DEPARTMENT Mathematics COURSE Probability & Statistics Advanced

Curriculum Development Timeline

School: Ocean Township High School

Course: Probability and Statistics Advanced

Department: Mathematics

Board Approval	Supervisor	Notes
July 2014	Amanda Maltese	Born Date
December 2017	Nichole Kerney	Revisions
August 2019	Nichole Kerney	Review
August 2022	Gerard Marrone	Alignment to Standards

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DEPARTMENT Mathematics COURSE Probability & Statistics Advanced

Township of Ocean Pacing Guide			
Week	Marking Period 1	**Week**	Marking Period 3
1	Collecting & Organizing Data	11	Probability & Inferences
2	Collecting & Organizing Data	12	Hypothesis Testing for 2 Samples
3	Projects Utilizing Statistical Skills	13	Hypothesis Testing for 2 Samples
4	Projects Utilizing Statistical Skills	14	Constructing & Interpreting Confidence Intervals
5	Misuses & Abuses of Statistics	15	Constructing & Interpreting Confidence Intervals
Week	Marking Period 2	**Week**	Marking Period 4
6	Misuses & Abuses of Statistics	16	Constructing & Interpreting Confidence Intervals
7	Data Displays & Analysis	17	Hypothesis Testing
8	Data Displays & Analysis	18	Hypothesis Testing
9	Data Displays & Analysis	19	Bivariate Hypothesis Tests
10	Probability & Inferences	20	Bivariate Hypothesis Tests

Core Instructional & Supplemental Materials including various levels of Texts
Core Instruction: Elementary Statistics (Pearson Prentice Hall) Supplemental: IXL Math, Kuta, Geogebra, and Desmos Special Education and ELL Supplemental: Video Tutor-bigideasmath.com

Time Frame	2 Weeks (10 blocks)

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DEPARTMENT Mathematics COURSE Probability & Statistics Advanced

Topic
Collecting and Organizing Data
Alignment to Standards
S-ID.1, S-ID.2, S-ID.3
Learning Objectives and Activities

SWBAT answer the following questions:

- How can we describe data?
- To what extent can statistics help us make predictions and inferences about our world?
- How can we determine the validity of our interpretation of the statistics?

SWBAT demonstrate understanding of the following:

- Data collection can be utilized to make summative statements or inferences about a population.
- Observational studies can be used to demonstrate correlation or association.
- Designed experiments can be used to prove causation.
- Data can be organized in a variety of useful ways.

Learning Activities:

- Identify types of statistics and data.
- Establish a process for planning and conducting a study Calculate relative frequency.
- Construct bar graphs and dot plots.
- Distinguish between an experiment and an observational study.
- Determine the processes of sampling.
- Create a procedure for conducting a designed experiment using proper terminology.
- Identify key concepts of a designed experiment and when to block an experiment.
- Understand the need to blind or double blind an experiment.
- United States of America – clips on DVD.
- Cooperative Group Activity – pg 42 # 1.

Assessments

Formative:

- Classwork and Homework
- Teacher Observation
- Graphic Organizer
- Entrance/Exit Cards

Summative:

- Mid-unit Quizzes
- Topic Tests

Alternative:

- Observation Assessment with Problem-solving
- Project – collect your own data and represent using bar graphs/dot plots

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

Technology Integration

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Students will use internet based game sites such as Quizizz, Kahoot, and Quizlet live to reflect on their learning progress.

- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math and Video Tutor-bigideasmath.com.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will utilize Geogebra and Statistical Websites to further investigate concepts to demonstrate understanding of standards.

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Career Education
CRP2: Apply appropriate academic and technical skills. CRP11: Use technology to enhance productivity.

Time Frame	2 Weeks (10 blocks)

Topic
Projects Using our Statistics Skills

Alignment to Standards
S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9

Learning Objectives and Activities

SWBAT answer the following questions:

- How do you go about proving or disproving a claim?
- What are the most effective and accurate techniques for collecting data that meet my goal?
- What is the best statistical test to analyze and interpret my collected data?
- What conclusions can be drawn from my data and hypothesis tests?

SWBAT demonstrate understanding of the following:

- Almost all data can be tested for significance.
- Data must be collected properly for test results to be valid.
- The internet is a valuable resource but not the only source of data.
- Learning can be more useful when applied to one's personal interests.

Learning Activities:

- Brainstorm project topics.
- Collect data conforming to rules of randomization.
- Organize data using appropriate method.
- Create a data display that best represents the data.
- Perform appropriate hypothesis test for data.
- Analyze and interpret results to draw conclusions about the original hypothesis.
- Write up results for formal presentation or create powerpoint.
- Parking Lot Survey.
- Creating Surveys to distribute.

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Assessments

Formative:
- Daily Practice Problems
- Teacher Observation
- Entrance/Exit Cards

Summative:
- Mid-unit Quizzes

Alternative:
- Observation Assessment with Problem-solving
- Project - student choice.
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

ELA: W.11-12.1: When students are justifying their reasoning on short answer and extended constructed response questions they write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Career Readiness, Life Literacies, and Key Skills

9.3.ST-SM.4: In the statistics lessons students will apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Technology Integration

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.
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Students will use internet based game sites such as Quizizz, Kahoot, and Quizlet live to reflect on their learning progress.
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Career Education

CRP6: Demonstrate creativity and innovation.
CRP11: Use technology to enhance productivity.

Time Frame	2 Weeks (10 blocks)

Topic

Misuses and Abuses of Statistics

Alignment to Standards

S-IC.1, S-IC.2, S-IC.3, S-IC.4, S-IC.5, S-IC.6

Learning Objectives and Activities

SWBAT answer the following questions:

- Can surveys be trusted?
- What are some red flags when reading a study or experiment that may indicate biased results?
- What should you look for to ensure a graph is not misleading in its construction?
- What information should be presented with a study to ease suspicion and lessen scrutiny?

SWBAT demonstrate understanding of the following:

- There are many ways to misuse or mislead with statistics.
- It is important to question results that are given and not accept them outright.
- Graphs can be misleading.

- It is possible to get desired results by selectively collecting data.

Learning Activities:

- Create misleading graphs using improper proportions or not starting at 0.
- Use non-random sampling to collect data.
- Construct misleading survey questionnaires.
- Design a study to achieve a certain predetermined outcome.
- Debate two opposing views using the same data set.
- Khan Academy Lessons.
- From Data to Decision pg 80.
- United States of America DVD.

Assessments

Formative:

- Daily Practice Problems
- Teacher Observation
- Graphic Organizer
- Entrance/Exit Cards

Summative:

- Mid-unit Quizzes
- Topic Tests

Alternative:

- Observation Assessment with Problem-solving
- Kahoot/Quizizz

Interdisciplinary Connections

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Career Education
CRP4: Communicate clearly and effectively with reason. CRP6: Demonstrate creativity and innovation.

Time Frame	3 Weeks (15 blocks)
Topic	
Data Displays and Analysis	
Alignment to Standards	
S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6	
Learning Objectives and Activities	

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SWBAT answer the following questions:

- What method of displaying data would best represent my purpose?
- Why can technology support but not replace our mathematics skills and understanding? What conclusions can be made and supported and what cannot be supported? When is data reliable to use?

SWBAT demonstrate understanding of the following:

- Data can be organized and displayed in a variety of ways.
- Understanding the distribution of data is important to determine how to analyze the data. Describing the variation of data is as important as defining the center of a data set. Standard deviation is essential to every data set.

Learning Activities:

- Use comparative bar graphs and pie graphs to display data.
- Construct and analyze stem and leaf plots for tendencies and distribution.
- Create frequency, relative frequency and cumulative frequency histograms.
- Identify distribution of data based on histograms.
- Display bivariate data using scatter plots.
- Calculate the mean, median, mode, midrange, range and standard deviation of data.
- Create and interpret boxplots.
- Understand and use the Empirical Rule.
- United States of America DVD.
- From Data To Decision pg 80.
- Search newspapers and magazines to find graphs that are misleading.

Assessments

Formative:

- Teacher Observation
- Class Debate of Approaches/Mathematical Methods
- Graphic Organizer
- Entrance/Exit Cards

Summative:

- Mid-unit Quizzes
- Topic Tests

Alternative:

- Observation Assessment with Problem-solving
- Kahoot/Quizizz

Interdisciplinary Connections

Science: HS-LS3-3. In the distribution section of the statistics unit students will apply

concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Career Readiness, Life Literacies, and Key Skills

Technology Integration

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Career Education

CRP4: Communicate clearly and effectively with reason.
CRP11: Use technology to enhance productivity.

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DEPARTMENT Mathematics COURSE Probability & Statistics Advanced

Time Frame	2 Weeks (10 blocks)

Topic

Probability and Inference

Alignment to Standards

S-CP.1, S-CD.2, S-CP.3, S-CP.4, S-CP.5, S-CP.6, S-CP.7, S-CP.8, S-CP.9, S-MD.1, S-MD.2, S-MD.3, S-MD.4, S-MD.5, S-MD.6, S-MD.7

Learning Objectives and Activities

SWBAT answer the following questions:

- Can probability be an accurate tool for making predictions?
- What are the differences between games of chance and skill and can probability be used for each?
- When is simulation a useful tool in calculating probability?
- When data is considered normally distributed and when can z-scores be used?

SWBAT demonstrate understanding of the following:

- Relative frequency of occurrence is probability.
- The Law of Large Numbers allows for accurate estimations when sample size is large enough.
- Tree diagrams are an excellent method of displaying sample space and calculating probability.
- Probability distribution of a discrete variable becomes more normal as the sample size increases.

Learning Activities:

- Create sample space for a chance experiment.
- Use Venn Diagrams to represent outcomes.
- Identify mutually exclusive events.
- Distinguish between experimental and theoretical probabilities.
- Calculate probabilities for compound events and conditional events.
- Establish rules for Independence of events.
- Calculate means of discrete random variables.
- Identify properties of a z-curve.
- Use z-scores to find probabilities and percentiles.
- Simulating the probability of a head with a fair coin.
- United States of America DVD.
- “Monty Hall problem” pg 183.

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Assessments

Formative:
- Khan Academy or IXL Practice
- Teacher Observation
- Graphic Organizer
- Entrance/Exit Cards

Summative:
- Mid-unit Quizzes
- Topic Tests

Alternative:
- Kahoot/Quizizz
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

Science: HS-ETS1-4: In this probability unit students use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Career Readiness, Life Literacies, and Key Skills

9.3.ST.2: When examining experimental probability data students will use technology to acquire, manipulate, analyze and report data.

Technology Integration

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Career Education

CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11: Use technology to enhance productivity.

Time Frame	2 Weeks (10 blocks)

Topic

Hypothesis Testing for Two Variables

Alignment to Standards

S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9

Learning Objectives and Activities

SWBAT answer the following questions:

- How can hypothesis Testing be used to find out if the difference between the two samples is greater than a given value?
- What are differences between pooled and unpooled and does it matter which is used to test data?
- When is it appropriate to use a matched pair t-test instead of a two sample t-test?
- Can the probability value be utilized to determine the strength of the test?

SWBAT demonstrate understanding of the following:

- Hypothesis testing for two samples involves the difference between the means or

proportions.
- Identifying and labeling each population allows for a more accurate and less confusing conclusions.
- Procedures vary for samples that are dependent as opposed to independent.
- Matched pair tests are an important analysis tool when analyzing the results of an experiment.

Learning Activities:
- Identify and label two groups to be tested.
- Create appropriate null and alternative hypotheses.
- Conduct two sample t-test for pooled or unpooled data.
- Distinguish between independent and dependent samples.
- Perform matching pair t-test and interpret results.
- Construct confidence intervals for matched pair results.
- Understand the cautions and limitations of hypothesis testing.
- Use paragraph method of conducting hypothesis tests.
- Comparing Populations – Internet Project pg 511.
- From Data to Decision pg. 512 – Do Academy Awards involve age discrimination?

Assessments

Formative:
- Teacher Observation
- Class Debate of Approaches/Mathematical Methods
- Entrance/Exit Cards

Summative:
- Mid-unit Quizzes
- Topic Tests

Alternative:
- Project – Hypothesis testing
- Kahoot/Quizizz

Interdisciplinary Connections

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Career Readiness, Life Literacies, and Key Skills

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DEPARTMENT Mathematics COURSE Probability & Statistics Advanced

Technology Integration

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Career Education

CRP4: Communicate clearly and effectively with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Time Frame	3 Weeks (15 blocks)

Topic

Constructing and Interpreting Confidence Intervals

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Alignment to Standards

S-IC.1, S-IC.2, S-IC.3, S-IC.4, S-IC.5, S-IC.6

Learning Objectives and Activities

SWBAT answer the following questions:

- How can a confidence interval be interpreted in the context of the problem?
- How is the width of the interval affected by changes in sample size or confidence level?
- How can a sample size be determined for a study that would place your results within a specified error?
- Can confidence intervals be used to draw conclusions about a claim?

SWBAT demonstrate understanding of the following:

- A point estimate is used to establish a value for a population parameter.
- A confidence interval is a range of plausible values for a characteristic of a population.
- Confidence intervals are always two tailed and the confidence level relates to the area under the curve between the intervals.
- Standard error is the estimated standard deviation of the statistic.

Learning Activities:

- Calculate a point estimate from a sample.
- Use formula to create a confidence interval for a sample mean.
- Understand the relationship between the interval and a normal curve.
- Interpret the interval in words in context of the problem.
- Find confidence intervals for one sample proportion.
- Understand the relationship between sample size and width of confidence interval.
- Work backwards to find sample size needed for a given study.
- Calculate and interpret intervals for the difference of two sample means or proportions.
- From Data to Decision pg 386 – “Do Not Call” registry.
- Pg 387 - # 5 – Confidence Interval – Correct age of the President.

Assessments

Formative:

- Classwork and Homework
- Teacher Observation
- Entrance/Exit Cards

Summative:

- Mid-unit Quizzes
- Topic Tests

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Alternative:

- Observation Assessment with Problem-solving
- Kahoot/Quizizz

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

Technology Integration

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Career Education

CRP2: Apply appropriate academic and technical skills.

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CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Time Frame	2 Weeks (10 blocks)

Topic

Hypothesis Testing

Alignment to Standards

S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9

Learning Objectives and Activities

SWBAT answer the following questions:

- Which hypothesis test is appropriate for a particular data set?
- What makes results “statistically significant” and how are they determined?
- When is interpreting results inconclusive and potentially dangerous?
- How can one data set be used to draw opposing conclusions?

SWBAT demonstrate understanding of the following:

- Hypothesis testing uses sample data to decide between two competing claims about a population characteristic.
- There is a possibility of making a Type I or Type II error when conducting a hypothesis test.
- Tests can be performed using the critical value approach of the p-value approach.
- The level of significance is the total area in the rejection region.

Learning Activities:

- Determine the null and alternate hypotheses for a given scenario.
- Understand difference between one tailed and two tailed test and draw curve.
- Identify and interpret Type I and Type II errors in the context of problem.
- Follow procedure and conduct hypothesis test on one sample mean.
- Understand and use p-value approach as well as critical value approach.
- Analyze results of test in the context of the problem.
- Perform hypothesis tests on one sample proportion.
- Establish and interpret the power of the test.
- Applet Project – Hypothesis Test for a Proportion – pg 456.

Assessments

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Formative:
- Classwork and Homework
- Teacher Observation
- Entrance/Exit Cards

Summative:
- Mid-unit Quizzes
- Topic Tests

Alternative:
- Observation Assessment with Problem-solving
- Kahoot/Quizizz

Interdisciplinary Connections

Career Readiness, Life Literacies, and Key Skills

Technology Integration

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DEPARTMENT Mathematics COURSE Probability & Statistics Advanced

to demonstrate understanding of standards.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Career Education

CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11: Use technology to enhance productivity.

Time Frame	2 Weeks (10 blocks)

Topic

Bivariate Hypothesis Tests

Alignment to Standards

S-ID.1, S-ID.2, S-ID.3, S-ID.4, S-ID.5, S-ID.6, S-ID.7, S-ID.8, S-ID.9

Learning Objectives and Activities

SWBAT answer the following questions:

- How can qualitative data be tested to draw inferential conclusions that are supported numerically?
- What are the differences between correlation and association when drawing conclusions about data?
- When is data usable for linear regression hypothesis testing?
- What assumptions must be met in order to use chi square testing and what if the assumptions are not met?

SWBAT demonstrate understanding of the following:

- Bivariate quantitative data can be tested using linear regression hypothesis testing procedures
- Bivariate qualitative data can be tested for association or independence using Chi Square tests
- A contingency table is a way of organizing bivariate qualitative data
- Chi Square curve is a right skewed non-normal curve

Learning Activities:

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- Calculate expected values for a multiple proportion study.
- Perform a Chi Square Goodness of Fit test and interpret results.
- Create contingency table from data collected.
- Calculate expected for each cell and the Chi Square test statistic.
- Perform the Chi Square test for Association or Independence.
- Calculate residuals for linear data.
- Find and interpret the correlation coefficient and coefficient of determination.
- Conduct a linear regression hypothesis test on the slope of a regression line and interpret results in context.
- Internet Project pg 456 – Hypothesis Testing.

Assessments

Formative:
- Classwork and Homework
- Daily Practice Problems
- Teacher Observation
- Entrance/Exit Cards

Summative:
- Mid-unit Quizzes
- Topic Tests

Benchmark:
- Cumulative final exam with multiple choice, short answer, and extended constructed response questions.

Alternative:
- Observation Assessment with Problem-solving
- Kahoot/Quizizz
- Individual or group productive struggle assessment during introductory lessons

Interdisciplinary Connections

ELA: W.11-12.1: When students are justifying their reasoning on short answer and extended constructed response questions they write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Career Readiness, Life Literacies, and Key Skills

Technology Integration

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Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

Students will use internet based game sites such as Quizizz, Kahoot, and Quizlet live to reflect on their learning progress.

- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math and Video Tutor-bigideasmath.com.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will utilize Geogebra and Statistical Websites to further investigate concepts to demonstrate understanding of standards.

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Modifications (ELL, Special Education, At Risk Students, Gifted & Talented, & 504 Plans)

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring

- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed

Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

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Meeting the needs of all students with a proud tradition of academic excellence.

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- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns