Unit 1 Introduction to Commercial Drones

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Curriculum Guide

INTRODUCTION TO DRONE FLYING, GRADES 10 TO 12

INTRODUCTION TO COMMERCIAL DRONES

Belleville Board of Education

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Unit Overview

- This unit provides some basic definitions in drone flying.
- There are 3 main purposes for flying drones.
- For each purpose, there are applications and regulations that need to be followed.
- There are different flight systems and components for each one.
- The drone has different ways of moving, and the controls used differ for each movement.
- There are additional components that can be added onto a drone, depending on the type of work that needs to be done.

Enduring Understanding

Enduring understandings:

- After the U.S. military used drones to arm themselves against terror attacks, people associated drones with war and destruction.
- Drones have been used by Amazon for deliveries, and they have begun to be used in other commercial industries.
- There are basic definitions and abbreviations like UAV, CS, corrective lenses, RPIC, VO, and VLOS that drone operators must understand in order to correctly interpret regulations and drone related articles.
- There are safety regulations that drone operators of all types must use in order to efficiently integrate into the National Airspace System.

- The FAA has websites where owners can register drones over 0.55 pounds or are for commercial use before operating them.
- Public safety organizations, like law enforcement and fire departments, use drones to gather information or even deliver materials to assist people in emergency situations.
- Public safety organizations have the option of following Part 107 regulations or the terms of a Certificate of Authorization, each of which has advantages and disadvantages.
- There are three main types of flight systems.
- A flight system consists of the drone, flight controller, airframe, propellers, motors, electronic speed controller, sensors, gimbal, camera, remote control transmitter, and ground control station.
- The type of additional components, or payload, that is used depends on the mission.

Essential Questions

Essential Questions:

- What purposes do drones have outside of war and destruction?
- What commercial industries have been using drones, and in which industries do you anticipate the use of drones?
- What are the advantages and disadvantages of using a Certificate of Authorization over following Part 107 regulations?
- What drone-specific terms need to be understood in order to comprehend drone-related articles?
- How and where can a person register a commercial or hobbyist drone?
- What actions would be in violation of the FAA's drone safety regulations?
- What parts of the drone can be seen, and which ones are inside of the drone?
- What components can be attached to a drone, and how do I know if I should purchase them?

Exit Skills

By the end of Unit 1, the student should be able to:

- Name at least 3 commercial industries where drones are being used.
- Describe what a Certificate of Authorization is.
- Identify the fields that may obtain a Certificate of Authorization.
- Define commonly used terms in the drone industry, like RPIC, VO, sUAS, UAV, VLOS and corrective lenses.
- Understand the steps taken to register a commercial or hobbyist drone.
- Name some basic safety guidelines to follow when flying drones.
- Name the parts of a drone, their functions, and additional components that can be attached to it.

New Jersey Student Learning Standards (NJSLS-S)

SCI.HS-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information.
SCI.HS-PS4-5	Communicate technical information about how some technological devices use the

	principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
SCI.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.

Interdisciplinary Connections

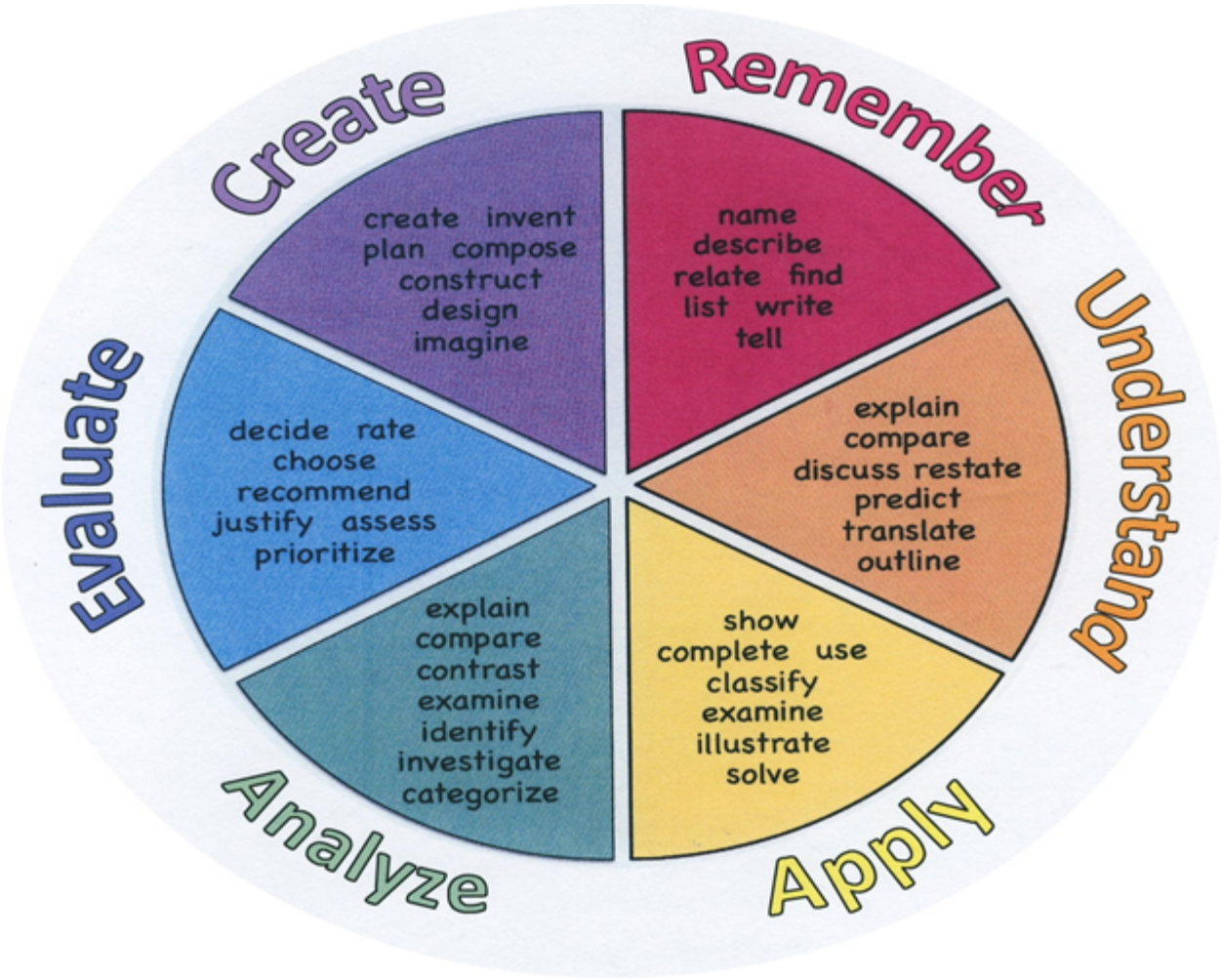
LA.RL.11-12.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
LA.SL.11-12.4	Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.
LA.L.11-12.6	Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.CS.3	Compare the functions of application software, system software, and hardware.
CS.9-12.8.1.12.IC.1	Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
SOC.6.2.12.D.6.a	Assess the role of increased personal and business electronic communications in creating a “global” culture, and evaluate the impact on traditional cultures and values.

Learning Objectives

- Identify the commericial industries where drones are used.
- Compare how the drones are used in different commercial industries.
- Use drone-specific terms appropriately when communicating about the field.
- Rewrite the steps taken to register a commercial or hobbyist drone in your own words.
- List the safety guidelines for drone flying, and justify the purpose of each of them.
- Defend or criticize authors' articles on how drones can be used to tackle climate change.
- Determine ways that the LGTBQ have used drones to celebrate Pride.
- Point out the different parts of a drone and explain their functions.
- Determine whether or not a mission requires additional components, and what they are.

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

Best Practices:

- Use of scaffolded notes, where students fill in blanks
- Use of short movie clips, not long films
- Station activities, based on interest and level of understanding
- Hands-on activities to familiarize with parts of a drone and the control station
- Google Classroom organized around units of study.
- Repetition and review of concepts, especially sample Part 107 test questions.

Exemplars:

- Keep discussing drone regulations, even before they appear in direct instruction.

- Use drag and drop notes for commerical drones, especially for students who have difficulty following the notes.
- Show drone racing and light shows, in addition to the drone career clips suggested by skyop.com.

Assessment Evidence - Checking for Understanding (CFU)

- edulastic.com - for practice exercises and assessment (Formative and Summative)
- whiteboard.fi/ - to present notes and questions (Formative)
- Jamboard - for group work (Formative)
- Google Forms - for Do Nows, Exit Tickets and Assessment activities (Formative)

Performance Task Example (Alternate):

Research how the LGBTQ community has been using drones.

If no one finds out, and for IEP/at risk students, provide the websites of the articles

Make a short slide presentation or essay of their findings.

- Google Slides - for Notes and Drag and Drop activities (Formative)
- Google Classroom - for open-ended questions (Formative)
- quizizz.com - for content practice in a game format (Alternate)
- oncourse.com - for benchmarks (if applicable) (Summative/Benchmark)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Illustration
- Journals
- Learning Center Activities
- Multimedia Reports
- Outline
- Question Stems
- Quizzes
- Self- assessments

- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Materials:

- Syma XSC-1 2.4G drone
- computer or chromebook

Resources:

- skyop.com - readings, notes and films about the drone industry and drone components
- faa.gov - clarifications and justifications of some drone regulations
- https://www.flyability.com/commercial-drones (Flyability) - for commercial uses of drones
- https://static.bhphotovideo.com/FrameWork/Product_Resources/monthlyPDF/winter2018/aerial.pdf - parts of drones diagrammed and described

Ancillary Resources

Drone Racing:

- https://www.youtube.com/watch?v=bZvNLuC12R0 - Championship Race: Xfinity CA Drone Speed Challenge, 2018
- https://www.youtube.com/watch?v=pZ0viMxYDA4&t=10s - Go Inside the World's First $1 Million Drone Race

Drone Light Shows:

- https://www.youtube.com/watch?v=TOvxxq9TwNg - VWLS - High in Heaven - Official Video
- https://www.youtube.com/watch?v=FNehPbWMw34 - Incredible South Korean Drone Display Tells Citizens to Wear a Mask
- https://www.youtube.com/watch?v=N_025VPGr5E - Vivid 2022 largest drone light show in the southern hemisphere - May 2022
- https://verge.aero/everything-about-drone-light-shows/ - Everything You Ever Wanted to Know About Drone Light Shows
- https://droneshowsoftware.com/ - How to Run a Profitable Business in the Light Show Industry

- https://www.youtube.com/c/WeTheFeeble/videos - New Tech Tutorials (Create a Drone Show Animation in Cinema 4D - Parts 1 to 3)
- https://www.youtube.com/watch?v=YW_VR3Yx0DE - Behind the scenes - How to make a drone show

LGBTQ:

- https://www.them.us/story/lgbtq-group-flies-rainbow-flag-over-ukraines-statue-of-liberty - LGBTQ uses drone to fly rainbow flag over Ukraine's Statue of Liberty
- https://www.cnet.com/culture/intel-drones-light-up-sky-to-celebrate-lgbtq-pride/ - Intel drones light up sky to celebrate LGBTQ pride
- https://vimeo.com/276997104 - Intel honors LGBTQ group community with Pride Month drone light show
- https://newsroom.intel.com/news/intel-celebrates-lgbtq-pride-2018-drone-light-show/#gs.1wskg4 - slides of Intel light show
- https://pinnacledronelightshows.com/ - A black-owned, LGBTQ inclusive drone company

Climate Change:

- https://social-innovation.hitachi/en-eu/stories/technology/drones-new-heights-climate-change/ - Drones to fight climate change
- https://www.oneearth.org/drones-an-unexpected-tool-in-the-climate-change-fight/ - Drones, an unexpected tool in the climate change fight
- https://enterprise-insights.dji.com/blog/drones-sustainable-future-earth - How drones are saving the planet

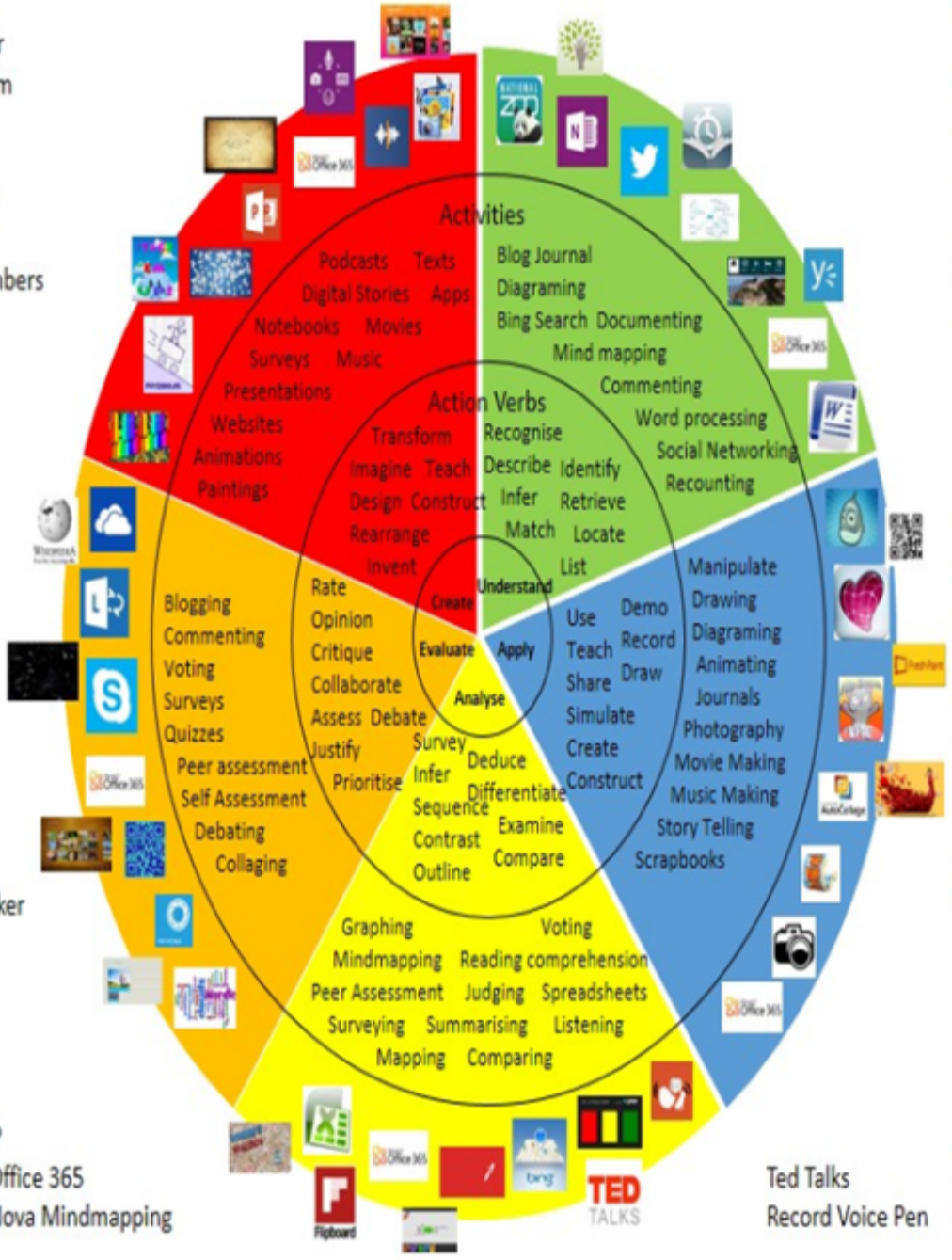
Technology Infusion

- use of the internet - for articles and websites about climate change and LGBTQ use of drones
- edulastic.com - for practice exercises and assessment
- whiteboard.fi/ - to present notes and questions
- Jamboard - for group work
- Google Forms - for Do Nows, Exit Tickets and Assessment activities
- Google Slides - for Notes and Drag and Drop activities (Formative)
- Google Classroom - for open-ended questions (Formative)
- quizizz.com - for content practice in a game format (Alternate)
- oncourse.com - for benchmarks (if applicable) (Summative/Benchmark)

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
Flipboard
Office 365
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

Alignment to 21st Century Skills & Technology

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Technology;

WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.DC.3	Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
TECH.9.4.12.DC.4	Explain the privacy concerns related to the collection of data (e.g., cookies) and generation of data through automated processes that may not be evident to users (e.g., 8.1.12.NI.3).

21st Century Skills/Interdisciplinary Themes

Exemplars:

- Students discover how drones are used in different career industries.
- Students learn about the different types of software that is used for the drone light display or collection of data.

- 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

Exemplars:

- Students brainstorm on the potential dangers and the people's concern of flying drones in public places.

- Students discover what organizations have incorporated LGBTQ pride into their business projects.

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy

Differentiation

Differentiations:

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

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Learning contracts
- Leveled rubrics
- Multiple intelligence options
- Project-based learning
- Problem-based learning
- Stations/centers
- Tiered activities/assignments
- Tiered products

Lo-Prep Differentiations

- Choice of books or activities

- Flexible grouping
- Goal setting with students
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Varied journal prompts
- Varied supplemental materials

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

Exemplars:

- Allow multiple-choice assignments, written assignments, and quizzes to be submitted late
