Unit 2 Atmospheric Variables (Earth and Space Science, Engineering Design)

Content Area: **Science**
Course(s): **Sample Course, Meteorology**
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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Meterology - 11, 12

Unit 2 - Atmospheric Variables

Belleville Board of Education

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Unit Overview

Surrounding the Earth is a gas layer or atmosphere, held in place by the planet's gravitational pull.

The Earth's atmosphere is a complex, ever changing physical, and chemical system.

Changes can be microscopic like the dynamics of evaporation, condensation, cloud formation and precipitation, to macroscopic like the localized wind motions, cyclones, hurricanes, typhoons, tornadoes, thunderstorms...finally amounting to the general circulation of the atmosphere.

Enduring Understanding

- Analyze data using mathematical models, in order to make valid scientific claims
- Science Investigations use diverse methods, to compile data, of which all may be valid.

- New technologies, serve to drive scientific knowledge and therefore continued innovation.
- Science arguments are mainly strengthened by multiples sources of empirical evidence.
- Empirical Evidence is required to identify patterns and distinguish between cause and correlation of proposed scientific claims.
- Rates of change can be quantified and modeled over long or short periods of time, and some cannot be reversed
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Essential Questions

- How does the energy flow in and out of the atmosphere, serve to make Earth suitable for life?
- What are the differences between energy transfer on a global versus local level?
- What is the Greenhouse effect? Is there validity to claims of harm, and vice versa beneficial?
- What contributes to Air Pressure and how can it be measured?
- What are some differences in the formation of dew or frost, versus fog?

Exit Skills

- Use a model to describe how variations in energy flow result in climate changes on Earth
- Explain the concept of the Ozone layer, and predict radiation budgets for given locations, and determine if climate change is affecting, the energy budget for the region.
- Compare and contrast Albedoes of of various geological surfaces and their contribution to climate change.
- Convert between Fahrenheit and Celsius.
- Construct and Evaluate Surface Pressure Maps.
- Analyze humidity and temperature in a given region in order to calculate the Heat Index.

New Jersey Student Learning Standards (NJSLS-S)

NextGen Science Standards

HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
HS-ETS1-4	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.
HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Interdisciplinary Connections

LA.RL.11-12.10a	By the end of grade 11, read and comprehend literature, including stories, dramas, and poems at grade level text-complexity or above with scaffolding as needed.
LA.RL.11-12.10b	By the end of grade 12, read and comprehend literature, including stories, dramas, and poems, at grade level or above.
LA.RI.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RI.11-12.2	Determine two or more central ideas of a text, and analyze their development and how they interact to provide a complex analysis; provide an objective summary of the text.
LA.RI.11-12.3	Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
MA.N-VM.B.4	Add and subtract vectors.

