Progress by Arizona Students Toward Mastery of Arizona's College and Career Ready Standards

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Overview: Arizona's College and Career Ready Standards (AZCCRS) in mathematics and English language arts and literacy were adopted by the Arizona State Board of Education in 2010. Since then, school districts and charter schools across Arizona have begun transitioning curriculum and instruction to promote the mastery of these standards by Arizona students. Assessment Technology, Incorporated (ATI) provides the Galileo® K-12 Online Instructional Improvement and Instructional Effectiveness System to 252 school districts and charter schools serving more than 500,000 students throughout the state of Arizona. As part of these services, ATI conducts ongoing research to provide districts and charter schools with information about student standards mastery that can guide instruction and intervention. The transition to the implementation of a new set of standards is by its very nature a fluid process that requires continuous evaluation and optimization to ensure that the desired goals are achieved. The goal of the current brief is to provide policy makers, school districts, charter schools, parents, families, and other stakeholders with information about the progress of Arizona students of various abilities towards mastery of the AZCCRS.

Item Response Theory and the ATI Arizona Score Distribution: ATI conducts ongoing research using procedures based in Item Response Theory (IRT) to evaluate all student responses to each item in the ATI item banks. This research estimates item parameters describing item characteristics such as difficulty and establishes an ATI Arizona score distribution based on the large population of Arizona students served by ATI districts/charters. The application of IRT procedures affords a number of benefits for the current research. First, standards mastery can be evaluated based on the entire ATI item bank rather than a small set of items from one specific assessment. Second, standards mastery can be evaluated for the entire population of Arizona students served by ATI rather than just the students who took a specific assessment. This is possible because the percentage of students likely to respond correctly to an item is directly linked to the item parameters and the ability of those students as represented by their position within the ATI Arizona score distribution.

Design and Analysis: This research focused on the current item parameter estimates for items within the ATI item banks aligned to the AZCCRS in mathematics and English language arts and literacy in third and eighth grade. On average, current item parameter estimates were available for approximately 12 items per standard in third grade mathematics, 21 items per standard in third grade English language arts and literacy, 12 items per standard in eighth grade mathematics, and 26 items per standard in eighth grade English language arts and literacy. These item parameter estimates were based on the most recent IRT analyses including item responses from more than 75,000 Arizona students served by ATI districts/charters. The most current item parameter estimates for the items aligned to each standard were summarized to establish the average item parameters for each standard. The average item parameters for each standard were then used to estimate the percentage of Arizona students attaining various percentile ranks within the ATI Arizona score distribution who are likely to show mastery of that standard. Cut points were also selected that categorize the standards based on the percentage of students with a given percentile rank who are likely to show mastery (i.e., 0-49%, 50-74%, 75-100%). These cut points were set to facilitate the identification of areas on which instruction should be focused. However, it is important to note that the cut points could be set to designate different ranges of standards mastery for the purposes of guiding other types of decisions (e.g., determining whether a student will pass the statewide assessment).

Results: Tables 1-4 (presented in the Supplementary Tables section) illustrate the full set of results including the percentage of students likely to show standards mastery for each standard within each

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grade and content area for students at the 5th, 15th, 50th, 85th, and 95th percentiles within the ATI Arizona score distribution. For example, as illustrated in Table 2, 81 percent of students whose ability places them at the 85th percentile of the ATI Arizona score distribution in third grade English language arts and literacy are likely to show mastery of standard AZ-L-3.1i, meaning that these students can produce simple, compound, and complex sentences. For ease of the reader, the results for each standard in Tables 1-4 have been color coded based on the selected cut points to indicate the percentage of students likely to show mastery (i.e., Grey = 0-49%, White = 50-74%, Green = 75-100%)

Conclusion: The results suggest several important conclusions related to the progress toward mastery of the AZCCRS by Arizona students of various abilities. First, student mastery of the AZCCRS is related to the percentile rank of the student within the ATI Arizona score distribution. Arizona students scoring at the 85th percentile or higher are successfully mastering the vast majority of the AZCCRS. In contrast, Arizona students scoring at the 15th percentile or lower are struggling with the vast majority of the AZCCRS, suggesting a need for additional efforts to promote standards mastery in these students. Second, as the results for Arizona students scoring at the 50th percentile illustrate, mastery varies for different standards. The typical student has mastered some standards, but not others. In this way, the type of information provided in this research has direct implications for instructional practice by identifying specific standards as targets for instruction. When updated information about student ability is continuously available to local school districts and charter schools throughout the year, instruction can be regularly adapted to address the student's current levels of mastery.

