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**The Transition from ACT to SAT as the Illinois College Entrance Exam and the Potential  
Implications on Student Scores in Mathematics**

By

**William Rose**

B.S. Mathematics, Illinois State University, 2009

CAPSTONE PROJECT

Submitted in partial fulfillment of the requirements  
For the Degree of Master of Science,  
With a Major in Mathematics

Governors State University  
University Park, IL 60484

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**TABLE OF CONTENTS**

List of Figures.....v

Abstract.....vi

Standardized Testing as a Means to Assess High School Performance.....1

Why Change from ACT to SAT as the Measure for Student Achievement?.....1

Traditional Versus Integrated Curriculum.....2

The Eight Mathematical Practices.....4

The Composition of the Mathematics Portion of the ACT.....7

The Composition of the Mathematics Portion of the SAT.....9

Differences in Mathematical Portion Composition and the Implications for  
High School Students.....10

Limitations of the ACT and SAT as Reliable Measures of Student Achievement.....19

The Purpose of Standardized Tests and the New Definition of Success.....20

Continued Implementation of the SAT and Potential Ways to  
Improve Standardized Testing.....23

References.....27

**LIST OF FIGURES**

|  |    |
|--|----|
| Figure 1: Sample SAT student-produced response item.....                                     | 12 |
| Figure 2: Sample ACT question assessing calculation of value from linear relationship.....   | 14 |
| Figure 3: Sample ACT question assessing slope-intercept understanding .....                  | 15 |
| Figure 4: Sample SAT question assessing representation of linear relationship.....           | 15 |
| Figure 5: Sample ACT question assessing calculation of intercept of quadratic function.....  | 16 |
| Figure 6: Sample SAT question assessing factored and standard form of quadratic equation.... | 17 |

**ABSTRACT**

For years schools have worked to create mathematics curricula that aim to both build students' understanding of the course content and prepare them for questions styled like those on their college entrance exam. In previous years, the exam mandated by the state of Illinois was the ACT (American College Testing); however, starting with the 2016-2017 school year the policy has now changed to administer the SAT (Scholastic Assessment Test). This transition poses many potential implications on the performance of students. In order to help identify these implications, both exams were studied at great depth. The following paper will focus on the similarities and differences in mathematics tests of the ACT and SAT. The paper also presents both the potential benefits and consequences for the eleventh-grade students who will be the first required by the state of Illinois to take the SAT, and the larger possible ramifications their performance on the mathematics portion holds on the public schools.

### **Standardized Testing as a Means to Assess High School Performance**

Success is a result that is easily ascertained; so long as the intended outcome is measurable. The determination is black and white: the goal was either met or it was not. But in education the measurement of success has proven to be far more difficult. The evaluation process the government uses to rate public high schools is an ever-evolving entity. In particular, high school mathematics is one of the most scrutinized fields in terms of establishing the performance level of a district.

Over the last 15 years the state of Illinois has utilized the ACT to measure the student achievement level of districts, and high school administrators have constructed curricula and implemented instructional strategies in an effort to strengthen their students' test scores on the mathematics portion. However, after an experiment with the Partnership for Assessment of Readiness for College and Careers (PARCC) assessment, the Illinois State Board of Education (ISBE, 2017) decided to switch to the newly redesigned SAT as the college entrance exam, starting with the 2016-2017 school year. There are many differences between the ACT and SAT and the transition from one assessment to the other presents concerns for education stakeholders, such as students, parents, teachers, and school administrators.

### **Why Change from ACT to SAT as the Measure for Student Achievement?**

When there is a major change in any field the initial reaction is to question why such a change is necessary. Has the ACT lost its validity as an exam and is the SAT more reliable in its assessing of student understanding? Is it a sign of the ever-present budget concerns with public school funding, because the SAT undercut the cost of ACT to ensure a statewide implementation? These and countless other questions certainly have their place, but one major reason as to why the state has chosen the implementation of the SAT over the ACT is because



the state has changed the composition of its mathematics curriculum when Illinois adopted the Common Core State Standards for Mathematics (CCSSM, 2010b).

The implementation of the CCSSM as the primary basis for the creation of mathematics courses necessitated a change in which the students are assessed. The CCSSM were created to establish a consistency between states in regards to content for a high school curricula. Currently 42 states implement the CCSSM as the basis for curriculum development; Illinois has used the CCSSM since the 2013-2014 school year (CCSS, 2010a). Though there are many similarities between classic mathematics curricula and the CCSSM, its implementation introduced some notable differences that school needed to accommodate. One key decision school districts needed to make was which mathematics pathway to use: the traditional or the integrated.

### **Traditional Versus Integrated Curriculum**

In the traditional pathway, schools still maintain the three primary courses of Algebra I, Algebra II, and Geometry, but realign the curriculum for each course to create a more unified idea of the concepts within each course. Prior to these standards, the composition of these courses varied not only from state to state, but also between districts within the same state. One reason this could be problematic is the case where a student moves into a new district during the school year. Without a consistent alignment, he or she may enter in a mathematics course where the class is significantly ahead, or even behind for that matter, and put the student at a disadvantage for his or her understanding of mathematics.

The integrated pathway is a more unconventional approach to the realignment of mathematics courses at the high school level. Rather than simply realign the mathematics content considered to be Algebra I, Algebra II, and Geometry, the integrated approach instead separates concepts into courses titled Math I, Math II, and Math III. At first glance many of the standards

in these integrated courses align with the already existing courses at the high school level; for example, Math I introduces the idea of factoring polynomial expressions to students in ninth grade, which is something a traditional Algebra I courses incorporates as well, also a course designed for ninth grade students. However a notable difference is the absence of isolated geometry and statistics courses. Rather than make a distinct geometry or statistics course, like the traditional pathway, those concepts are dispersed and integrated with algebra concepts to create these different courses (hence the title of “integrated pathway”). The state of Illinois showed support for the integrated pathway by changing the official graduation requirements in mathematics, changing the official phrasing of the mathematics graduation requirement from “three (3) years of mathematics, including one (1) year of Algebra and one (1) year of Geometry” to “3 years of mathematics, one of which must be Algebra 1 and one of which must include geometry content” (State Graduation Requirements, 2016).

When the CCSSM were adopted by the state of Illinois some, school districts, regardless of pathway, began to replace traditional grading scales with standards-based grades. The intention of the standards-based grades is to give students, parents, and teachers a better understanding of the mathematical content mastered by each individual student. Traditional letter grades can be equated to telling someone “Good job” or “Bad job” at a performance review and expect him or her to use that feedback to improve deficiencies in performance. By not providing students the reasoning behind the scores, they receive the reports schools provide are useless. Standards-based grades provide students a more detailed look at their progression of mastering the standards addressed in the mathematics course in which they are enrolled. Another benefit of the new grading procedures is the capability to better monitor student growth. Expecting student achievement to improve from below acceptable level to above has been shown to be an

ineffective method of assessment. A more meaningful way to measure student and school performance is to measure the growth of student performance from year to year (The Wallace Foundation, n.d.).

In addition to the curricular and feedback changes brought forth by the CCSSM, mathematics teachers must also incorporate specific practices into the lessons they prepare. Mathematics provides opportunities for students to strengthen their cognitive skills such as critical thinking and reasoning. These key components of the CCSSM are referred to as the eight mathematical practices and are described in the Standards for Mathematical Practice (CCSS, 2010b).

### **The Eight Mathematical Practices**

Regardless of the pathway used the courses are expected to incorporate the eight mathematical practices in the teaching and assessing of the state standards. The mathematical practices, as well as a brief description, are as follows (CCSS, 2010):

#### **Make sense of problems and persevere in solving them.**

Students who are considered mathematically proficient can understand the processes and meaning of the solutions they obtain. Students are also able to overcome struggles they encounter on their path to a solution, and can incorporate additional strategies to work through a problem should their initial method fail.

#### **Reason abstractly and quantitatively.**

Students who are considered mathematically proficient can use mathematical operations to solve a given problem. Students are able to take the relevant information presented and represent that information using mathematics; conversely they can take a given mathematical problem and give it context.

**Construct viable arguments and critique the reasoning of others.**

Students who are considered mathematically proficient can justify the steps used in solving a problem. They can prove the mathematics used is accurate and an appropriate strategy to use to arrive at the solution. Students are also able to comprehend the reasoning of others, particularly when the approach used differs from their own. They are capable of recognizing the alternate methods and, when appropriate, identifying errors in others' work.

**Model with mathematics.**

Students who are considered mathematically proficient can use mathematics to solve real-world problems. Students can also interpret the mathematics in the context of the situation.

**Use appropriate tools strategically.**

Students who are considered mathematically proficient can effectively incorporate tools, both technological and practical, when solving problems. Students are not dependent on the use of these tools, but understand when using them is appropriate.

**Attend to precision.**

Students who are considered mathematically proficient can accurately solve problems.

Students can also represent the solutions and included graphs and diagrams correctly.

**Look for and make use of structure.**

Students who are considered mathematically proficient can see the patterns and structure that exist within mathematics. Students also understand the contribution of the components of formulas or expressions.

**Look for and express regularity in repeated reasoning.**

Students who are considered mathematically proficient can derive formulas and develop efficient strategies through repeated calculations. Students also deepen the understanding of different fields of mathematics and anticipate solutions based on their experiences solving problems.

Though many teachers have incorporated these practices in their mathematics instruction for years, formally defining the eight mathematical practices and including them in the CCSSM ensures their implementation. Students are no longer expected to memorize mathematical processes; instead they are now required to understand mathematics on a deeper level and make conjectures about the structure of mathematics. Students are challenged to make the connections that exist in mathematics with the goal of becoming stronger problem-solvers and critical thinkers. Lessons designed to incorporate the eight mathematical practices often involve the requirement to justify the reasoning for a particular method in solving a mathematics problem and analyzing other students' work to identify errors in the logic they used. Mathematics understanding is no longer determined by the students' ability to understand *what* to do to solve a problem; they must now demonstrate an understanding of *how* and *why* the chosen method is appropriate. If students are expected to strengthen their use of the eight mathematical practices, then the standardized assessment used to evaluate mathematics competency must reflect that expectation. However, the current compositions of the ACT and SAT focus more on the mathematical content students are expected to know and less on the cognitive skills developed in the learning and use of mathematics.

## **The Composition of the Mathematics Portion of the ACT**

The mathematics subsection of the ACT allows 60 minutes for students to answer 60 multiple-choice questions. Students are permitted to use a graphing calculator as necessary. According to the official ACT preparation guide, *Preparing for the ACT*, the 60 questions are broken down into two main categories, where the percentage indicates the amount of the test that the particular:

### **Preparing for Higher Math (57–60%)**

This category captures the more recent mathematics that students are learning, starting when students begin using algebra as a general way of expressing and solving equations. This category is divided into the following five subcategories:

#### **Number and quantity. (7–10%)**

Demonstrate knowledge of real and complex number systems. Students will understand and reason with numerical quantities in many forms, including integer and rational exponents, and vectors and matrices.

#### **Algebra. (12–15%)**

Solve, graph, and model multiple types of expressions. Students will employ many different kinds of equations, including but not limited to linear, polynomial, radical, and exponential relationships. The student will find solutions to systems of equations, even when represented by simple matrices, and apply their knowledge to applications.

#### **Functions. (12–15%)**

The questions in this category test knowledge of function definition, notation, representation, and application. Questions may include but are not limited to linear, radical, piecewise, polynomial, and logarithmic functions.

Students will manipulate and translate functions, as well as find and apply important features of graphs.

**Geometry. (12–15%)**

Define and apply knowledge of shapes and solids, such as congruence and similarity relationships or surface area and volume measurements.

Understand composition of objects, and solve for missing values in triangles, circles, and other figures, including using trigonometric ratios and equations of conic sections.

**Statistics and probability. (8–12%)**

Describe center and spread of distributions, apply and analyze data collection methods, understand and model relationships in bivariate data, and calculate probabilities, including the related sample spaces.

**Integrating Essential Skills (40-43%)**

Addresses concepts typically learned before 8th grade, such as rates and percentages; proportional relationships; area, surface area, and volume; average and median; and expressing numbers in different ways. Students will solve problems of increasing complexity, combine skills in longer chains of steps, apply skills in more varied contexts, understand more connections, and become more fluent. (ACT, 2017, pp. 5-6).

Programs designed to help students prepare for the ACT have analyzed the exam composition and provided even more detailed breakdowns of the exam. One such analysis described the test as it applies to the traditional mathematical courses (ACT, 2017, pp. 5-6):

Pre-Algebra (23%)

Elementary Algebra (17%)

Intermediate Algebra (15%)

Coordinate Geometry (15%)

Plane Geometry (23%)

Trigonometry (7%)

### **The Composition of the Math Portion of the SAT**

The mathematical subsection of the SAT consists of two exams, one on which students are not permitted to use a calculator and the other on which calculators are allowed. The calculator-exam allows 55 minutes to complete 38 questions. The no calculator exam allows 25 minutes to complete 20 questions. Of the 58 questions, 45 are multiple choice and 13 student-produced responses, which involves the students generating his or her answer on a gridded response form. The College Board, the company that both creates and manages the SAT exam, breaks down the assessment as follows (Test Specifications for the Redesigned SAT, 2015):

#### **Heart of Algebra (33%)**

Analyzing and fluently solving linear equations and systems of linear equations. Creating linear equations and inequalities to represent relationships between quantities and to solve problems. Understanding and using the relationship between linear equations inequalities and their graphs to solve problems.

#### **Problem Solving and Data Analysis (19 questions, 29%)**

Creating and analyzing relationships using ratios, proportional relationships, percentages, and units. Representing and analyzing quantitative data. Finding and applying probabilities in context.



**Passport to Advanced Mathematics (16 questions, 28%)**

Identifying and creating equivalent algebraic expressions. Creating, analyzing, and fluently solving quadratic and other nonlinear equations.

**Additional Topics in Mathematics (6 questions, 10%)**

Solving problems related to area and volume. Applying definitions and theorems related to lines, angles, triangles, and circles. Working with right triangles, the unit circle, and trigonometric functions.

**Contribution of Items to Cross-Test Scores – Analysis in Science (8 questions, 14%)****Contribution of Items to Cross-Test Scores – Analysis in History (8 questions, 14%)****Differences in Mathematical Portion Composition and the Implications for High School Students**

One of the most notable differences between the two exams is the requirement that students complete a no calculator portion on the SAT, a recent change to the assessment. The College Board rationalized the separation of calculator and no calculator portions of the assessment because higher-levels exam, such as Advanced Placement (AP) exams, have the same format (Math Test). High schools implementing the CCSSM incorporate the calculator throughout many courses, primarily due to the inclusion of graphing calculators as outlined in the standards as well as utilizing the mathematical practice of utilizing technology appropriately. Whether the reasoning is because students are dependent on calculators, or not having one may cause test anxiety, students enrolled in courses where a calculator is permitted on assessments

could be put at a disadvantage considering the SAT would be the first instance of when they would be expected to solve mathematics problems without using a graphing calculator.

The percentage of each mathematical topic covered on the ACT and SAT illustrated a major difference between the content of the two exams. A major push of the CCSSM, particularly in the integrated curricula, was the removal of an isolated geometry course. The alignment of SAT with the CCSSM was made more apparent with the lack of emphasis on geometry topics. The Additional Topics in Mathematics category of the SAT contains the concepts covered in traditional geometry courses and the entire category only makes up 10% of the mathematics concepts assessed. The ACT defined a specific Geometry subcategory that comprised 12-15% of the overall assessment, seemingly extremely comparable to the percentage of questions on the SAT over the same content. However the 12-15% does not incorporate the geometry concepts that fall under the Integrating Essential Skills section. The ACT preparation companies that analyzed the exam in regards to traditional mathematics courses, identified roughly 38% of the average ACT exam was composed of questions over geometry material. That percentage could even be considered a bit low, as trigonometry concepts can often be learned in a typical geometry curriculum. The significant decrease in focus on geometry topics could put the students in districts that have not yet adopted the CCSSM at a disadvantage.

Another major notable difference between the two exams is the incorporation of student-produced response questions on the SAT. Though multiple-choice questions give students the opportunity to guess correctly by randomly bubbling in an answer choice, the format still ensures students will get credit when they are correct. That is to say that there is no chance the student will mistakenly record their answer (unless the student bubbles in the letter choice in the incorrect position, which one would assume is an extremely low percentage). However the

student-produced response portion of the SAT could present an error in test validity that has not yet been encountered through previous standardized tests. A sample of a student-produced response question and answer, taken directly from the College Board online resource (2017) is pictured:

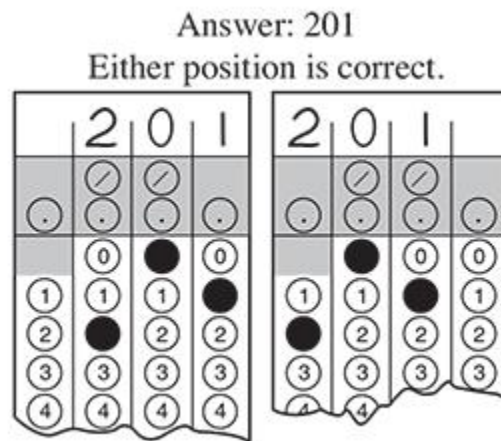


Figure 1

The College Board stated that either representation of the solution is correct. However, suppose a student solved an equation with an answer of “12”. Students would receive credit for “12” written in any of the three potential ways. However, given the format of the answer recording document it is not unreasonable to think a student could bubble in “012”. According to the College Board (2015), the response “012” would be marked incorrect for this question. This is just one of several different scenarios where a student would fail to receive credit for having come up with the correct answer solely due to an error in representing their answer as needed to allow technology to score the assessments.

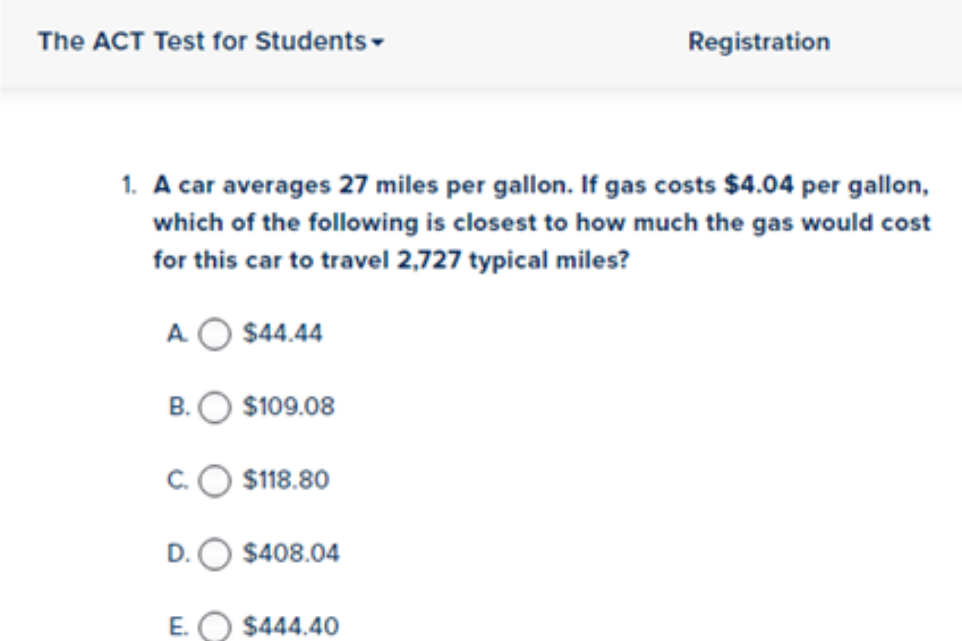
Through exploration of the sample questions each company provided for their respective assessments, other differences become apparent. Something immediately obvious between the

two exams is the multiple-choice questions on the ACT provide five answer choices for the tester to choose from while the SAT provides only four. Thus the SAT test-taker has a 25% chance to guess the correct answer, which is an advantage over the 20% chance of an ACT test-taker. However, the advantage for SAT can be misinterpreted because not all of the mathematics questions provide answer choices. Unlike the ACT, where students will always have at least a 20% probability at guessing correct for every question, students taking the SAT will have sets of questions that provide no choice options. Though no official justification has been provided by either assessment company regarding the number of answer choices for their respective multiple-choice questions, a potential reasoning for College Board having limited the answer choices is to provide a balance to the student-produced response section.

In regards to question composition and intention, most sample problems examined from the mathematics portion of the ACT prompt students to provide each solution to very straightforward problems. That is not to say the problems posed to students are simple, but rather the procedural fluency to arrive at the solution is the most commonly assessed mathematical ability. The sample set of questions provided by SAT for test preparation procedural fluency is still assessed, but other questions also contained within the problem set require students to demonstrate mathematical ability beyond just arriving at the solution.

To help highlight the difference in questioning some sample problems were taken directly from the official ACT and SAT resources. Figure 2 (ACT, 2017a), Figure 3 (ACT, 2017b), and Figure 4 (College Board, 2016a) are intended to assess the algebraic concept of linear functions, something previously noted as covered on the SAT as part of the Heart of Algebra content. Figure 2 and Figure 3 are sample questions pulled from the ACT source. Both sample questions are presented to illustrate the straight-forward questioning common to the mathematics portion of

the ACT assessment. The ACT sample question in Figure 2 provides students with the freedom to solve the problem using their own methods. A student who does not grasp the idea of writing the equation of a linear function can simply use his or her own real-world understanding to solve the problem. Deciding whether or not the problem adequately assesses a student's mathematics ability depends on the intention of the assessment. A student's proficiency in linear functions cannot be definitively determined by the question, but his or her ability to take mathematics and the real-world application to solve the problem may be deemed the more important skill. The ACT sample question in Figure 3 does require the student to understand the composition of a linear function, demonstrating knowledge of the initial value and the constant rate of change. However, the question is presented to the student with limited context and at no point requires the student to demonstrate an understanding between velocity and time. Students are assessed on their ability to calculate the slope from a table and state the slope-intercept equation resulting from the values.



The ACT Test for Students ▾ Registration

1. A car averages 27 miles per gallon. If gas costs \$4.04 per gallon, which of the following is closest to how much the gas would cost for this car to travel 2,727 typical miles?

A.  \$44.44

B.  \$109.08

C.  \$118.80

D.  \$408.04

E.  \$444.40

Figure 2

Which of the following equations represents the linear relationship between time,  $t$ , and velocity,  $v$ , shown in the table below?

|     |     |     |     |
|-----|-----|-----|-----|
| $t$ | 0   | 1   | 2   |
| $v$ | 120 | 152 | 184 |

- F.   $v = 32t$
- G.   $v = 32t + 120$
- H.   $v = 120t$
- I.   $v = 120t + 32$
- J.   $v = 120t + 120$

Figure 3

Figure 4 is an SAT question used for test preparation from the College Board resource. The question requires the students to apply more algebraic concepts to arrive at the correct mathematical conclusion. Students are expected to model a real-world situation with mathematics, one of the eight mathematical practices. They are also expected to calculate a rate of change from given values, one of the ninth grade standards of the CCSSM.

25

Population of Greenleaf, Idaho

| Year | Population |
|------|------------|
| 2000 | 862        |
| 2010 | 846        |

The table above shows the population of Greenleaf, Idaho, for the years 2000 and 2010. If the relationship between population and year is linear, which of the following functions  $P$  models the population of Greenleaf  $t$  years after 2000?

- A)  $P(t) = 862 - 1.6t$
- B)  $P(t) = 862 - 16t$
- C)  $P(t) = 862 + 16(t - 2,000)$
- D)  $P(t) = 862 - 1.6(t - 2,000)$

Figure 4

A direct comparison of the two assessment questions clearly demonstrated that the redesigned SAT more closely aligned to the CCSSM and eight mathematical practices than the ACT.

The study of quadratic functions is an integral part of all high school math curricula and appears frequently on the mathematical portion of standardized assessments. Figure 5 (ACT, 2017c) is a sample ACT question used to assess students' understanding of a quadratic function and its x-intercepts. There are countless methods students could use to solve the problem. One method could be to use the graphing calculator to determine the zero of the function, a very direct route that requires no computational knowledge. Students could set the function equal to zero and factor the equation to calculate the solutions, which shows an overall understanding that a solution to a given equation corresponds to an x-intercept on the graph. Whether students employ either of these methods or any of the other possibilities the fact remains that students could receive the same credit for demonstrating extremely different levels of understanding.

**What is the x-intercept of the graph of  $y = x^2 - 4x + 4$ ?**

- A.  -2
- B.  -1
- C.  0
- D.  1
- E.  2

*Figure 5*

Figure 6 is a sample question from the College Board SAT test preparation materials (2016b) and requires more than a basic understanding of quadratic functions and equivalency. The sample question appeared on the non-calculator portion of the assessment, immediately taking

away any potential support the graphing calculator could provide to the test-taker. Students are required to demonstrate an understanding of factored form and standard form of quadratic functions. Students could either factor the left-side of the equation and then find the answer choice with the leading coefficient for each factor, or they could substitute each answer option in the right-side of the equation and distribute the first binomial into the second binomial until they find the correct value that would simplify to the standard form of the function. In either instance the students are expected to demonstrate fluency in equivalent representations of function, a topic emphasized heavily by CCSSM (CCSSM, 2017).

$$4x^2 - 9 = (px + t)(px - t)$$

In the equation above,  $p$  and  $t$  are constants.  
Which of the following could be the value of  $p$  ?

- A) 2
- B) 3
- C) 4
- D) 9

*Figure 6*

The two assessments greatly differ in the feedback provided by the score report. The report for the ACT gives the student a composite score, calculated as the average of the score on each subsection. The scores on each subsection, and therefore the overall composite score, range between 1 and 36. Thus the only feedback given to the students on their mathematical competency is the one score. The report does provide a “score range” which takes into account standards of error in the assessment as well as a benchmark score to indicate the college-readiness level. Similar to the ACT, the SAT score report provides a numerical value for each



student, where the scores can range from 200-800. However the SAT does provide three subscores within the mathematics section of the assessment: Heart of Algebra, Problem Solving and Data Analysis, and Passport to Advanced Math. By providing a report of the sub-scores within the mathematics section of the SAT, students can gain a better understanding of the content in which they excelled and in which they were deficient, something the ACT report lacks. Though it would be far more beneficial to have an extensive breakdown of the standards mastery of each individual student the College Board has demonstrated an acknowledgement of meaningful feedback for the student and made progress in producing a more effective report.

With the recent restructuring of the SAT to more align with the CCSSM, students enrolled in districts that have not yet adopted the standards are put at a disadvantage. The mathematics courses in which these students are enrolled may not cover all the content necessary for success on the SAT. Additionally, due to the importance of success on standardized tests, some high school mathematics courses were designed to incorporate ACT-style questions and testing strategies. Casey Quinlan, a policy reporter for Think Progress, notes that many teachers forego creating challenging lessons that would enhance students' understanding, and rather let the implications of student performance on standardized assessments drive lesson-planning (Quinlan, 2016). The lesson-planning around standardized assessments should not be the focus of the teaching of mathematics, but the problem is only furthered when a new assessment is introduced state-wide, as was the case with the SAT. Teachers are not as familiar with the assessment and lack the proper understanding of the test to create materials designed to help students achieve. The years and years enrolled in mathematics courses structured around the ACT as the intended standardized assessment could dramatically put the students who will take the SAT at a disadvantage.

### **Limitations of the ACT and SAT as Reliable Measures of Student Achievement**

Dr. Diane Ravitch, research professor of education at New York University, famously stated “Sometimes the most brilliant and intelligent students do not shine in standardized tests because they do not have standardized minds” (Neufeld, 2015). Are standardized tests completely reliable in their assessment of students’ mathematical understanding and critical thinking skills? A common complaint against standardized testing, regardless of the assessment administered, is the prevalence of factors that can limit student achievement beyond just academic ability. Particularly in the standardized assessment of mathematics several limiting factors have been recognized and, despite efforts to minimize the impact of such factors, they still impact students today.

A noted limitation to the mathematics portion of the ACT is that students can be handicapped by the coursework they have completed prior to testing. Students who are enrolled in courses beyond grade level will have an extensive advantage over those at or below grade level simply because they have been exposed to more content coursework. A 2005 study conducted by the ACT found that students who completed the three standard mathematics courses for high school students Algebra I, Algebra II, and Geometry scored on average five and a half points lower than students who completed the same three courses and additional mathematics coursework in trigonometry, calculus, or other advanced mathematics (The Sensitivity of ACT to Instruction, 2005). Some may argue that such an achievement gap is justified since the students in higher-level mathematics courses know more mathematical concepts and have developed a stronger understanding of the mathematics assessed. However, this rationale assumes that the only intent of assessing mathematics is the content knowledge students possess; many would agree that, in addition to assessing content mastery, the purpose of

the mathematics portion of the assessment should be to test students' ability to think critically, problem-solve, and apply logic. ACT has been identified as an achievement-measuring assessment, whereas the SAT measures cognitive abilities, with an emphasis on reasoning in addition to the content knowledge of students (General Questions).

A Reuters investigation (Dudley, 2016) of the newly designed SAT uncovered an issue with the wordiness of the mathematics problems and the ability of some students to complete the assessment in the time allotted. Typically low-income students and minority students are disadvantaged by mathematics problems that are lengthy in their wording. The College Board strived to limit the inclusion of these questions when the SAT was redesigned, but it was discovered that even after additional efforts to cut down the text-heavy questions the SAT was launched with enough of them to be considered unfair to the aforementioned groups of students. Particularly concerning is that the mathematics portion of the SAT puts the mathematics ability of an individual student secondary to his or her reading comprehension.

### **The Purpose of Standardized Tests and the New Definition of Success**

The earlier comparison of the linear function questions from the ACT and SAT presents the larger issue behind the transition of the Illinois standardized tests: what *do* standardized tests measure and what *should* these assessments measure? With the focus shifting from memorization of mathematical processes to a deeper understanding of concepts and problem-solving ability the standardized tests used to assess mathematics competency need to incorporate the both the content covered in the CCSSM and the skills outlined by the eight mathematical practices.

Before the mandatory delivery of the SAT to all high school eleventh grade students in the spring of 2017, high schools in the state of Illinois had the option the previous year to give the ACT to their students. Students in the Naperville School District 203 voiced their concerns

over switching from the SAT to ACT. One student, Abby Rader, stated “they’re already studying for it (the ACT). It would be a waste of their time” in regards to administering the SAT to the high school juniors in the spring of 2016 (Beckman, 2015). It is a great concern that students believe their coursework in mathematics did not adequately prepare them for the SAT. Is it unreasonable to expect that a student who successfully completed the prerequisite mathematics coursework should be able to maintain a consistent level of achievement from assessment to assessment? Students should feel adequately prepared for success on any standardized test. The noted differences between the two assessments certainly gives a degree of validation to the students’ apprehension, which not only could affect their scores but also the resulting test anxiety for the students entering the testing center to take an unfamiliar assessment.

The PARCC assessment, as previously mentioned, aimed to provide the state of Illinois with a CCSSM aligned standardized test. Unfortunately, when the state of Illinois implemented the PARCC assessment to its high school students to measure student performance, the schools and administrators encountered many problems. Schools needed the hardware and software capable of administering the assessment, as well as enough bandwidth to support the substantial toll its implementation would take on a school’s internet system. The number of test dates, the amount of allotted time for each test, and the resulting schedule conflicts that arose also proved problematic for schools to accommodate. The state Superintendent of Education, Tony Smith, ultimately ended the PARCC test implementation because they determined that the state-provided assessments should serve dual-purposes: recording school performance while also providing students with an assessment that can be submitted for college acceptance (Rado, 2016).

Even though the PARCC test was used for only two years at the secondary level, the assessment did bring some necessary change to outdated practices. During the ACT era, a school's performance was measured solely on the collective score of its eleventh grade population. Schools could analyze the data on a year-to-year basis and establish improvements or declines in student achievement but the overall emphasis was on the scores each year. A major component of the PARCC test was to measure the growth of students in mathematics and place a higher emphasis on those results rather than on the achievement. As previously mentioned the necessity for extra days of testing ultimately proved too problematic for schools, but the concept that individual student growth should be the primary evaluative focus for schools aligned with the change in educational philosophy. For example during the implementation of the No Child Left Behind Act, under which the state of Illinois used the ACT to measure academic level of students, schools where students typically scored below the state average would consistently fail to meet the academic benchmark set by the state of Illinois. The notion that a school could go from failing to meet a benchmark to then exceeding it the following year was a bit unrealistic, and so the transition from achievement-based performance to growth-based performance began. Through multiple assessment intervals the PARCC exam measured student growth in each subject area. The first assessment interval served to establish the baseline mathematics level of each student. Subsequent assessment dates then measured each student's improvement, or decline, against his or her earlier performance. This process could have allowed low-achieving schools to be considered successful as measured by the level of growth in student achievement, but the short length of implementation did not allow for sufficient results.

The other strength to the PARCC assessment was its alignment with the CCSSM for Mathematics. Despite the continued debate of the CCSSM use in curriculum development, the

fact is the standards are the structure behind mathematics curricula across the state of Illinois. For a standardized test to accurately assess the mathematics content knowledge of the students, it must build into its questions the material the students covered in their secondary studies. The PARCC assessment was built to directly assess the CCSSM. Educators could analyze the student results and see how their students performed when assessed on the actual standards that comprised the course frameworks. The PARCC test, at least for the state of Illinois, provided results for schools that had a strong indication of each student's cumulative knowledge of mathematics and not simply a score that assigned a college-readiness level, which made for a more meaningful assessment for students.

### **Continued Implementation of the SAT and Potential Ways to Improve Standardized Testing**

A strong case against using the SAT, or even reverting back to the ACT, is the fact that the assessment has not been validated to adequately assess the high school mathematics curricula. Catherine Gewertz of *Education Week* (2016) points out that the primary purpose of the SAT is to assess the college-and-career-readiness level of high school students, not necessarily to assess the CCSSM. This basically implies that, despite the CCSSM giving a framework for the mathematics to be assessed on the SAT, the exam has not been a verified assessment of the standards themselves; the score provided to students is instead qualified only to provide the students' performance against the college-readiness benchmark, which serves as a predictor for success at the post-secondary level. However, a 2014 study by William Hiss concluded that a student's performance on standardized college-entry exams, like ACT and SAT, did not indicate his or her level of success at the post-secondary level. According to the study students who scored moderately on standardized exams and performed higher than average in

their coursework, were more successful in college than those who scored higher than average in testing and performed lower than average in their coursework (Sheffer, 2014).

One result of the SAT implementation and the potential implications it could have on students was the proposal of a bill to the Illinois Senate that would no longer require schools to include standardized test scores on a student's academic record. On March 29, 2017, the Illinois Senate unanimously voted to amend the language of the school code, removing the requirement of student performance on the state college-and-career-readiness exams to be a part of the student's personal academic record. The language does state that a student has the option of including his or her performance on state-wide standardized assessments, should the student think the inclusion of the scores would benefit his or her academic record (Berkowitz, 2017).

One method the College Board could use to revise the SAT to meet the needs of students and administration would be to provide a report of the student performance in regards to the CCSSM. The legislators of the state of Illinois indicated the importance of providing a college-entrance exam to every student. Using standardized tests as an opportunity for students to receive a free college-entrance exam is not necessarily a bad practice. However, it does not provide schools with a report of student performance on the standards they are expected to master. Adapting the SAT to serve the dual-purpose of assessing students' mastery of the CCSSM, as well as a college-readiness score, would better serve the needs of all stakeholders in the standardized testing process.

The standardized tests used to evaluate teaching practices and effectiveness should also strive to assess the student proficiency of the eight mathematical practices outlined in the CCSSM. It can be argued that some, such as model with mathematics and persevere in solving mathematics problems, are encompassed on the SAT but the current structure of the test does not

make the assessment of the practices a priority. The composition of the ACT and the older version of the SAT encouraged mathematics teachers to resort to straight-forward, low-level questions that were indicative of the level of questions on the assessments. The redesigned SAT incorporates a more diverse arrangement of mathematics problems, beyond just the straightforward solving of equations (O'Shaughnessy). This new format of the SAT challenges teachers to incorporate more higher-order thinking in their mathematics instruction, and to promote the eight mathematical practices within those lessons. However, the SAT still assesses the students' ability to draw a conclusion from a mathematics problem, whether it the solution to a given scenario or the equation used to model given information. The limitation remains that a student either chose the correct letter, or wrote the correct answer for the student-produced response, or did not. The structure of the test does not give recognition for the thought process a student used to reach a conclusion. It is common in high school mathematics courses that students are given credit for the demonstration of content understanding through the process of solving a problem, even if the conclusion reached is incorrect. Essentially students can receive some or even all the credit assigned to a question even if they did not answer the question correctly. The creation of an assessment that could accurately score the level of student achievement of the eight mathematical practices or credit the mathematical understanding demonstrated in solving a problem would be an extremely difficult task, as the standardized structure of the test as well as the necessity for efficient grading could prove problematic.

Standardized testing continues to be an extremely polarizing topic in the education field. The multiple viewpoints of all stakeholders in education, from students and parents to school staff and public officials, rarely overlap and cause for constant debate as to the best way to improve American education. The fact remains that for the foreseeable future the state of Illinois



will use the SAT to evaluate the quality of its high schools, so the focus must now move to ensure that it is being implemented and evaluated in the best possible manner. By acknowledging the shortcomings of the assessment and limitations of current mathematical instruction the state of Illinois can begin to work toward improving the quality of education for all its students and focus on providing the potential for success at the post-secondary level.

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