- Convert articles to PDF and highlight important ideas for students
- Have drag and drop notes so that students do not need to read or write as much
- During drag and drop, discuss information with students so that they understand their notes.

- 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
- 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 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)

Exemplars:

- Have all notes, activity directions, and assessment items translated into Spanish.
- Place students next to Spanish-speaking peers.
- Have individual interaction with students to make sure that they understand the content and expectations.
- Have film clips with subtitles available - show students how to use them.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- 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 work presented or required
- having peers take notes or providing a copy of the teacher's notes
- providing study guides
- tutoring by peers
- using computer word processing spell check and grammar check features

At Risk

Exemplars:

- Minimize the amount of reading that needs to be done.
- Make multi-colored notes, and provide drag/drop notes instead of requiring students to write the information down.
- Show short film clips, and use short lectures because their attention span is short.

- 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 work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- providing study guides
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Exemplars:

- Have students research the use of drones in a particular field.
- Show students how to take apart and put together the basic parts of a drone.

- 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
- 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

Unit Name: LGBTQ and Drone Light Shows

NJSLS:

Interdisciplinary Connection: Technology Connection: Drone light shows use computer software to coordinate the drones.

Statement of Objective: The student should be able to: determine locations where the LGBTQ has celebrated pride with drone light shows

name some of the software that is available to create drone light shows

identify the basic steps to making a drone light shows

Anticipatory Set/Do Now: Show a short clip of a drone light show and discuss environmental benefits of using light shows instead of fireworks

Learning Activity: Do Now.

Present articles/videos of the LGBTQ and pride light shows - students can research in pairs of groups

Students should also look through suggested articles or research for software and basic steps to create drone light shows

Students write their findings as a Performance-Based Assessment (essay or slide presentation)

Students discuss their findings with the class

Student Assessment/CFU's: observation, questioning

Materials: articles/videos on internet, chromebooks/computers, