctor	•	•	•	
		Examiner; Room/Associate Supervisor	•	•	•	
		Proctor	•	•	•	
Required Training	By State or Vendor	Attendance reported to state or vendor	-	School	-	A, B, R, S, T, U
		Attendance monitored locally	District	-	School	
	By District or School Staff	Attendance reported to state or vendor	-	Room	-	
		Attendance monitored locally	School/Room	-	Room	
Allowed Credentials for Testing Staff	Current or Retired	Faculty/professional staff	-	✓	✓	A, B, R, U
		Administrative/clerical/secretarial staff	-	✓	✓	
		Substitute teacher	-	✓	-	
		Paraprofessional	-	✓	-	
	Current	Georgia certified educator (all roles)	✓	-	-	
		Non-certified school employee (proctors only)	✓	-	-	
		Student teacher	-	✓	-	
		Graduate student	-	-	✓	
Other	Volunteer (proctor only, no materials handling)	✓	-	-		

\* Source documents (the last column of the table) are identified in [Appendix A](#).  
 \*\* Relatives include children, wards, household, nuclear family, extended family.  
 • Roles are described in coordinator/supervisor manuals rather than role-specific manuals.

Table 1.3 (continued). *Local staff roles and requirements on EOC, ACT, and rSAT.*

			Assessment			Sources*
			GM	Vendor		
			EOC	ACT	SAT	
Prohibited Credentials for Testing Staff	Credential	High school student	-	✓	-	B, R, U, AD
		Volunteer	-	✓	-	
		Lower-division undergraduate student	-	✓	-	
		Plans to test in the next 12 months	-	✓	-	
		Involved in test prep outside school role	-	✓	-	
		Tested within the last 180 days	-	-	✓	
Recommended that teachers not proctor their own classrooms		✓	-	-		
Restrictions on Athletic Coaches	Role	Room-level only	-	✓	-	B, R, U, AD
		May not administer 1-on-1 to athletes	-	✓	-	
	Materials	Prohibited access before test day	-	✓	-	
	None listed	✓	-	✓		
Restrictions on Examinee Relatives**	Role	Not allowed in any role	-	-	✓	B, R, U, AD
		Not allowed in the room with relative	✓	-	-	
		Strongly discouraged in same grade level as relative	✓	-	-	
		No school-level role, not in same room as relative	-	✓	-	
	Materials	Prohibited	-	-	✓	
		Prohibited before test day	-	✓	-	
		Prohibited (for relative's materials)	-	✓	-	

\* Source documents (the last column of the table) are identified in [Appendix A](#).

\*\* Relatives include children, wards, household, nuclear family, extended family.

• Roles are described in coordinator/supervisor manuals rather than role-specific manuals.

Manuals available to the various roles are also similar. Likewise, staff training is required for all three assessments, including all roles at all levels applicable to each assessment. The sole difference is that ACT requires documentation of attendance at all training sessions, whereas EOC and rSAT leave attendance monitoring to the local level.

The largest differences between the three systems are the qualifications of testing staff and restrictions based on conflict of interest. EOC qualifications are stricter: they require every person involved to be a Georgia-licensed educator. rSAT and ACT permit a wider array of credentials. All three programs specifically list restrictions on who may serve in which roles based on potential conflicts of interest. Both rSAT and ACT are more restrictive in that some restrictions specified for rSAT and ACT are given as recommendations for EOC.

## Accommodations for Students with Disabilities

The EOC assessments, ACT, and rSAT all involve different approaches to accommodations for students with disabilities (SWDs). Based on federal law (IDEA and ESSA), accommodations on EOC assessments are determined by IEP teams. Instead, ACT and College Board indicate that IEP specifications are *considered* in approving or denying accommodation requests. ACT and the College Board reserve the right to deny accommodations specified on an IEP. If denied, the student, parent, and school must together decide whether to administer the test *without* accommodations and receive college-reportable scores or test *with* accommodations and receive non-college-reportable scores.

The availability of each accommodation is displayed in Table 1.5. A detailed legend for Table 1.5 is provided in Table 1.4. As shown in Table 1.5, most standard accommodations on the EOC can (if approved by the vendor) result in college-reportable ACT and/or rSAT scores (displayed in the lighter green). However, for a sizeable number of the fifty-one standard accommodations on the EOC, it is unclear whether their use would result in college-reportable scores (displayed in yellow) because they are not specifically listed as allowed on the ACT or rSAT. Without explicit listing as approvable, it is unknown whether any requests for such accommodations would be approved. This amounts to twenty-three (or 43%) and sixteen (or 31%) accommodations for the rSAT and ACT, respectively.

A few standard EOC accommodations are specified as resulting in non-college-reportable scores on the ACT or rSAT (displayed in the lighter red). They include *preferential seating* (rSAT and ACT list seating near the front of the room, but “preferential seating” is broader), *signing test questions*, and *signing reading passages*, and *use of a less restricted computer than rSAT* (The rSAT does not allow copy/cut/paste functionality, but this is allowable on both EOC and ACT). This amounts to four (or 8%) and five (or 10%) of accommodations listed for the rSAT and ACT, respectively.

Finally, some accommodations not allowed on the EOC assessment are allowed on the ACT or rSAT. These include audio presentation via MP3 (listed for the rSAT, unlisted but not prohibited for the ACT) or audio plus DVD (audio + video of the current test page) presentation of the entire test (both rSAT and ACT), and use of a computer with grammar/spelling check capabilities (ACT only).

Table 1.4. *Legend for Tables 1.5 and 1.6.*

Code	Meaning	Code	Meaning
S	Standard accommodation	L	Listed as college-reportable if approved by vendor
s	Implied by another labeled with "S"	l	Implied by another labeled with "L"
C	Conditional accommodation allowable for a highly restricted set of students, and scores are not included in aggregates.	U	Unlisted, might be approved as college-reportable
A	Allowed for any student (not an accommodation)	n	State allowed (scores are not college-reportable)
		N	Non-standard (scores are invalidated)

*Note. Conditional accommodations are treated as non-standard if they are not approved by the Georgia Department of Education.*

Table 1.4. *Available accommodations for students with disabilities on the EOC, ACT, and rSAT.*

		Assessment			Sources*
		GM	Vendor		
		EOC	ACT	SAT	
Setting	Special education classroom	S	U	U	H, J, K, L, M, N, O, P, Q, AC, AF
	Wheelchair accessible room	S	L	I	
	Alternative test site (with proctor present)	s	I	L	
	Special/adapted lighting	S	U	U	
	Small group	S	L	L	
	Preferential seating	S	n	n	
	Seating near front of room	s	L	L	
	Sound field adaptations	S	U	U	
	Adaptive furniture	S	U	U	
	Individual or study carrel	S	U	U	
	Individual administration	S	L	I	
	Private room	s	U	L	
	Given by certified educator familiar w/student	S	U	U	
	Presentation	Large print or large font	S	L	
Assistive-technology-compatible Format		s	U	L	
Highlighter		S	U	L	
Written instructions		s	L	U	
Visual notification of time remaining		A	L	U	
Signed directions		S	L	L	
Signed test questions		S	n	n	
Signed passages (ELA only)		C	n	n	
MP3 audio of entire test		N	U	L	
DVD presentation of entire test		N	L	U	
Oral reading of entire test in English		s	L	L	
Oral reading of instructions in English		s	I	L	
Oral reading of test questions in English		S	I	I	
Oral reading of passages in English (ELA only)		C	I	I	
	Explain/paraphrase directions in English	S	U	U	
	Braille	S	L	L	
	Braille graphs	S	L	L	
	Color overlays	S	L	L	
	Color templates or place markers	S	U	U	
	Low vision aids	S	U	L	
	Repetition of directions in English	S	U	A	
	Audio amplification or noise/buffer devices	S	U	U	
	Response	Software/devices <u>without</u> grammar/spell, <u>with</u> cut/paste	S	I	N
		Software/devices <u>without</u> cut/paste/grammar/spell	s	I	L
		Software/devices <u>with</u> cut/paste/grammar/spell	N	L	n
		Student marks answers in test booklet	S	L	L
		Student points to answers	S	U	U
		Verbal response in English only	S	I	L
Scribe		S	L	L	
Respond in ASL (with scribe)		s	U	n	
Tape recorder		s	U	L	
Braille writer		S	L	L	
Abacus (math only)		S	U	U	
4-function calculator on non-calculator section		N	N/A	L	
Large-block answer sheet		s	N	L	
Adapted writing tools		S	U	U	
Adapted/lined paper		S	U	U	

Table 1.4 (continued). *Available accommodations for students with disabilities on the EOC, ACT, and rSAT.*

		Assessment			Sources*
		GM	Vendor		
		EOC	ACT	SAT	
Schedule	Frequent monitored breaks	S	L	L	H, J, K, L, M, N, O, P, Q, AC, AF
	Optimal time of day for testing	S	U	L	
	Extended time	S	L	L	
	Multiple days	A	L	L	
	Flexibility in order of subject administration	S	U	U	

\* Source documents (the last column of the table) are identified in [Appendix A](#). Accommodations available for GM end-of-grade (GM EOG) assessments may be different than for EOC assessments.

Table 1.6 shows additional differences in requesting and approving accommodations for SWDs. To receive an accommodation, the EOC requires only that the student be marked in state data systems as an SWD and as needing a standard accommodation shortly before the test window. The rSAT and ACT require requests be submitted with considerable documentation far in advance of testing, and a decision may take up to six or eight weeks, respectively. There are also considerable differences in the timelines for receiving approval for accommodations. For standard accommodations on the EOC, the timeline for approval is immediate and the timeline for approval of novel accommodations is up to six weeks. For the rSAT and ACT approval can take up to six or eight weeks, respectively.

Table 1.6. *Requesting and Receiving Approval for Accommodations for Students with Disabilities on the EOC, ACT, and rSAT.*

		Assessment			Sources*	
		GM	Vendor			
		EOC	ACT	SAT		
Required Documentation	Marked as EL status, and requested in state system		✓	-	-	H, J, K, L, M, N, O, P, Q, AC
	Professional diagnosis of disability		-	✓	✓	
	Current IEP, 504, or accommodations plan		-	✓	✓	
	Additional documents, if denied		-	✓	✓	
	"Full" documentation for specific disabilities		-	✓	✓	
Time from Request to Approval or Denial Decision	For standard accommodations	Immediate	✓	-	-	
	For unique (unlisted, novel) accommodations	Up to 6 weeks	✓	-	-	
	For all accommodations	Up to 6 weeks	-	✓	-	
		Up to 8 weeks	-	-	✓	

\* Source documents (the last column of the table) are identified in [Appendix A](#).

## Accommodations for English Learners

Accommodations for English learners (ELs) are described in Table 1.7. EOC, ACT, and rSAT differ much more substantially on accommodations for ELs than for SWDs. Neither ACT nor rSAT offers what they call “accommodations” for ELs. rSAT and ACT do offer a few “supports” listed as accommodations on EOC assessments. If ELs are approved for this limited set of “supports,” they can still receive college-reportable scores. However, both vendors again reserve the right to deny any requested “support.” If ELs need additional accommodations, they may be used, but their use results in non-college-reportable scores. The same legend (Table 5) applies to the contents of Table 1.7. Likewise, the documentation and timeline (Table 1.6) applies to ELs, but with evidence of receiving a listed EL support in instruction replacing IEP and 504 plans required documentation. Table 1.7 demonstrates that ELs receiving most accommodations available on EOC would not receive the benefit of a college-reportable score if provided on the ACT or rSAT.

Table 1.7. *Accommodations for English learners on the EOC, ACT, and rSAT.*

		Assessment			Sources*
		GM	Vendor		
		EOC	ACT	SAT	
Setting	ESOL classroom	S	L	n	I, O, Q
	Small group	S	L	n	
	Preferential seating	S	n	n	
	Individual or study carrel	S	n	n	
	Individual administration	S	n	n	
Presentation	Explain/paraphrase directions in English	S	n	n	
	Read directions in student's native language	N	L	L	
	Math test content in student's native language	N	n	n	
	Oral reading of test questions in English	S	n	n	
	Oral reading of passages in English (ELA only)	R	n	n	
	Repetition of directions in English	S	n	A	
Response	Student marks answers in test booklet	S	n	n	
	Verbal response in English to scribe	S	n	n	
	Word-to-word dictionary (non-electronic)	S	L	L	
	Word-to-word dictionary (electronic)	S	n	n	
Schedule	Frequent monitored breaks	S	n	n	
	Extended time	S	n	n	

\* Source documents (the last column of the table) are identified in [Appendix A](#).

## Nature of and Scoring of Direct Writing Tasks

There are considerable differences between programs in the nature of writing tasks (or essays), scores produced for the essays, and in the availability of information about scoring procedures and associated analyses. These differences are summarized in Table 1.8. Regarding the nature of tasks, the EOC in American Literature and Composition includes two writing prompts: one for narrative writing and one for informational writing. The EOC in Ninth Grade Literature includes one writing prompt requiring either argumentative writing or informational writing. On the ACT, examinees are required to produce an argumentative essay. On the rSAT, examinees are required to engage in text dependent analysis (e.g., read and comprehend a passage of text, analyze how the author accomplishes a purpose, and do so with sound writing). These differences in the types of writing required are consequential, with implications for what high school English is intended to entail.

It is unclear to what degree different procedures and analyses are used in scoring essays across the three programs. It may be that the analyses are similar, but the rSAT and ACT documentation does not adequately represent the procedures and analyses conducted. Known similarities and dissimilarities are described below. The rubrics used for essay scoring are hybrids between typical holistic rubrics (a single, detailed, narrative description of the typical features of essays at each score point) and typical analytic rubrics (short narrative descriptions of the typical features of essays in multiple areas for each score point). In all cases, the rubrics specify multiple dimensions on which essays of different quality vary, and those descriptions are highly detailed. For the ACT and the EOC narrative writing task, separate scores are not provided for each of the dimensions, rather raters must select which of the score point rubrics is most like a given student's essay across the board. On the other hand, for the EOC argumentative and informational writing tasks and the rSAT writing tasks, separate scores are assigned for each dimension.

On the ACT and rSAT assessments, at least two raters read and score each essay, with a third (supervisory) rater scoring the essay if the two primary raters assign scores more than one point away from each other. For EOC 10 percent of essays are scored by a second rater as a check on validity.



For both the ACT and EOC, essay scores are incorporated into an overall score – simply part of the overall scale reported for the EOC assessments and as an English Language Art scale score for the ACT. The essay scores are not incorporated into an overall score for rSAT. In fact, the multiple rSAT essay scores are not aggregated to produce an overall essay score. This separation of the essay scores on the rSAT would likely cause complications for inclusion in the state's accountability system if the state desires to maintain essay scores as a contributor to school accountability. In particular, including the rSAT essay scores requires the state to adopt a decision rule for producing a composite, which would have an unknown impact on the outcomes of the accountability system.

Table 1.8. *Essay features on EOC, ACT, and rSAT.*

Writing Task Feature Description			Assessment			Sources*	
			GM	Vendor			
Level 1	Level 2	Level 3	EOC	ACT	SAT		
<b>Documentation</b>	Scoring Protocols	Vague narrative description	-	✓	-	V, X, Y, Z, AA, AB, AC, AE, AG, AH, AI, AJ, AK, AL	
		Detailed narrative description	-	-	✓		
		Highly detailed narrative description	✓	-	-		
		Highly detailed qualification and monitoring business rules	✓	-	-		
		Detailed statistical summaries of rater performance	✓	-	-		
	Type of Rubric	Holistic	-	-	-		
		Analytic	-	-	-		
		Hybrid	✓	✓	✓		
	Number of Scorers	Scored by two raters, third with disagreement		-	✓		✓
		Scored by one rater, with 10% read behind by a second		✓	-		-
	Essay Scores Provided	Overall score only		-	✓		-
		No overall essay score		✓	-		✓
		Reading comprehension		-	-		✓
		Text-dependent analysis		-	-		✓
		Writing		-	-		✓
		Narrative writing		✓	-		-
		Informational writing: organization, ideas, coherence		✓	-		-
		Informational writing: language usage and conventions		✓	-		-
	Essay score(s) incorporated into an overall language arts score			✓	✓		-
	Type of Essay	Informational/Explanatory		✓	-		-
Narrative		✓	-	-			
Persuasive/Argumentative		✓	✓	-			
Text-dependent analysis		-	-	✓			
<b>Essay Reliability</b>	Rater agreement range	Exact score agreement	0.69-0.78	-	-		
		Exact or adjacent agreement	0.97-1.00	-	-		
		Unclear what type of agreement	-	0.92-0.94	-		
	Mean alternate Form reliability (all form pairs treated as interchangeable)		0.70	-	-		
	Median internal consistency (median G-coefficient across Form pairs)		0.67	-	-		
<b>Essay Validity</b>	Validity papers exact score match rate		0.78-0.88	-	-		

\* Source documents (the last column of the table) are identified in [Appendix A](#).

Likewise, there are differences in the types of scores provided across the programs. ACT provides only an overall writing score running from 2-12 for the single writing prompt. The rSAT provides three scores [reading comprehension, analysis (of the associated text), and writing] but does not provide an overall essay score. EOC provides an overall score for the narrative writing task and multiple scores (organization, ideal development, and coherence and language usage and conventions) but no overall essay score for the informational writing task. Whether these differences in scores provided are substantively meaningful is a matter of the priorities Georgia has set for writing instruction.

It is unclear to what degree scoring protocols differ across programs. The EOC documentation provides highly detailed narrative descriptions of the rules and procedures for scoring essays. The EOC documentation also provides highly detailed rules for raters to qualify and for monitoring rater performance, along with detailed statistical summaries of rater performance. The documentation for rSAT is a somewhat detailed narrative, in that it gives a general idea of the scoring rules, but with insufficient information to be able to understand some key details. The ACT documentation contains only a vague narrative. The rSAT documentation provides a somewhat detailed narrative description of rules for rater qualification and monitoring, but does not make available statistical summaries of rater performance. The ACT documentation does not describe rater qualification or performance monitoring procedures with any detail, nor do they provide any statistical summaries of rater performance. It should be noted here that the documentation from which this analysis was drawn are the documents provided by the College Board and ACT to their statewide testing clients.

The three programs have considerable differences in rater reliability and validity statistics reported. EOC reports clearly defined rater agreement indices (including both exact agreement and adjacent or exact agreement among the two raters). ACT reports rater agreement indices but does not specify what kind of agreement. Thus, it is difficult to compare rater agreement statistics available on EOC and ACT. Because the statistics reported for ACT are relatively high, we assume that they represent adjacent or exact agreement. In that case, they would be similar to the values for EOC. If they represent exact agreement only, then ACT rater agreement is superior. On the other hand, no rater agreement statistics are provided in rSAT documentation, although the documentation indicates that rater agreement is calculated and evaluated. ACT also provides two additional types of essay scoring reliability indices not available on either EOC or rSAT. These estimates of reliability are available through a special study of many writing prompts. These indicate relatively strong alternate-form reliability and internal consistency reliability.

Finally, a major difference between the three programs is the documented use of validity papers in hand scoring. Validity papers are pre-scored essay responses that have clear ratings determined through a consensus process with expert raters. EOC documents usage of validity papers and the rate at which raters exactly matched the consensus scores on the validity papers at 78 to 88 percent. The rSAT documents describe the use of validity papers, but does not report the rater agreement rates. ACT documents do not describe the use of validity papers.

## Section 2 Concordance Study

### Executive Summary

- We examined the tenability of concordance relationships between the two nationally recognized high school assessments, the Redesigned SAT (rSAT) and ACT, and seven Georgia Milestones End of Course (EOC) assessments:
  - Two literature and composition assessments - Ninth Grade Literature and Composition, American Literature and Composition;
  - Four mathematics assessments - Coordinate Algebra, Algebra I, Analytic Geometry, and Geometry; and,
  - One science assessment – Biology.
- Based on data from three academic years, 2014-2015, 2015-2016 and 2016-2017, we found that very few students took the EOC assessments and the rSAT or ACT in the same academic year, with the exception of the American Literature EOC assessment. In addition, most students who took an EOC assessment did not take the rSAT or ACT at any point within the three years of available data. At most, 26% of students took both an EOC assessment and the rSAT or ACT assessment.
- We used an equipercentile method to create concordances between the EOC assessments and the rSAT and ACT assessments. We then examined the differences between the EOC scores students actually attained and those they were expected, or predicted, to receive based on the equipercentile results (we refer to these scores based on concordances from the rSAT or ACT assessments as “expected EOC scores”). We found that:
  - For a typical student who took an EOC and the rSAT or ACT, the score he or she is expected to receive based on the concordances is approximately three fourths to one standard deviation different than what he or she did receive - large differences for assessments intended to be used interchangeably.
  - Approximately half of the students who took an EOC and the rSAT or ACT had an expected EOC score that would place them into the same achievement level as their actual scores did.
- These differences are a function of the somewhat low correlations between the assessments – likely due, at least in part, to the differences in administration patterns of the EOC assessments and the rSAT and ACT. The EOC assessments are generally taken by students in earlier in high school (e.g., grades 9, 10, or 11) whereas the rSAT and ACT are generally taken late in high school (mostly grade 12).
- We also examined shifts in one of the components of Georgia’s redesigned College and Career Ready Performance Index (CCRPI) – the Content Mastery component – based on the expected EOC scores. The Content Mastery component is an index that ranges from 0 to 100 points that aggregates across assessments from English Language Arts, Math, Science, and Social Studies. Scores on the Content Mastery component, when based on the expected EOC scores differed by approximately 6 to 7 points relative those based on the actual scores. Standardized, this 6 to 7 point shift is approximately 0.30.

## Introduction

Establishing whether scores from the Georgia Milestones End of Course (EOC) Assessments are comparable to those from the rSAT and ACT hinges, in part, on the empirical relationships between the scores. In this study, we summarize our efforts to establish linking relationships between scores on the EOC Assessments and scores on the Redesigned SAT (rSAT) and ACT Assessments using an equipercentile approach. The study included seven EOC Assessments:

- Two literature and composition assessments - Ninth Grade Literature and Composition, American Literature and Composition;
- Four mathematics assessments - Coordinate Algebra, Algebra I, Analytic Geometry, and Geometry; and,
- One science assessment – Biology<sup>6</sup>.

These EOC Assessments represent all assessments that may be a match, in terms of assessed content, to the content assessed on the rSAT and ACT Assessments. Thus, this work casts as wide a net as possible in terms of EOC assessments examined. The impetus for this investigation comes from Georgia Senate Bill 211, which requires an investigation of the viability of substituting scores from the rSAT and ACT assessments in the place of scores from EOC assessments. To this end, this study focuses on not only the viability of linking the scores from the rSAT and ACT assessments to those of the EOCs, but also how those scores would function within Georgia's approved Every Student Succeeds Act (ESSA) accountability system, and in particular as the Content Mastery component of Georgia's College and Career Ready Performance Index (CCRPI). Given this focus, the results of this work should not be generalized to other uses, such as educator effectiveness or for other components of the CCRPI that use EOC scores (i.e., the Progress, Closing Gaps and Readiness components).

Before beginning, it is important to recognize that comparability can be conceptualized as a continuum from most stringent (equating) to least stringent (prediction). Falling in between these two extremes is concordance, which is historically how the scores from the rSAT and ACT have been linked to each other. The EOC assessments and the rSAT and ACT do not meet the requirements of equating (for example, the assessments do not meet the equal constructs requirement, as detailed in Dorans & Holland, 2000) and therefore scores from the assessments should not be considered interchangeable. The distinction between concordance and prediction is partially in terms of the intended purpose – concordance is meant to determine scores at which the same percentage of examinees score above and below each score; whereas prediction (as noted in Pommerich, Hanson, Harris & Sconing, 2004) is better suited to predicting each individual student's score.

In the first section, we overview the available data as well as approaches used to expand the number of students whose data can be used to establish a linking relationship. In the second section, we describe the results from multiple equipercentile linkings. In the final section we provide a summary and discussion.

## Methods

### Measures

**Georgia Milestone End of Course Assessments.** We examined seven EOC assessments in this study (Ninth Grade Literature and Composition, American Literature and Composition, Analytic Geometry, Geometry,

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<sup>6</sup> Note that we only link the Biology EOC assessment to the ACT Science Section Score.

Coordinate Algebra, Algebra I, and Biology). Whether the rSAT and ACT assessments align well to the Georgia Standards of Excellence, which are measured by the EOC assessments, is an open question and one that is beyond the scope of this study – such questions are the purview of an alignment study. Thus, a key assumption for linking the EOC and rSAT and ACT assessments – that of the same or similar construct – is not addressed by our analysis.

Each EOC Assessment is designed “to measure how well students have acquired the knowledge and skills across the full achievement continuum as described in the Georgia-mandated content standards” as well as to indicate “student preparedness for the next level, be it the next grade, the next course, college, or a career” (Data Recognition Corp, 2017, p. 3). To create scale scores, all EOCs are scaled using the Partial Credit Model (Wright & Masters, 1982). The assessments are administered three times per year – in the fall, spring and summer. The fall and spring administrations have two forms, each of which has its own raw to scale score conversation table.

It is worth noting that high school mathematics instruction in Georgia shifted during the window for which we have data. Many districts moved from instruction that integrates mathematics content domains across courses (e.g., teaching Algebra and Geometry content together) to sequential instruction of mathematics by content domain (e.g., teaching Algebra in one course, followed by a second Geometry course). The Analytic Geometry and Coordinate Algebra assessments correspond to the integrated instructional model, whereas the Geometry and Algebra I assessments correspond to the sequential model. As can be seen in Table 2.2 of the Data section, the number of students taking the integrated math assessments decreased drastically across the three years of data available to us (2014-2015, 2015-2016 and 2016-2017); whereas the number of students taking the sequential math assessments, introduced in 2015-2016, drastically increased. The numbers of items by type, along with descriptive statistics (means, standard deviation, reliabilities and standard errors of measurement) for scores on the EOCs, rSAT and ACT, are presented in Table 2.1.

**Redesigned SAT.** The rSAT, first available in March of 2016, is meant to be an “actionable performance indicator for college and career readiness of students” (College Board, 2016, p. 3). The rSAT is made up of four sections – Reading, Writing and Language, Mathematics, and an optional Essay. The first two sections are combined into a single reporting scale – Evidence Based Reading and Writing (EBRW). Both the Mathematics and Essay sections have their own reporting scales. We restrict our analysis to the EBRW and Mathematics reporting scales<sup>7</sup>. Classical Test Theory methods are used to create the rSAT section scale scores, which range from 200 to 800 in 10-point increments.

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<sup>7</sup> We investigated the relationship between the SAT Verbal and Essay sections of the prior (pre-2016) version of the SAT using Georgia data from the 2015-2016 school year and found the correlation to be 0.85. The SAT Verbal section was revised to create the rSAT EBRW section, and the correlation of 0.85 suggests that linking on just the rSAT EBRW section score would not be substantially different than linking based on a composite of both the EBRW and Essay section scores.

Table 2.1. *Item Counts by Types, Classical Test Statistics, Raw and Scale Score Summaries by Assessment.*

	Item Counts by Type						Possible Points	Total Score				Scale Score		
	SR	CR	ECR	TEI	SPR	EWR		Mean	SD	SEM	Reliability	Mean	SD	SEM
<b>GA EOC Assessments</b>														
9th Grade Literature	38	2	1	1		1	55	32.7	9.3	3.18	0.88	509.7	51.3	17.8
American Literature	38	2	1	1		1	55	33.5	9.1	3.10	0.88	511.7	55.5	19.2
Analytic Geometry	48	2	1	1			58	28.5	10.2	3.48	0.87	522.3	59.3	21.4
Geometry	48	2	1	1			58	30.9	11.3	3.26	0.91	532.0	72.8	21.8
Coordinate Algebra	48	2	1	1			58	26.2	10.1	3.44	0.87	498.3	52.9	19.1
Algebra I	48	2	1	1			58	29.0	10.2	3.42	0.88	510.7	57.3	19.8
Biology	55						55	30.8	10.2	3.20	0.90	513.8	73.1	23.6
<b>rSAT Assessment Sections</b>														
EBRW	96						96	--	--	--	0.94	500.1	104.2	23.33
Reading	52						52	25.6	9.9	2.96	0.88	25.0	5.4	1.59
Writing and Language	44						44	24.0	8.7	2.68	0.88	25.0	5.5	1.71
Math	45					13	58	27.5	9.9	3.07	0.90	500.2	99.9	31.17
<b>ACT Assessment Sections</b>														
Reading	40						40	--	--	--	0.87	22.5	6.1	2.1
English	75						75	--	--	--	0.92	21.6	6.4	1.7
Math	60						60	--	--	--	0.91	21.7	5.4	1.5
Science	40						40	--	--	--	0.85	21.9	5.1	2.2

Notes: SR = Selected Response, CR = Constructed Response, ECR = Extended Constructed Response, TEI = Technology Enhanced Item – in ELA for the EOC assessment this is an evidence based selected response item and in Math for the EOC assessments these are multiple-select or multiple-part items, SPR = Student Produced Response (gridded response), EWR = Extending Writing Response, and --- indicates that we were unable to find this information. In addition, SEM = Standard Error of Measurement – for the total score columns the SEM is based on Classical Test Theory, as are the SEMs in the scale score columns for the rSAT and ACT. Since the EOC assessments are scaled using the Rasch Model, we calculated the Scale Score SEM as  $\text{Scale Score SD} \times \sqrt{1 - \text{Reliability}}$ . For the EOC assessments, the raw statistics are based on the average across forms for the 2015-2016 operational test forms (see Tables 5.42, 5.43, 5.44 for the raw statistics, and 6.5 and 6.6 for the scale score statistics, DRC, 2016) and the item counts are drawn from the 2017 Assessment Guides (Georgia Department of Education 2017a to 2017f), excluding Biology which is based on the 2015 Assessment Guide (Georgia Department of Education 2015), as the test appeared to be revised slightly for 2017, with item counts differing slightly than those reported in the technical manual. For the rSAT, the statistics are based on the operational scaling detailed in the rSAT Technical Manual and its Appendix (see Tables 6.1, 6.2, A-6.1, A-6.8; The College Board, 2016). For the ACT, the statistics are based on the 2015-2016 National Administrations detailed in the ACT Technical Manual Supplement (see Tables 2.1 and 2.2; ACT, 2016).

**ACT.** The ACT assessment “measures students’ academic readiness for college in key content areas” (ACT, 2014, p. 1). The ACT contains five assessment sections - Reading, English, Mathematics, Science, and an optional Writing Section in which students write an essay. Unlike the rSAT, which combines the Reading section and Writing and Language section to create the EBRW reporting scale, ACT does not produce a combined reporting scale for Reading and Writing. Instead, the ACT reports an ELA score, which is the rounded average of the scores from the English, Reading, and Writing sections. It would be preferable to link using this ELA score, as it appears to align to the assessed content of the EOC assessments better than the other sections. However, most students in Georgia do not take the optional Writing section and thus do not receive an ELA score. Given this, we have decided to use the English reporting scale, as ACT uses this scale to set their career and college readiness benchmark for English Composition courses<sup>8</sup>. The ACT scale scores are produced using Classical Test Theory in a similar fashion to the rSAT scores. The ACT scale scores range from 1 to 36 in 1-point increments.

## Data

Ideally, every Georgia high school student would take the given Georgia EOC, the rSAT and ACT during the same academic year (and at approximately the same time during the year). Under this scenario, establishing a link between the assessment scales would then be a matter of comparing performance across all students. In this section we first detail how the data departs from this ideal, then detail the ways in which we address these departures (i.e., by pooling the data across years and adjusting the samples to be more representative).

Table 2.2 below shows the sample sizes for each EOC assessment in each academic year for which we have data (2014-2015, 2015-2016 and 2016-2017) and across all three academic years. Each academic year essentially represents a cohort of students moving through the Georgia education system. The first row for each EOC assessment shows the number of students who have a score on the EOC assessment in question. The subsequent rows for each EOC shows the number of students who have a score for the EOC assessment *and* a score on one of the rSAT or ACT sections in two ways – first restricted to only those students who took the EOC and the rSAT or ACT within the same academic year (the “Within Year” columns), and then by pooling the rSAT and ACT data across years, so that students within each academic year are counted if they took the EOC in the given year and the rSAT or ACT sections *at any point* within the three years of provided data (the “Pooled” columns). For example, 197 students took the 9<sup>th</sup> Grade Literature EOC assessment and the ACT English Section during the 2015-2016 year, whereas 412 students who took the 9<sup>th</sup> Grade Literature EOC assessment also took the ACT English Section at least once during the 2014-2015, 2015-2016 and 2016-2017 academic years. The counts of students taking both the EOC and the rSAT or ACT within the same year are low. The percentages of the total number of students who took a given EOC and the rSAT or ACT in the same year ranged from 0.01% (for Algebra I EOC and the rSAT Math in 2015-2016) to 26.23% (for the American Literature EOC and the rSAT EBRW in 2016-2017), with a mean of 1.99%. In the infrequent case in which a student took an assessment more than once, we use the maximum score he or she attained for that assessment. This approach follows Georgia’s policy on EOC assessments, in which the maximum EOC score is used for a student who takes that assessment more than once.

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<sup>8</sup> In addition, the English scale scores have slightly higher correlations with the EOC assessment scores than the Reading Scale scores. An alternative, not investigated here, would be to take the average of the English and Reading assessment scores to produce a score analogous to the EBRW.

Table 2.2. Student Counts, restricted to those who took both the EOC and the rSAT or ACT in the Same Academic Year and Pooled Across Academic Years.

Students who Took	Within Year				Pooled			
	2014-2015	2015-2016	2016-2017	Total <sup>2</sup>	2014-2015	2015-2016	2016-2017	Total <sup>2</sup>
<b>9th Grade Literature</b>								
EOC	129,364	132,007	135,732	388,495	129,364	132,007	135,732	388,495
EOC & ACT E/R <sup>1</sup>	172	197	182	551	983	412	199	1,590
EOC & ACT ELA	--	93	62	155	369	160	72	599
EOC & rSAT EBRW	--	33	824	857	33,130	5,005	839	38,582
<b>American Literature</b>								
EOC	108,144	111,688	118,193	336,765	108,144	111,688	118,193	336,765
EOC & ACT E/R	9,071	10,012	831	19,912	46,777	40,493	1,008	88,147
EOC & ACT ELA	17	6,523	330	6,870	20,661	18,235	406	39,237
EOC & rSAT EBRW	--	192	30,997	31,189	7,099	38,141	31,351	76,479
<b>Analytic Geometry</b>								
EOC	120,075	94,406	25,141	237,938	120,075	94,406	25,141	237,938
EOC & ACT Math	706	432	89	1,227	38,467	1,442	101	39,925
EOC & rSAT Math	--	83	841	924	39,749	20,871	852	61,248
<b>Geometry</b>								
EOC	--	35,998	98,975	134,727	--	35,998	98,975	134,727
EOC & ACT Math	--	102	180	282	--	458	217	674
EOC & rSAT Math	--	14	2,765	2,779	--	9,274	2,829	12,088
<b>Coordinate Algebra</b>								
EOC	148,238	43,258	29,001	201,790	148,238	43,258	29,001	201,790
EOC & ACT Math	101	131	61	293	1,488	238	78	1,792
EOC & rSAT Math	--	21	203	224	34,642	2,492	206	35,735
<b>Algebra I</b>								
EOC	--	101,448	85,950	175,512	--	101,448	85,950	175,512
EOC & ACT Math	--	63	81	144	--	167	92	252
EOC & rSAT Math	--	7	381	388	--	2,590	390	2,882
<b>Biology</b>								
EOC	125,148	126,095	125,048	373,574	125,148	126,095	125,048	373,574
EOC & ACT Science	723	681	338	1,742	10,863	2,048	385	13,278

Notes: Cells highlighted in grey have increases of over 15,000 students relative to the within year sample sizes, which translates to approximately 15% of the total number of students taking any given EOC assessment. <sup>1</sup>E/R = English/Reading, since all students take the ACT assessment sections together, the counts were identical – thus we have collapsed these two assessments together. <sup>2</sup>The total dataset was created by “stacking” the year-specific data sets together and students who have more than one assessment score are only counted once. The concordances follow the same logic – links based on the total data use a student’s maximum rSAT or ACT score, if he or she took the assessment more than once.



**Sample Sizes.** The sample sizes vary across the academic years in ways that are partially a function of student test taking patterns, shifting instructional practices and the limitations of the available data. In terms of student test taking patterns, students tend to take the EOC assessments earlier in high school and the rSAT or ACT later on (see Table 2C in [Appendix C](#) for the mean grade levels by assessment). Specifically, in 9<sup>th</sup> grade students typically take the 9<sup>th</sup> Grade Literature EOC, an Algebra EOC (either Algebra I or Coordinate Algebra) and the Biology EOC - the median<sup>9</sup> grade in which students take these assessments is 9, with mean grades ranging from 8.93 to 9.38. In 10<sup>th</sup> grade, students typically take a Geometry EOC (either Analytic Geometry or Geometry) – the median grade in which students take either of these assessments is 10, with mean grades of 9.96 and 9.90. In 11<sup>th</sup> grade, students typically take the American Literature EOC – the median grade is 11, with a mean of 10.90. In contrast, students typically take the rSAT or ACT in 12<sup>th</sup> grade – the median grade of students taking these assessments is 12 (across all test sections on both the rSAT and ACT), with mean grades of 11.92 and 11.43<sup>10</sup>, respectively.

These patterns mean that few students take an EOC assessment and the rSAT or ACT together; and that there is a difference of one to three years between the administrations of an EOC and the rSAT or ACT. After pooling the data, the sample sizes increase for the earlier academic years, as many students are in the data long enough for them to have taken the rSAT or ACT. For example, if a student was in 10<sup>th</sup> grade in 2014-2015 then it is likely that he or she would be in 12<sup>th</sup> grade in 2016-2017, the grade in which most students take the rSAT or ACT. These increases can be seen in Table 2.2, in which the pooled sample sizes<sup>11</sup> are substantially larger for certain combinations of EOC assessments and the rSAT or ACT (the cells highlighted in grey in the table). These increases are seen most often for the rSAT, as there are greater numbers of students with rSAT scores within the last year of available data, 2016-2017 (see Table 1C).

The sample sizes are also influenced by the shifts in mathematics instruction previously mentioned, with decreasing numbers of students taking the Coordinate Algebra and Analytic Geometry assessments and increasing numbers taking the Algebra I and Geometry assessments. Finally, the differences in the numbers of students taking the rSAT or the ACT (also shown unconditionally in Table 1C) may not directly correspond to differences in the numbers of students taking each assessment. Rather, the ACT files appear to contain data only for graduating students, whereas the rSAT files appear to contain data for all tested students in a given year.

**Representativeness.** The subset of students who do take both an EOC and the rSAT or ACT, either in the same year or at any point during their high school career, appear to be somewhat non-representative of all students who take a given EOC assessment in terms of demographic characteristics and average EOC scores. These differences, however, are not consistent across assessments (see Table 1D as well as the supporting text in [Appendix D](#) for details). This lack of representativeness could impact the generalizability of the results - any link not based on a representative sample of students could impact how well the study results generalize to overall test-taking population in Georgia. As noted in the analytic approach section, we re-sample the available data to mitigate this possibility. Moreover, this partial lack of representativeness does not impair the findings for the samples of students analyzed. Therefore, unless the rSAT and ACT test taking patterns shift in Georgia drastically, the findings

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<sup>9</sup> The median and mean grade levels are based on the total sample.

<sup>10</sup> The grade distribution for rSAT is skewed – with smaller numbers of students taking the assessments in earlier grades.

<sup>11</sup> An alternative approach to expanding the sample sizes is to match students who have an rSAT or ACT score, but not an EOC score, to those students who do have an EOC Score on all available covariates, then treat the EOC scores as if they had come from the students with the rSAT or ACT scores. However, this approach cannot control for unobserved covariates. In addition, this approach would repeatedly match the small numbers of students taking the EOC assessments to the larger group of students who took the rSAT and ACT- which is particularly problematic for EOCs with very small sample sizes (i.e., all EOC assessments but the American Literature EOC).

of this report should be generalizable to future samples of Georgia students taking an EOC assessment and the rSAT or ACT assessment.

## Analytic Approach

To create concordances between the EOC assessments and the rSAT and ACT we use equipercentile linking (Kolen & Brennan, 2004) for both the within year and pooled samples. These concordances are established in one direction only, from an rSAT or ACT section to an EOC assessment. Care needs to be taken when using these concordances because the interpretation of the results of the within-year and pooled samples *are not the same*. The within-year concordances answer the question, “Given a student’s rSAT or ACT score, what score is he or she expected to attain on the EOC assessment taken *during the same academic year?*”. The pooled concordances, on the other hand, answer the question, “Given a student’s rSAT or ACT score, what score is he or she expected to attain on the EOC assessment taken *at any point during his or her high school career?*”. This latter interpretation is less typical in linking studies. In addition, as shown in [Appendix G](#) and [Appendix H](#), the concordances do differ between the within-year and pooled samples. We suggest that the way in which the results are to be used (e.g., only allowing rSAT or ACT scores taken in the same academic year as the course vs. allowing scores from any year) should guide the choice of concordance results to use. In addition, the results from the within-year samples are more in line with the typical interpretation of concordances; whereas the results from the pooled samples are best thought of as predictions.

**Adjusting the Samples.** As noted previously, the samples of students who take both a given EOC assessment and the rSAT or ACT are not very representative of the overall population of students that take the EOC assessment (see Tables 1D and 2D in [Appendix D](#)). To mitigate this issue, we use stratified random sampling, without replacement, to draw new samples of students from those who took both tests. The stratification is based on the students’ EOC scores, and thus adjusts the distribution of EOC scores of students taking both tests to look more like the distribution of EOC scores for all students taking the EOC in question. Because we sampled without replacement, the adjusted samples included approximately 45% of the students in the original samples detailed in Table 2.2. Additional details of the stratified random sampling approach are presented in [Appendix D](#). After sampling, the difference in the distribution of EOC scores between all students taking an EOC assessment and those who took both an EOC and the rSAT or ACT was small – with mean differences typically within one standard error of measurement (approximately 20 EOC scale score points).

**Equipercentile Linking.** To conduct equipercentile linking<sup>12</sup>, we use the `equate` function in the R package `equate` (Albano, 2016) with polynomial loglinear presmoothing on the rSAT and ACT scores. In addition to presmoothing, we also use a cubic smoothing spline to extrapolate to rSAT or ACT scale score values that are not captured in the data. For example, while it is possible for students to obtain a score of 210 on the rSAT EBRW section, no Georgia students in the available data obtained this score. In our reported concordances, we extrapolate the EOC score for such a missing rSAT or ACT scale score. We also extrapolate to scores outside of the range of available data, as scores at the extremes are often missing. For example, ACT scores of less than 5 are often not observed. We do so to provide complete concordance tables<sup>13</sup>, but note that such extrapolation introduces additional error. It is worth noting that the equipercentile method, when used to produce a concordance relationship, assumes that the underlying ability of the group of students used is the same. This assumption is most

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<sup>12</sup> This method has been used extensively in concordance studies, most notably between the SAT and the ACT. In addition, the scatterplots in [Appendix E](#) show that the relationships between the EOC and rSAT or ACT scales are somewhat non-linear at the extremes, and the equipercentile method can accommodate non-linearity between the scales.

<sup>13</sup> We round our results up after extrapolating.

likely violated when rSAT or ACT scores from different academic years are used – as students have most certainly learned more, or even forgotten, subject area content knowledge over the course of one or more years of high school. The concordances provided in the results section are based on the total samples for each assessment – that is the samples that combine the three academic years together (concordances for each academic year alone are shown graphically in [Appendix G](#)).

**Evaluating the Linking Results at the Student-Level.** To evaluate the concordances, we provide several statistics that capture the differences between the EOC scores students actually received and those EOC scores they are expected to receive based on their rSAT or ACT results. Specifically, we report root mean squared differences (RMSD) and standardized root mean squared differences<sup>14</sup> between the observed and expected values as well as the percent agreement between achievement level classifications based on actual and expected scores. To create the standardized RMSD, we divide the RMSD by the standard deviation of the actual EOC scores from the sample of students in question. The RMSD statistic is, essentially, the standard deviation of the differences between the actual and expected scores, and thus summarizes the magnitude of differences between the scores. As noted by Dorans and Holland (2000), the standardized RMSD can be thought of as a type of effect size. In addition, we provide bootstrap linking standard errors (based on 1,000 replications) alongside the concordance results in [Appendix H](#) and summarize the linking standard errors graphically in [Appendix F](#).

**Evaluating the Linking Results at the School-Level.** We also examine the impact these differences have on the redesigned CCRPI Content Mastery component – as defined under Georgia’s Every Student Succeeds Act state plan. This component is created via a multistep approach<sup>15</sup>. A type of weighted percentage<sup>16</sup> is first computed, in which the weights are assigned based on student achievement levels – 0 for Beginning Learners, 0.5 for Developing Learners, 1.0 for Proficient Learners and 1.5 for Distinguished Learners. The resulting weighted percentage runs roughly from 0 to 100 and is computed for each of four content areas<sup>17</sup> – English Language Arts (ELA), Mathematics, Science and Social Studies. The full set of EOC assessments that are used to compute each subject area weighted percentage are shown in Table 2.3. In high school, these weighted percentages each account for a quarter of the Content Mastery component, and are therefore multiplied by 0.25 and summed together, creating the Content Mastery component score, which again runs roughly 0 to 100. The Content Mastery component accounts for 30% of a school’s overall CCRPI score.

We create the subject area weighted percentages using the student achievement level classifications based on the expected EOC scores from the equipercentile results from the pooled, total samples. There is, however, a question of what set of rSAT and ACT scores should be used to produce the expected EOC scores. Each CCRPI component, including the Content Mastery component, is defined annually, but students generally take the EOC assessments in earlier in high school (e.g., grades 9, 10, or 11) and the rSAT and ACT late in high school (mostly grade 12). To compare differences in actual and expected Content Mastery component scores, we either need to (a) compare the performance of the *same* students across multiple years, an impossibility unless student scores are used “retroactively” for the purposes of accountability, or (b) compare the performance of *different* students within the same year, the likely scenario in practice. As an example, this latter approach would mean that the comparison

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<sup>14</sup> See Dorans & Holland, 2000, who refer to the RMSD statistics we calculate as the Root Expected Mean Square Differences.

<sup>15</sup> Based on the document *Overview of the Redesigned CCRPI* available from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Accountability/Documents/Webinars%20and%20Presentations\\_FY18/Redesigned%20CCRPI%20Pioneer%20RESA%2001.24.18.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Accountability/Documents/Webinars%20and%20Presentations_FY18/Redesigned%20CCRPI%20Pioneer%20RESA%2001.24.18.pdf)

<sup>16</sup> The term “weighted percentage” is consistent with the term “indicator” within Georgia’s state accountability plan.

<sup>17</sup> Each of these subject area scores are individually adjusted if the school participation rate, for that subject, in the given grade band or for a specific subgroup falls below 95%. We did not apply this adjustment, as the data we have is limited to those who students took the EOC assessments (instead of all students eligible to take the EOC assessments, which would allow us calculate participation rates).

within the 2014-2015 school year for Biology would be between the students who took the Biology that year, typically in 9<sup>th</sup> grade, and the students who took the ACT that year, typically in 12<sup>th</sup> grade. We implement approach (b), as it better matches practice.

To do so, we limit our analysis to the 2016-2017 school year (the year for which we have the most complete set of assessment data for the rSAT and ACT, as the rSAT was fully implemented that year) and create expected EOC scores for students based on their rSAT or ACT scores from that year. We create expected EOC scores for all students who took the rSAT or ACT in the 2016-2017 school year, not just those students who took both an EOC and the rSAT or ACT. To determine what concordance(s) to apply to each student's subject area rSAT or ACT section score, we use each student's EOC assessment administration history. For example, if a student had taken both the 9<sup>th</sup> Grade Literature and American Literature Assessments previously, we apply the two corresponding concordances to that student's EBWR score to produce expected 9<sup>th</sup> grade Literature and American Literature Scores.

In addition, we also used the classifications based on actual EOC scores for the three EOC assessments we did not create concordances for. These three EOC assessments are of Physical Sciences, U.S. History and Economics. The inclusion of these assessments reduces the potential differences between the Content Mastery scores based on the actual EOC scores and those that included the expected EOC scores – as the science and social studies percentages use the same EOC score across actual, rSAT and ACT conditions (excluding the expected Biology EOC scores based on the ACT Science Section Score). However, the complete set of assessments allows us to create an approximation of each school's Content Mastery component score. We use the term approximation because the results are based only on the samples of students who took the rSAT or ACT – resulting in fewer schools, and fewer students in those schools, than in the total population (i.e., all students taking EOCs and the schools these students are in).

Like the student level analyses, we characterize the shifts in between actual and expected subject area percentages and CCRPI Content Mastery scores using RMSD and standardized RMSD. In this case, the RMSD values are standardized using the standard deviation of the subject area percentages or Content Mastery values for the schools appearing the Actual columns of Table 2.3. Note that for these comparisons, the sample sizes are limited to those of the rSAT or ACT (as the additional schools do not have enough students taking the rSAT or ACT).

Table 2.3. *Structure of the CCRPI Content Mastery Component with Median Students Per School And Number of Schools.*

Subject Area	EOC Assessments	Actual		rSAT		ACT	
		Median Students	Number of Schools	Median Students	Number of Schools	Median Students	Number of Schools
ELA	9 <sup>th</sup> Grade Literature American Literature	67	564	76	407	66	362
Mathematics	Analytic Geometry Geometry Coordinate Algebra Algebra I	67	697	65	441	58	356
Science	Biology <sup>1</sup> Physical Sciences <sup>2</sup>	63	731	--	--	62	705
Social Studies	U.S. History <sup>2</sup> Economics <sup>2</sup>	57	448	--	--	--	--
Content Mastery (i.e., composite) <sup>3</sup>		55	469	60	445	56	425

Notes: -- indicates that the results from the actual EOC assessment scores will be used. Median Students refers to the median number of students with scores per school. We apply a filter of  $n > 15$  for the medians and school counts for each subject area. We do so for the median and school counts for the overall Content Mastery score as well, but only *after* aggregating across subject areas. <sup>1</sup>We only link the Biology EOC assessment to the ACT Science Section Score. <sup>2</sup>We did not create concordances for these assessments and therefore use classifications based on actual scores for these students. <sup>3</sup>The Content Mastery scores for the rSAT and ACT are based on expected and actual classifications - expected classifications for assessments that we created concordances for and actual classifications for assessments we did not create concordances for.

## Results

### Student Level

Prior to presenting the results of the linking, we show the correlations between the EOC assessment scores and those from the rSAT and ACT sections. The correlations for the adjusted samples, shown below in Table 2.4 and in detail in Table 2E in [Appendix E](#), range from 0.28 to 0.78 for the within-year samples and 0.34 to 0.78 for the pooled samples. These correlations are lower than those in typical applications of the equipercentile method (for example, the correlations for one concordance of previous versions of the rSAT and ACT ranged from 0.83 to 0.93, see Pommerich et al., 2004, p. 267).

Table 2.4 *Pearson Correlations between the EOC scale scores and rSAT and ACT Section Scores, for the Adjusted Total Samples.*

	Within Year		Pooled	
	ACT	rSAT	ACT	rSAT
9 <sup>th</sup> Grade Literature	0.61	0.59	0.45	0.58
American Literature	0.73	0.78	0.72	0.78
Analytic Geometry	0.58	0.70	0.59	0.71
Geometry	0.46	0.73	0.51	0.73
Coordinate Algebra	0.54	0.67	0.59	0.51
Algebra I	0.28	0.70	0.34	0.62
Biology	0.57	--	0.62	--

Notes: these values are based on the ACT English, Math and Science section scores and the rSAT EBRW and Math section scores.

To quantify the potential error introduced by using expected scores, we next investigate RMSD between the EOC scores students actually received and those produced based on the concordances (after rounding the expected EOC values in the concordances up to the nearest whole number). The RMSD statistics in Table 2.5 summarize the average differences across all students – some students may have differences much larger than the expected values

while others may have differences that are much smaller. In [Appendix H](#), we also compute RMSD statistics for each rSAT or ACT score point.

Table 2.5. *Root Mean Squared Differences and Standardized Root Mean Squared Differences between Actual and Expected EOC Scale Score for the Total Samples.*

	RMSD				Standardized RMSD			
	Within Year		Pooled		Within Year		Pooled	
	ACT	rSAT	ACT	rSAT	ACT	rSAT	ACT	rSAT
9 <sup>th</sup> Grade Literature	41.1	41.3	43.4	37.2	0.81	0.81	0.85	0.73
American Literature	39.4	34.6	37.0	34.6	0.71	0.62	0.67	0.62
Analytic Geometry	39.0	42.9	38.6	39.6	0.66	0.73	0.66	0.67
Geometry	44.6	45.6	45.2	42.7	0.68	0.69	0.69	0.65
Coordinate Algebra	40.3	53.5	46.2	65.6	0.69	0.91	0.79	1.12
Algebra I	45.9	53.5	43.9	44.9	0.73	0.85	0.70	0.71
Biology	61.7	--	59.2	--	0.83	--	0.80	--

Notes: these values are based on the ACT English, Math and Science section scores and the rSAT sEBRW and Math section scores.

These RMSD values show that, on average, the students' expected EOC scores are roughly three fourths to one EOC standard deviation different than what they actually did receive (in comparison to the EOC scale score standard deviations provided in Table 2.1).

Finally, we examine the degree to which student achievement level classifications based on expected EOC scores agree with actual student achievement level classifications. Tables 2.6 and 2.7 below present three percentages – the percent of students whose expected scores place them in a *lower* achievement level than their actual scores, the percent of students whose expected scores places them in the *same* achievement level as their actual scores, and the percent of students whose expected scores places them in a *higher* achievement level than their actual scores.

Table 2.6 *Identifications by Achievement Level – Expected vs. Actual, for the Within-Year Adjusted Total Samples.*

	ACT			rSAT		
	Expected < Actual	Expected = Actual	Expected > Actual	Expected < Actual	Expected = Actual	Expected > Actual
9 <sup>th</sup> Grade Literature	23	49	28	28	54	18
American Literature	24	59	17	21	64	16
Analytic Geometry	22	55	23	29	53	18
Geometry	28	49	23	27	56	17
Coordinate Algebra	24	59	17	28	51	21
Algebra I	24	57	19	28	52	20
Biology	28	50	23	--	--	--

Notes: these values are based on the ACT English, Math and Science section scores and the rSAT EBRW and Math section scores.

Table 2.7 *Identifications by Achievement Level – Expected vs. Actual, for the Pooled Adjusted Total Samples.*

	ACT			rSAT		
	Expected < Actual	Expected = Actual	Expected > Actual	Expected < Actual	Expected = Actual	Expected > Actual
9 <sup>th</sup> Grade Literature	22	51	27	26	58	15
American Literature	24	58	19	23	61	16
Analytic Geometry	22	58	20	24	58	18
Geometry	24	51	25	24	58	18
Coordinate Algebra	22	53	25	47	35	17
Algebra I	25	53	22	24	57	19
Biology	27	51	22	--	--	--

Notes: these values are based on the ACT English, Math and Science section scores and the rSAT EBRW and Math section scores.

The percentages of students who had the same classifications between their actual and predicted values ranged from 49% to 59% for the ACT and 51% to 64% for the rSAT based on the within-year samples and 51% to 58% for the ACT and 35% to 61% for the rSAT based on the pooled samples.

### School Level

Table 2.8 summarizes the differences between the actual and expected scores for the subject area percentages and the overall CCRPI Content Mastery component. [Appendix I](#) provides additional detail on these differences. The RMSD and standardized RMSD values show that when expected EOC scores are substituted for actual EOC scores, a typical school's Content Mastery component is likely to differ by 6.66 points when ACT scores are used and by 7.04 points when rSAT scores are used. When standardized, these differences are 0.31 and 0.30, meaning that the differences are about one third of the standard deviation of the actual Content Mastery Indicator.

Table 2.8. *Differences in CCRPI Mastery Values by Percentiles, based on Actual and Expected EOC Scores from the Pooled Linking, based on all Students who took an EOC assessment and the rSAT or ACT.*

	RMSD		Standardized RMSD	
	ACT	rSAT	ACT	rSAT
ELA	8.85	12.1	0.35	0.47
Mathematics	10.47	12.8	0.31	0.37
Science	6.99	--	0.24	--
Social Studies	--	--	--	--
Content Mastery	6.66	7.04	0.30	0.31

## Section 3

### Summary and Conclusions

This report shows that there are considerable differences between the (i) EOC assessments and the rSAT and ACT in terms of policies and procedures regarding administrations, accommodations and scoring and (ii) EOC assessment scores and classifications students actually received and those based concordances from the rSAT or ACT scores. Key findings that support these conclusions are:

- Of the fifty-one standard accommodations on the EOC assessments for students with disabilities, approximately 60% are listed as allowable on the rSAT and 45% are listed as allowable on the ACT. In addition, five (or 10%) of the standard EOC accommodations were specifically prohibited on the rSAT and four (or 8%) were specifically prohibited on the ACT
- Of the fifteen standard accommodations for the EOC assessments provided for English language learners, 20% are listed as allowable supports on the rSAT and 25% on the ACT. The remaining accommodations are not permitted.
- That approximately half of the students within the available data had their achievement level classifications correctly identified based concordances from the rSAT or ACT scores. At the scale score level, a typical student's EOC assessment score is likely to differ by approximately 35 to 65 scale score points, which translates into standardized differences of 0.60 to 1.12.
- At the school level, the CCRPI Content Mastery component for a typical school is likely to shift by approximately 6 to 7 points, which translates into a standardized difference of 0.30.

Ultimately, these differences suggest that the scores from the EOC assessments investigated and those of the rSAT and ACT should not be treated as comparable and therefore not treated as interchangeable.

Finally, there are two key caveats to our empirical analyses. First, the available data are limited, in terms of the students taking both the EOC assessments and the rSAT and ACT. The available data show that less than a quarter of the students who took an EOC assessment also took the rSAT or ACT during the three years of available data. In addition, the students who do take the rSAT or ACT are not representative of the population of all students taking the EOC assessments. These limited and unrepresentative samples illustrate the differences in when students take the EOC assessments and the rSAT or ACT. The EOC assessments are generally taken by students in earlier grades (e.g., 9, 10, and 11) whereas the rSAT and ACT are generally taken in the later grades (mostly grade 12). These differences posed difficulties to our effort to link the assessments together and also suggest that there are logistical challenges to using the rSAT or ACT results in lieu of the EOC assessment results. That is, Georgia's accountability system is designed to provide annual CCRPI ratings at the school level. Given current administration patterns, this means that districts using the rSAT or ACT scores lieu of the EOC scores would be using scores mostly from grade 12 students, whereas the other districts would be using scores mostly from students in earlier grades. Alternatively, students could take the rSAT or ACT in the same year as they take each course for which there is an EOC assessment. Since students often take courses with EOC assessments in multiple years, this would mean students would take the rSAT or ACT several times during their academic career.

Second, our investigation did not fully examine the potential impact that substituting results from the rSAT or ACT in place of those from the EOC assessments could have on the redesigned College and Career Ready Performance Index (CCRPI). Of the four components that are based on assessment scores – Content Mastery, Progress, Closing Gaps and Readiness – we only investigated the first, the Content Mastery component. It is likely that using the



results from the rSAT or ACT in place of the EOC assessments would result in shifts for the remaining components as well – the Progress, Closing Gaps and Readiness components. Taken together, the considerable differences at the student- and school-levels suggest that overall impact to the CCRPI would be similar to, or even greater than, those identified in this investigation.

## References

- ACT. (2016). *Technical Manual Supplement*. Retrieved from <https://www.act.org/content/dam/act/unsecured/documents/ACT-Technical-Manual-Supplement.pdf>
- Albano, A.D. (2016). equate: An R package for observed-score linking and equating. *Journal of Statistical Software*, 74(8), 1-36. Data Recognition Corp. (2017). *Georgia milestones assessment system: 2016 operational technical report*. Maple Grove, MN: Author.
- Dorans, N. J., & Holland, P. W. (2000). Population invariance and the equatability of tests: Basic theory and the linear case. *Journal of Educational Measurement*, 37, 281-306.
- Georgia Department of Education. (2015). *Assessment guide: Biology*. Atlanta, GA: Author
- Georgia Department of Education. (2017a). *Assessment guide: American Literature and Composition*. Retrieved from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM\\_ALIT\\_AG\\_10-26.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_ALIT_AG_10-26.pdf)
- Georgia Department of Education. (2017b). *Assessment guide: Analytic Geometry*. Retrieved from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM\\_AGEO\\_AG\\_20161207.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_AGEO_AG_20161207.pdf)
- Georgia Department of Education. (2017c). *Assessment guide: Algebra I*. Retrieved from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM\\_CALG\\_AG\\_20161207.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_CALG_AG_20161207.pdf)
- Georgia Department of Education. (2017d). *Assessment guide: Coordinate Algebra*. Retrieved from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM\\_CALG\\_AG\\_20161207.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_CALG_AG_20161207.pdf)
- Georgia Department of Education. (2017e). *Assessment guide: Ninth grade literature and composition*. Retrieved from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM\\_9LIT\\_AG\\_11-21-16.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_9LIT_AG_11-21-16.pdf)
- Georgia Department of Education. (2017f). *Assessment guide: Geometry*. Retrieved from [http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM\\_GEOM\\_AG\\_20161207.pdf](http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_AG_20161207.pdf)
- Kolen, M. J., & Brennan, R. L. (2014). *Test equating, scaling, and linking. Methods and practices* (Third Edition). New York, NY: Springer.
- Martineau, J., Domaleski, C., Egan, K., Patelis, T., & Dadey, N. (2015, November). Recommendations for addressing the impact of test administration interruptions and irregularities. Washington, DC: Council of Chief State School Officers (CCSSO). Available online: [http://www.ccsso.org/Resources/Publications/Recommendations\\_for\\_Addressing\\_the\\_Impact\\_of\\_Test\\_Administration\\_Interruptions\\_and\\_Irregularities.html](http://www.ccsso.org/Resources/Publications/Recommendations_for_Addressing_the_Impact_of_Test_Administration_Interruptions_and_Irregularities.html)
- Pommerich, M., Hanson, B. A., Harris, D. J., & Sconing, J. A. (2004). Issues in conducting linkages between distinct tests. *Applied Psychological Measurement*, 28(4), 247-273.

Wright, B. D. & Masters, G. N. (1982). *Rating scale analysis*. Chicago: MESA Press.

## Appendix A: Source Documents for Audit of Administration, Accommodations, and Scoring

Code	Reference
A	Georgia Department of Education. (2017). <i>Georgia Milestones Assessment System: Spring, Summer, and Fall Mid-Month 2017 Online Examiner's Manual - End of Course</i> . Atlanta, GA: Author
B	ACT, Inc. (2017). <i>The ACT Test Administration Manual: State and District Testing - Standard Time, Paper Testing</i> . Iowa City: Author.
C	The College Board. (n.d.). <i>Compare the SAT to the ACT</i> (web page). NY, NY: Author. ( <a href="https://collegereadiness.collegeboard.org/sat/inside-the-test/compare-new-sat-act">https://collegereadiness.collegeboard.org/sat/inside-the-test/compare-new-sat-act</a> )
D	Georgia Department of Education. (2017). <i>Georgia Milestones Assessment System: Assessment Guide - American Literature and Composition</i> . Atlanta, GA: Author
E	Georgia Department of Education. (2017). <i>Georgia Milestones Assessment System: Assessment Guide - Analytic Geometry</i> . Atlanta, GA: Author
F	The College Board. (2015). <i>Test Specifications for the Redesigned SAT</i> . NY, NY: Author.
G	ACT, Inc. (2016). <i>The ACT Technical Manual Supplement</i> . Iowa City, IA: Author
H	Georgia Department of Education. (n.d.). <i>Allowable Accommodations for English Learners</i> . Atlanta, GA: Author.
I	Georgia Department of Education. (n.d.). <i>Allowable Accommodations for Students with Disabilities</i> . Atlanta, GA: Author.
J	The College Board. (2017). <i>Accommodations on College Board Exams - Extended Time</i> (web page). NY, NY: Author. ( <a href="https://www.collegeboard.org/students-with-disabilities/typical-accommodations/time">https://www.collegeboard.org/students-with-disabilities/typical-accommodations/time</a> )
K	The College Board. (2017). <i>Accommodations on College Board Exams - Other Accommodations</i> (web page). NY, NY: Author. ( <a href="https://www.collegeboard.org/students-with-disabilities/typical-accommodations/other">https://www.collegeboard.org/students-with-disabilities/typical-accommodations/other</a> )
L	The College Board. (2017). <i>Accommodations Request Approval Process</i> (web page). NY, NY: Author. ( <a href="https://www.collegeboard.org/students-with-disabilities/request-accommodations/approval-overview">https://www.collegeboard.org/students-with-disabilities/request-accommodations/approval-overview</a> )
M	The College Board. (2017). <i>Eligibility for Accommodations on College Board Exams</i> (web page). NY, NY: Author. ( <a href="https://www.collegeboard.org/students-with-disabilities/eligibility">https://www.collegeboard.org/students-with-disabilities/eligibility</a> )
N	The College Board. (2017). <i>Providing Documentation for Accommodations Requests</i> (web page). NY, NY: Author. ( <a href="https://www.collegeboard.org/students-with-disabilities/documentation-guidelines">https://www.collegeboard.org/students-with-disabilities/documentation-guidelines</a> )
O	Michigan Department of Education. (2017). <i>M-STEP, MI-Access, SAT, ACT WorkKeys and WIDA Student Supports and Accommodations Table</i> . Lansing, MI: Author.
P	ACT, Inc. (2015). <i>Accommodations on the ACT Test - ACT State and District Testing</i> . Iowa City, IA: Author.
Q	ACT, Inc. (2017). <i>English Learner Supports Guide</i> . Iowa City, IA: Author.
R	The College Board. (2017). <i>The SAT School Day SSD Coordinator Manual - Michigan</i> . NY, NY: Author.
S	The College Board. (2017). <i>The SAT School Day Supervisor Manual - Michigan</i> . NY, NY: Author.
T	The College Board. (2017). <i>The SAT School Day Testing Room Manual - Michigan</i> . NY, NY: Author.
U	Georgia Department of Education. (2016). <i>Georgia Milestones Assessment System: 2016-2017 School and System Test Coordinator's Manual - End of Course/End-of-Grade Spring, Summer, and Fall 2017</i> . Atlanta, GA: Author.
V	ACT, Inc. (2014). <i>The ACT Technical Manual</i> . Iowa City, IA: Author.
W	ACT, Inc. (2017). <i>Test Coordinator Information: State and District Testing - Paper Testing</i> . Iowa City, IA: Author.
X	ACT, Inc. (2009). <i>The ACT Writing Test Technical Report</i> . Iowa City, IA: Author.
Y	ACT, Inc. (n.d.). <i>The ACT Writing Test Scoring Rubric</i> . Iowa City, IA: Author.
Z	The College Board Assessment Division. (2016). <i>SAT Technical Manual: Characteristics of the SAT</i> . NY, NY: The College Board.
AA	The College Board. (2017). <i>SAT Essay Scores</i> (web page). NY, NY: Author. ( <a href="https://collegereadiness.collegeboard.org/sat/scores/understanding-scores/essay">https://collegereadiness.collegeboard.org/sat/scores/understanding-scores/essay</a> )
AB	The College Board. (n.d.). <i>Essay Prompts and Sample Student Essays</i> (web page). NY, NY: Author. ( <a href="https://collegereadiness.collegeboard.org/sample-questions/essay">https://collegereadiness.collegeboard.org/sample-questions/essay</a> )
AC	The College Board. (n.d.). <i>Essay Sample 1 Bogard</i> (web page). NY, NY: Author. ( <a href="https://collegereadiness.collegeboard.org/sample-questions/essay/1">https://collegereadiness.collegeboard.org/sample-questions/essay/1</a> )
AD	Georgia Department of Education. (2017). <i>Georgia Student Assessment Program Student Assessment Handbook 2017-2018</i> . Atlanta, GA: Author.
AE	The College Board Assessment Division. (2016). <i>SAT Technical Manual: Characteristics of the SAT --Appendices</i> . NY, NY: The College Board.
AF	Georgia Department of Education. (2017). <i>Georgia Milestones Assessment System: Spring, Summer, and Fall Mid-Month 2017 Paper and Pencil Examiner's Manual - End of Course</i> . Atlanta, GA: Author
AG	Georgia Department of Education (2017). <i>Georgia TAC Slide Deck – June 2017</i> . Atlanta, GA: Author.
AH	Georgia Department of Education (2016). <i>Georgia Milestones EOC Handscoring Final Quality Management Report</i> . Atlanta, GA: Author.
AI	Georgia Department of Education (2016). <i>Georgia Milestones Spring 2016 Performance Scoring Plan</i> . Atlanta, GA: Author.
AJ	Georgia Department of Education (2016). <i>Georgia Milestones Rangefinding Summary</i> . Atlanta, GA: Author.
AK	Georgia Department of Education (2017). <i>Sample Georgia Milestones EOC Individual Student Report</i> . Atlanta, GA: Author.

## Appendix B: Detailed Item Completion Rates for the End of Course Assessments

Table B.1 *Algebra I End-of-Test Item Completion Rates.*

Form	Minimum Response Rate of Last 5 Items		Response Rate of Last Item	
	Calculator	Non-Calculator	Calculator	Non-Calculator
2015 Winter Form A	99%	94%	99%	94%
2015 Winter Form B	99%	97%	99%	97%
2016 Winter Form A	99%	99%	99%	100%
2016 Winter Form B	99%	99%	99%	100%
2016 Spring Form A	99%	98%	99%	98%
2016 Spring Form B	99%	97%	99%	97%
2017 Spring Form A	99%	99%	99%	100%
2017 Spring Form B	99%	99%	99%	100%
Average across forms	99%	98%	99%	98%

Table B.2 *Geometry End-of-Test Item Completion Rates.*

Form	Minimum Response Rate of Last 5 Items		Response Rate of Last Item	
	Calculator	Non-Calculator	Calculator	Non-Calculator
2016 Winter Form A	99%	99%	99%	100%
2016 Winter Form B	100%	99%	100%	100%
2016 Spring Form A	99%	99%	99%	99%
2016 Spring Form B	99%	99%	99%	100%
2017 Spring Form A	100%	99%	100%	100%
2017 Spring Form B	100%	99%	100%	100%
Average across forms	100%	99%	100%	100%

Table B.3 *Coordinate Algebra End-of-Test Item Completion Rates.*

Form	Minimum Response Rate of Last 5 Items		Response Rate of Last Item	
	Calculator	Non-Calculator	Calculator	Non-Calculator
2015 Winter Form A	99%	98%	99%	99%
2015 Winter Form B	99%	98%	99%	99%
2016 Winter Form A	98%	99%	98%	99%
2016 Winter Form B	98%	98%	98%	99%
2016 Spring Form A	99%	98%	99%	99%
2016 Spring Form B	99%	98%	99%	99%
2017 Spring Form A	99%	99%	99%	99%
2017 Spring Form B	99%	99%	99%	99%
Average across forms	99%	98%	99%	99%

Table B.4 *Analytic Geometry-of-Test Item Completion Rates.*

Form	Minimum Response Rate of Last 5 Items		Response Rate of Last Item	
	Calculator	Non-Calculator	Calculator	Non-Calculator
2015 Winter Form A	99%	99%	99%	99%
2015 Winter Form B	99%	99%	99%	99%
2016 Winter Form A	99%	99%	99%	100%
2016 Winter Form B	99%	98%	99%	100%
2016 Spring Form A	99%	99%	99%	99%
2016 Spring Form B	99%	99%	99%	99%
2017 Spring Form A	99%	99%	99%	99%
2017 Spring Form B	99%	99%	99%	99%
Average across forms	99%	99%	99%	99%

Table B.5 *9th Grade Literature and Composition End-of-Test Item Completion Rates.*

Form	Minimum Response Rate of Last 5 Items		Response Rate of Last Item	
	Reading & Vocabulary	Writing & Language	Reading & Vocabulary	Writing & Language
2015 Winter Form A	98%	94%	98%	97%
2015 Winter Form B	98%	94%	98%	98%
2016 Winter Form A	98%	96%	98%	98%
2016 Winter Form B	99%	96%	99%	98%
2016 Spring Form A	98%	94%	98%	97%
2016 Spring Form B	98%	94%	98%	98%
2017 Spring Form A	99%	96%	99%	99%
2017 Spring Form B	100%	94%	100%	99%
Average across forms	99%	95%	99%	98%

Table B.6 *American Literature and Composition End-of-Test Item Completion Rates.*

Form	Minimum Response Rate of Last 5 Items		Response Rate of Last Item	
	Reading & Vocabulary	Writing & Language	Reading & Vocabulary	Writing & Language
2015 Winter Form A	98%	91%	98%	98%
2015 Winter Form B	98%	98%	98%	98%
2016 Winter Form A	98%	92%	98%	99%
2016 Winter Form B	98%	92%	98%	98%
2016 Spring Form A	98%	93%	98%	98%
2016 Spring Form B	98%	93%	98%	98%
2017 Spring Form A	100%	95%	100%	99%
2017 Spring Form B	100%	94%	100%	100%
Average across forms	99%	94%	99%	99%

## Appendix C: Supplemental Descriptive Statistics

Table 1C. *Unconditional Sample Sizes for EOC, rSAT and ACT Assessments.*

<b>End of Course Assessments</b>	<b>2014- 2015</b>	<b>2015- 2016</b>	<b>2016- 2017</b>	<b>Total</b>
9th Grade Literature (9th)	129,364	132,007	135,732	388,495
American Literature (AME)	108,144	111,688	118,193	336,765
Analytic Geometry (AGE)	120,075	94,406	25,141	237,938
Geometry (GEO)	0	35,998	98,975	134,727
Coordinate Algebra (Cal)	148,238	43,258	29,001	201,790
Algebra I (Alg)	0	101,448	85,950	175,512
Biology	125,148	126,095	125,048	373,574
<b>NR-HS Assessments<sup>1</sup></b>	<b>2014- 2015</b>	<b>2015- 2016</b>	<b>2016- 2017</b>	<b>Total</b>
ACT (English, Reading Math & Science)	51,646	58,245	42,532	137,167
ACT ELA	23	29,452	13,798	43,265
SAT (EBRW & Math)	0	5,497	80,183	85,021

Notes: Students who have more than one assessment score are only counted once within each academic year. Similarly, the total columns only count students once, even if they have multiple years of test data. <sup>1</sup>Additionally, the data was provided in merged format, in which students that did not have an EOC score (for all possible EOC assessments) were dropped. Thus the National Recognized High School (NR-HS) assessments counts may not capture all students taking the rSAT or ACT in Georgia.

The rSAT sample sizes for the 2016-2017 academic year are much larger than those for the preceding years, as well as all the ACT sample sizes. The rSAT was introduced during the 2015-2016 school year, thus limiting the sample sizes in the prior years. In addition, it is unclear whether the rSAT is taken more often by Georgia students, or if the data files provided by ACT are somehow restricted in ways that the data files provided by the rSAT are not (e.g., restricted to the most recent score for students within the graduating the cohort).

Students tend to take the EOC assessments earlier in their high school career and the rSAT or ACT later on. To show this, we have recreated Table 1C, but instead of counting the number of students, we take the mean grade-level of the students captured within each cell. The average grade-levels range from 8.91 to 10.91 for the EOC assessments across the samples of students in each year and in the combined sample, whereas for the 2016-2017 sample (the only year for which we have grade-level for the rSAT and ACT assessments) the average grade-level is 11.43 for the rSAT and 11.99 for the ACT.

Table 2C. Mean Grade Level for the Unconditional EOC, rSAT and ACT Assessment Samples.

<b>End of Course Assessments</b>	<b>2014- 2015</b>	<b>2015- 2016</b>	<b>2016- 2017</b>	<b>Total</b>
9th Grade Literature	9.03	9.04	9.04	9.04
American Literature	10.88	10.91	10.91	10.90
Analytic Geometry	9.95	9.96	9.99	9.96
Geometry	--	9.92	9.89	9.90
Coordinate Algebra	8.96	9.07	9.06	9.03
Algebra I	--	8.91	8.91	8.93
Biology	9.36	9.38	9.41	9.38
<b>NR-HS Assessments</b>	<b>2014- 2015</b>	<b>2015- 2016</b>	<b>2016- 2017</b>	<b>Total</b>
ACT (English, Reading Math & Science)	11.81	11.98	11.99	11.92
ACT ELA	--	11.99	11.99	11.99
SAT (EBRW & Math)	--	11.76	11.43	11.44

Notes: the above medians include the grade-levels of students who have taken the rSAT or ACT more than once (e.g., if a student took the ACT in 2015-2016 in grade 11, and then again in 2016-2017 in grade 12, both grades are included in the calculations for each year). The within year concordances between each assessment are created using the same logic, whereas the total data uses a student's maximum rSAT or ACT score if he or she took the assessment more than once.



## Appendix D: Differences between Samples and Populations

The subset of students who do take both an EOC and the rSAT or ACT in the same year do differ from the full population of students taking the EOC assessments, in terms of background characteristics and EOC scores. Although these trends are not consistent across all EOC assessments, some groups of EOC assessments do display certain trends, as shown in Table 1D. Based on the combined sample of students, we find that

- For the 9<sup>th</sup> Grade Literature, Analytic Geometry, Geometry and Coordinate Algebra EOC assessments, the group of students who also took the corresponding ACT subject assessment were, in terms of percentages, less-white (the differences ranged from 10 to 30 percentage points, relative to the EOC Only group) and more economically disadvantaged (differences ranged from 4 to 17 percentage points). In addition, the group also had lower average EOC scores, with differences ranging from about 8 to 28 points.
- Across all of the EOC assessments, students who also took the corresponding rSAT subject assessment had higher average EOC scores, with differences ranging from 9 to 45 points. Similarly, on the American Literature EOC, those students who also took the corresponding ACT assessment had higher average EOC scores, with a difference of 48 points (for the ACT English and Reading Sections).

The patterns presented in Table 1D suggest that there are distinct groups of students who take both an EOC assessment and the rSAT or ACT, and that these groups differ from the population of students who take just an EOC assessment. These differences may be problematic, as the intended purpose of this work is to establish a link that can be used for the entire population of EOC test takers (i.e., the text of SB 211 implies that the ACT or rSAT may be substituted for an EOC in the future).

To mitigate this issue, we use stratified random sampling to draw new samples of students from those who took both tests. The stratification is based on the students' EOC scores – essentially we are using sampling to make a new sample of doubling testing students whose EOC score distribution looks like the overall population. To do so, we first divide the empirical range of each EOC score scale into 80 equal intervals, resulting in bins of approximately 15 scale score points.

We then determine the probability of being in each bin based on the EOC scores for all of the students taking the EOC assessment in question via kernel density estimation. Finally, we then draw a stratified random sample, with replacement, from the set of students who took both the EOC and the rSAT or ACT, where the strata are the bins and the probabilities of selection are those previously computed based on the total sample. We found empirically that a sample of approximately 45% of the students who double tested resulted in EOC assessment score distributions that well approximated that of the total population of students taking the EOC assessments – for samples that have around 100 or more students to start. We conduct these adjustments for the samples within each academic year, separately for the rSAT and ACT assessments<sup>18</sup>.

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<sup>18</sup> Note: For the ACT we only adjust the sample of students who had Reading/English scores. Those students who have ELA scores are a much smaller subsection of students and we therefore do not link the EOC assessment scales to the ACT ELA section scale score.

Table 1D. *Characteristics of Students Who Took Only an EOC Compared to Those Students Who Took Both an EOC and the rSAT or ACT, for the Within-Year Total Sample.*

Students who Took	Sample Size	% Non-White	% Female	% Economically Disadvantaged	% Students with Disabilities	%LEP	Mean EOC Score
<b>9th Grade Literature</b>							
EOC Only	388495	58%	49%	60%	10%	4%	517
EOC & ACT E/R	551	28%	-5%	17%	-4%	15%	-13
ACT ELA	155	29%	-2%	23%	0%	14%	-11
rSAT EBRW	857	4%	0%	-7%	-7%	9%	27
<b>American Literature</b>							
EOC Only	336765	56%	51%	55%	8%	2%	516
EOC & ACT E/R	19914	-13%	3%	-20%	-5%	0%	32
ACT ELA	6870	-13%	4%	-22%	-6%	0%	48
rSAT EBRW	31189	-6%	5%	-19%	-6%	-1%	38
<b>Analytic Geometry</b>							
EOC Only	237938	58%	50%	57%	9%	3%	512
EOC & ACT Math	1227	10%	1%	4%	-1%	0%	-8
SAT Math	924	-5%	8%	-15%	-5%	0%	25
<b>Geometry</b>							
EOC Only	134727	56%	50%	56%	8%	3%	525
EOC & ACT Math	282	24%	-5%	18%	0%	-1%	-29
SAT Math	2779	-14%	10%	-17%	-5%	-1%	33
<b>Coordinate Algebra</b>							
EOC Only	201790	59%	49%	59%	9%	4%	506
EOC & ACT Math	293	30%	7%	19%	-3%	-2%	-20
SAT Math	224	15%	2%	-1%	-5%	0%	14
<b>Algebra I</b>							
EOC Only	175512	57%	49%	57%	9%	4%	516
EOC & ACT Math	144	31%	-5%	19%	4%	-2%	-20
SAT Math	388	9%	2%	-6%	-5%	-1%	30
<b>Biology</b>							
EOC	373574	58%	50%	58%	9%	3%	518
EOC & ACT Science	1742	13%	3%	5%	-3%	1%	3

Note: the EOC & rSAT or ACT Rows are Differences from the EOC Only Row (EOC & rSAT or ACT – EOC Only). Also note that the EOC Only row summarizes all students taking the EOC and is thus the target we are trying to adjust the groups of students who are taking the EOC and the rACT or rSAT to.

Table 2D is essentially a revised version of Table 1D, based on the stratified random samples for the within-in year data. Table 3D presents the same results for the pooled data. Generally, the mean EOC values of the re-sampled set of students do not differ greatly from the population of all students taking the EOC assessments, with a few exceptions. These exceptions stem from either distributions that are very different (in the case of the rSAT EBRW samples) or small sample sizes (in the case of some of the cells for the mathematics assessments). In addition, the stratified random sample did reduce some of the differences on the other variables, but sizeable differences did remain.

Table 2D. *Characteristics of Students Who Took an EOC Compared to Those Students Who Took Both an EOC and the rSAT or ACT, for the Within-Year Total Sample, Adjusted via Stratified Random Sampling.*

Students who Took	Sample Size	% Non-White	% Female	% Economically Disadvantaged	% Students with Disabilities	%LEP	Mean EOC Score
<b>9th Grade Literature</b>							
EOC Only	388495	58%	49%	60%	10%	4%	517
EOC & ACT E/R	245	27%	-5%	16%	-6%	12%	-2
ACT ELA	64	33%	-3%	25%	-2%	12%	1
rSAT EBRW	415	11%	-4%	-3%	-5%	13%	10
<b>American Literature</b>							
EOC Only	336765	56%	51%	55%	8%	2%	516
EOC & ACT E/R	9211	-6%	1%	-11%	-3%	1%	5
ACT ELA	2917	-6%	3%	-12%	-4%	1%	20
rSAT EBRW	13926	1%	4%	-11%	-4%	0%	14
<b>Analytic Geometry</b>							
EOC Only	237938	58%	50%	57%	9%	3%	512
EOC & ACT Math	582	10%	-1%	4%	0%	-1%	-5
SAT Math	428	3%	9%	-7%	-4%	0%	2
<b>Geometry</b>							
EOC Only	134727	56%	50%	56%	8%	3%	525
EOC & ACT Math	118	17%	-10%	11%	-1%	-2%	-22
SAT Math	1323	-6%	9%	-10%	-4%	-1%	3
<b>Coordinate Algebra</b>							
EOC Only	201790	59%	49%	59%	9%	4%	506
EOC & ACT Math	104	27%	13%	16%	-4%	-2%	-15
SAT Math	100	17%	-6%	1%	-3%	-1%	4
<b>Algebra I</b>							
EOC Only	175512	57%	49%	57%	9%	4%	516
EOC & ACT Math	51	31%	-4%	23%	4%	-2%	-19
SAT Math	189	17%	5%	2%	-4%	-2%	9
<b>Biology</b>							
EOC	373574	58%	50%	58%	9%	3%	518
EOC & ACT Science	859	15%	2%	7%	-3%	1%	0

Note: the EOC & rSAT or ACT Rows are Differences from the EOC Only Row (EOC & rSAT or ACT – EOC Only). Also note that the EOC Only row summarizes all students taking the EOC and is thus the target we are trying to adjust the groups of students who are taking the EOC and the rACT or rSAT to.

Table 3D. *Characteristics of Students Who Took an EOC Compared to Those Students Who Took Both an EOC and the rSAT or ACT, for the Pooled Total Sample, Adjusted via Stratified Random Sampling.*

Students who Took	Sample Size	% Non-White	% Female	% Economically Disadvantaged	% Students with Disabilities	%LEP	Mean EOC Score
<b>9th Grade Literature</b>							
EOC Only	388495	58%	49%	60%	10%	4%	517
EOC & ACT E/R	771	22%	0%	9%	-4%	14%	-5
ACT ELA	307	22%	2%	10%	-5%	19%	-1
rSAT EBRW	17239	-4%	5%	-16%	-6%	0%	4
<b>American Literature</b>							
EOC Only	336765	56%	51%	55%	8%	2%	516
EOC & ACT E/R	42683	2%	4%	-6%	-3%	-1%	1
ACT ELA	17898	1%	5%	-8%	-4%	-1%	10
rSAT EBRW	35942	4%	5%	-5%	-4%	0%	8
<b>Analytic Geometry</b>							
EOC Only	237938	58%	50%	57%	9%	3%	512
EOC & ACT Math	19725	0%	7%	-7%	-3%	-1%	-2
SAT Math	29735	3%	8%	-6%	-4%	-1%	2
<b>Geometry</b>							
EOC Only	134727	56%	50%	56%	8%	3%	525
EOC & ACT Math	296	13%	-4%	6%	-2%	0%	-14
SAT Math	5639	-4%	8%	-12%	-4%	-1%	9
<b>Coordinate Algebra</b>							
EOC Only	201790	59%	49%	59%	9%	4%	506
EOC & ACT Math	820	19%	5%	9%	-2%	2%	-6
SAT Math	18445	-6%	8%	-18%	-6%	-2%	1
<b>Algebra I</b>							
EOC Only	175512	57%	49%	57%	9%	4%	516
EOC & ACT Math	107	20%	4%	19%	-1%	-3%	-16
SAT Math	1270	-8%	12%	-11%	-6%	-1%	8
<b>Biology</b>							
EOC Only	373574	58%	50%	58%	9%	3%	518
EOC & ACT Science	6567	1%	6%	2%	-4%	-1%	-3

Note: the EOC & rSAT or ACT Rows are Differences from the EOC Only Row (EOC & rSAT or ACT – EOC Only). Also note that the EOC Only row summarizes all students taking the EOC and is thus the target we are trying to adjust the groups of students who are taking the EOC and the rACT or rSAT to.

## Appendix E: Relationships between EOC Assessments

This appendix describes the patterns of associations between the EOC assessments and the rSAT and ACT. First, it presents the correlations between the assessments for both the within and pooled samples. Next, these correlations are shown graphically. Table 1E shows that the correlations do fluctuate across academic years. These shifts are most pronounced for the mathematics assessments - potentially due to shifts in the populations of test takers. Figures 1E to 6E provide scatterplots that correspond to Table 1E, with Loess lines capturing the empirical relationships between each pair of assessments. The trends are usually linear within the middle of the scale ranges, but depart from linearity in the extremes.

Table 1E. *Pearson Correlations for those students who took both the EOC and the rSAT or ACT in the Same Academic Year and Pooled Across Academic Years (Unadjusted Samples).*

Number of Students who Took	Within Year				Pooled			
	2014- 2015	2015- 2016	2016- 2017	Total	2014- 2015	2015- 2016	2016- 2017	Total
<b>9th Grade Literature</b>								
EOC & ACT English	0.57	0.52	0.47	0.53	0.57	0.56	0.45	0.55
ACT Reading	0.48	0.46	0.45	0.46	0.50	0.50	0.42	0.49
ACT ELA	--	0.65	0.59	0.62	0.61	0.69	0.53	0.62
rSAT EBRW	--	0.75	0.66	0.66	0.68	0.71	0.65	0.67
<b>American Literature</b>								
EOC & ACT English	0.73	0.79	0.72	0.75	0.73	0.78	0.72	0.75
ACT Reading	0.70	0.73	0.68	0.71	0.68	0.73	0.68	0.70
ACT ELA	-0.01	0.80	0.76	0.80	0.73	0.80	0.76	0.76
rSAT EBRW	--	0.78	0.78	0.79	0.76	0.79	0.78	0.79
<b>Analytic Geometry</b>								
EOC & ACT Math	0.76	0.64	0.54	0.73	0.77	0.62	0.53	0.77
SAT Math	--	0.42	0.74	0.74	0.80	0.79	0.73	0.78
<b>Geometry</b>								
EOC & ACT Math	--	0.75	0.46	0.60	--	0.66	0.51	0.62
SAT Math	--	0.40	0.76	0.76	--	0.80	0.76	0.78
<b>Coordinate Algebra</b>								
EOC & ACT Math	0.57	0.61	0.69	0.61	0.50	0.53	0.68	0.51
SAT Math	--	0.36	0.69	0.69	0.36	0.79	0.69	0.39
<b>Algebra I</b>								
EOC & ACT Math	--	0.65	0.50	0.56	--	0.57	0.51	0.54
SAT Math	--	0.46	0.72	0.72	--	0.75	0.71	0.74
<b>Biology</b>								
EOC & ACT Science	0.67	0.71	0.64	0.68	0.68	0.68	0.66	0.68

Note: Sample sizes for the correlations are provided in Table 2.2. Correlations based on sample sizes of less than 1,000 students (one rule of thumb for linking sample sizes) are highlighted in grey.

Table 2E. *Pearson Correlations for those students who took both the EOC and the rSAT or ACT in the Same Academic Year and Pooled Across Academic Years (Adjusted Samples).*

Number of Students who Took	Within Year				Pooled			
	2014- 2015	2015- 2016	2016- 2017	Total	2014- 2015	2015- 2016	2016- 2017	Total
<b>9th Grade Literature</b>								
EOC & ACT English	0.69	0.56	0.61	0.61	0.61	0.65	0.45	0.45
ACT Reading	0.48	0.55	0.55	0.55	0.56	0.60	0.37	0.37
ACT ELA	--	0.70	0.54	0.54	0.62	0.80	0.47	0.47
rSAT EBRW	--	0.87	0.59	0.59	0.64	0.71	0.58	0.58
<b>American Literature</b>								
EOC & ACT English	0.69	0.78	0.73	0.73	0.72	0.78	0.72	0.72
ACT Reading	0.66	0.71	0.67	0.67	0.67	0.73	0.68	0.68
ACT ELA	0.07	0.80	0.75	0.75	0.73	0.82	0.78	0.78
rSAT EBRW	--	0.78	0.78	0.78	0.76	0.81	0.78	0.78
<b>Analytic Geometry</b>								
EOC & ACT Math	0.74	0.68	0.58	0.58	0.78	0.67	0.59	0.59
SAT Math	--	0.58	0.70	0.70	0.76	0.78	0.71	0.71
<b>Geometry</b>								
EOC & ACT Math	--	0.72	0.46	0.46	--	0.71	0.51	0.51
SAT Math	--	--	0.73	0.73	--	0.81	0.73	0.73
<b>Coordinate Algebra</b>								
EOC & ACT Math	0.57	0.46	0.54	0.54	0.57	0.52	0.59	0.59
SAT Math	--	0.48	0.67	0.67	0.24	0.79	0.51	0.51
<b>Algebra I</b>								
EOC & ACT Math	--	0.44	0.28	0.28	--	0.46	0.34	0.34
SAT Math	--	--	0.70	0.70	--	0.74	0.62	0.62
<b>Biology</b>								
EOC & ACT Science	0.68	0.66	0.57	0.57	0.68	0.67	0.62	0.62

Figure 1E. Scatter Plots for 9<sup>th</sup> Grade Literature EOC Assessment and ACT and rSAT Scores (Unadjusted Samples).

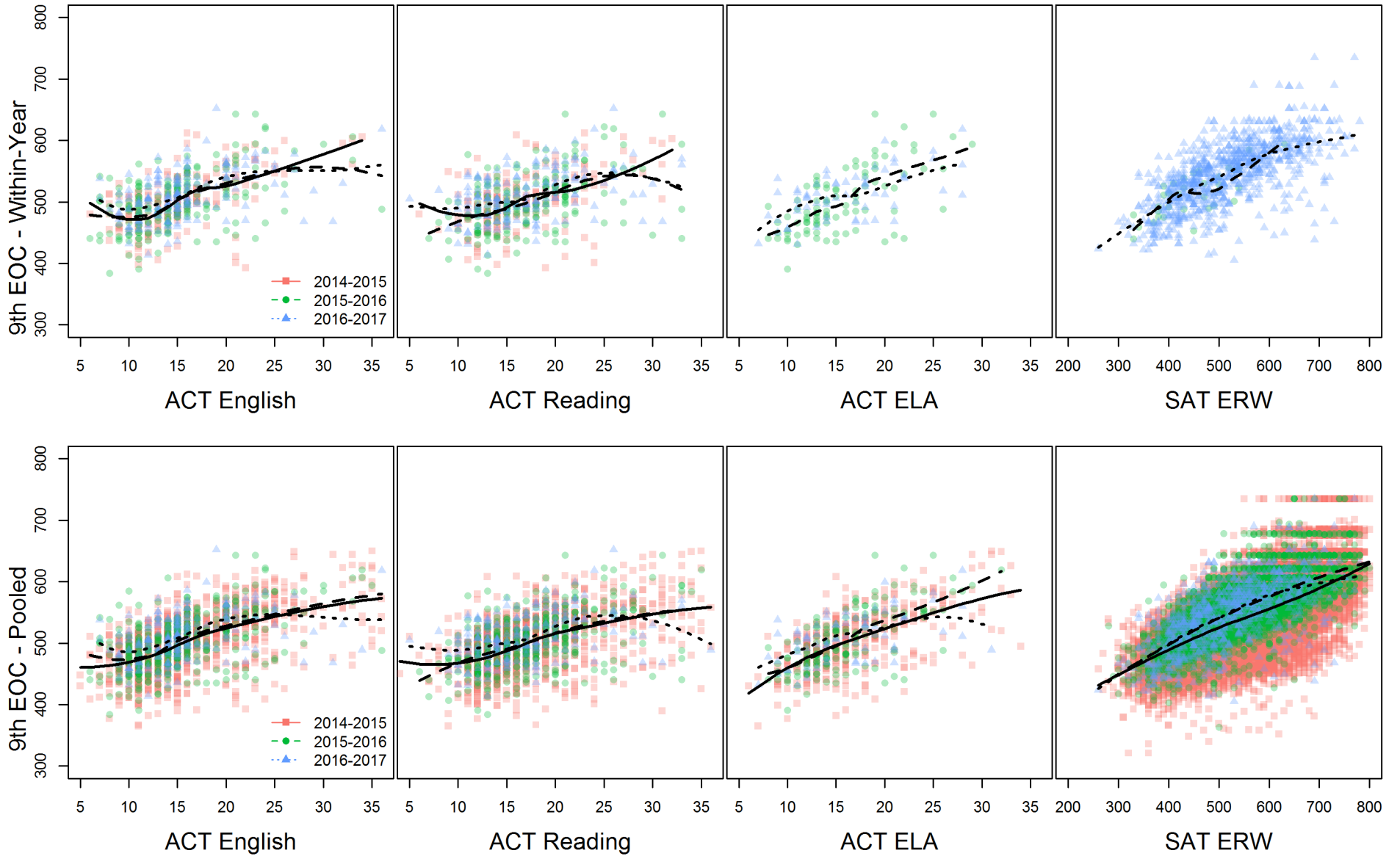


Figure 2E. *Scatter Plots for American Literature EOC Assessment and ACT and rSAT Scores (Unadjusted Samples).*

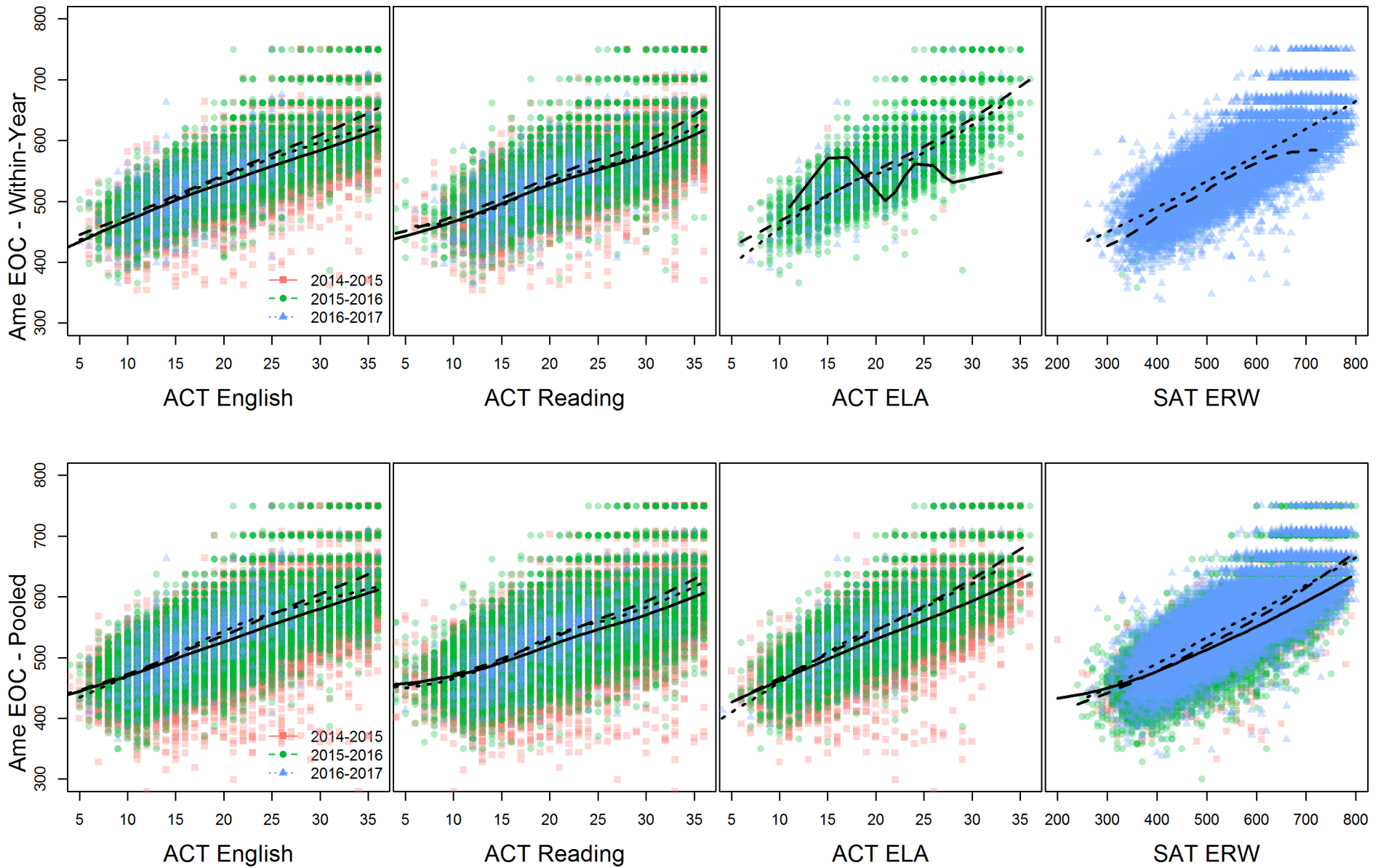




Figure 3E. *Scatter Plots for Analytic Geometry Assessment and ACT and rSAT Scores (Unadjusted Samples).*

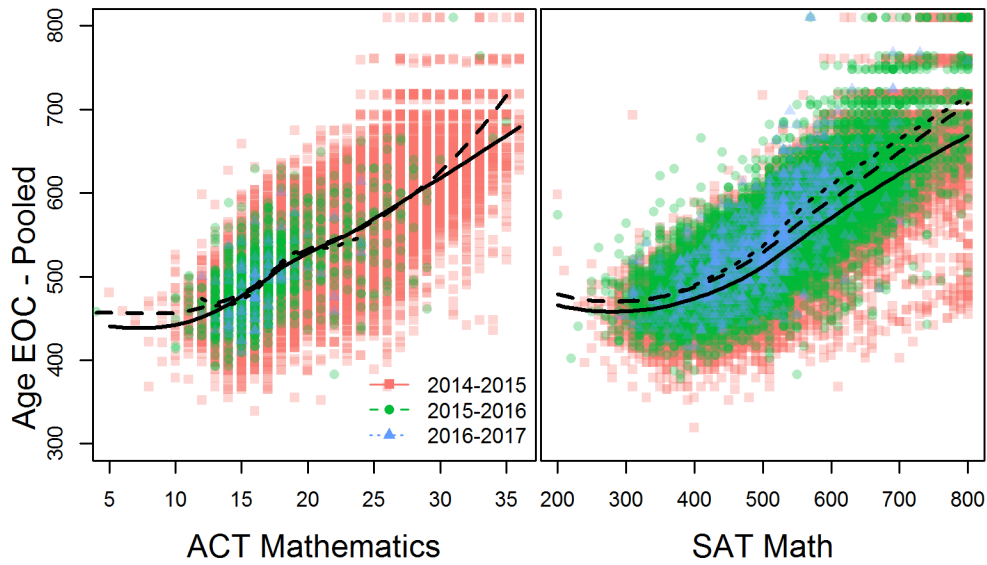
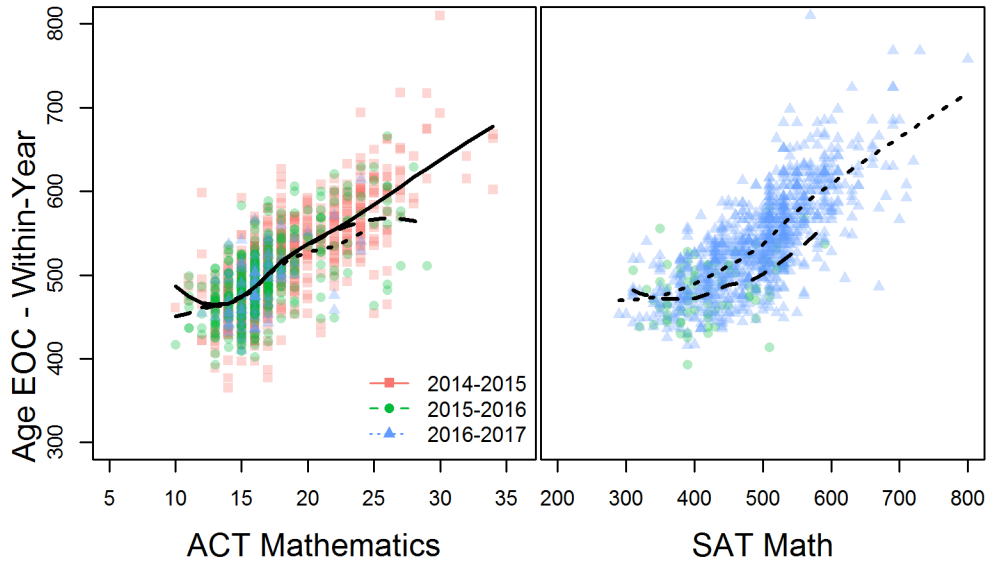


Figure 4E. *Scatter Plots for Geometry EOC Assessment and ACT and rSAT Scores (Unadjusted Samples).*

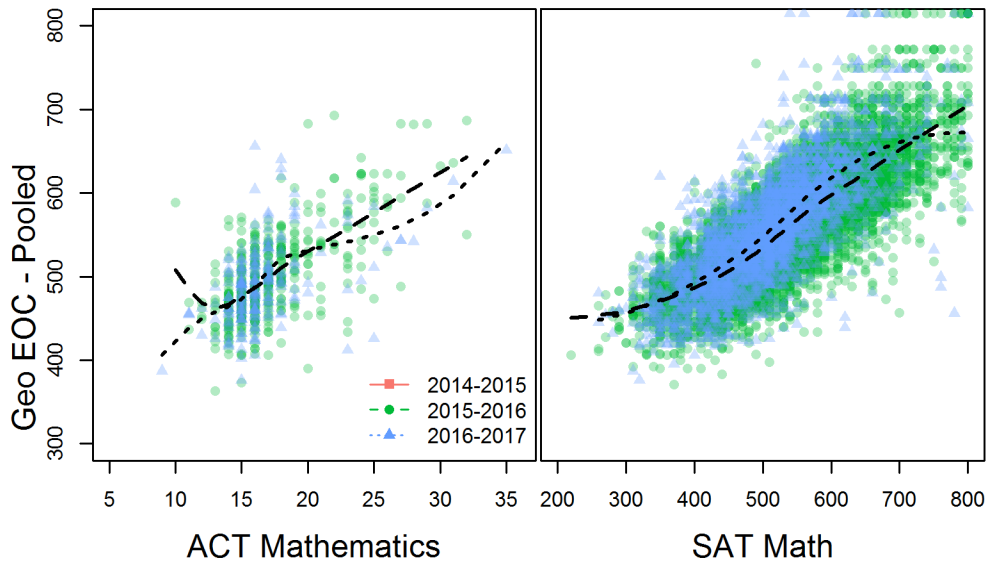
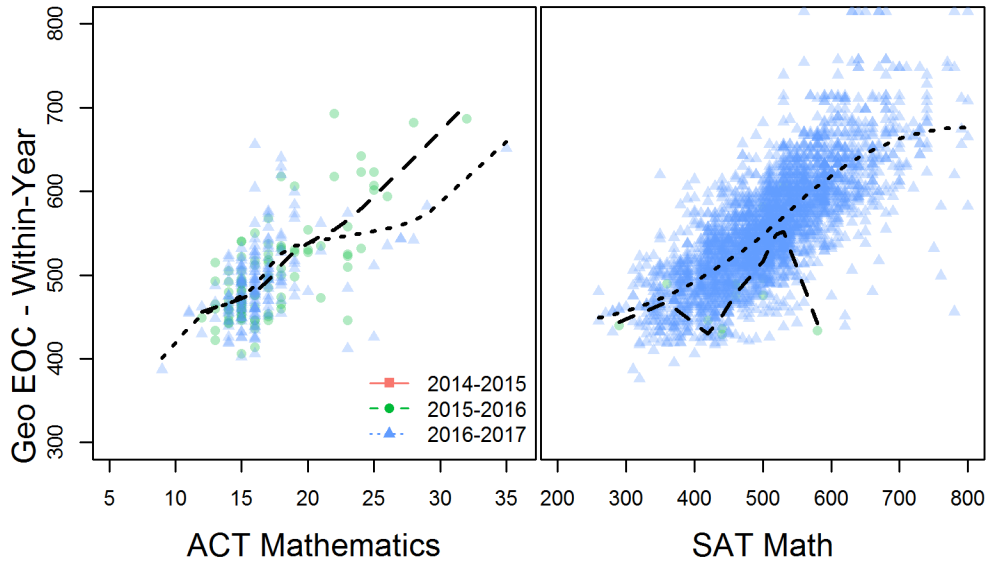


Figure 5E. Scatter Plots for Coordinate Algebra EOC Assessment and ACT and rSAT Scores (Unadjusted Samples).

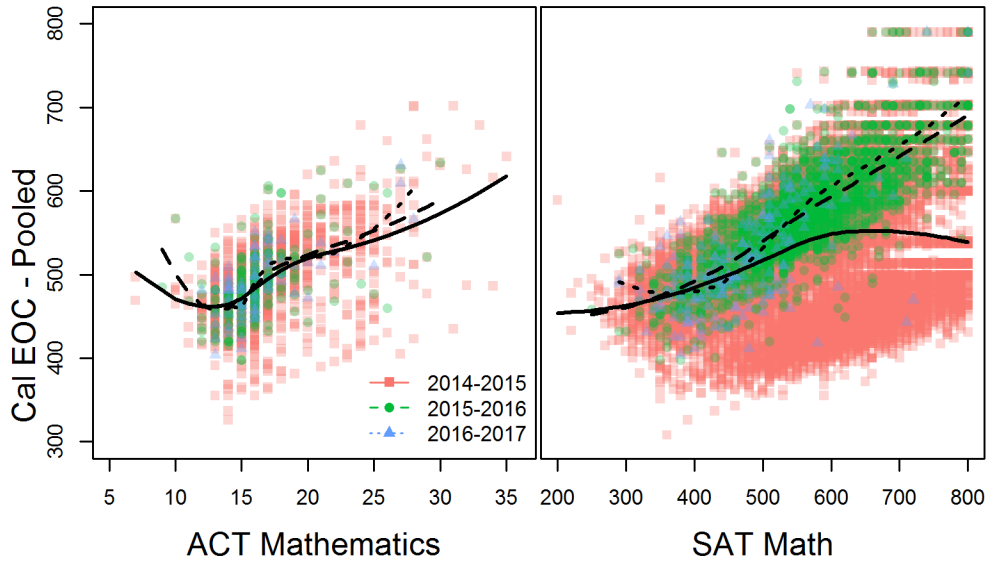
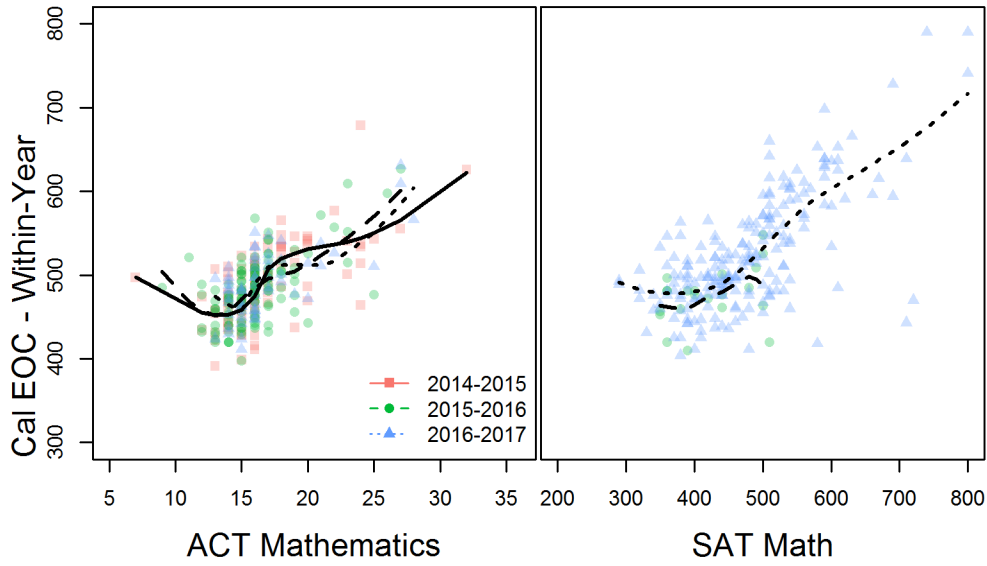


Figure 6E. *Scatter Plots for Algebra I EOC Assessment and ACT and rSAT Scores (Unadjusted Samples).*

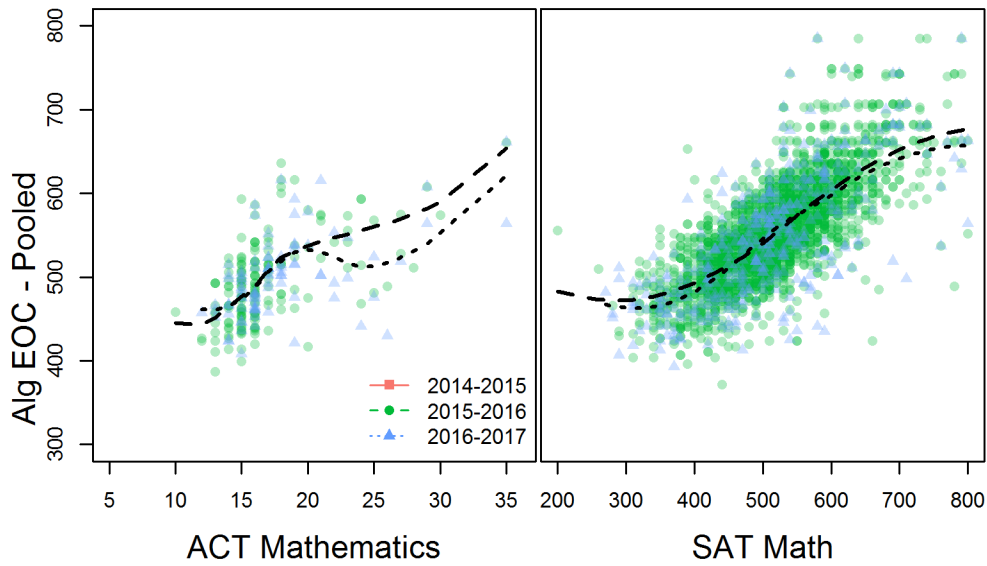
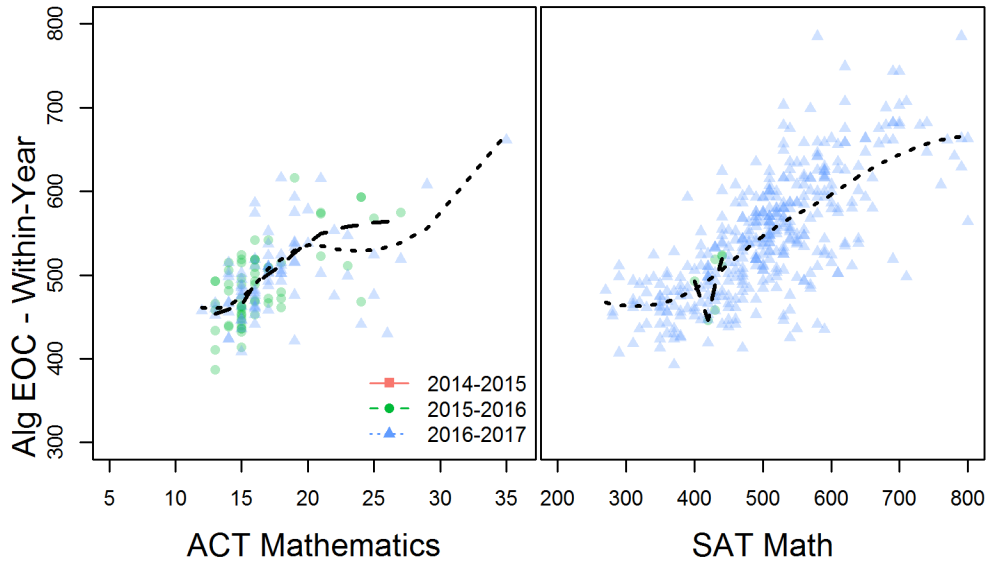
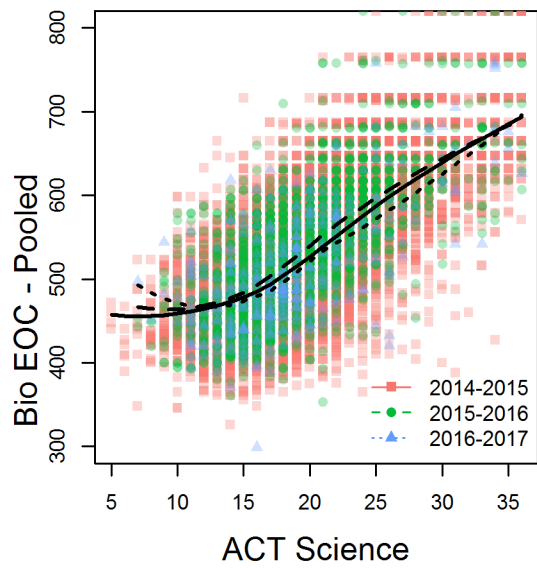
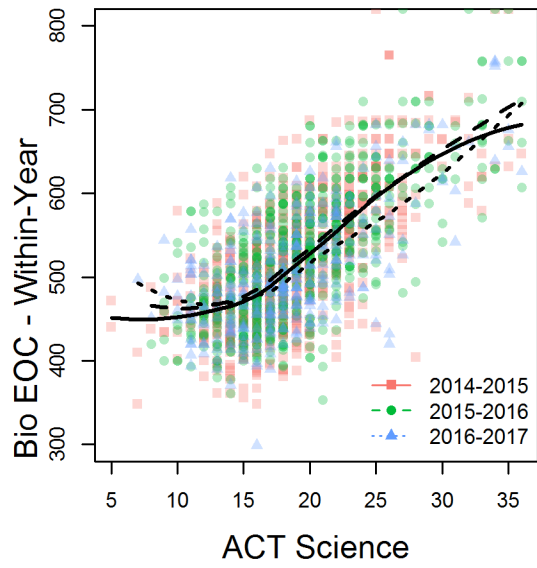


Figure 7E. Scatter Plots for Biology EOC Assessment and ACT Biology Scores (Unadjusted Samples).



## Appendix F: Bootstrap Standard Linking Errors

Figure 1F. *Bootstrapped Standard Linking Errors for 9<sup>th</sup> Grade Literature EOC Assessment.*

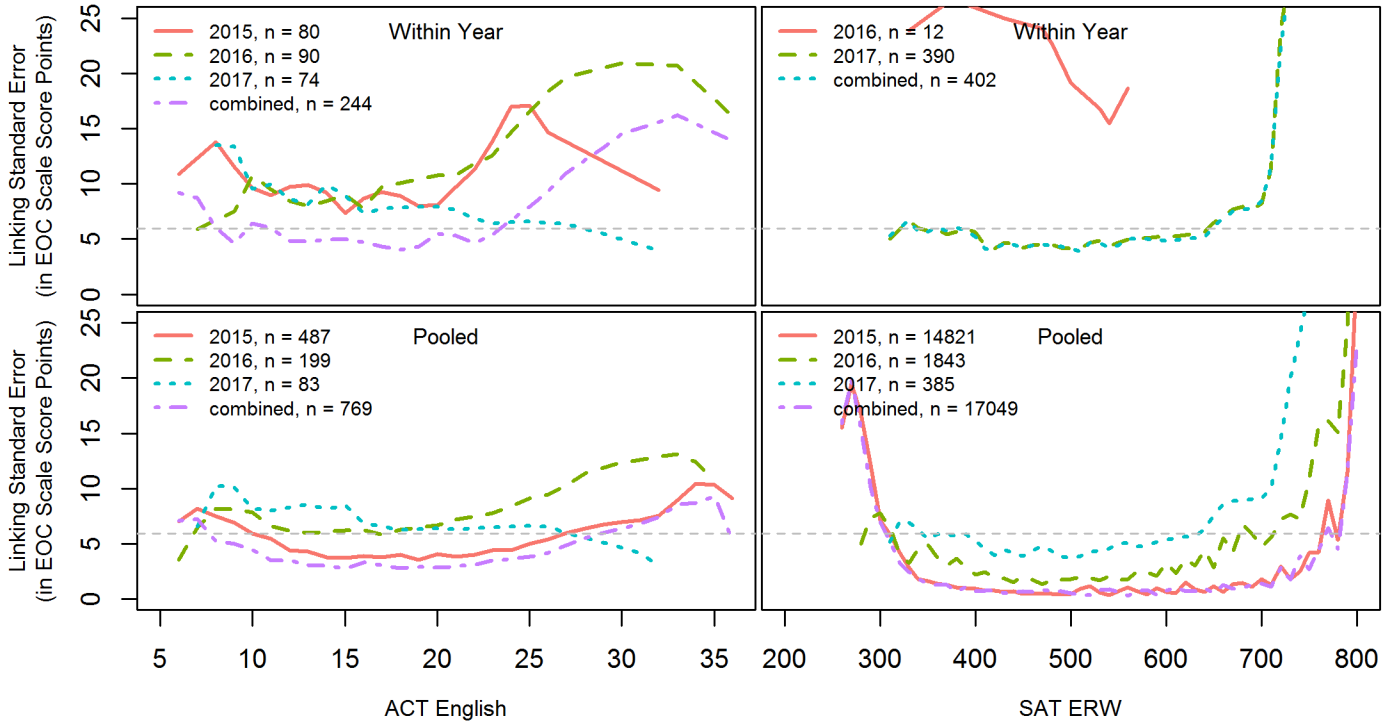
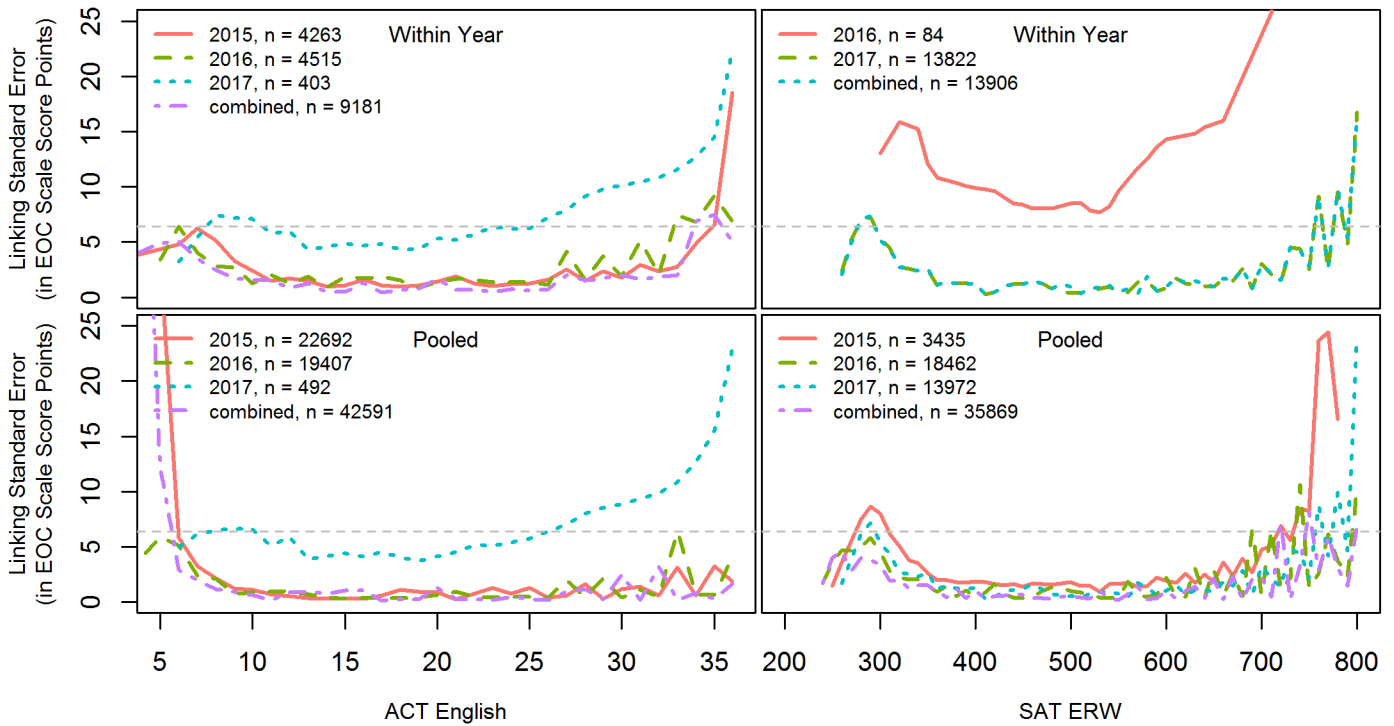


Figure 2F. *Bootstrapped Standard Linking Errors for American Literature EOC Assessment.*



Note: the horizontal line is at two thirds an EOC standard error of measurement, as suggested by Pommerich et al. (2004).

Figure 3F. *Bootstrapped Standard Linking Errors for Analytic Geometry EOC Assessment.*

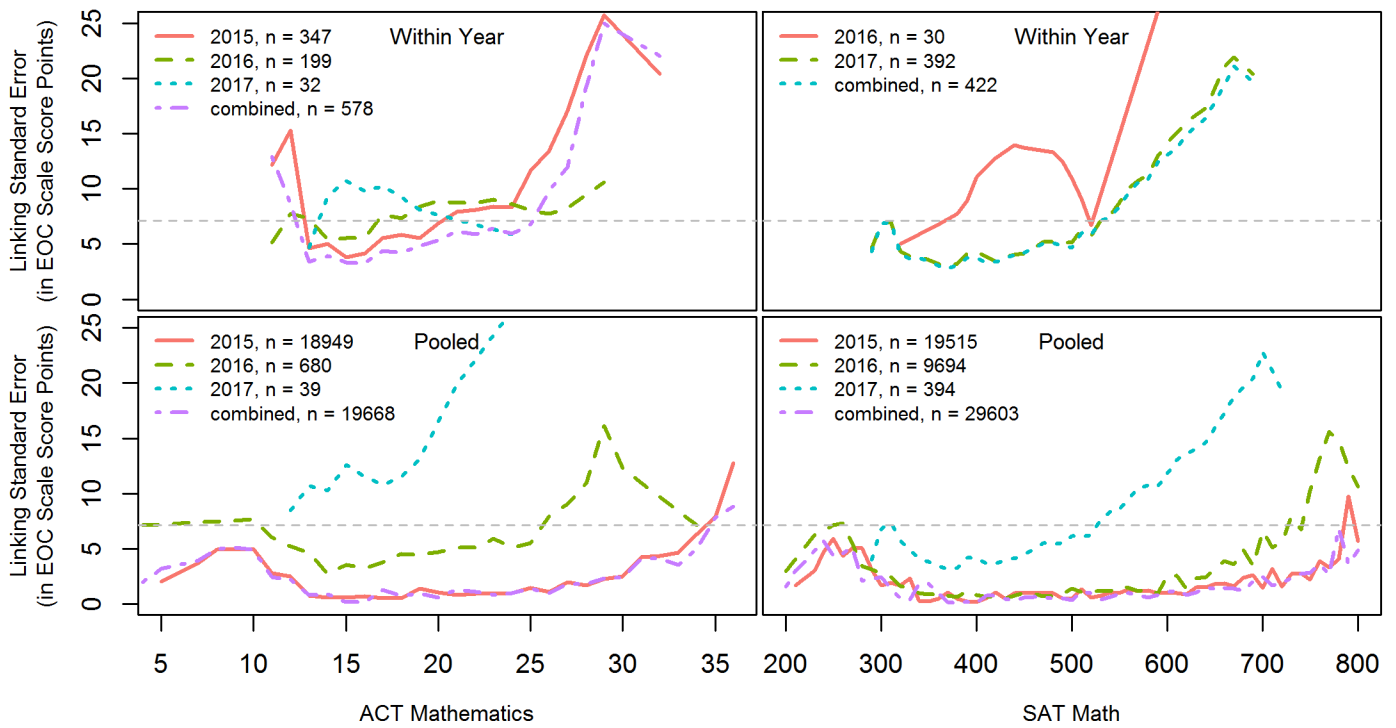
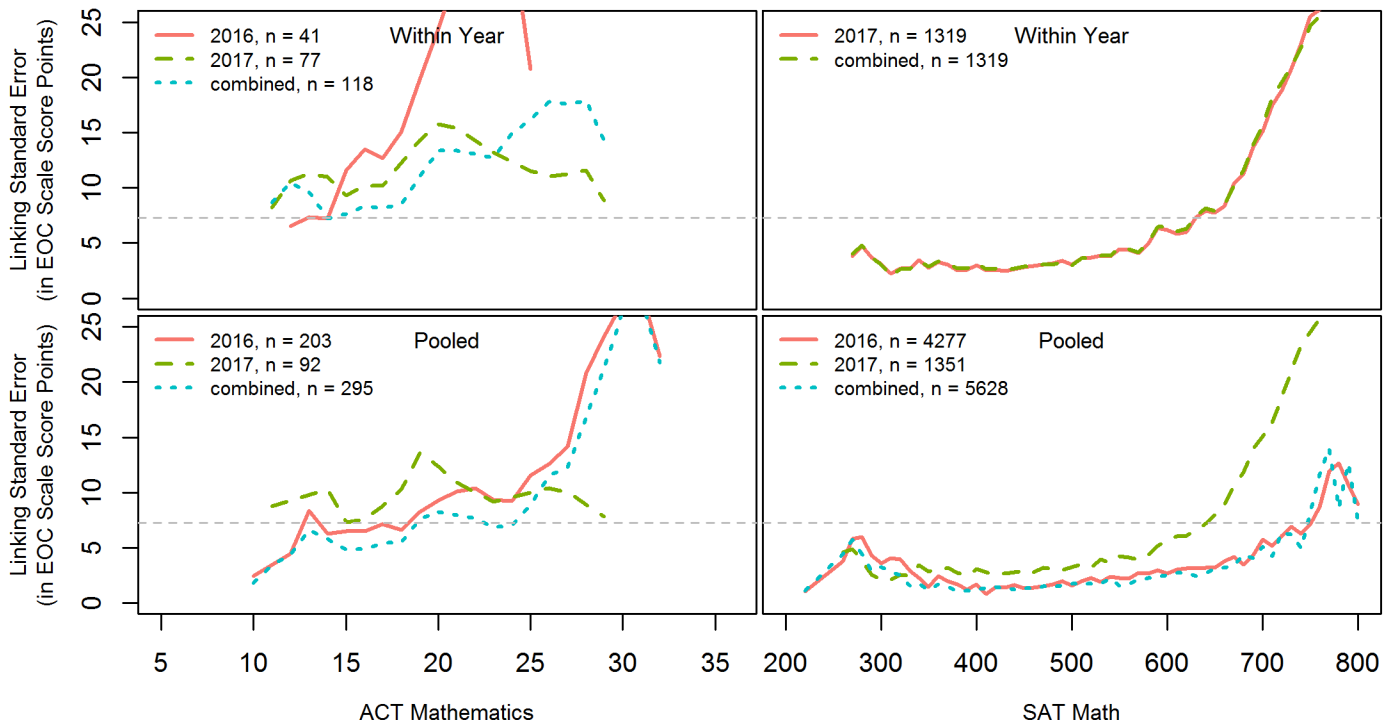


Figure 4F. *Bootstrapped Standard Linking Errors for Geometry EOC Assessment.*



Note: the horizontal line is at two thirds an EOC standard error of measurement, as suggested by Pommerich et al. (2004).

Figure 5F. *Bootstrapped Standard Linking Errors for Coordinate Algebra EOC Assessment.*

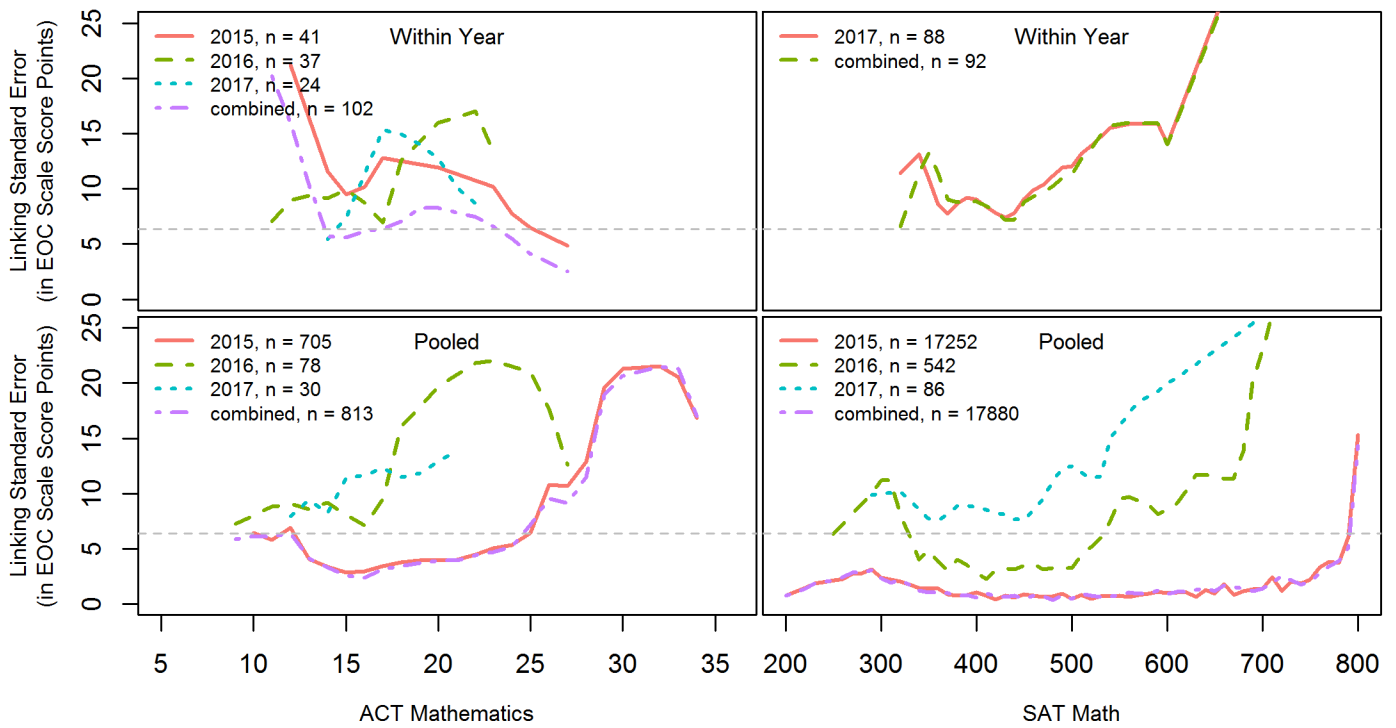
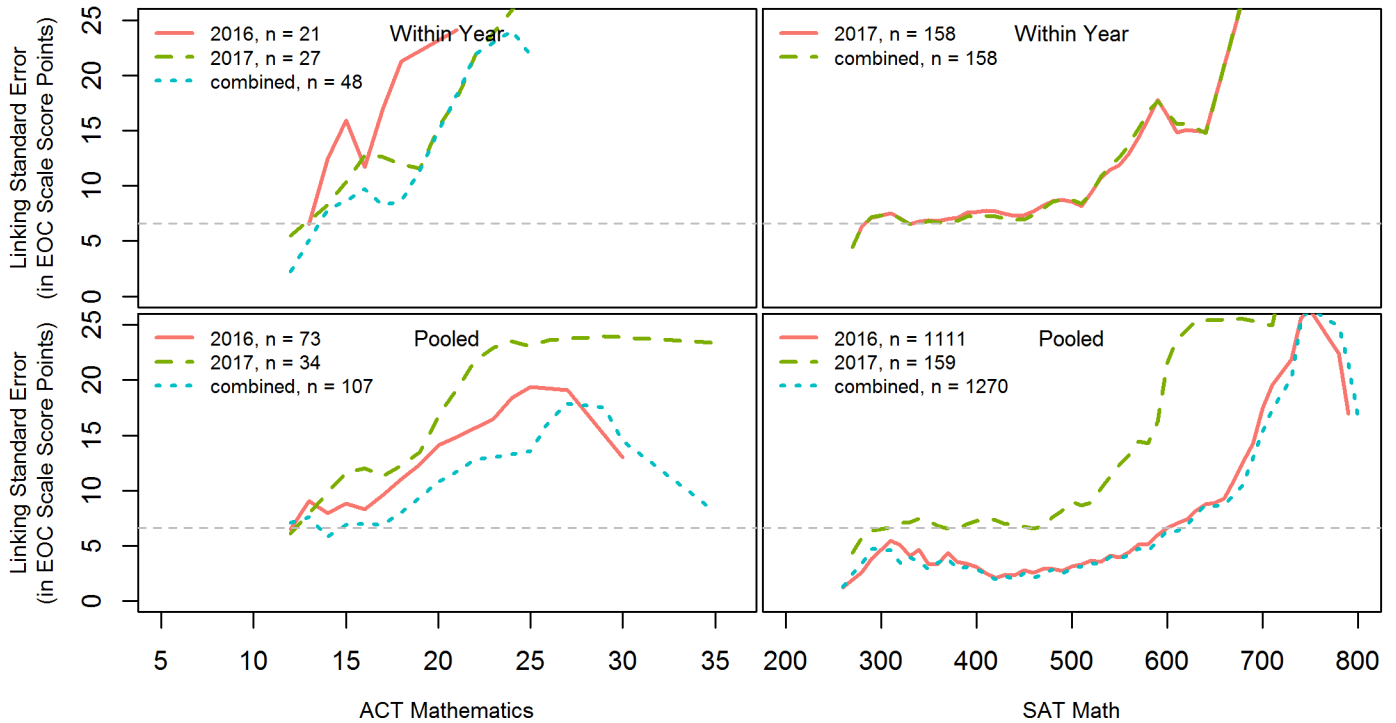


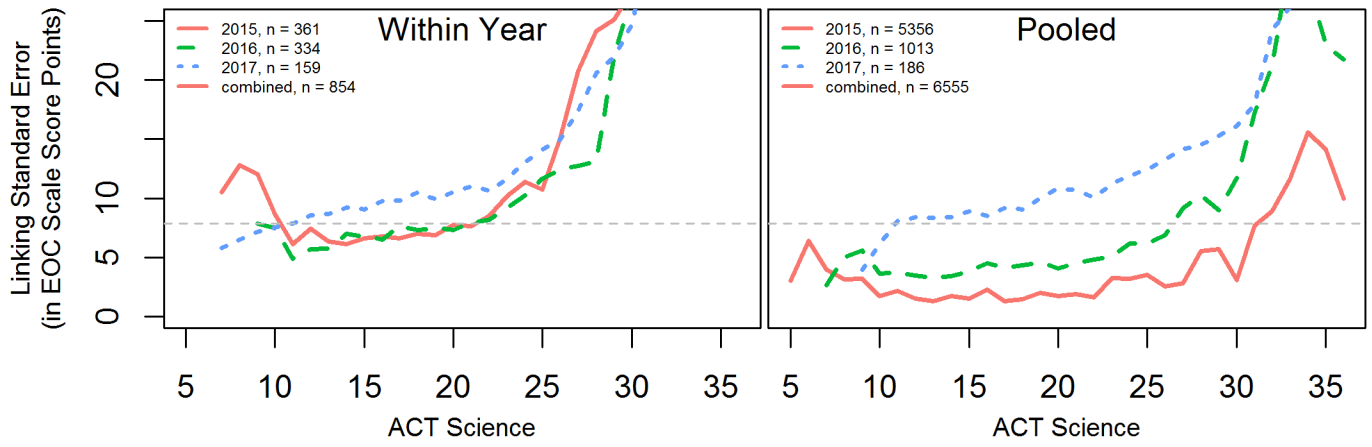
Figure 6F. *Bootstrapped Standard Linking Errors for Algebra I EOC Assessment.*



Note: the horizontal line is at two thirds an EOC standard error of measurement, as suggested by Pommerich et al. (2004).



Figure 7F. *Bootstrapped Standard Linking Errors for Biology EOC Assessment.*



Note: the horizontal line is at two thirds an EOC standard error of measurement, as suggested by Pommerich et al. (2004).

## Appendix G: Plots of Equipercentile Linking Relationships

Figure 1G. Concordance Plots for 9<sup>th</sup> Grade Literature EOC Assessment.

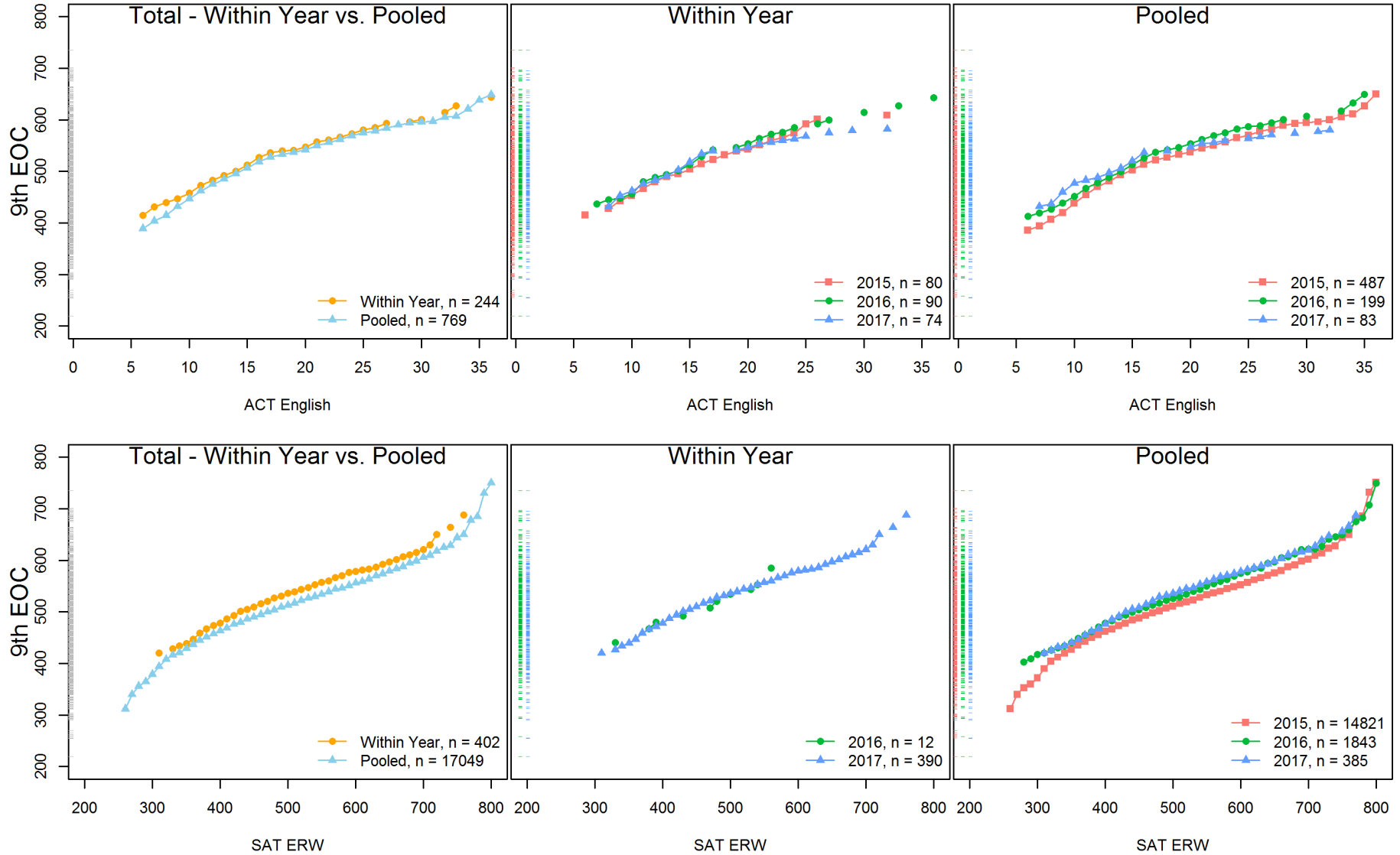


Figure 2G. Concordance Plots for American Literature EOC Assessment.

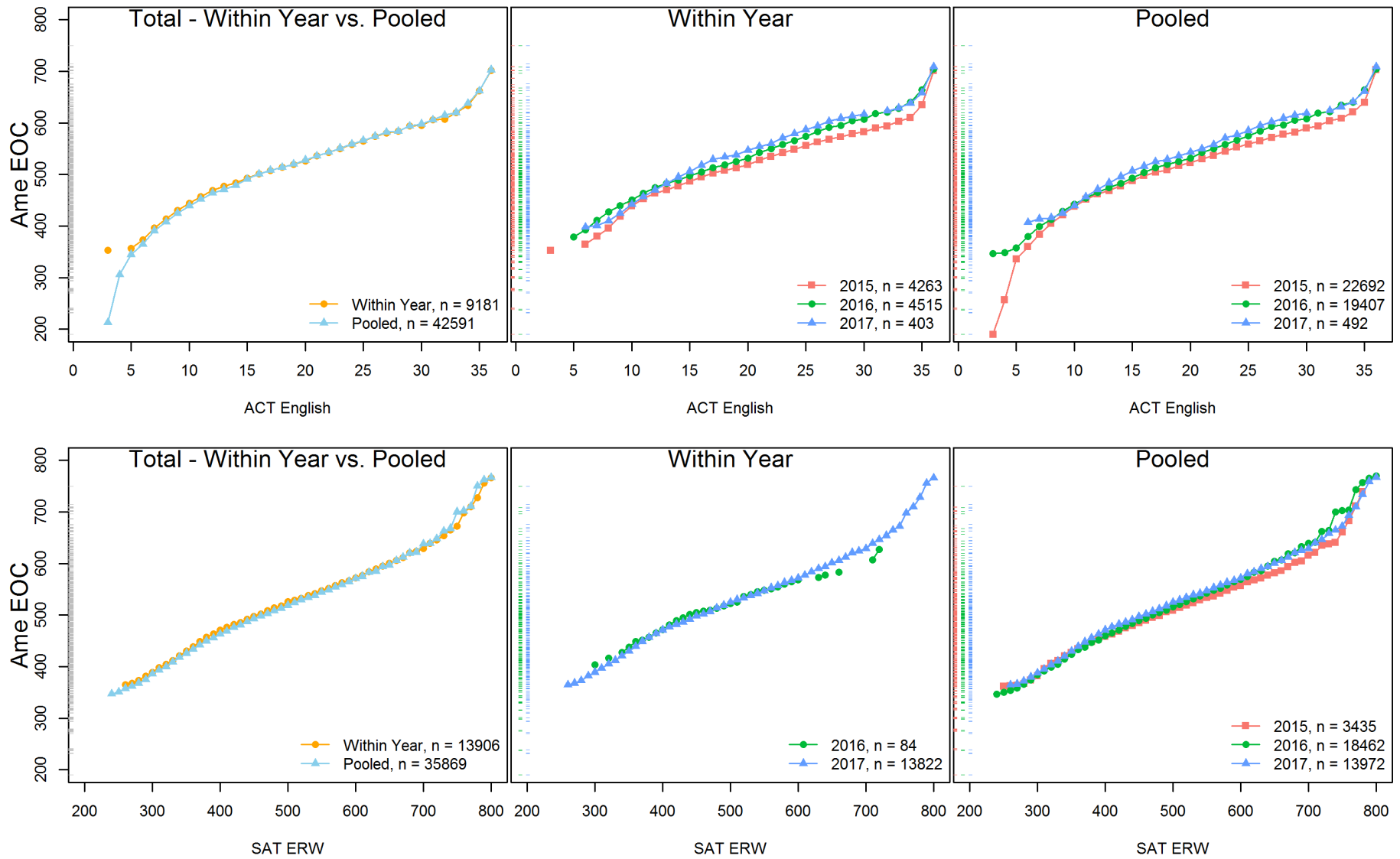


Figure 3G. Concordance Plots for Analytic Geometry EOC Assessment.

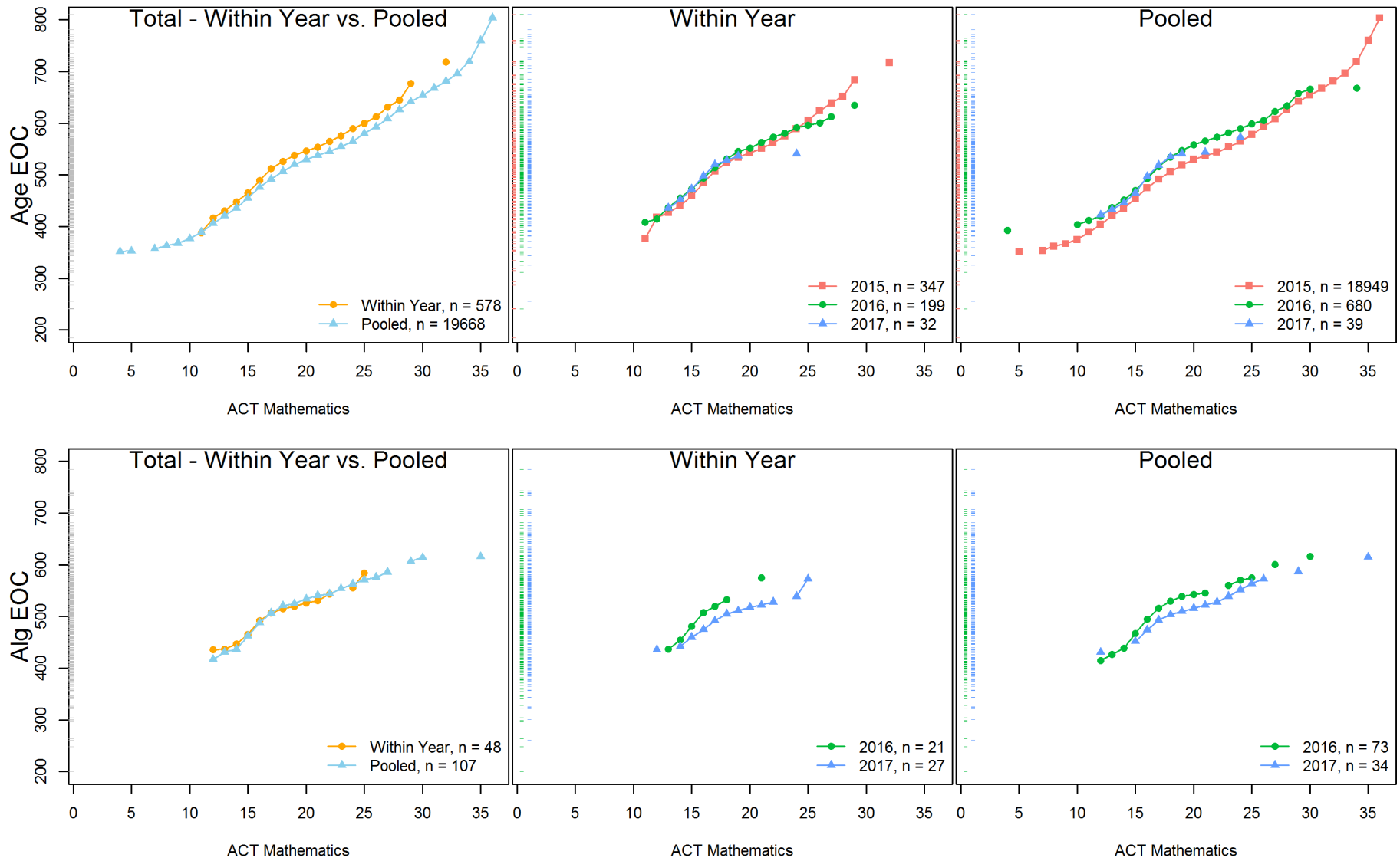


Figure 4G. Concordance Plots for Geometry EOC Assessment.

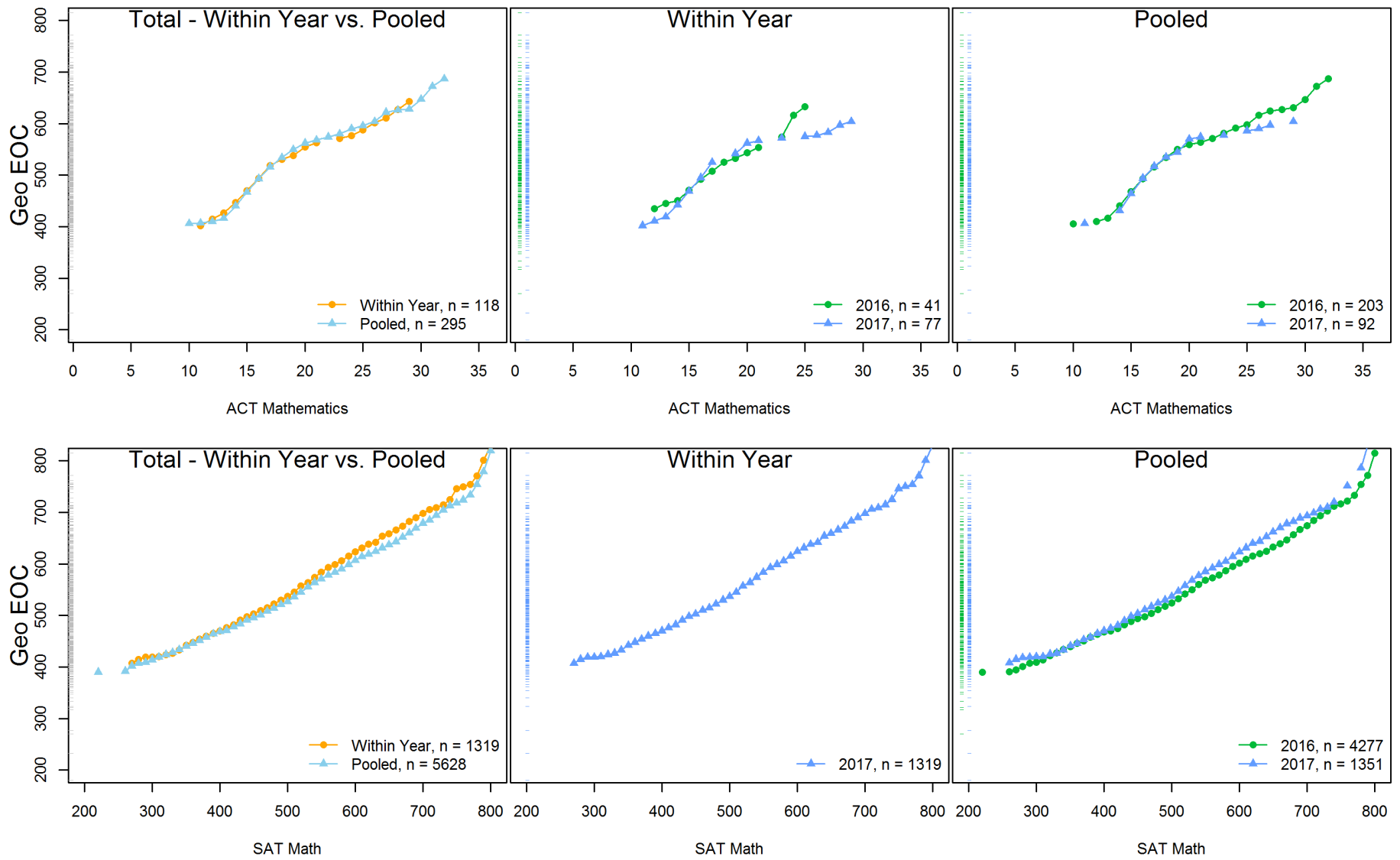


Figure 5G. Concordance Plots for Coordinate Algebra EOC Assessment.

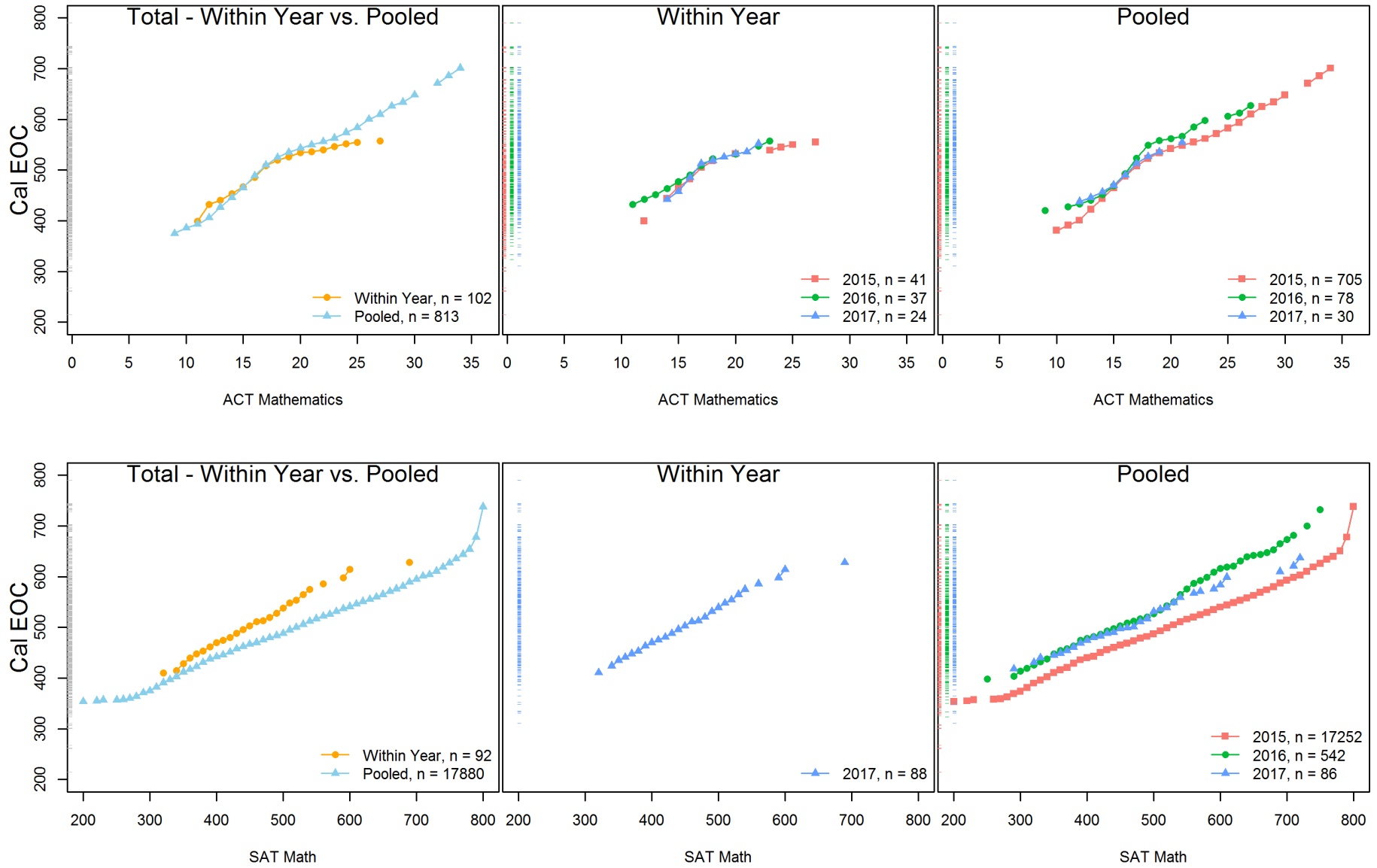


Figure 6G. Concordance Plots for Algebra I EOC Assessment.

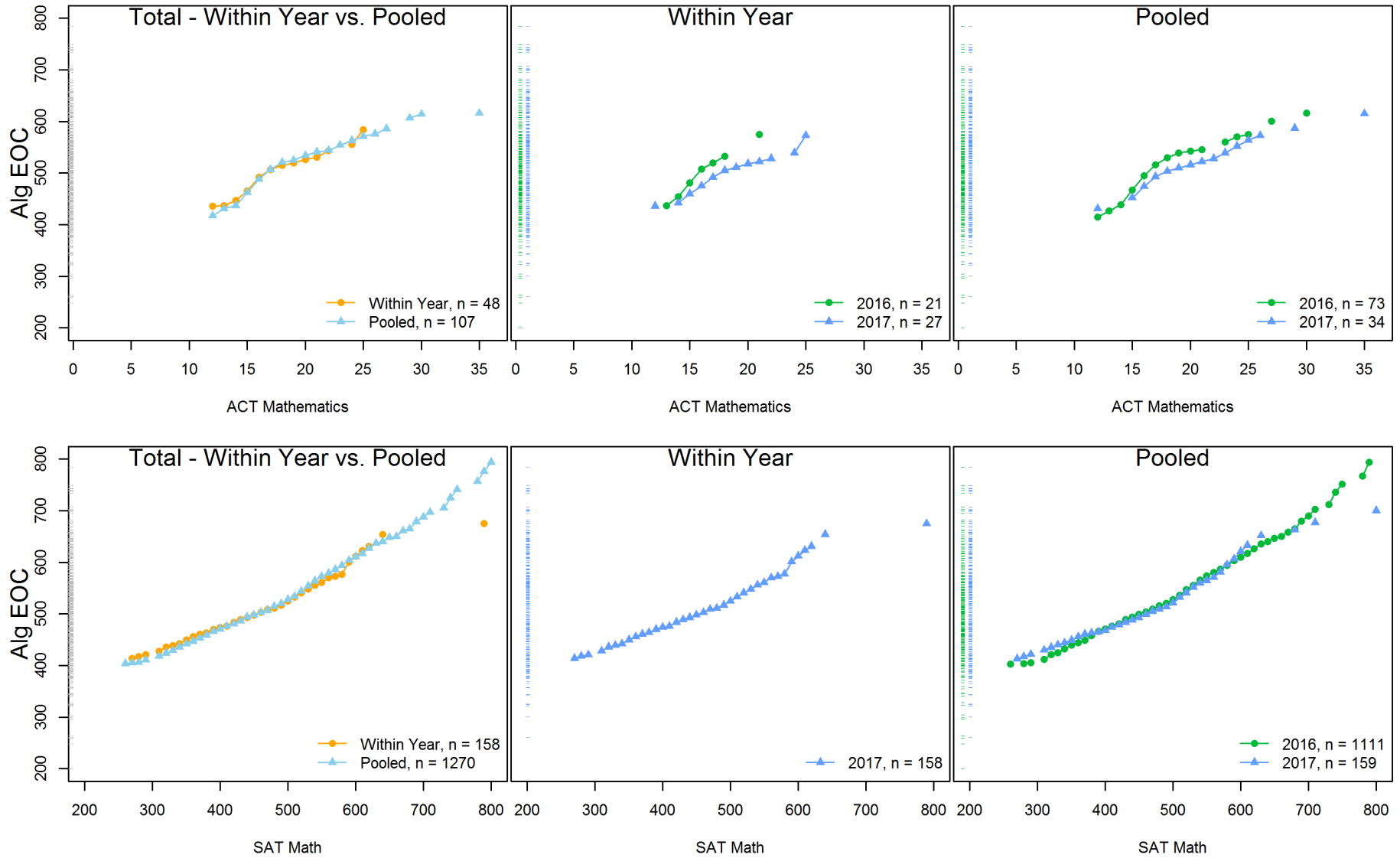
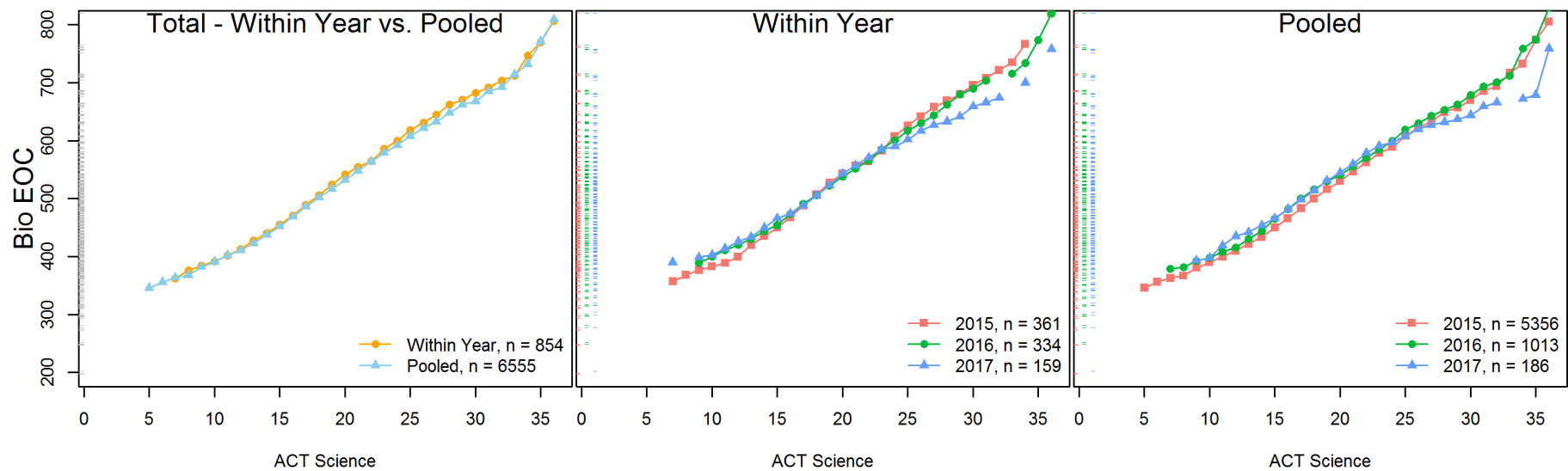


Figure 7G. Concordance Plots for Biology EOC Assessment.





## Appendix H: Concordance Tables based on Equipercentile Linking

Table 1H. *Concordance for the 9<sup>th</sup> Grade Literature EOC Assessment to the ACT English Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>329</i>					<i>307</i>				
2	<i>346</i>					<i>324</i>				
3	<i>364</i>					<i>340</i>				
4	<i>381</i>					<i>356</i>				
5	<i>398</i>					<i>372</i>		67.60		2
6	415	9.21	49.50	1	2	389	7.08	80.77	3	6
7	431	8.72	75.44	3	8	404	7.26	84.08	5	15
8	440	6.00	54.31	4	12	415	5.20	66.39	10	27
9	447	4.61	41.93	6	21	432	5.03	49.95	27	52
10	458	6.44	36.28	16	34	447	4.49	45.39	35	91
11	473	6.01	35.17	17	57	462	3.49	35.20	49	149
12	483	4.87	33.58	16	36	475	3.48	31.43	54	103
13	492	4.78	35.90	14	43	485	3.10	37.11	49	128
14	500	4.95	31.03	17	51	496	3.05	32.37	71	146
15	512	4.98	28.51	37	70	507	2.78	36.71	82	177
16	527	4.76	34.03	27	54	519	3.29	34.19	68	143
17	536	4.31	37.38	14	26	528	3.11	36.29	38	79
18	540	4.06	43.14	4	13	533	2.79	41.18	19	48
19	541	4.35	54.27	6	12	537	2.89	42.50	32	48
20	547	5.49	31.82	15	27	542	2.87	35.18	41	73
21	557	5.30	65.87	11	23	550	2.95	55.93	33	56
22	561	4.65	66.85	7	11	556	3.10	52.53	26	45
23	567	5.35	46.04	8	15	562	3.52	50.93	30	52
24	573	6.71	51.84	5	7	569	3.59	55.50	20	30
25	580	7.93	29.64	5	7	575	3.86	53.28	16	34
26	585	9.31	63.93	2	5	578	4.18	57.23	8	14
27	593	10.97	29.69	3	4	584	4.88	49.58	15	18
28	595		127.00		1	590	5.54	68.29	7	13
29	596	13.29	78.00	1	1	594	6.00	52.13	3	3
30	601	14.55	7.00	1	1	596	6.39	39.35	3	4
31	607		139.00		1	597	6.83	105.66	3	3
32	614	15.56	60.90	2	2	605	7.44	46.17	5	5
33	627	16.24	47.05	1	4	607	8.55	72.46	4	8
34	636		30.00		1	621	8.73	64.53	7	8
35	<i>641</i>					638	9.27	80.22	5	9
36	644	13.92	111.83	1	2	649	5.35	110.17	1	5

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 2H. *Concordance for the 9<sup>th</sup> Grade Literature EOC Assessment to the rSAT EBRW for the Adjusted Total Samples (both Within Year and Pooled).*

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
200	369					200				
210	374					200				
220	378					200				
230	383					221				
240	388					251				
250	392					282				
260	397		27.00		1	312	15.87	130.12	1	2
270	401					340	19.81	117.27	2	2
280	406					356	15.42	158.87	3	4
290	411					365	10.08	65.90	3	3
300	415		52.00		1	379	6.94	86.48	11	13
310	420	5.34	46.95	2	2	394	5.17	74.03	24	24
320	425		32.57		2	408	3.30	61.52	33	34
330	429	6.71	29.71	3	4	416	2.46	62.26	35	38
340	434	5.69	72.19	4	6	421	1.86	56.37	59	67
350	439	5.64	36.73	4	5	429	1.38	49.50	108	119
360	447	6.09	47.76	10	13	437	1.30	47.69	157	178
370	459	5.77	31.13	11	16	445	1.26	43.94	194	229
380	467	5.99	45.45	12	18	451	0.72	43.04	246	289
390	474	5.86	28.17	6	13	458	1.11	40.48	306	373
400	478	5.20	37.23	15	27	463	0.70	39.74	341	436
410	487	4.12	34.45	19	24	469	0.77	39.23	464	589
420	493	4.08	34.52	23	35	476	0.74	37.49	557	755
430	501	4.60	37.42	15	31	480	0.55	37.93	534	748
440	505	4.48	29.95	8	16	486	0.62	33.37	599	842
450	510	4.24	37.13	23	39	490	0.69	35.96	644	1001
460	516	4.43	34.70	17	31	495	0.67	34.68	682	1097
470	521	4.49	42.88	19	32	500	0.79	34.79	656	1138
480	527	4.42	43.96	15	34	504	0.72	34.97	681	1195
490	531	4.31	47.31	16	29	509	0.73	33.95	719	1351
500	536	4.14	36.62	11	27	513	0.52	32.60	644	1323
510	539	3.89	39.30	16	32	517	0.33	34.79	705	1484
520	544	4.66	33.37	13	26	522	0.36	31.99	674	1482
530	547	4.67	41.03	13	35	527	0.82	33.01	643	1511
540	553	4.20	30.61	17	36	530	0.86	31.69	651	1485
550	557	4.47	31.98	6	24	534	0.67	33.09	628	1579
560	560	4.95	34.45	17	36	539	0.33	32.15	585	1521
570	567	5.06	35.28	7	27	544	0.78	33.10	546	1476
580	570	5.04	34.06	11	28	546	0.84	33.18	516	1508
590	577	4.89	33.03	10	20	551	0.44	34.55	512	1526
600	579	4.87	28.34	4	16	556	0.78	33.94	460	1383
610	581	4.89	44.52	6	23	559	1.08	36.47	487	1464
620	583	5.02	36.22	5	20	564	0.72	34.20	395	1330
630	587	5.07	58.75	4	13	570	0.68	36.34	378	1245
640	592	5.17	48.04	11	23	574	1.00	37.28	322	1142
650	597	6.17	32.44	3	10	579	0.53	37.43	279	967
660	602	6.87	40.33	6	17	584	1.28	38.52	286	1000
670	607	7.54	32.61	3	14	588	0.94	38.92	254	838
680	611	7.70	40.87	3	11	595	1.00	40.78	209	778

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
690	615	7.81	90.61	3	9	599	1.32	44.07	166	601
700	621	8.43	29.15	3	4	606	1.38	43.73	116	537
710	630	11.56	84.00	5	7	610	1.14	44.07	118	470
720	650	22.73	61.92	1	6	618	2.88	44.91	103	426
730	<i>660</i>		104.46		4	625	1.78	46.06	84	358
740	664	34.69	51.84	1	3	629	3.91	48.23	66	267
750	<i>674</i>		78.45		3	644	2.66	55.36	52	239
760	688	47.41	82.00	1	1	650	4.47	56.27	51	224
770	<i>704</i>		86.27		2	678	6.45	72.15	25	145
780	<i>719</i>		88.00		1	685	4.55	73.98	20	93
790	<i>735</i>					730	11.57	118.26	13	36
800	<i>750</i>					750	23.17	125.66	2	9

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sample), Full N = number of students in the total sample.

Table 3H. *Concordance for the American Literature EOC Assessment to the ACT English Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>353</i>					<i>200</i>				
2	<i>353</i>					<i>200</i>				
3	353	3.43	77.00	1	1	213	59.27	243.27	3	4
4	<i>353</i>					306	50.29	164.33	2	3
5	357	4.93	121.25	2	3	345	12.26	106.48	15	18
6	373	5.05	87.96	17	20	365	2.88	92.80	57	68
7	396	3.50	71.25	45	48	391	1.99	75.27	186	249
8	414	2.48	58.15	78	88	408	1.16	63.55	328	419
9	430	1.74	47.23	158	183	425	0.97	51.62	675	864
10	444	1.56	45.22	256	312	439	0.66	45.26	1272	1782
11	457	1.57	39.64	428	522	452	0.21	39.44	2174	3047
12	469	0.86	37.36	359	455	464	0.86	36.30	1770	2581
13	477	1.27	33.33	416	521	471	0.94	34.45	1967	3010
14	484	0.53	35.12	521	754	479	0.74	33.64	2876	4699
15	493	0.48	35.36	693	1089	491	1.05	32.08	3490	6267
16	501	1.32	32.59	598	974	501	1.03	30.85	3154	5925
17	508	0.43	32.33	490	826	508	0.12	30.82	2294	4439
18	514	0.66	32.84	479	868	514	0.25	31.07	2094	4309
19	520	0.80	33.25	445	861	520	0.25	31.78	2013	4215
20	526	1.64	33.68	615	1308	528	1.29	31.38	2527	5510
21	536	0.66	34.25	525	1220	536	0.28	32.24	2432	5607
22	543	0.67	35.80	429	1080	543	0.24	33.26	2091	5021
23	550	0.50	35.62	469	1203	551	0.17	33.73	2027	4895
24	558	0.76	33.72	361	996	559	0.45	34.78	1646	4288
25	565	0.63	39.35	344	945	566	0.32	36.67	1425	3797
26	574	0.73	39.63	250	788	574	0.17	38.52	969	2554
27	580	1.99	37.71	163	569	582	0.94	38.29	836	2298
28	584	1.58	40.97	183	622	584	1.18	39.19	678	1914
29	594	1.69	42.28	114	440	594	0.25	41.78	550	1514
30	595	1.99	41.53	125	521	598	2.51	40.73	658	1819
31	606	1.67	48.58	113	442	606	0.19	45.50	474	1380
32	607	1.82	43.41	71	348	615	3.21	45.62	313	946
33	620	2.02	44.75	132	534	620	0.18	46.04	438	1313
34	634	6.86	48.87	100	463	638	0.84	52.69	425	1271
35	662	7.45	61.15	160	696	662	0.32	61.28	569	1758
36	702	5.00	73.77	41	214	703	1.64	76.03	163	494

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 4H. *Concordance for the American Literature EOC Assessment to the rSAT EBRW Section for the Adjusted Total Samples (both Within Year and Pooled).*

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
200	353					321		208.00		1
210	355					327				
220	357					333				
230	359					339				
240	361					347	1.71	108.00	1	1
250	363					351	4.01	90.93	3	3
260	365	2.08	107.20	2	2	358	4.60	100.85	5	7
270	368	4.97	81.01	2	2	362	2.83	102.22	8	9
280	373	7.03	117.66	3	4	368	4.03	97.11	12	14
290	382	7.37	69.71	3	3	375	3.78	65.56	16	16
300	389	5.20	72.99	8	8	386	3.35	75.80	30	34
310	398	4.41	74.40	18	19	393	1.93	64.78	58	64
320	405	2.69	69.81	22	24	400	1.99	66.19	67	86
330	412	2.64	73.00	32	40	409	1.24	60.87	128	157
340	421	2.39	53.33	56	61	418	1.51	53.47	189	227
350	430	2.60	54.31	85	99	426	1.53	48.18	294	359
360	439	1.12	47.04	146	166	434	0.99	46.06	414	515
370	449	1.41	44.60	180	210	442	0.42	42.35	540	697
380	457	1.24	37.49	229	261	450	1.23	37.59	630	834
390	464	1.23	37.11	268	330	456	0.36	37.23	792	1047
400	471	1.29	36.17	311	383	463	1.00	34.92	879	1276
410	476	0.24	36.27	417	522	469	0.33	34.77	1023	1508
420	482	0.52	33.56	502	659	476	0.53	33.48	1248	1852
430	486	1.02	34.73	497	667	481	0.59	32.60	1253	2010
440	492	1.18	30.96	556	751	487	0.78	30.14	1344	2201
450	498	1.18	31.87	579	882	493	0.64	29.83	1473	2444
460	502	1.52	31.64	594	947	498	0.36	29.73	1526	2670
470	509	1.26	29.25	595	967	503	0.38	29.03	1495	2741
480	514	0.79	29.95	572	986	508	0.32	29.84	1439	2816
490	518	1.22	29.42	602	1138	513	0.45	29.64	1553	3110
500	526	0.94	29.83	555	1076	519	0.60	29.75	1453	2959
510	529	0.33	29.73	548	1172	524	0.39	28.75	1502	3165
520	533	0.85	29.59	501	1172	530	0.30	29.86	1377	3066
530	538	0.94	29.96	504	1199	534	0.97	29.54	1357	3138
540	542	1.10	29.74	532	1202	538	0.39	29.51	1262	2985
550	547	0.49	28.43	516	1259	544	0.20	30.35	1271	2988
560	552	0.79	29.62	446	1181	549	0.69	30.35	1130	2869
570	557	0.33	31.36	432	1152	554	1.40	30.87	1071	2723
580	563	1.90	30.44	392	1154	559	0.23	31.34	1081	2747
590	567	0.55	31.04	398	1182	565	0.37	32.34	979	2554
600	572	0.97	32.19	356	1058	571	1.00	33.44	941	2458
610	577	1.73	33.07	331	1060	575	0.27	33.48	790	2334
620	584	1.29	30.83	302	1027	583	0.98	33.20	723	2156
630	590	1.46	33.81	279	941	585	1.43	34.49	668	2018
640	595	1.25	34.97	238	864	594	0.34	36.50	592	1793
650	601	1.00	35.75	212	741	597	2.15	36.67	516	1496
660	606	1.70	37.52	181	759	606	0.22	39.71	504	1535
670	612	1.51	37.45	145	633	612	2.33	38.28	420	1227
680	621	2.61	41.24	156	581	620	0.19	42.43	342	1065

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
690	624	0.79	41.16	108	458	622	2.05	41.70	284	884
700	629	2.95	42.02	96	410	638	2.24	48.46	250	785
710	639	2.20	42.68	90	383	639	0.46	45.17	237	715
720	646	1.54	45.27	77	337	648	7.04	47.79	187	552
730	654	4.55	44.70	60	284	663	0.24	51.85	148	485
740	665	4.27	50.24	51	203	668	3.40	55.76	109	343
750	672	2.80	52.18	40	183	700	8.15	73.32	84	280
760	698	9.10	64.67	36	166	702	2.93	69.82	78	243
770	710	2.87	75.80	22	108	711	5.93	77.52	50	155
780	728	9.68	76.70	15	76	750	3.07	101.02	27	116
790	756	5.35	108.49	6	31	762	1.49	112.75	12	48
800	766	16.04	121.44	2	6	767	6.91	104.84	4	10

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sample), Full N = number of students in the total sample.

Table 5H. *Concordance for the Analytic Geometry EOC Assessment to the ACT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>200</i>					<i>347</i>				
2	<i>200</i>					<i>348</i>				
3	<i>200</i>					<i>350</i>				
4	<i>200</i>					352	1.96	106.00	1	1
5	<i>200</i>					353	3.21	128.00	1	1
6	<i>215</i>					<i>354</i>		105.00		1
7	<i>250</i>					357	3.93	88.05	2	2
8	<i>284</i>					363	4.98	79.62	4	4
9	<i>319</i>					368	5.09	80.26	5	6
10	<i>353</i>		88.77		2	377	4.87	86.59	17	25
11	388	12.90	86.36	3	10	389	2.42	72.34	33	52
12	417	8.63	73.00	7	13	406	2.19	61.27	136	190
13	430	3.39	39.41	25	57	421	0.80	49.85	440	654
14	448	3.93	36.94	46	101	436	0.89	41.99	1178	1805
15	465	3.33	32.52	85	196	455	0.20	34.75	2460	3947
16	489	3.30	30.70	136	282	476	0.17	32.03	3180	5570
17	512	4.38	37.95	68	150	492	1.26	32.91	2434	4692
18	526	4.22	36.70	42	88	507	0.74	33.45	1670	3516
19	538	4.87	36.83	32	63	520	0.91	34.84	1369	2989
20	546	5.40	34.38	19	33	530	0.57	33.90	891	2068
21	554	6.18	45.52	20	32	538	1.33	36.27	738	1692
22	565	5.91	44.31	21	43	545	1.11	35.65	715	1795
23	576	6.41	35.23	20	35	555	0.83	37.54	730	1792
24	590	5.98	38.11	20	43	565	0.99	37.86	837	2124
25	600	6.75	56.11	11	23	580	1.43	39.76	704	1786
26	613	9.87	60.70	10	27	593	1.01	43.98	585	1494
27	631	11.97	53.44	6	13	609	1.78	45.50	570	1469
28	645	19.24	40.85	3	4	626	1.82	49.95	313	823
29	677	24.96	81.26	3	5	642	2.34	57.21	215	509
30	<i>700</i>		77.94		2	654	2.37	54.80	119	291
31	<i>712</i>					668	4.09	64.80	100	223
32	718	22.02	90.51	1	2	681	4.12	70.93	68	176
33	<i>722</i>					696	3.52	77.51	69	143
34	<i>727</i>		87.94		3	719	5.01	88.90	40	82
35	<i>732</i>					760	7.82	113.57	30	65
36	<i>736</i>					800	8.84	114.42	14	23

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 6H. *Concordance for the Analytic Geometry EOC Assessment to the rSAT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
200	427					352	1.60	217.17	1	3
210	426					353	3.01	154.00	1	1
220	424					355	3.81	47.00	1	1
230	423					358	4.82	95.20	2	2
240	422					364	5.71	86.65	3	3
250	421					369	4.35	106.38	8	9
260	420					375	4.59	99.17	7	8
270	419					381	5.10	80.09	12	13
280	418					390	2.12	68.65	23	25
290	416	4.31	37.00	1	1	398	2.24	68.30	46	54
300	419	6.81	34.00	1	1	402	2.46	67.60	32	48
310	434	6.98	53.14	5	8	408	1.41	64.80	115	152
320	438	4.02	41.31	4	5	416	0.55	52.68	181	233
330	440	3.68	63.06	2	3	422	0.39	47.34	140	167
340	443	3.76	31.19	5	9	429	1.82	44.60	293	371
350	447	3.45	48.89	10	15	435	1.86	45.94	519	692
360	451	3.06	25.13	9	13	437	1.02	41.51	376	503
370	455	2.75	23.70	6	7	443	0.21	39.93	538	731
380	457	3.13	34.82	18	29	449	0.12	38.50	948	1308
390	464	3.73	43.85	18	32	455	0.19	35.58	906	1270
400	469	3.74	32.50	12	17	460	0.14	35.73	557	820
410	474	3.36	36.62	19	24	464	0.77	36.18	926	1345
420	480	3.39	29.08	27	39	470	0.78	32.93	1349	2010
430	487	3.71	35.30	22	42	475	0.46	34.32	1316	2114
440	492	4.03	40.26	20	41	480	0.36	34.01	1137	1920
450	496	4.19	39.25	14	27	484	0.62	34.36	1123	1948
460	500	4.67	37.61	12	29	489	0.67	33.29	1259	2198
470	506	5.01	42.76	22	37	495	0.60	34.22	1267	2324
480	514	5.12	32.13	16	36	501	0.52	32.23	1128	2072
490	518	4.84	39.91	13	30	506	0.56	33.83	1251	2476
500	524	4.66	29.91	21	43	511	0.34	33.79	1143	2360
510	534	5.99	41.05	29	81	519	1.09	35.20	1794	3917
520	543	5.82	41.11	14	41	527	0.97	35.19	1268	2819
530	555	7.13	42.75	30	81	535	0.43	35.51	1380	3315
540	572	7.45	44.23	16	31	544	0.66	36.04	1186	2806
550	581	8.31	42.26	8	35	551	0.95	36.35	867	2245
560	587	9.75	42.70	11	29	559	0.97	36.63	737	1947
570	601	10.61	57.73	7	17	564	0.83	38.67	551	1537
580	611	10.91	47.37	7	19	570	0.57	37.85	676	1852
590	623	12.37	44.74	8	30	577	0.81	39.09	681	1960
600	639	13.11	51.02	4	18	583	1.03	39.83	402	1200
610	651	13.66	42.03	3	13	589	1.23	41.50	466	1274
620	657	14.96	115.14	1	3	595	0.84	41.08	327	1058
630	661		70.73		8	600	1.04	43.50	322	947
640	665	16.37	49.17	3	7	605	1.44	42.16	315	927
650	671					611	1.38	43.16	271	854
660	678	19.44	31.20	1	5	617	1.46	47.28	276	810
670	687	21.08	132.02	1	3	624	1.38	45.01	218	597
680	699		88.84		2	631	1.25	46.71	233	756



rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
690	711	19.69	44.44	2	6	640	2.04	48.77	171	545
700	<i>725</i>		115.93		2	643	2.46	53.13	108	404
710	<i>738</i>		138.23		2	651	1.67	53.80	97	316
720	<i>751</i>		115.00		1	653	1.95	53.62	89	283
730	<i>764</i>		4.00		1	663	2.31	58.25	100	356
740	<i>778</i>					668	2.71	61.91	103	306
750	<i>791</i>					677	2.85	62.36	36	128
760	<i>800</i>					683	3.60	65.87	62	192
770	<i>800</i>					692	2.65	64.56	66	215
780	<i>800</i>					703	6.85	78.24	53	210
790	<i>800</i>					719	3.63	84.01	81	281
800	<i>800</i>		42.00		1	762	4.86	123.46	59	234

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 7H. *Concordance for the Geometry EOC Assessment to the ACT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>262</i>					<i>401</i>				
2	<i>276</i>					<i>402</i>				
3	<i>290</i>					<i>402</i>				
4	<i>304</i>					<i>403</i>				
5	<i>318</i>					<i>403</i>				
6	<i>332</i>					<i>404</i>				
7	<i>346</i>					<i>404</i>				
8	<i>360</i>					<i>405</i>				
9	<i>374</i>		13.00		1	<i>405</i>		18.00		1
10	<i>388</i>					<i>406</i>	1.80	183.00	1	1
11	<i>402</i>	8.66	53.01	1	2	<i>407</i>	3.40	48.29	1	5
12	<i>415</i>	10.47	34.59	2	3	<i>410</i>	4.42	45.78	1	6
13	<i>427</i>	9.64	47.55	3	9	<i>416</i>	6.64	51.30	6	18
14	<i>447</i>	7.22	32.84	13	31	<i>440</i>	5.82	42.18	24	70
15	<i>470</i>	7.66	29.61	25	66	<i>467</i>	4.82	34.42	55	137
16	<i>494</i>	8.32	45.68	23	60	<i>493</i>	4.88	38.32	59	146
17	<i>519</i>	8.18	37.82	18	39	<i>516</i>	5.49	36.54	40	92
18	<i>531</i>	8.49	54.39	4	23	<i>534</i>	5.51	46.71	31	61
19	<i>538</i>	11.08	42.12	9	13	<i>550</i>	7.64	47.39	22	35
20	<i>555</i>	13.39	41.94	3	4	<i>562</i>	8.22	71.02	6	16
21	<i>563</i>	13.37	50.10	2	4	<i>568</i>	7.94	58.20	7	14
22	<i>567</i>		96.12		2	<i>574</i>	7.67	56.48	3	7
23	<i>571</i>	12.73	84.26	6	8	<i>580</i>	6.85	73.12	13	19
24	<i>577</i>	14.96	52.81	1	3	<i>590</i>	7.03	57.29	5	12
25	<i>588</i>	16.18	82.41	3	5	<i>596</i>	8.90	68.38	6	12
26	<i>602</i>	17.77	47.71	1	2	<i>604</i>	11.55	43.71	5	6
27	<i>611</i>	17.60	68.00	2	2	<i>622</i>	12.32	76.32	4	6
28	<i>627</i>	17.89	71.59	1	2	<i>626</i>	16.82	71.39	1	2
29	<i>643</i>	14.24	61.00	1	1	<i>628</i>	21.23	47.40	2	3
30	<i>657</i>					<i>647</i>	26.40	15.00	1	1
31	<i>672</i>					<i>672</i>	27.67	48.27	1	2
32	<i>687</i>		0.00		1	<i>687</i>	21.75	96.87	1	2
33	<i>701</i>					<i>700</i>				
34	<i>716</i>					<i>712</i>				
35	<i>731</i>		80.00		1	<i>725</i>		74.00		1
36	<i>746</i>					<i>737</i>				

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 8H. *Concordance for the Geometry EOC Assessment to the rSAT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
200	343					397				
210	352					394				
220	361					390	1.09	16.00	1	1
230	370					386				
240	379					385				
250	389					386				
260	398		66.83		2	392	4.43	57.84	5	5
270	407	4.05	47.00	1	1	402	5.73	55.24	3	3
280	415	4.78	34.89	3	3	407	4.40	45.07	5	5
290	419	3.71	35.22	2	3	409	2.93	48.30	10	10
300	419	3.03	43.00	1	1	414	3.29	28.30	3	3
310	420	1.99	57.15	5	6	419	2.85	53.65	23	27
320	424	2.63	55.94	10	12	424	2.49	51.31	22	26
330	427	2.66	46.74	14	14	428	1.60	47.03	27	34
340	433	3.36	42.50	21	24	434	1.73	46.71	64	74
350	442	2.88	54.35	31	32	440	1.18	50.91	90	118
360	448	3.37	35.33	18	19	446	1.70	35.86	51	61
370	454	3.15	38.41	29	38	451	1.46	41.34	104	136
380	460	2.68	39.40	40	49	458	1.04	38.35	169	215
390	465	2.71	46.39	45	58	464	1.11	40.69	169	220
400	470	3.15	56.59	19	31	469	1.24	47.18	73	92
410	476	2.67	36.10	51	64	471	1.42	37.49	157	212
420	482	2.72	43.67	64	94	478	1.46	37.42	253	357
430	491	2.58	40.27	71	104	484	1.33	38.99	225	339
440	498	2.71	43.32	58	96	491	1.20	40.44	257	398
450	503	2.89	39.15	64	92	496	1.37	36.16	196	323
460	510	2.94	42.92	45	93	501	1.34	38.81	200	346
470	515	3.03	47.54	53	100	508	1.49	39.60	244	419
480	522	3.06	40.51	58	120	514	1.49	38.57	233	455
490	530	3.32	37.01	65	117	521	1.58	38.39	236	461
500	537	3.01	37.67	48	109	527	1.76	34.43	193	455
510	545	3.61	38.34	82	193	536	1.74	36.47	372	814
520	557	3.67	34.47	49	136	545	1.73	35.86	219	547
530	564	3.89	47.66	58	165	555	1.78	39.00	282	696
540	574	3.87	38.65	50	133	564	2.23	39.37	197	550
550	584	4.58	39.35	44	114	571	1.59	39.00	152	458
560	593	4.44	47.11	34	106	578	1.75	41.17	164	472
570	599	4.17	42.41	29	73	584	2.12	39.87	106	346
580	606	5.02	43.20	22	85	590	2.25	39.78	129	426
590	615	6.48	40.51	27	103	599	2.38	40.03	161	452
600	624	6.40	48.71	13	49	607	2.49	39.90	96	256
610	631	6.05	46.90	15	63	614	2.72	44.94	94	302
620	638	6.31	58.38	13	46	619	2.72	45.36	57	218
630	642	7.53	61.11	11	35	624	2.42	47.60	67	216
640	654	8.13	59.33	11	37	631	2.68	46.36	78	242
650	659	7.93	64.63	5	21	637	3.15	47.54	51	179
660	666	8.45	54.53	11	29	643	3.21	50.49	64	197
670	673	10.26	83.08	3	15	652	3.39	54.49	46	136
680	683	11.58	60.28	7	23	660	4.42	53.05	63	164

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
690	690	13.92	56.83	2	13	669	4.05	56.29	39	108
700	698	15.56	58.29	4	14	679	5.13	57.36	23	95
710	706	18.20	55.81	1	5	685	4.25	59.63	37	87
720	709	19.60	62.16	2	4	694	6.37	54.28	18	46
730	715	20.93	53.95	1	8	704	6.23	61.49	21	73
740	725	22.72	49.35	3	11	713	4.94	65.18	17	56
750	746	24.65	214.00	1	1	718	8.14	85.34	5	24
760	750	25.60	213.57	1	2	724	11.64	93.34	9	26
770	754	26.20	4.24	1	2	734	14.01	59.84	11	28
780	771	26.92	176.42	1	4	754	8.60	99.16	16	33
790	800	29.42	121.84	1	3	779	12.64	116.71	11	31
800	800	28.59	136.42	1	4	800	7.53	101.09	10	30

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sample), Full N = number of students in the total sample.

Table 9H. *Concordance for the Coordinate Algebra EOC Assessment to the ACT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>200</i>					<i>298</i>				
2	<i>200</i>					<i>307</i>				
3	<i>200</i>					<i>317</i>				
4	<i>200</i>					<i>327</i>				
5	<i>200</i>					<i>336</i>				
6	<i>206</i>					<i>346</i>				
7	<i>244</i>		253.00		1	<i>355</i>		128.76		2
8	<i>283</i>					<i>365</i>				
9	<i>322</i>		163.00		1	<i>375</i>	5.85	110.00	1	1
10	<i>361</i>					<i>386</i>	6.19	128.97	3	6
11	<i>399</i>	20.24	122.00	1	1	<i>393</i>	6.13	81.04	5	8
12	<i>432</i>	16.00	34.32	3	6	<i>406</i>	6.39	55.81	10	29
13	<i>441</i>	10.39	28.79	2	19	<i>427</i>	4.11	48.19	47	108
14	<i>453</i>	5.65	26.78	13	40	<i>446</i>	3.34	37.90	76	203
15	<i>467</i>	5.62	45.63	15	52	<i>465</i>	2.55	34.44	130	338
16	<i>486</i>	6.16	29.98	29	73	<i>489</i>	2.40	33.39	168	387
17	<i>509</i>	6.42	29.97	15	34	<i>510</i>	3.19	39.03	117	237
18	<i>520</i>	7.04	23.90	8	19	<i>525</i>	3.46	43.01	50	122
19	<i>526</i>	8.29	42.92	1	11	<i>535</i>	3.71	42.65	43	79
20	<i>534</i>	8.29	44.05	4	10	<i>543</i>	3.93	52.64	26	55
21	<i>536</i>	7.87	25.33	2	3	<i>550</i>	3.93	53.08	26	37
22	<i>540</i>	7.45	24.86	2	3	<i>556</i>	4.41	59.97	18	35
23	<i>546</i>	6.58	37.46	3	5	<i>563</i>	4.72	66.81	20	32
24	<i>552</i>	5.47	71.92	2	5	<i>574</i>	5.14	77.75	25	40
25	<i>555</i>	4.13	52.45	1	3	<i>584</i>	7.23	82.82	16	30
26	<i>557</i>		41.00		1	<i>600</i>	9.60	75.73	10	14
27	<i>557</i>	2.53	57.19	1	4	<i>610</i>	9.12	76.01	8	12
28	<i>558</i>		8.00		1	<i>626</i>	11.49	95.17	7	13
29	<i>559</i>					<i>634</i>	18.92	101.01	1	5
30	<i>559</i>					<i>648</i>	20.63	15.45	2	3
31	<i>560</i>					<i>659</i>		161.28		2
32	<i>560</i>		66.00		1	<i>671</i>	21.44	133.94	2	2
33	<i>561</i>					<i>686</i>	21.29	7.00	1	1
34	<i>562</i>					<i>701</i>	17.02	163.48	1	2
35	<i>562</i>					<i>717</i>		76.00		1
36	<i>563</i>					<i>732</i>				

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 10H. *Concordance for the Coordinate Algebra EOC Assessment to the rSAT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
200	442					354	0.77	235.00	1	1
210	440					355				
220	437					355	1.40	102.99	2	2
230	434					357	1.85	133.00	1	1
240	432					357				
250	429					357	2.14	119.63	1	3
260	426					358	2.44	121.73	2	4
270	424					360	2.85	105.01	4	6
280	421					364	2.84	88.47	8	9
290	418		73.03		2	371	3.10	104.78	18	22
300	416					375	2.31	88.71	9	16
310	413					382	1.94	89.29	53	64
320	410	6.62	77.98	1	3	391	2.15	84.77	64	86
330	409		22.00		1	397	1.77	80.47	51	65
340	415	11.43	52.77	1	2	403	1.23	67.49	133	183
350	429	13.29	53.73	2	5	412	1.08	68.16	226	321
360	440	11.41	57.30	3	8	417	1.03	62.65	125	181
370	448	9.04	43.62	4	6	423	0.97	58.77	273	357
380	453	8.80	54.87	2	9	431	0.76	55.77	455	616
390	462	8.79	34.49	7	13	438	0.83	54.15	399	615
400	470	8.88	26.00	1	7	442	0.58	49.99	182	240
410	475	8.46	36.88	5	8	446	1.00	49.85	417	637
420	480	8.07	32.91	4	8	451	0.66	47.95	640	936
430	488	7.20	34.56	7	11	458	0.67	48.79	591	945
440	496	7.23	24.12	10	14	462	0.79	49.43	615	1022
450	503	8.81	26.40	5	8	467	0.55	47.12	468	818
460	511	9.33	37.44	2	8	470	0.74	48.96	511	907
470	513	9.70	32.93	3	7	475	0.73	48.51	626	1150
480	520	10.22	44.39	6	12	480	0.37	47.40	612	1203
490	528	10.98	19.24	3	6	484	0.74	47.06	610	1256
500	538	11.28	46.53	8	12	488	0.50	47.91	586	1241
510	548	12.77	64.69	2	16	495	0.94	48.37	1007	2300
520	554	13.64	44.61	3	5	500	0.77	50.23	629	1474
530	565	14.90	45.74	3	9	506	0.65	52.58	867	2154
540	575	15.68	56.09	3	8	512	0.62	53.06	662	1696
550	583		30.23		2	517	0.88	55.78	524	1364
560	586	15.99	20.92	2	5	522	1.05	57.19	560	1407
570	588		15.00		1	526	0.95	59.16	401	1071
580	590		129.52		2	531	0.96	59.97	492	1370
590	598	15.91	47.67	2	7	537	1.20	61.87	542	1438
600	614	14.01	51.34	2	3	541	0.89	66.12	354	887
610	628		72.74		4	546	1.08	66.18	404	947
620	638		47.00		1	551	1.12	69.28	330	819
630	644		22.00		1	555	1.31	71.57	327	762
640	646					560	1.43	72.89	312	821
650	646					565	1.18	76.91	319	726
660	643		47.00		1	571	1.67	81.84	312	748
670	639		24.00		1	576	1.50	82.38	240	517
680	634					581	1.41	87.38	295	649

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
690	628	33.78	74.69	1	2	589	1.16	93.85	258	521
700	<i>623</i>					595	1.41	93.20	189	386
710	<i>617</i>		124.02		2	601	1.95	97.75	173	368
720	<i>611</i>		141.00		1	604	2.56	100.98	114	244
730	<i>606</i>					611	2.13	112.52	180	333
740	<i>600</i>		190.00		1	619	1.73	106.41	171	305
750	<i>594</i>					627	2.04	114.21	73	133
760	<i>588</i>					635	2.80	130.21	99	173
770	<i>583</i>					644	3.46	134.10	93	190
780	<i>577</i>					654	3.92	134.62	95	202
790	<i>571</i>					678	5.07	152.55	110	247
800	<i>565</i>		201.99		2	738	14.34	177.96	65	181

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

Table 11H. *Concordance for the Algebra I EOC Assessment to the ACT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>441</i>					<i>239</i>				
2	<i>441</i>					<i>255</i>				
3	<i>440</i>					<i>271</i>				
4	<i>440</i>					<i>288</i>				
5	<i>439</i>					<i>304</i>				
6	<i>439</i>					<i>320</i>				
7	<i>438</i>					<i>336</i>				
8	<i>438</i>					<i>353</i>				
9	<i>437</i>					<i>369</i>				
10	<i>437</i>					<i>385</i>		73.00		1
11	<i>436</i>					<i>401</i>				
12	436	2.26	21.00	1	1	417	7.10	24.15	2	3
13	437	5.10	35.12	2	10	431	7.59	37.04	3	14
14	447	7.89	40.80	4	14	437	5.82	43.72	6	26
15	465	8.63	28.95	12	31	462	6.92	38.06	24	53
16	492	9.70	36.66	9	24	488	7.00	39.58	20	55
17	507	8.29	23.93	7	18	507	6.94	27.00	18	29
18	515	8.61	37.84	3	12	521	8.02	54.48	5	19
19	520	11.41	54.96	3	10	525	9.34	49.89	6	14
20	526	15.00	37.74	1	2	534	10.82	59.50	2	6
21	531	18.22	48.29	2	5	541	11.72	40.88	4	7
22	544	21.92	49.20	1	2	544	12.86	43.15	1	4
23	548		35.45		3	554	13.00	30.09	4	6
24	556	24.06	76.99	1	4	563	13.28	74.98	2	5
25	584	21.86	71.93	2	3	571	13.57	69.54	4	4
26	617		187.00		1	576	16.33	120.18	1	2
27	650		106.74		2	586	17.90	51.56	2	3
28	683					597		86.00		1
29	716		108.00		1	607	17.52	24.84	1	3
30	749					614	14.52	40.00	1	1
31	782					618				
32	800					620				
33	800					620				
34	800					619				
35	800		139.00		1	616	8.07	47.45	1	3
36	800					614				

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.



Table 12H. *Concordance for the Algebra I EOC Assessment to the rSAT Math Section for the Adjusted Total Samples (both Within Year and Pooled).*

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
200	386					399		157.00		1
210	390					399				
220	394					400				
230	398					401				
240	402					402				
250	406					403				
260	410					404	1.30	106.00	1	1
270	414	4.44	68.00	1	1	405	2.42	77.00	1	1
280	418	6.36	35.59	1	2	406	3.45	52.04	2	3
290	421	7.19	68.86	1	3	411	4.72	60.86	4	5
300	424					415				
310	428	7.50	41.34	3	5	418	4.57	48.19	7	9
320	436	7.00	35.45	3	3	424	3.41	53.66	11	13
330	439	6.52	35.37	3	4	429	3.98	56.97	7	9
340	442	6.54	69.82	2	2	436	3.60	40.94	18	19
350	450	6.83	23.37	7	10	442	2.86	46.74	21	32
360	456	6.68	26.15	5	8	447	3.50	31.09	17	19
370	461	6.74	42.14	2	7	453	3.88	44.08	21	30
380	464	6.80	25.29	8	8	459	2.94	41.89	33	41
390	470	7.22	58.46	3	5	466	3.08	51.10	36	51
400	474	7.25	21.78	4	5	471	2.90	46.43	23	29
410	476	7.29	44.36	3	7	476	2.39	37.86	45	61
420	484	7.21	28.94	9	15	481	1.99	44.90	61	92
430	489	7.08	29.35	5	11	486	2.26	36.43	64	92
440	493	6.94	62.53	5	13	494	1.99	41.02	57	96
450	498	6.96	36.22	8	11	498	2.50	35.45	48	83
460	503	7.37	53.76	6	11	503	2.12	42.99	54	95
470	509	7.96	45.29	6	18	507	2.47	39.90	63	117
480	511	8.54	47.73	2	7	515	2.86	37.36	51	113
490	517	8.81	48.84	8	19	520	2.52	39.29	63	135
500	525	8.77	37.38	7	16	528	2.96	34.38	49	120
510	533	8.41	44.09	10	26	534	3.12	35.84	87	219
520	541	9.33	36.87	6	15	544	3.43	31.73	57	147
530	548	10.83	69.46	6	21	554	3.37	46.63	77	187
540	556	11.90	63.69	3	16	564	4.00	44.82	44	149
550	561	12.57	54.91	4	10	573	3.82	42.39	31	118
560	570	13.70	50.53	4	13	579	4.20	36.64	32	120
570	573	15.18	71.14	1	8	586	4.78	42.22	22	88
580	577	16.77	87.35	5	12	594	4.51	49.54	31	101
590	601	17.64	58.83	5	14	604	5.42	44.51	29	121
600	612	16.62	55.65	2	7	611	6.41	50.37	11	59
610	623	15.60	70.47	3	7	617	6.36	42.31	16	71
620	631	15.67	71.58	3	8	627	6.82	48.77	16	50
630	643		90.42		3	637	7.88	52.00	10	37
640	654	14.77	85.38	3	4	640	8.66	60.71	5	44
650	664		36.51		4	648	8.62	51.38	4	27
660	672		76.16		2	650	8.76	56.89	8	36
670	679		15.81		2	661	9.51	56.52	4	18
680	683		16.22		3	665	10.60	42.68	7	22

rSAT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
690	<i>687</i>		80.11		5	679	12.98	53.89	6	18
700	<i>689</i>		28.55		4	688	15.36	46.18	3	20
710	<i>691</i>		136.94		2	697	17.36	92.92	2	6
720	<i>691</i>					<i>700</i>		64.35		6
730	<i>690</i>		11.00		1	705	20.18	53.00	4	10
740	<i>689</i>		30.11		2	725	25.36	75.70	2	12
750	<i>687</i>					741	26.50	80.00	1	1
760	<i>685</i>		77.00		1	<i>747</i>		168.22		5
770	<i>682</i>		21.00		1	<i>751</i>		67.56		4
780	<i>679</i>		37.00		1	757	24.81	131.33	2	6
790	675	61.94	69.19	1	3	776	21.49	98.56	1	7
800	<i>672</i>		76.63		2	794	16.70	190.91	1	4

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sample), Full N = number of students in the total sample.

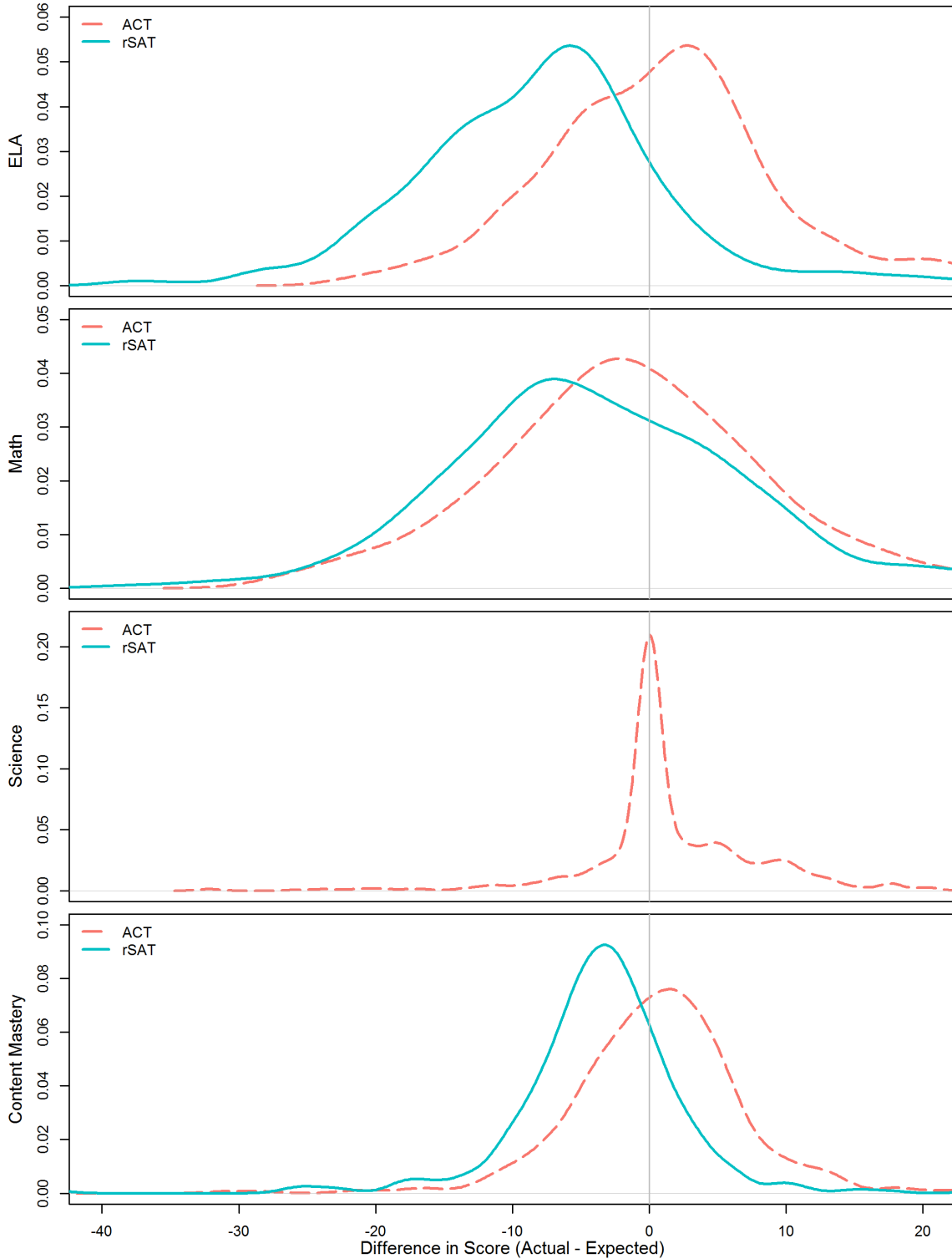
Table 13H. *Concordance for the Biology EOC Assessment to the ACT Science Section for the Adjusted Total Samples (both Within Year and Pooled).*

ACT	Within Year					Pooled				
	EOC	SE	RMSD	Linking N	Full N	EOC	SE	RMSD	Linking N	Full N
1	<i>295</i>					<i>313</i>				
2	<i>307</i>					<i>322</i>				
3	<i>318</i>					<i>330</i>				
4	<i>329</i>					<i>338</i>				
5	<i>341</i>		116.11		2	346	3.04	109.67	2	4
6	<i>352</i>					356	6.46	71.26	5	7
7	362	11.07	83.12	2	3	364	3.43	97.67	8	13
8	376	11.34	77.38	1	4	368	3.78	82.23	19	27
9	384	6.10	84.93	6	11	382	2.51	82.87	38	62
10	392	4.45	89.64	8	17	391	1.93	90.70	78	132
11	402	4.75	84.07	18	38	402	1.54	77.85	117	184
12	413	4.12	66.29	26	54	411	1.64	71.94	210	353
13	428	3.81	56.89	45	97	423	1.49	65.55	295	520
14	441	4.67	61.74	55	101	438	2.13	59.16	439	763
15	455	4.04	52.46	49	102	452	1.96	55.61	460	776
16	471	4.12	54.49	83	174	469	1.92	52.04	552	1015
17	489	4.66	55.86	74	139	486	2.13	50.88	560	1082
18	506	4.85	57.39	78	160	502	2.14	51.36	580	1176
19	524	4.50	53.19	69	142	517	1.50	50.97	457	1020
20	542	4.78	61.45	71	136	532	2.12	52.05	486	1042
21	555	5.49	64.60	36	82	548	2.03	55.31	436	918
22	565	5.10	53.33	53	104	564	1.46	54.98	422	944
23	586	6.03	54.36	50	93	579	1.79	55.37	283	690
24	600	6.80	64.73	32	56	592	3.96	60.37	275	649
25	618	7.19	66.28	27	57	608	1.53	61.37	224	468
26	631	7.93	77.08	18	43	622	3.50	64.20	149	348
27	645	10.03	79.80	14	28	633	3.17	65.20	89	223
28	662	10.37	85.43	12	18	648	2.56	71.74	84	186
29	671	11.55	37.52	6	15	662	6.86	71.18	66	166
30	683	13.96	72.50	5	11	668	4.01	77.11	51	107
31	692	18.65	67.38	3	9	685	5.40	77.27	52	117
32	704	24.06	75.25	2	7	692	7.40	83.89	22	46
33	712	27.24	75.81	2	15	714	10.26	85.30	37	94
34	747	30.53	84.08	5	9	732	18.92	92.47	20	66
35	770	26.55	92.53	1	8	771	9.70	105.02	22	51
36	800	21.79	131.95	3	7	800	9.80	121.05	17	47

Notes: EOC values in *italics* have been extrapolated using a cubic smoothing spline. EOC = The expected or concordant score for the given rSAT or ACT score point, SE = Standard Error of Linking based on 1,000 bootstrap replications, RMSD = the root mean squared difference between the expected score and actual student EOC scores for the given rSAT or ACT score point, Linking N = the number of students used in the linking (i.e., adjusted sampled), Full N = number of students in the total sample.

## Appendix I: Supplemental School Level Statistics

Figure 1I. *Distributions of Score Differences (Actual - Expected) for School Subject Area Percentages and CCRPI Content Mastery Component.*



Note: the Y-Axis is the density of the differences between the Actual and Expected Subject Area Percentages or Content Mastery Component Values.

Table 1I. Summary Statistics for Score Differences (*Actual - Expected*) for School Subject Area Percentages and CCRPI Content Mastery Component.

	<b>Min.</b>	<b>1st Qu.</b>	<b>Median</b>	<b>Mean</b>	<b>3rd Qu.</b>	<b>Max.</b>
<b>ACT</b>						
ELA	-22.5	-4.5	1.2	1.0	5.4	39.9
Math	-27.6	-8.0	-1.7	-1.3	4.8	36.4
Science	-32.2	0.0	0.0	1.8	4.6	34.3
Content Mastery	-47.2	-3.0	0.8	0.4	4.1	23.0
<b>SAT</b>						
ELA	-38.4	-13.5	-7.4	-7.8	-3.2	28.9
Math	-38.9	-10.2	-4.4	-2.8	3.7	49.9
Content Mastery	-43.2	-6.4	-3.3	-3.6	-0.5	23.8