Supplementary Tables: Tables 1 through 4 follow.

TABLE 1
Third Grade Mathematics – Percentage of Students Likely to Show Mastery

Third Grade Mathematics – Percentage of Students Likely to Show Mastery						
3rd Grade Mathematics		**Legend**	0-49%	Percentage of Students Likely to Show Mastery (For Various Percentile Ranks in the Arizona Ability Distribution)		
			50-74%			
			75-100%			
Arizona's College and Career Ready Domain and Standard		**5th Percentile**	**15th Percentile**	**50th Percentile**	**85th Percentile**	**95th Percentile**
Geometry	AZ-3.G.A.1 Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	44%	49%	58%	66%	71%
	AZ-3.G.A.2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.	32%	39%	57%	78%	87%
Measurement and Data	AZ-3.MD.A.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.	33%	40%	56%	74%	83%
	AZ-3.MD.A.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).1 Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.	52%	60%	73%	83%	88%

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TABLE 1-Continued
Third Grade Mathematics – Percentage of Students Likely to Show Mastery - Continued

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Measurement and Data – Continued	AZ-3.MD.B.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.	35%	45%	71%	90%	95%
	AZ-3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.	26%	29%	41%	67%	82%
	AZ-3.MD.C.5 Recognize area as an attribute of plane figures and understand concepts of area measurement. (a) A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. (b) A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.	41%	47%	59%	72%	79%
	AZ-3.MD.C.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).	55%	61%	71%	80%	84%
	AZ-3.MD.C.7a Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.	64%	70%	79%	87%	90%
	AZ-3.MD.C.7b Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.	25%	29%	38%	52%	62%
	AZ-3.MD.C.7c Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c. Use area models to represent the distributive property in mathematical reasoning.	31%	37%	54%	74%	83%

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TABLE 1-Continued
Third Grade Mathematics – Percentage of Students Likely to Show Mastery - Continued

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Measurement and Data – Continued	AZ-3.MD.C.7d Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems.	34%	38%	49%	63%	72%
	AZ-3.MD.D.8 recognize perimeter as an attribute of plane figures and distinguish between linear and area measures: Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	36%	44%	62%	80%	88%
Number and Operations in Base 10	AZ-3.NBT.A.1 Use place value understanding to round whole numbers to the nearest 10 or 100.	30%	35%	52%	74%	85%
	AZ-3.NBT.A.2 Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.	37%	45%	61%	78%	85%
	AZ-3.NBT.A.3 Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.	36%	46%	68%	86%	92%
Numbers and Operations-Fractions	AZ-3.NF.A.1 Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.	63%	71%	82%	90%	93%
	AZ-3.NF.A.2a Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line.	26%	27%	38%	71%	88%
	AZ-3.NF.A.2b Represent a fraction a/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size a/b and that its endpoint locates the number a/b on the number line.	36%	41%	56%	74%	83%

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TABLE 1-Continued
Third Grade Mathematics – Percentage of Students Likely to Show Mastery - Continued

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Numbers and Operations-Fractions – Continued	AZ-3.NF.A.3a Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line.	18%	19%	26%	60%	84%
	AZ-3.NF.A.3b Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3). Explain why the fractions are equivalent, e.g., by using a visual fraction model.	52%	64%	80%	91%	94%
	AZ-3.NF.A.3c Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.	20%	21%	23%	44%	74%
	AZ-3.NF.A.3d Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.	52%	58%	70%	80%	85%
Operations and Algebraic Thinking	AZ-3.OA.A.1 Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each.	52%	61%	76%	87%	92%
	AZ-3.OA.A.2 Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.	30%	37%	56%	78%	87%
	AZ-3.OA.A.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	31%	39%	63%	86%	93%
	AZ-3.OA.A.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers.	31%	38%	58%	78%	87%
	AZ-3.OA.B.5 Apply properties of operations as strategies to multiply and divide.- Students need not use formal terms for these properties.	33%	39%	56%	76%	85%

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Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Operations and Algebraic Thinking– Continued	AZ-3.OA.B.6 Understand division as an unknown-factor problem.	31%	42%	66%	87%	93%
	AZ-3.OA.C.7 Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.	46%	57%	76%	89%	94%
	AZ-3.OA.D.8 Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	24%	28%	40%	63%	76%
	AZ-3.OA.D.9 Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.	30%	36%	52%	72%	82%

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TABLE 2
Third Grade English Language Arts – Percentage of Students Likely to Show Mastery

Third Grade English Language Arts – Percentage of Students Likely to Show Mastery						
3rd Grade English Language Arts		**Legend**	0-49%	Percentage of Students Likely to Show Mastery (For Various Percentile Ranks in the Arizona Ability Distribution)		
			50-74%			
			75-100%			
Arizona's College and Career Ready Domain and Standard		**5th Percentile**	**15th Percentile**	**50th Percentile**	**85th Percentile**	**95th Percentile**
Language	AZ-L.3.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	44%	54%	73%	88%	93%
	AZ-L.3.1a Conventions of Standard English: Explain the function of nouns, pronouns, verbs, adjectives, and adverbs in general and their functions in particular sentences.	34%	40%	55%	73%	82%
	AZ-L.3.1b Conventions of Standard English: Form and use regular and irregular plural nouns.	33%	40%	57%	75%	84%
	AZ-L.3.1e Conventions of Standard English: Form and use the simple (e.g., I walked; I walk; I will walk) verb tenses.	40%	48%	64%	78%	85%
	AZ-L.3.1f Conventions of Standard English: Ensure subject-verb and pronoun-antecedent agreement.	40%	50%	70%	85%	91%
	AZ-L.3.1g Conventions of Standard English: Form and use comparative and superlative adjectives and adverbs, and choose between them depending on what is to be modified.	27%	30%	44%	71%	85%
	AZ-L.3.1h Conventions of Standard English: Use coordinating and subordinating conjunctions.	30%	41%	71%	93%	97%
	AZ-L.3.1i Conventions of Standard English: Produce simple, compound, and complex sentences.	38%	46%	64%	81%	88%
	AZ-L.3.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	38%	46%	63%	80%	87%
	AZ-L.3.2a Conventions of Standard English: Capitalize appropriate words in titles.	33%	38%	51%	67%	76%
	AZ-L.3.2b Conventions of Standard English: Use commas in addresses.	24%	26%	33%	53%	70%
	AZ-L.3.2c Conventions of Standard English: Use commas and quotation marks in dialogue.	26%	29%	40%	62%	76%

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Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Language-Continued	AZ-L.3.2d Conventions of Standard English: Form and use possessives.	30%	35%	47%	62%	71%
	AZ-L.3.2e Conventions of Standard English: Use conventional spelling for high-frequency and other studied words and for adding suffixes to base words (e.g., sitting, smiled, cries, happiness).	35%	42%	58%	74%	82%
	AZ-L.3.2f Conventions of Standard English: Use spelling patterns and generalizations (e.g., word families, position-based spellings, syllable patterns, ending rules, meaningful word parts) in writing words.	44%	55%	75%	88%	93%
	AZ-L.3.3a Knowledge of Language: Choose words and phrases for effect.	27%	30%	43%	66%	79%
	AZ-L.3.4a Vocabulary Acquisition and Use: Use sentence-level context as a clue to the meaning of a word or phrase.	31%	41%	71%	93%	97%
	AZ-L.3.4b Vocabulary Acquisition and Use: Determine the meaning of the new word formed when a known affix is added to a known word (e.g., agreeable/disagreeable, comfortable/uncomfortable, care/careless, heat/preheat).	30%	37%	57%	79%	89%
	AZ-L.3.4d Vocabulary Acquisition and Use: Use glossaries or beginning dictionaries, both print and digital, to determine or clarify the precise meaning of key words and phrases.	26%	29%	41%	62%	75%
	AZ-L.3.5a Vocabulary Acquisition and Use: Distinguish the literal and nonliteral meanings of words and phrases in context (e.g., take steps).	29%	35%	51%	72%	82%
	AZ-L.3.6 Vocabulary Acquisition and Use: Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships (e.g., After dinner that night we went looking for them).	26%	29%	38%	53%	65%
Reading: Foundational Skills	AZ-RF.3.3a Phonics and Word Recognition: Identify and know the meaning of the most common prefixes and derivational suffixes.	24%	27%	39%	70%	86%
	AZ-RF.3.3c Phonics and Word Recognition: Decode multisyllable words.	62%	72%	86%	94%	96%
Reading for Informational Text	AZ-RI.3.1 Key Ideas and Details: Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.	30%	35%	52%	74%	84%

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TABLE 2-Continued
Third Grade English Language Arts – Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Reading for Informational Text-Continued	AZ-RI.3.10a Range of Reading and Level of Text Complexity: By the end of the year, read and comprehend functional texts, including history/social studies, science, and technical texts, at the high end of the grades 2–3 text complexity band independently and proficiently.	25%	28%	41%	63%	76%
	AZ-RI.3.2 Key Ideas and Details: Determine the main idea of a text; recount the key details and explain how they support the main idea.	26%	31%	46%	68%	79%
	AZ-RI.3.3 Key Ideas and Details: Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.	28%	35%	55%	79%	88%
	AZ-RI.3.4 Craft and Structure: Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.	30%	37%	57%	80%	89%
	AZ-RI.3.5 Craft and Structure: Use text features and search tools (e.g., key words, sidebars, hyperlinks) to locate information relevant to a given topic efficiently.	27%	32%	49%	73%	85%
	AZ-RI.3.6 Craft and Structure: Distinguish their own point of view from that of the author of a text.	35%	42%	59%	77%	85%
	AZ-RI.3.7 Integration of Knowledge and Ideas: Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).	39%	49%	68%	84%	90%
	AZ-RI.3.8 Integration of Knowledge and Ideas: Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence).	29%	34%	49%	70%	81%
	AZ-RI.3.9 Integration of Knowledge and Ideas: Compare and contrast the most important points and key details presented in two texts on the same topic.	31%	34%	45%	63%	75%
Reading for Literature	AZ-RL.3.1 Key Ideas and Details: Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.	33%	42%	62%	82%	90%

TABLE 2-Continued
Third Grade English Language Arts – Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Reading for Literature- Continued	AZ-RL.3.2 Key Ideas and Details: Recount stories, including fables, folktales, and myths from diverse cultures; determine the central message, lesson, or moral and explain how it is conveyed through key details in the text.	31%	39%	59%	81%	89%
	AZ-RL.3.3 Key Ideas and Details: Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events.	30%	37%	55%	76%	85%
	AZ-RL.3.4 (Use also L.3.4a & L.3.5a) Craft and Structure: Determine the meaning of words and phrases as they are used in a text, distinguishing literal from nonliteral language.	38%	46%	63%	79%	86%
	AZ-RL.3.5 Craft and Structure: Refer to parts of stories, dramas, and poems when writing or speaking about a text, using terms such as chapter, scene, and stanza; describe how each successive part builds on earlier sections.	36%	43%	59%	77%	85%
	AZ-RL.3.6 Craft and Structure: Distinguish their own point of view from that of the narrator or those of the characters.	34%	41%	57%	74%	82%
	AZ-RL.3.7 Integration of Knowledge and Ideas: Explain how specific aspects of a text's illustrations contribute to what is conveyed by the words in a story (e.g., create mood, emphasize aspects of a character or setting).	52%	64%	81%	91%	95%
	AZ-RL.3.9 Integration of Knowledge and Ideas: Compare and contrast the themes, settings, and plots of stories written by the same author about the same or similar characters (e.g., in books from a series).	35%	42%	59%	76%	84%
Writing	AZ-W.3.1a Text Types and Purposes: Introduce the topic or text they are writing about, state an opinion, and create an organizational structure that lists reasons.	30%	35%	45%	58%	67%
	AZ-W.3.1b Text Types and Purposes: Provide reasons that support the opinion.	39%	47%	65%	81%	88%
	AZ-W.3.1c Text Types and Purposes: Use linking words and phrases (e.g., because, therefore, since, for example) to connect opinion and reasons.	28%	36%	57%	80%	89%
	AZ-W.3.1d Text Types and Purposes: Provide a concluding statement or section.	33%	39%	52%	68%	76%
	AZ-W.3.2a Text Types and Purposes: Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.	32%	38%	55%	74%	83%

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Writing-Continued	AZ-W.3.2b Text Types and Purposes: Develop the topic with facts, definitions, and details.	30%	35%	49%	66%	76%
	AZ-W.3.2c Text Types and Purposes: Use linking words and phrases (e.g., also, another, and, more, but) to connect ideas within categories of information.	26%	31%	45%	65%	76%
	AZ-W.3.2d Text Types and Purposes: Provide a concluding statement or section.	38%	44%	59%	74%	81%
	AZ-W.3.8 Research to Build and Present Knowledge: Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.	41%	51%	69%	84%	90%

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TABLE 3
Eighth Grade Mathematics- Percentage of Students Likely to Show Mastery

Eighth Grade Mathematics- Percentage of Students Likely to Show Mastery

8th Grade Mathematics		Legend	0-49%	Percentage of Students Likely to Show Mastery (For Various Percentile Ranks in the Arizona Ability Distribution)		
			50-74%			
			75-100%			
Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Expressions and Equations	AZ-8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions.	30%	39%	63%	85%	93%
	AZ-8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that SQRT2 is irrational.	27%	33%	51%	75%	86%
	AZ-8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.	31%	39%	58%	78%	87%
	AZ-8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	27%	31%	41%	57%	67%
	AZ-8.EE.B.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.	37%	44%	59%	76%	83%
	AZ-8.EE.B.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.	27%	29%	37%	51%	63%

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TABLE 3-Continued
Eighth Grade Mathematics- Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Expressions and Equations-Continued	AZ-8.EE.C.7 Solve linear equations in one variable.	34%	37%	49%	67%	78%
	AZ-8.EE.C.7a Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers).	26%	27%	33%	52%	69%
	AZ-8.EE.C.7b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	23%	25%	36%	64%	81%
	AZ-8.EE.C.8a Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.	26%	30%	40%	58%	69%
	AZ-8.EE.C.8b Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.	24%	27%	36%	55%	69%
	AZ-8.EE.C.8c Solve real-world and mathematical problems leading to two linear equations in two variables.	39%	46%	61%	76%	83%
Functions	AZ-8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)	29%	33%	48%	69%	81%
	AZ-8.F.A.2 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	29%	32%	43%	63%	75%

TABLE 3-Continued
Eighth Grade Mathematics- Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Functions- Continued	AZ-8.F.A.3 Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.	34%	41%	57%	76%	85%
	AZ-8.F.B.4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	31%	36%	51%	70%	80%
	AZ-8.F.B.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	32%	37%	48%	62%	71%
Geometry	AZ-8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations.	22%	24%	38%	70%	86%
	AZ-8.G.A.1a Lines are taken to lines, and line segments to line segments of the same length.	28%	34%	58%	86%	94%
	AZ-8.G.A.1b Angles are taken to angles of the same measure.	47%	54%	68%	80%	85%
	AZ-8.G.A.1c Parallel lines are taken to parallel lines.	42%	48%	61%	73%	80%
	AZ-8.G.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	37%	45%	60%	76%	84%
	AZ-8.G.A.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	32%	38%	54%	73%	82%

TABLE 3-Continued
Eighth Grade Mathematics- Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Geometry-Contineud	AZ-8.G.A.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	27%	31%	48%	72%	84%
	AZ-8.G.A.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.	31%	34%	43%	60%	71%
	AZ-8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse.	30%	34%	44%	60%	71%
	AZ-8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	23%	26%	42%	74%	89%
	AZ-8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	30%	33%	44%	64%	76%
	AZ-8.G.C.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	31%	35%	47%	63%	73%
The Number System	AZ-8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	29%	33%	43%	59%	70%
	AZ-8.NS.A.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., pi^2).	33%	43%	67%	87%	93%

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TABLE 3-Continued
Eighth Grade Mathematics- Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Statistics and Probability	AZ-8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	52%	59%	70%	79%	84%
Statistics and Probability Cont.	AZ-8.SP.A.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	27%	30%	43%	69%	83%
	AZ-8.SP.A.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	25%	27%	32%	42%	51%
	AZ-8.SP.A.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.	32%	37%	52%	70%	79%

TABLE 4
Eight Grade English Language Arts-Percentage of Students Likely to Show Mastery

Eighth Grade English Language Arts- Percentage of Students Likely to Show Mastery						
8th Grade English Language Arts		**Legend**	0-49%	Percentage of Students Likely to Show Mastery (For Various Percentile Ranks in the Arizona Ability Distribution)		
			50-74%			
			75-100%			
Arizona's College and Career Ready Domain and Standard		**5th Percentile**	**15th Percentile**	**50th Percentile**	**85th Percentile**	**95th Percentile**
Language	AZ-L.8.1 Conventions of Standard English: Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	43%	54%	74%	89%	94%
	AZ-L.8.1a Conventions of Standard English: Explain the function of verbals (gerunds, participles, infinitives) in general and their function in particular sentences.	32%	39%	58%	79%	87%
	AZ-L.8.1b Conventions of Standard English: Form and use verbs in the active and passive voice.	36%	39%	46%	55%	60%
	AZ-L.8.1c Conventions of Standard English: Form and use verbs in the indicative, imperative, interrogative, conditional, and subjunctive mood.	54%	64%	78%	89%	93%
	AZ-L.8.2 Conventions of Standard English: Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	26%	30%	42%	64%	77%
	AZ-L.8.2a Conventions of Standard English: Use punctuation (comma, ellipsis, dash) to indicate a pause or break.	30%	37%	54%	74%	84%
	AZ-L.8.2b Conventions of Standard English: Use an ellipsis to indicate an omission.	35%	39%	49%	63%	71%
	AZ-L.8.2c Conventions of Standard English: Spell correctly.	41%	47%	58%	70%	76%
	AZ-L.8.3 Knowledge of Language: Use knowledge of language and its conventions when writing, speaking, reading, or listening.	35%	43%	61%	80%	88%

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Language-Continued	AZ-L.8.4a Vocabulary Acquisition and Use: Use context (e.g., the overall meaning of a sentence or paragraph; a word's position or function in a sentence) as a clue to the meaning of a word or phrase.	30%	37%	58%	79%	88%
	AZ-L.8.4b Vocabulary Acquisition and Use: Use common, grade-appropriate Greek or Latin affixes and roots as clues to the meaning of a word (e.g., precede, recede, secede).	41%	50%	66%	81%	87%
	AZ-L.8.4c Vocabulary Acquisition and Use: Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning or its part of speech.	34%	40%	58%	77%	85%
	AZ-L.8.5a Vocabulary Acquisition and Use: Interpret figures of speech (e.g. verbal irony, puns) in context.	36%	43%	57%	73%	81%
	AZ-L.8.5b Vocabulary Acquisition and Use: Use the relationship between particular words to better understand each of the words.	35%	42%	57%	75%	83%
	AZ-L.8.5c Vocabulary Acquisition and Use: Distinguish among the connotations (associations) of words with similar denotations (definitions) (e.g., bullheaded, willful, firm, persistent, resolute).	35%	41%	57%	75%	84%
	AZ-L.8.6 Vocabulary Acquisition and Use: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.	33%	37%	50%	67%	76%
Reading for Informational Text	AZ-RI.8.1 Key Ideas and Details: Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.	36%	43%	60%	78%	85%