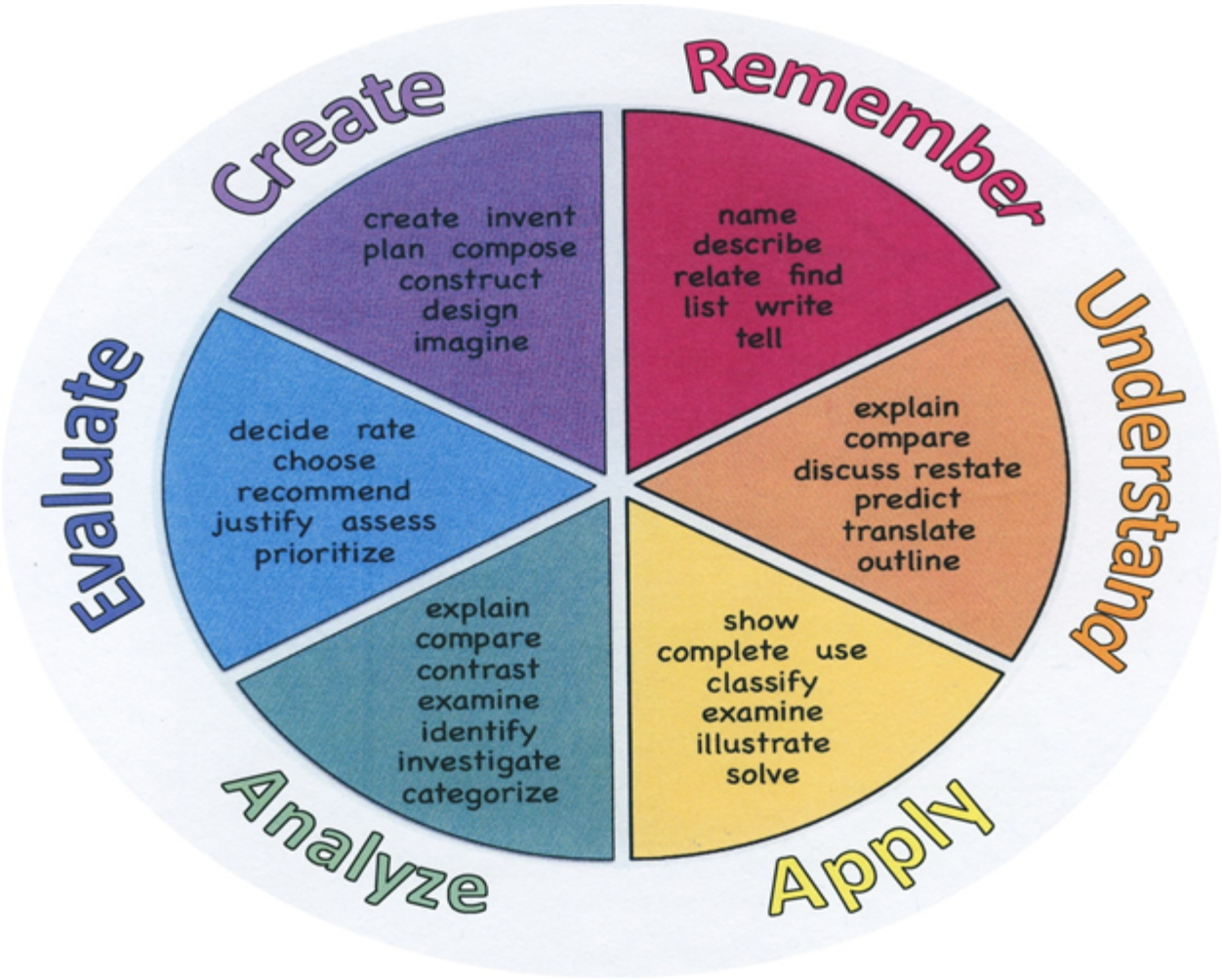
MA.N-VM.C.6	Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.
MA.N-VM.C.8	Add, subtract, and multiply matrices of appropriate dimensions.

Learning Objectives

- Students will be able to analyze data using mathematical models ,in order to make valid scientific claims.
- Students will be able to analyze GeoScience data, to estimate the current rate of climate change.
- Students will be able to explain why human driven climate change, is apparent now, and predict what future Biomes/ Anthromes will look like 100 years from today.
- Students will be able to deduce why surface temperature is taken 1.5 meters above the ground, and always in the shade.
- Students will be able to establish the significant relationship between air pressure, density, and temperature.
- Students will be able to illustrate that warmer air is more capable or holding a greater amount of water vapor, thereby giving certain states, their hurricane seasons.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Assessment Evidence - Checking for Understanding (CFU)

Weather Journal (Alternate)

Permance Task - Wind Farms - Weather and Global Economy (Formative)

Common, Department Quarterly Benchmarks (Benchmark)

Oncourse Assessment Tools (Formative)

Unit Test/Quiz (Summative)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Kenneth R Miller, Ph.D. - Joseph Levine, Ph.D. - New Jersey - Pearson Prentice Hall, Upper Saddle River - 2014

