Core Content Connectors: Data Analysis, Probability, and Statistics 2

National Center and State Collaborative

The National Center and State Collaborative (NCSC) is applying the lessons learned from the past decade of research on alternate assessments based on alternate achievement standards (AA-AAS) to develop a multi-state comprehensive assessment system for students with significant cognitive disabilities. The project draws on a strong research base to develop an AA-AAS that is built from the ground up on powerful validity arguments linked to clear learning outcomes and defensible assessment results, to complement the work of the Race to the Top Common State Assessment Program (RTTA) consortia.

Our long-term goal is to ensure that students with significant cognitive disabilities achieve increasingly higher academic outcomes and leave high school ready for post-secondary options. A well-designed summative assessment alone is insufficient to achieve that goal. Thus, NCSC is developing a full system intended to support educators, which includes formative assessment tools and strategies, professional development on appropriate interim uses of data for progress monitoring, and management systems to ease the burdens of administration and documentation. All partners share a commitment to the research-to-practice focus of the project and the development of a comprehensive model of curriculum, instruction, assessment, and supportive professional development. These supports will improve the alignment of the entire system and strengthen the validity of inferences of the system of assessments.

These materials and documents were developed under the National Center and State Collaborative (NCSC) General Supervision Enhancement Grant and are consistent with its goals and foundations. Any changes to these materials are to be consistent with their intended purpose and use as defined by NCSC.

This document is available in alternative formats upon request.

National Center and State Collaborative

NCSC is a collaborative of 15 states and five organizations.

The states include (shown in blue on map): Arizona, Connecticut, District of Columbia, Florida, Georgia, Indiana, Louisiana, Nevada, Pacific Assessment Consortium (PAC-6)[1], Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, and Wyoming.

Tier II states are partners in curriculum, instruction, and professional development implementation but are not part of the assessment development work. They are (shown in orange on map): Arkansas, California, Delaware, Idaho, Maine, Maryland, Montana, New Mexico, New York, Oregon, and U.S. Virgin Islands.

District of Columbia

Pacific Assessment Consortium (PAC-6)

U.S. Virgin Islands
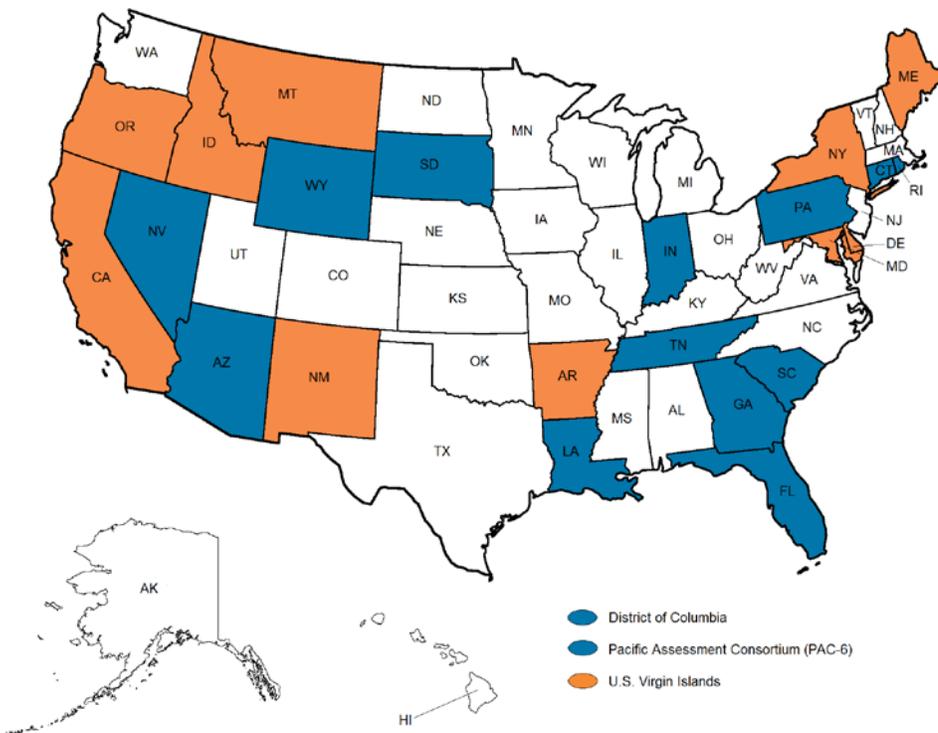
*Core partner states are blue in color and Tier II states are orange in color.

