Verona Public School District Curriculum Overview

AP Statistics



Curriculum Committee Members: Bob Cashill

Supervisor: GlenStevenson

Curriculum Developed: 2011

Board Approval Date: 9/27/11

Verona Public Schools 121 Fairview Ave., Verona, NJ 07044 www.veronaschools.org

Verona Public Schools Mission Statement:

The mission of the Verona Public Schools, the center of an engaged and supportive community, is to empower students to achieve their potential as active learners and productive citizens through rigorous curricula and meaningful, enriching experiences.

Course Description:

This course is designed to prepare students for the Advanced Placement Statistics Exam. This course is for students that have completed Algebra II and possess sufficient mathematical maturity and quantitative reasoning ability. The topics for this course have been organized into four conceptual themes: Exploring Data, Sampling and Experimentation, Anticipating Patterns, and Statistical Inference. Student must provide their own TI NSpire CAS graphing calculator; these will be an important tool that will routinely be used in instruction.

Prerequisite(s): Algebra II

Standard 8: Technology Standards					
8.1: Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate 8.2: Technology Education, Engineering, Design, and Computational Programming: All students will develop an understanding of the nature and important to the na					
and to create and communicate knowledge.	Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the				
	individual, global society, and the environment.				
A. Technology Operations and Concepts	A. The Nature of Technology: Creativity and Innovation				
X B. Creativity and Innovation	B. Technology and Society				
X C. Communication and Collaboration	C. Design				
D. Digital Citizenship	X D. Abilities for a Technological World				
E. Research and Information Fluency	E. Computational Thinking: Programming				
X F. Critical thinking, problem solving, and decision making					

SEL Competencies and Career Ready Practices					
Social and Emotional Learning Core Competencies: These competencies	Ca	reer Rea	dy Practices: These practices outline the skills that all individuals need to have		
are identified as five interrelated sets of cognitive, affective, and behavioral	to	truly be a	daptable, reflective, and proactive in life and careers. These are researched		
capabilities	pra	actices th	at are essential to career readiness.		
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their		CRP2.	Apply appropriate academic and technical skills.		
influence on behavior. This includes accurately assessing one's strengths and		CRP9.	Model integrity, ethical leadership, and effective management.		
limitations and possessing a well-grounded sense of confidence and optimism.		CRP10.	Plan education and career paths aligned to personal goals.		
Self-management: The ability to regulate one's emotions, thoughts, and behaviors		CRP3.	Attend to personal health and financial well-being.		
effectively in different situations. This includes managing stress, controlling impulses,	Х	CRP6.	Demonstrate creativity and innovation.		
motivating oneself, and setting and working toward achieving personal and academic	Х	CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.		
goals.		CRP11.	Use technology to enhance productivity.		
Social awareness: The ability to take the perspective of and empathize with others from		CRP1.	Act as a responsible and contributing citizen and employee.		
diverse backgrounds and cultures, to understand social and ethical norms for		CRP9.	Model integrity, ethical leadership, and effective management.		
behavior, and to recognize family, school, and community resources and supports.					
Relationship skills: The ability to establish and maintain healthy and rewarding	Х	CRP4.	Communicate clearly and effectively and with reason.		
relationships with diverse individuals and groups. This includes communicating clearly,		CRP9.	Model integrity, ethical leadership, and effective management.		
listening actively, cooperating, resisting inappropriate social pressure, negotiating		CRP12.	Work productively in teams while using cultural global competence.		
conflict constructively, and seeking and offering help when needed.					
Responsible decision making: The ability to make constructive and respectful choices		CRP5.	Consider the environmental, social, and economic impact of decisions.		
about personal behavior and social interactions based on consideration of ethical	Х	CRP7.	Employ valid and reliable research strategies.		
standards, safety concerns, social norms, the realistic evaluation of consequences of	Х	CRP8.	Utilize critical thinking to make sense of problems and persevere in solving them.		
various actions, and the well-being of self and others.		CRP9.	Model integrity, ethical leadership, and effective management.		

	Standard 9: 21 st Century Life and Careers							
9.1: Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.	9.2: Career Awareness, Exploration & Preparation: This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.	9.3: Career and Technical Education: This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.						
 A. Income and Careers B. Money Management C. Credit and Debt Management D. Planning, Saving, and Investing X E. Becoming a Critical Consumer F. Civic Financial Responsibility G. Insuring and Protecting 	 A. Career Awareness (K-4) B. Career Exploration (5-8) X C. Career Preparation (9-12) 	A.Agriculture, Food & Natural Res.B.Architecture & ConstructionC.Arts, A/V Technology & Comm.D.Business Management & Admin.E.Education & TrainingF.FinanceG.Government & Public Admin.H.Health ScienceI.Hospital & TourismJ.Human ServicesK.Information TechnologyL.Law, Public, Safety, Corrections & SecurityM.ManufacturingN.MarketingXO.Science, Technology, Engineering & MathP.Transportation, Distribution & Log.						

Course Materials					
Core Instructional Materials : These are the board adopted and approved materials to support the curriculum, instruction, and assessment of this course.	Differentiated Resources : These are teacher and department found materials, and also approved support materials that facilitate differentiation of curriculum, instruction, and assessment of this course.				
AP Statistics - 5th Edition	 Udemy Online Course How to Pass AP Statistics College Statistics & Probability FRAPPY Home Page AP Stats Free Response Problems & Solutions: 1998-2016 Math Ops: Targeted Math Instruction 				

Curriculum Scope & Sequence

Subject/Grade Level: MATH/HIGH SCHOOL

Course: ADVANCED PLACEMENT STATISTICS

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
1 Exploring Data	8 Days	 Unit Goals: 1.1 Analyzing Categorical Data Bar Graphs & Pie Charts Graphs: Good & Bad Two-Way Tables & Marginal Distributions Conditional Distributions Organizing a Statistical Problem Simpson's Paradox 1.2 Displaying Quantitative Data with Graphs Dotplots Describing Shape Comparing Distributions Stemplots Histograms Using Histograms Wisely 1.3 Displaying Quantitative Data with Numbers Measuring Center: The Mean Measuring Center: The Mean Measuring the Mean & the Median Comparing Spread: The Interquartile Range (IQR) Identifying Outliers The Five-Number Summary 	Students will be able to independently use their learning of graphical and numerical analysis of data distributions to determine if discrimination exists in hiring practices.	 Interpretation of data is dependent upon the graphical displays and numerical summaries. The <i>Who, What, Where, Why,</i> and <i>How</i> of the data are important information that must be depicted in each given data set. The shape, center, and spread are important characteristics of a distribution. The question to be answered determines the data to be collected and how best to collect it. 	 What is data? How do we communicate and understand data? Can you lie with statistics? How and to what extent? How can data analysis be used to predict future happenings? Does the data always lead to the truth? Is all data "created equal"?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
2 Modeling Distributions of Data	6 Days	Goals& BoxplotsMeasuring Spread: The Standard DeviationChoosing Measures of Center & SpreadStandards: S.ID.1 S.ID.2 S.ID.3 S.ID.4 S.ID.5Unit Goals: 2.1 Describing Location in a DistributionMeasuring Position: PercentilesCumulative Relative Frequency GraphsMeasuring Position: z-ScoresTransforming DataDensity Curves2.2 Normal DistributionsThe 65-95-99.7 RuleThe Standard Normal DistributionNormal Distribution Sessing NormalityStandards: S.ID.2	Students will be able to independently use their learning and knowledge of the mean, standard deviation and normal distributions to analyze standardized test results.	 Understandings Understandings The normal distribution is a fundamental component of statistical inference. Density curves are used to mimic probability. The normal distribution is used to model the spread of data. 	 How does one assess normality? Why is the normal distribution essential to the study of statistics? How does the normal distribution apply to the real world? How do density curves relate to probability?
		S.ID.3 S.ID.4			

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
3 Describing Relationships	7 Days	GoalsUnit Goals:3.1 Scatterplots & Correlation• Explanatory & Response Variables• Displaying Relationships: Scatterplots• Displaying Relationships: Scatterplots• Interpreting Scatterplots• Measuring Linear Association: Correlation• Facts about Correlation3.2 Least Squares Regression Line• Interpreting a Regression Line• Prediction• Residuals & the Least- Squares Regression Line• Calculating the Equation of the Least-Squares Line• How Well the Line Fits the Data: Residual Plots• How Well the Line Fits the Data: The Role of r^2 in Regression• Interpreting Computer Regression Output• Correlation & Regression 	Students will be able to independently use their learning and knowledge of scatterplots, correlations, and least squares regressions to determine the relationship between endangered species and modern technology.	 Regression is an effective model for prediction. There is a difference between causation and correlation. Scatterplots and other graphs are used to illustrate solutions and solve problems. The way that data is collected, organized, analyzed and displayed influences interpretation. Data is analyzed to verify the truth. 	 What does it mean to regress? What is association? What is correlation? How are they connected? Does association imply causation? How can modeling data help us to understand patterns? Can we use extrapolation to predict the future? Is it possible to test for lack of correlation?
		S.ID.3 S.ID.6			

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
Unit 4 Designing Studies	Duration 12 Days	GoalsS.ID.7S.ID.8S.ID.9Unit Goals:4.1 Sampling & Surveys• The Idea of a Sample Survey• How to Sample Badly• How to Sample Well: Random Sampling• Other Sampling Methods• Inference for Sampling• Random Surveys: What Can Go Wrong?4.2 Experiments	Transfer Goal(s) Students will be able to independently use their learning of sample surveys, experiments, and observational studies to design a study to measure the effect of texting on high school class work.	 Understandings Careful planning is essential to obtaining valid data. Clarifying the question leads to the appropriate methodology. The analysis is only as good as the data. Well-designed experiments can allow us to reach appropriate cause-and-effect 	 What is an experiment? What is bias? How can it be identified? How can it be prevented? To what extent is data biased? To what extent can data be purposely biased? Does size matter? Is all data "created
		 Observational Study versus Experiment The Language of Experiments How to Experiment Badly How to Experiment Well: The Randomized Comparative Experiment Three Principles of Experimental Design Experiments: What Can Go Wrong? Inference for Experiments Blocking Matched Pairs Design 4.3 Using Studies Wisely Scope of Inference The Challenges of 		conclusions.	equal"?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
5	8 Days	Establishing Causation • Data Ethics Standards: S.IC.1 S.IC.2 S.IC.3 S.IC.5 S.IC.6 Unit Goals:	Students will be able	 Probability models are 	What is the
Probability: What are the Chances?		 5.1 Randomness, Probability & Simulation The Idea of Probability Myths about Randomness Simulation 5.2 Probability Rules (IE, IE2, IIIA3) Probability Models Basic Rules of Probability Two-Way Tables and Probability Venn Diagrams and Probability 5.3 Conditional Probability& Independence What is Conditional Probability Conditional Probability and Independence Tree Diagrams and the General Multiplication Rule Independence: A Special Multiplication Rule Calculating Conditional 	to independently use their learning of randomness, probability and simulation to understand the operations of casinos.	 useful tools for making decisions and predictions. The notion and behavior of a random variable is foundational to understanding probability distributions. Probability is based on relative frequencies. The Law of Large Numbers is an important concept when simulating probability experiments but should be interpreted carefully. 	 probability of understanding probability? How can we base decisions on chance? How can probability be used to simulate events and to predict future happenings? What are the benefits of simulating events as opposed to gathering real data? Is independence desirable?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
		Probabilities Standards: S.IC.1 S.IC.2 S.CP.1 S.MD.5 S.MD.6 S.MD.7 S.CP.1 S.CP.2 S.CP.3 S.CP.4 S.CP.5 S.CP.6 S.CP.7 S.CP.9			
6 Random Variables	9 Days	 Unit Goals: 6.1 Discrete & Continuous Random Variables Discrete Random Variables Mean (Expected value) of a Discrete Random Variable Standard Deviation (and Variance) of a Discrete Random Variable Continuous Random Variables 6.2 Transforming & Combining Random Variables Linear Transformations Combining Random Variables 	Students will be able to independently use their learning of discrete and continuous random variables to be able to analyze medical test results to determine how often false positives occur.	 Randomness and probability are the theoretical bases of statistical theory. Probability models are useful tools for making decisions and predictions. Probability is the basis of statistical inference. The notion and behavior of a random variable is foundational to understanding probability distributions. 	 What is randomness? How can modeling predict the future? To what extent does our world exhibit binomial and geometric phenomena? When is probability a sure thing? How can we base decisions on chance? Is anything in nature truly random?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
		 Combining Normal Random Variables Binomial & Geometric Random Variables Binomial and Geometric Random Variables Binomial Settings and Binomial Random Variables Binomial Probabilities Mean and Standard Deviation of a Binomial Distribution Binomial Distributions in Statistical Sampling Geometric Random Variables Standards: S.IC.4 S.MD.1 S.MD.4 			
7 Sampling Distributions	12 Days	 Unit Goals: 7.1 What is a Sampling Distribution? Parameters and Statistics Sampling Variability Describing Sampling Distributions 7.2 Sample Proportions The Sampling Distribution of p Using the Normal Approximation for p 7.3 Sample Means	Students will be able to independently use their learning of data exploration, planning studies and probability to estimating endangered species populations from sample data.	 Many discrete phenomena may be described and thus predicted by binomial and geometric models. The normal distribution and central limit theorem are essential to analyzing samples of data. Variation can be expected in the results of random samples and is affected by the design of the sample or 	 How can modeling predict the future? How does the normal distribution apply to the real world? Does the Central Limit Theorem test one's limit? Is all data "created equal"?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
0	2 Dava	 The Sampling Distribution of x: Mean and Standard Deviation The Central Limit Theorem Standards: S.ID.4 S.IC.1 S.IC.2 S.IC.4 Unit Cooler 	Studente will be able	experiment.	
8 Estimating with Confidence	8 Days	 Unit Goals: 8.1 Confidence Intervals: The Basics The Idea of a Confidence Interval Interpreting Confidence Levels and Confidence Intervals Constructing a Confidence Interval Using Confidence Intervals Wisely 8.2 Estimating Population Proportion Conditions for Estimating p Constructing a Confidence Interval for p Putting It All Together: The Four-Step Process Choosing the Sample Size 8.3 Estimating a Population Mean When σ is Known: The One-Sample z Interval for a Population Mean Choosing the Sample Size When σ is Unknown: The t 	Students will be able to independently use their learning of data exploration, design of experiments, probability and sampling distributions to analyze 911 call response times in a major United States city.	 Statistical inference guides the selection of appropriate models. Inference is based upon chance. Confidence intervals are effective tools for estimation. Tests of significance and confidence intervals drive decision making in our world. Error analysis is a critical component of significance testing. 	 How much evidence do you need before you are able to make a reasonable conjecture? Is it reasonable to think that different people require different amounts of convincing? How is statistical inference used to draw conclusions from data? How is probability used to express the strength of our conclusions? What is inference? To what extent should decisions be made based on chance?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
		 Distributions Constructing a Confidence Interval for μ Using t Procedures Wisely Standards: S.ID.4 S.IC.4 S.MD.2 			
9 Testing a Claim	8 Days	 Unit Goals: 9.1 Significance Tests: The Basics The Reasoning of Significance Tests Stating Hypotheses Interpreting P-Values Statistical Significance Type I and Type II Errors Planning Studies: The Power of a Statistical Test 9.2 Tests about Population Proportion Carrying Out a Significance Test The One-Sample z Test for a Proportion Two-Sided Tests Why confidence Intervals give More Information 9.3 Tests about a Population Mean Carrying Out a Significance Test for μ The One-Sample t Test Two-Sided Tests and 	Students will be able to independently use their learning of data exploration and experimental design to determine the effect of steroids on baseball records.	 Confidence intervals are effective tools for estimating the mean or proportion of a population. Significance tests determine the likelihood of a sample. The analysis is only as good as the data. Significance tests determine the likelihood of a sample. 	 To what extent are significance tests reliable? How can one prepare for errors from significance tests? Is all data "created equal"? What makes an argument statistically convincing? What is significant about significance?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
10 Comparing	10 Days	Goals Confidence Intervals Inference for Means: Paired Data Using Tests Wisely Standards: S.ID.4 S.IC.4 S.MD.2 Unit Goals: 10.1 Confidence Intervals	Students will be able to independently use	Confidence intervals are effective tools for	• What does it mean to be 95% confident ?
Comparing Two Populations or Groups		 The Sampling Distribution of a Difference between Two Proportions Confidence Intervals for p1 – p2 Significance Tests for p1 – p2 Inference for Experiments 10.2 Comparing Two Means The Sampling Distribution of a Difference between Two Means The Two-Sample t-Statistic Confidence Intervals for μ1 – μ2 Significance Tests for μ – μ2 Using Two-Sample t Procedures Wisely Standards: S.ID.4 S.IC.5 S.MD.2	to independently use their learning of population comparisons to determine the accuracy of fast food restaurant servers.	 effective tools for estimating the mean or proportion of a population. Significance tests determine the likelihood of a sample. The analysis is only as good as the data. Inference is a tool for validating a claim about a population parameter. Inference is a tool for estimating an unknown population parameter. 	 be 95% confident ? How do you determine if there is a statistical significance? What does it mean to make an inference? What is a confidence interval? What makes an argument statistically convincing?

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
Unit 11 Inference for Distribution of Categorical Data	6 Days		Students will be able to independently use their learning and knowledge of chi- square tests and inference to determine if M&Ms contain the correct amount of each color.	0	 Essential Questions How can we verify that two variables are independent? How does one distinguish among the various tests of significance? What does it mean to make an inference? How can decisions be based on chance? What makes an argument statistically convincing? How do we make a declaration of independence statistically? Is independence desirable?
		S.IC.2 S.IC.3			

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
12 More about Regression	9 Days		Students will be able to independently use their learning and knowledge of linear regression to analyze the relationship between salaries and movie grosses for Hollywood stars.	<u> </u>	 Essential Questions How can we test a series of proportions? How can we test the slope of a correlation? How do we use a model to make statistical inference? How can decisions be made based on chance? Is all data "created equal"? What makes an argument statistically
13	10 Days	 Transforming with Powers and Roots Transforming with Logarithms Standards: S.IC.1 S.IC.2 S.IC.3 S.IC.4 S.IC.5 S.IC.6 Unit Goals: 	Students will be able	• Inference is a tool for validating a claim about a population parameter.	convincing?
AP Exam Review	10 Days	 Choosing the Correct Inference Procedure Participate in Mock Grading Sessions 	to independently apply their learning to effectively complete the AP		

Unit	Duration	Common Core Standards/ Unit Goals	Transfer Goal(s)	Enduring Understandings	Essential Questions
		 Participate in Mock AP Exams Practice Multiple Choice Questions Practice Free Response Questions Review Grading and Strategies for Success Standards: All of the standards listed in units 1- 12. 	Statistics Exam.		
14 Post Exam Project	14 Days	 Unit Goals: Apply all previously learned material Standards: All of the standards listed in units 1-12. 	Students will be able to independently apply their learning to demonstrate an understanding of the major conceptual themes of statistics.		