Ancillary Resources

1. AMS *Glossary of Meteorology*
   Authoritative source with over 12,000 definitions of meteorological terms.
2. iWeathernet
   Atmospheric data analyses and forecasts.
3. National Weather Service (NWS) Homepage
   Source for education, advisories, maps, safety, and additional information on all NOAA/NWS products.
4. NOAA's nowCOAST mapping portal
   Real-time coastal information and NOAA forecasts.
5. The Weather Channel
   Providing national and local weather forecast for cities, as well as weather radar, report, and hurricane coverage.
6. Hydrological Prediction Center
   Surface weather systems including regional maps.
7. NWS "Weather Page"
   Access to National Weather Service information for the entire United States.
8. Ohio State University Wx Twister
   Current real-time weather information page for weather data, maps, and imagery from Ohio State University's Atmospheric Sciences Program.
9. Penn State University e-Wall: The Electronic Map Wall
   Electronic map wall with current, future, and past data from multiple model predictions produced by Penn State University.
10. Plymouth State Weather Center
    Current real-time and archived weather information page for weather data, maps, and imagery from Plymouth State University weather program.
11. Texas A&M University Department of Atmospheric Sciences Weather Interface
    Metar data for any specific location from Texas A&M University's Department of Atmospheric Sciences.
12. The Florida State University Florida Climate Center
    Florida Climate Center data, forecasts, and topic resource for both the state of Florida and national climate data.
13. Unisys Weather Map System
    Another map source, also an archive for surface, upper air, and satellite maps.
14. University of Northern Iowa's STORM Project
    Seeks to initiate, support, and coordinate education, service, and research activities that relate weather information in Iowa and the Midwest.
15. Weather Guides at the University of Illinois
    Integrates current and archived weather data with multimedia instructional resources using new and innovative technologies.

16. AGI Education GeoSource
    Thousands of free geoscience education resources from a variety of organizations, from lessons to outreach and teacher professional development, for use in classrooms, scout programs, or at home.
17. California Education and the Environment Initiative
    Providing educators with professional learning and instructional materials that demonstrate how to blend the environment into the teaching of traditional academic subjects like science, history, and English language arts.
18. Educator's Bridge
    Resources for elementary, middle, and high school science educators.
19. GOES-R Education Proving Ground
    Featuring the design and development of pre- and post-launch lesson plans and activities for teachers and students.
20. Iowa State University Iowa Environmental Mesonet
    Collecting environmental data from cooperating members with observing networks. The data are stored and made available on this website.
21. Learn: Atmospheric Science Explorers
    Middle-school-specific modules include background information, hands-on activities using simple materials, and authentic assessment tools for teaching weather in the classroom.
22. MetEd Educator's Portal
    Providing education and training resources to benefit the operational forecaster community, university atmospheric scientists and students, and anyone interested in learning more about meteorology, weather forecasting, and related geoscience topics.
23. National Center for Atmospheric Research (NCAR) Education and Outreach
    Resources for elementary, middle, and high school students as well as parents, teachers, college students and the public at large.
24. National Weather Service Virtual School Talks
    The NWS National School Outreach team is ready to teach and answer your students weather questions through an online virtual classroom.
25. NOAA Education Resources
    NOAA's portal to weather education.
26. NOAA's Jetstream - Online School for Weather
    Designed to help educators, emergency managers, or anyone interested in learning about weather and weather safety.
27. NSF Earth and Environment Classroom Resources
    Collection of lessons and web resources is aimed at classroom teachers, their students, and students' families.
28. Penn State University Weather Links
    Selection of weather resources both local to Pennsylvania and national.
29. Rutgers Weather Center
    Current real-time weather information page for weather data, maps, and imagery from Rutgers University's Meteorology program.
30. The GLOBE Program
    Promotes and supports students, teachers and scientists to collaborate on inquiry-based investigations of the environment and the Earth system.
31. UCAR Teaching Boxes
    Dense topic material for middle and high school science educators teaching weather-related coursework with goals and activities.
32. Weather and Climate Resource List
    Listing of available resources intended to assist those who teach weather and climate at any level from preschool through introductory college level courses.
33. Weather Safety Information
    Safety tips for earthquakes, tornadoes, hurricanes, floods, and wildfires.

34. AGI Career Compass
    Career Compass provides options, tips, suggestions, and strategies for how students can obtain critical skills, experiences, and competencies in order to launch their geoscience career.
35. AGI Geoscience in Your State Factsheets
    Highlighting geoscience areas including employment, water, minerals, energy, and hazards in each state.
36. NOAA Teaching Climate and the Essential Principles of Climate Literacy
    Climate.gov presents information that is deemed important for individuals and communities to know and understand about Earth's climate, impacts of climate change, and approaches to adaptation or mitigation.
37. Climate Literacy & Energy Awareness Network Climate Literacy Quiz
    How's your climate literacy? The explanations beneath each question describes each concept in plain language and links to teaching materials and references. Test your knowledge, and learn as you go.

- NWS Weather Forecast Offices
- NWS Office of Climate, Water, and Weather Services

Lockheed Martin GOES-R Series
Explore the GOES-R satellite series with a wealth of facts, videos, and outreach material

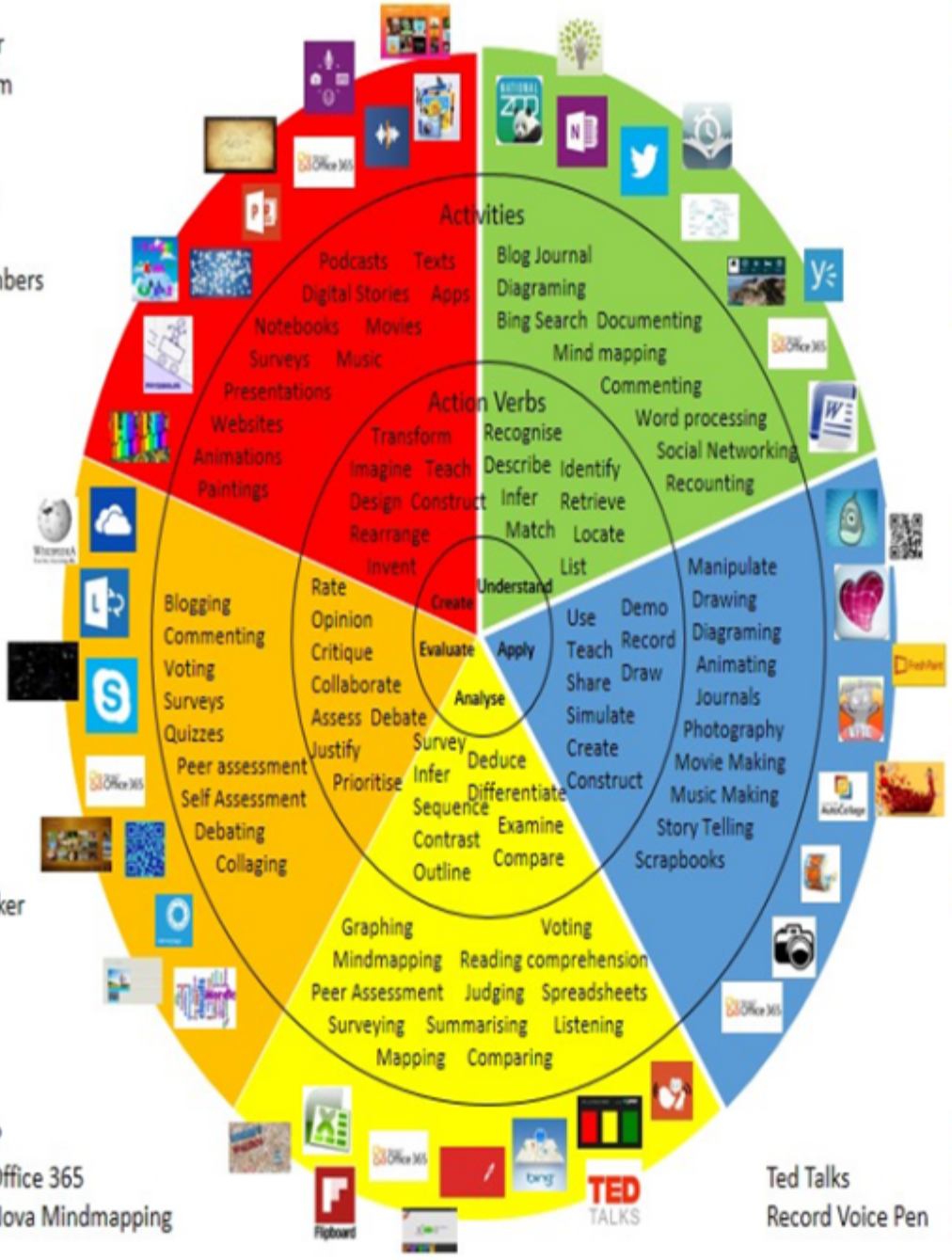
- NASA Meteorology resources for Inquiry based learning
- Chrome Book Projects/ Research/ Analysis
- Google Classroom
- American Meteorological Society On line Resources