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[1] The Pacific Assessment Consortium (including the entities of American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Palau, and Republic of the Marshall Islands) partner with NCSC as one state, led by the University of Guam Center for Excellence in Developmental Disabilities Education, Research, and Service (CEDDERS).

National Center and State Collaborative

The five partner organizations include: The National Center on Educational Outcomes (NCEO) at the University of Minnesota, The National Center for the Improvement of Educational Assessment (Center for Assessment), The University of North Carolina at Charlotte, The University of Kentucky, and edCount, LLC.

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Identifying the Core Content of the Learning Progressions Framework for the Common Core State Standards for Students Who Participate in AA-AAS

Introduction

The purpose of this paper is to describe the development and prioritization of the academic content for students with significant cognitive disabilities. This prioritized academic content is referred to as Core Content Connectors (CCCs). This work is part of the NCSC GSEG and provides the foundation for the development of curriculum resources, professional development, instructional resources, and alternate assessment based on alternate achievement standards (AA-AAS). A unique feature of the development and prioritization of academic content is the use of learning progressions framework (LPF), which is built to include relationships with the Common Core State Standards (CCSSs). The LPF does not provide details of grade-specific curriculum, but describes a path for student learning as an ongoing developmental progression and is a starting point for thinking about how students develop competency in an academic domain (Hess, 2010). The following sections describe the use of LPFs for identifying specific grade-level Common Core State Standards (CCSS), and the development of the CCCs for providing more specificity for teachers.

Learning Progression Framework

The National Alternate Assessment Center, under the leadership of Karin Hess, developed LPFs. Hess's (2008) definition of LPs is based on four interrelated guiding principles: (a) LPs are developed and refined using available research and evidence, (b) LPs have clear binding threads that articulate the essential core concepts and processes of a discipline sometimes referred to as the "big ideas" of the discipline, (c) LPs articulate movement towards increased understanding, and (d) LPs go hand-in-hand with well-designed and aligned assessments.

The grade span learning targets of the LPF were identified by national content experts and are a broad description of the essential content and general sequencing for student learning and skill development. The LPF does not provide details of grade-specific curriculum, but describes a path for student learning as an ongoing developmental progression. The LPF is currently available at http://www.nciea.org/publications/Math_LPF_KH11.pdf

Core Content Connectors

The Core Content Connectors (CCCs) are the prioritized academic content designed to frame the instruction and assessment of students with significant cognitive disabilities. The CCCs create a connection between the Learning Progressions Framework (LPF) and Common Core State Standards (CCSS) for these students.

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┌─────────────────┐        ┌─────────────────┐
│   Learning      │        │  Common Core    │
│  Progressions   │        │ State Standards  │
│   Framework     │        │                 │
└─────────────────┘        └─────────────────┘
            ↘              ↙
          ┌─────────────────┐
          │  Core Content   │
          │   Connectors    │
          └─────────────────┘
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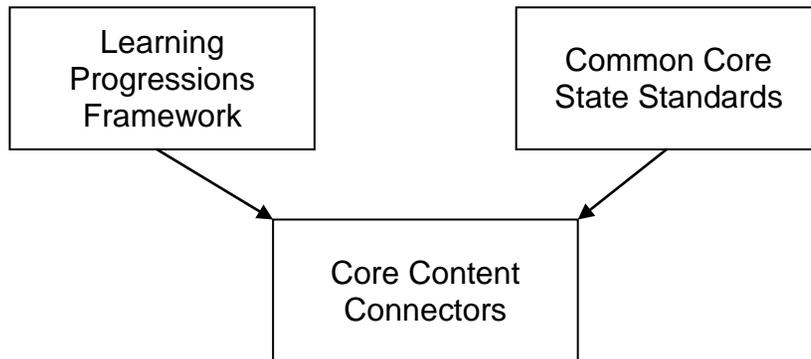
The purpose of the CCCs is to identify the most salient core academic content in ELA and math found in both the CCSS and the LPF Progress Indicators (LPF PIs) (i.e., observable learning along the learning continuum for each strand in the LPFs). The CCCs illustrate the necessary knowledge and skills students with significant cognitive disabilities need to reach the learning targets or critical big ideas within the Learning Progression Frameworks (LPF, Hess et al., 2010) and the Common Core State Standard. This identified core content serves as a connection or stage between the LPF (designed for typically developing students) and the CCSS (which define grade level content and achievement). The CCCs are intentionally dually aligned with both the LPFs and the CCSSs. The CCCs identify priorities for the instruction for students in this population, and the alternate assessment. CCCs are designed to contribute to a fully aligned system of content, instruction, and assessment.

Progress Indicator: M.NO.1e describing, representing, and comparing absolute value relationships		
Core Content Connectors: 6	**CCSS Domain/Cluster**	**Common Core State Standard**
6.NO.1e1 Determine the meaning of absolute value	**Expressions and Equations** 6 NS Apply and extend previous understandings of numbers to the system of rational numbers.	6.NS.7c Understand ordering and absolute value of rational numbers. a) Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of -30 dollars write |-30| = 30 to describe the size of the debt in dollars.

Progress Indicator: M.NO.1f recognizing equivalence of representations using fractions, decimals, and percents and using them solve ratio problems		
Core Content Connectors: 6	**CCSS Domain/Cluster**	**Common Core State Standard**
6.NO.1f1 Find a percent of a quantity as rate per 100	**Ratios and Proportional Relationships** 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.3c Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. c) Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.
6.NO.1f2 Write or select a ratio to match a given statement and representation	**Ratios and Proportional Relationships** 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."
6.NO.1f3 Select or make a statement to interpret a given ratio	**Ratios and Proportional Relationships** 6 RP Understand ratio concepts and use ratio reasoning to solve problems.	6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

The CCCs preserve the sequence of learning outlined in the LPFs to the extent possible while disaggregating the progress indicators (which describe concepts and skills along the learning continuum for each grade span in the learning progression) into teachable and assessable segments of content. The connectors and corresponding curriculum resource guides were written to help promote how students can engage in the CCSS while following the learning progression.

The CCCs have the following characteristics:

- Sequenced according to the LPFs to help guide meaningful instruction for students and lead to enduring skills in successive grades
- Written as outcome based, which provides a description of what students should know and do
- Written at high levels of expectations for students to eliminate potential ceiling effect for student learning
- Aligned to the grade-level CCSSs to provide access to the general curriculum
- Organized by the six major LPF strands (Symbolic Expression; Nature of Numbers & Operations; Measurement; Patterns, Relations, & Functions; Geometry; and Data Analysis, Probability, & Statistics)

In some grades, CCCs were developed that were considered important for student learning but were not aligned to the LPF. CCCs for some prerequisite skills were included in some of the grades, but these CCCs are for instructional purposes and not intended as a target for assessment. At the high school level, where only one AA-AAS will be administered to students but many CCSSs and LPFs are provided, some subsets of LPF Progress Indicators were selected for developing CCCs.

All CCCs will be provided by the curriculum and instruction work group in NCSC. While states may add additional content standards as they deem necessary that is specific to the needs, states and teachers will NOT have to develop any further CCCs. The complete set will be disseminated upon completion and validation. It is anticipated that states who have adopted the Common Core State Standards can use the CCCs as the priorities for students who take AA-AAS and will not need to create other forms of translations or create extensions of the Common Core unless they choose to do so. Teachers will be able to use these, along with the various curriculum resources, to plan instruction.

Uses of the document

There are several potential uses for this document. The first is to demonstrate how the identified core content builds critical big ideas across the grades. The format is intended to show how students can grow within the linked content across the grades and the connections between the related content to help guide sequential and meaningful instructional efforts. The second potential use is to provide clarity and specificity of the content within each grade level. In the process of identifying the CCC within each of the PI, it was evident that some considerations were necessary related to the content. First, it is necessary to disaggregate the content within some of the PI to a finer grain size. As students with significant cognitive disabilities may require instruction on single concepts, PIs that include multiple concepts may need to be separated in the unpacked content. Additionally, identifying core content requires focusing on the critical big ideas within the content and the need for considering meaningful instructional context within the instruction of students who participate in the alternate assessment. The third use for this document is to demonstrate how the CCCs have direct links to the CCSS. The CCSS that are identified as having the closest match are listed beside the corresponding CCC. As these direct links indicate, the CCC are not weakly linked or "watered down" translations, but instead pinpoint the most salient content in the standard. The potential users of this document ranges from assessment designers to teachers. While the document is not intended to be a standalone instructional resource, it is intended to support teachers in their understanding of the content.

References

Hess, K. (2010, December). *Learning progressions frameworks designed for use with the Common Core State Standards in mathematics K-12.* National Alternate Assessment Center at the University of Kentucky and the National Center for the Improvement of Educational Assessment, Dover, N.H.

Hess, K. (2008). Developing and using learning progressions as a schema for measuring progress [online]. Retrieved from http://www.nciea.org/publications/CCSSO2_KH08.pdf

	(K-4) Elementary School Learning Targets		(5-8) Middle School Learning Targets		(9-12) High School Learning Targets	
	E.DPS-2 Conduct simple probability experiments and characterize the outcomes in words, diagrams, or numerically.		*M.DPS-2 Conduct probability experiments:* • *Generate random samples to characterize variability in estimates and predictions;* • *Analyze and build models of the association between two variables.*		*H.DPS-2 Use the rules of probability to interpret data, develop explanations, and address real-world problems.*	
	Grades K-2	**Grades 3-4**	**Grades 5-6**	**Grades 7**	**Grade 8**	**HS**
Data Analysis: Probability				**7.DPS.2a1 Conduct simple probability experiments**	**8.DPS.2e1 Determine the theoretical probability of multistage probability experiments (2 coins, 2 dice)**	**H.DSP.2b1 Label the degree to which something is "good" or "bad" based on numerical information**
				7.DPS.2d1 Describe the probability of events as being certain or impossible, likely, less likely or equally likely	**8.DPS.2e2 Collect data from multistage probability experiments (2 coins, 2 dice)**	
				7.DPS.2d2 State the theoretical probability of events occurring in terms of ratios (words, percentages, decimals)	**8.DPS.2e3 Compare actual results of multistage experiment with theoretical probabilities**	**H.DPS.2c1 Determine the theoretical probability of multistage probability experiments**
				7.DPS.2b1 Identify sample space for a single event (coin, spinner, die)	**8.DPS.2g1 Distinguish between a linear and non-linear association when analyzing bivariate data on a scatter plot**	**H.DPS.2c2 Collect data from multistage probability experiments**

	(K-4) Elementary School Learning Targets		(5-8) Middle School Learning Targets		(9-12) High School Learning Targets	
	E.DPS-2 *Conduct simple probability experiments and characterize the outcomes in words, diagrams, or numerically.*		**M.DPS-2** *Conduct probability experiments:* • *Generate random samples to characterize variability in estimates and predictions;* • *Analyze and build models of the association between two variables.*		**H.DPS-2** *Use the rules of probability to interpret data, develop explanations, and address real-world problems.*	
	Grades K-2	**Grades 3-4**	**Grades 5-6**	**Grades 7**	**Grade 8**	**HS**
				7.DPS.2d3 Using a tree diagram, represent all possible outcomes of a situation, with the number of possible outcomes being less than 3	**8.DPS.2g2 Interpret the slope and the y-intercept of a line in the context of a problem**	**H.DPS.2c3 Compare actual results of multistage experiment with theoretical probabilities**
				7.DPS.2d4 Make a prediction regarding the probability of an event occurring		**H.DSP.2d1 Select or make an appropriate statement based on a two-way frequency table**
				7.DPS.2d5 Compare actual results of simple experiment with theoretical probabilities		**H.DSP.2e1 Select or make an appropriate statement based on real world examples of conditional probability**
				7.DPS.2e1 Determine the theoretical probability of multistage probability experiments (2 coins, 2 dice)		

(K-4) Elementary School Learning Targets		(5-8) Middle School Learning Targets		(9-12) High School Learning Targets	
E.DPS-2 Conduct simple probability experiments and characterize the outcomes in words, diagrams, or numerically.		*M.DPS-2 Conduct probability experiments:* • *Generate random samples to characterize variability in estimates and predictions;* • *Analyze and build models of the association between two variables.*		*H.DPS-2 Use the rules of probability to interpret data, develop explanations, and address real-world problems.*	
Grades K-2	Grades 3-4	Grades 5-6	Grades 7	Grade 8	HS
			7.DPS.2e2 Collect data from multistage probability experiments (2 coins, 2 dice)		
			7.DPS.2e3 Compare actual results of multistage experiment with theoretical probabilities		

Grade Differentiation

Progress Indicator: M.DPS.2a conducting simple probability experiments and expressing results in terms of relative frequencies or proportions as first estimate of probability		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**
7.DPS.2a1 Conduct simple probability experiments		**No CCSS linked**
Progress Indicator: E.DPS.2d describing the probability of events as being certain, likely, equally likely, unlikely, or impossible		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**
7.DPS.2d1 Describe the probability of events as being certain or impossible, likely, less likely or equally likely	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7. SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
7.DPS.2d2 State the theoretical probability of events occurring in terms of ratios (words, percentages, decimals)	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability near 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
Progress Indicator: M.DPS.2b describing and representing (e.g., tree diagrams) all possible outcomes (sample space) and the theoretical probabilities of each outcome (as proportion of a specific outcome relative to all possible outcomes) in simple probability experiments		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**
7.DPS.2b1 Identify sample space for a single event (coin, spinner, die)		
Progress Indicator: M.DPS.2d identifying sample spaces for multi-stage probability experiments (independent events) and determining the theoretical probabilities of specific event combinations		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**
7.DPS.2d3 Using a tree diagram, represent all possible outcomes of a situation, with up to 3 compound events with 2 or 3 possibilities per category		

(selecting the color of shirt, pant, type of shoes)		
7.DPS.2d4 Make a prediction regarding the probability of an event occurring; conduct simple probability experiments	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.6 Approximate the probability of a chance event by collecting data on the chance process that produce it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*

7.DPS.2d5 Compare actual results of simple experiment with theoretical probabilities	**Statistics and Probability**
	7 SP Investigate chance processes and develop, use, and evaluate probability models.
		7.SP.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
		  a) Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.*
		  b) Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*

Progress Indicator: M.DPS.2e designing and conducting multi-stage (compound) probability experiments (independent events) and comparing the results with theoretical probabilities		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**

7.DPS.2e1 Determine the theoretical probability of multistage probability experiments (2 coins, 2 dice)	**Statistics and Probability**
	7 SP Investigate chance processes and develop, use, and evaluate probability models.
		7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
		  a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
		  b) Represent sample spaces for compound events using methods such as organized lists, tables and tree

		diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
		a) Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
7.DPS.2e2 Collect data from multistage probability experiments (2 coins, 2 dice)	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
		a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
		b) Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
		c) Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
7.DPS.2e3 Compare actual results of multistage experiment with theoretical probabilities	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
		a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
		b) Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
		c) Design and use a simulation to generate frequencies for

		compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

Progress Indicator: M.DPS.2f distinguishing between association of two variables and cause and effect relationship between two variables		
Core Content Connectors: 7	**CCSS Domain/Cluster**	**Common Core State Standard**
No CCCs developed for this PI		

Progress Indicator: M.DPS.2e designing and conducting multi-stage (compound) probability experiments (independent events) and comparing the results with theoretical probabilities		
Core Content Connectors: 8	**CCSS Domain/Cluster**	**Common Core State Standard**
8.DPS.2e4 Determine the theoretical probability of multistage probability experiments (2 coins, 2 dice)	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b) Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. c) Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
8.DPS.2e5 Collect data from multistage probability experiments (2 coins, 2 dice)	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound

		event occurs.
		b) Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.
		c) Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*
8.DPS.2e6 Compare actual results of multistage experiment with theoretical probabilities	**Statistics and Probability** 7 SP Investigate chance processes and develop, use, and evaluate probability models.	7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a) Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b) Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. c) Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

Progress Indicator: M.DPS.2g using simple lines to model association between two numerical variables in a bivariate data set		
Core Content Connectors: 8	**CCSS Domain/Cluster**	**Common Core State Standard**
8.DPS.2g1 Distinguish between a linear and non-linear association when analyzing bivariate data on a scatter plot	**Statistics and Probability** 8 SP Investigate patterns of association in bivariate data.	8.SP.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.

8.DPS.2g2 Interpret the slope and the y-intercept of a line in the context of a problem	**Statistics and Probability** 8 SP Investigate patterns of association in bivariate data.	8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

Progress Indicator: H.DSP.2b exploring (framing effects) the degree to which we rate something as "good" or "bad"/ "desirable" or "undesirable" when numerical information is presented positively (75% lean) or negatively (25% fat)		
Core Content Connectors: 9-12	**CCSS Domain/Cluster**	**Common Core State Standard**
H.DPS.2b1 Identify and describe the degree to which something is rated "good" or "bad"/ desirable or undesirable based on numerical information	**Using Probability to Make Decisions** S MD Use probability to evaluate outcomes of decisions.	S.MD.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
Progress Indicator: H.DSP.2c designing and conducting multi-stage (compound) probability experiments (independent events) and comparing the results with theoretical probabilities		
Core Content Connectors: 9-12	**CCSS Domain/Cluster**	**Common Core State Standard**
H.DPS.2c1 Determine the theoretical probability of multistage probability experiments	**Using Probability to Make Decisions** S MD Calculate expected values and use them to solve problems.	S.MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*
H.DPS.2c2 Collect data from multistage probability experiments	**Using Probability to Make Decisions** S MD Calculate expected values and use them to solve problems.	S.MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*

H.DPS.2c3 Compare actual results of multistage experiment with theoretical probabilities	**Using Probability to Make Decisions** S MD Calculate expected values and use them to solve problems.	S.MD.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*

Progress Indicator: H.DSP.2d constructing and interpreting two-way frequency tables when two categories are associated with each object being classified

Core Content Connectors: 9-12	**CCSS Domain/Cluster**	**Common Core State Standard**
H.DPS.2d1 Select or make an appropriate statement based on a two-way frequency table	**Conditional Probability and the Rules of Probability** S CP Understand independence and conditional probability and use them to interpret data.	S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

Progress Indicator: H.DSP.2e researching and finding real-world examples and explaining the concept of conditional probability (e.g., compare the chances of having lung cancer if you are a smoker with the chances of being a smoker if you have lung cancer)

Core Content Connectors: 9-12	**CCSS Domain/Cluster**	**Common Core State Standard**
H.DPS.2e1 Select or make an appropriate statement based on real world examples of conditional probability	**Conditional Probability and the Rules of Probability** S CP Understand independence and conditional probability and use them to interpret data.	S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*