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TABLE 4-Continued
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Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Reading for Informational Text- Continued	AZ-RI.8.10a Range of Reading and Level of Text Complexity: By the end of the year, read and comprehend informational and functional text, including history/social studies, science, and technical texts, in the grades 6–8 text complexity band independently and proficiently.	38%	45%	60%	75%	83%
	AZ-RI.8.2 Key Ideas and Details: Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.	35%	41%	56%	73%	81%
	AZ-RI.8.3 Key Ideas and Details: Analyze how a text makes connections among and distinctions between individuals, ideas, or events (e.g., through comparisons, analogies, or categories).	31%	38%	57%	80%	89%
	AZ-RI.8.4 Craft and Structure: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.	33%	40%	56%	75%	84%
	AZ-RI.8.5 Craft and Structure: Analyze in detail the structure of a specific paragraph in a text, including the role of particular sentences in developing and refining a key concept.	36%	42%	56%	72%	79%
	AZ-RI.8.6 Craft and Structure: Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.	32%	38%	54%	71%	81%
	AZ-RI.8.8 Integration of Knowledge and Ideas: Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.	31%	36%	50%	68%	77%

TABLE 4-Continued
Eighth Grade English Language Arts- Percentage of Students Likely to Show Mastery

Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Reading for Informational Text- Continued	AZ-RI.8.9 Integration of Knowledge and Ideas: Analyze a case in which two or more texts provide conflicting information on the same topic and identify where the texts disagree on matters of fact or interpretation.	22%	23%	28%	48%	67%
Reading for Literature	AZ-RL.8.1 Key Ideas and Details: Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.	31%	37%	52%	71%	81%
	AZ-RL.8.2 Key Ideas and Details: Determine a theme or central idea of a text and analyze its development over the course of the text, including its relationship to the characters, setting, and plot; provide an objective summary of the text.	34%	40%	54%	70%	79%
	AZ-RL.8.3 Key Ideas and Details: Analyze how particular lines of dialogue or incidents in a story or drama propel the action, reveal aspects of a character, or provoke a decision.	30%	36%	57%	80%	89%
	AZ-RL.8.4 Craft and Structure: Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.	30%	35%	51%	72%	82%
	AZ-RL.8.5 Craft and Structure: Compare and contrast the structure of two or more texts and analyze how the differing structure of each text contributes to its meaning and style.	33%	39%	52%	67%	76%
	AZ-RL.8.6 Craft and Structure: Analyze how differences in the points of view of the characters and the audience or reader (e.g., created through the use of dramatic irony) create such effects as suspense or humor.	37%	45%	63%	81%	88%
Writing	AZ-W.8.1a Text Types and Purposes: Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.	29%	33%	44%	60%	70%

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Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Writing-Continued	AZ-W.8.1b Text Types and Purposes: Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.	27%	32%	47%	69%	81%
	AZ-W.8.1c Text Types and Purposes: Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.	36%	42%	56%	71%	79%
	AZ-W.8.1d Text Types and Purposes: Establish and maintain a formal style.	28%	33%	47%	67%	78%
	AZ-W.8.1e Text Types and Purposes: Provide a concluding statement or section that follows from and supports the argument presented.	25%	29%	43%	64%	77%
	AZ-W.8.2a Text Types and Purposes: Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.	38%	44%	55%	68%	75%
	AZ-W.8.2b Text Types and Purposes: Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.	30%	36%	55%	77%	87%
	AZ-W.8.2c Text Types and Purposes: Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.	26%	31%	47%	72%	85%
	AZ-W.8.2d Text Types and Purposes: Use precise language and domain-specific vocabulary to inform about or explain the topic.	35%	41%	54%	69%	77%
	AZ-W.8.2e Text Types and Purposes: Establish and maintain a formal style.	28%	31%	41%	59%	71%
	AZ-W.8.2f Text Types and Purposes: Provide a concluding statement or section that follows from and supports the information or explanation presented.	32%	37%	48%	63%	71%

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TABLE 4-Continued
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Arizona's College and Career Ready Domain and Standard		5th Percentile	15th Percentile	50th Percentile	85th Percentile	95th Percentile
Writing-Continued	AZ-W.8.8 Research to Build and Present Knowledge: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.	26%	29%	42%	67%	80%