Technology Infusion

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.

Alignment to 21st Century Skills & Technology

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration

- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Content

1. **1. Using reading materials at varying readability levels;**
2. **2. Using spelling or vocabulary lists**
3. **3. Presenting ideas through both auditory and visual means;**
4. **4. Using small groups and share pairs; and**
5. **5. Meeting with small groups to re-teach an idea or skill for struggling learners, or to extend the thinking or skills of advanced learners.**

Process

1. **1. Using tiered activities through which all learners work with the same important understandings and skills, but proceed with different levels of support, challenge, or complexity;**
2. **2. Developing personal agendas**
3. **3. Offering manipulatives or other hands-on supports**
4. **4. Varying the length of time a student may take to complete a task in order to provide additional support for a struggling learner or to encourage an advanced learner to pursue a topic in greater depth.**

Products

1. **1. Giving students options of how to express required learning**
2. **2. Using rubrics that match and extend students' varied skills levels;**
3. **3. Allowing students to work alone or in small groups on their products; and**
4. **4. Encouraging students to create their own product assignments as long as the assignments contain required elements.**

Learning environment

1. **1. Making sure there are places in the room to work quietly and without distraction, as well as places that invite student collaboration;**
2. **2. Providing materials that reflect a variety of cultures and home settings;**
3. **3. Setting out clear guidelines for independent work that matches individual needs;**
4. **4. Developing routines that allow students to get help when teachers are busy with other students and cannot help them immediately; and**
5. **5. Helping students understand that some learners need to move around to learn, while others do better sitting quietly (Tomlinson, 1995, 1999; Winebrenner, 1992, 1996).**

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles

- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

- Textbook for at-home use - Meterology
- Additional time for assignments - performance tasks - Wond Farms - Weather and Global Energy
- Provision of notes or outlines - Chapters 2-5
- Choice of test format (multiple-choice, essay, true-false) - Chapter Tests 2-5
- Alternate ways to evaluate (projects or oral presentations instead of written tests) - performance task

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding

- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

ELP Level 2: Define vocabulary concepts from illustrations and word/ phrase banks. Chapters 2-5

ELP Level 3: Give examples of vocabulary concepts from illustrations and word/phrase banks. Chapters 2-5

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student’s learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher’s notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test

- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Special Topics Project, TED Talk, Independent Study Project: Climate and the Global Economy

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery

- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson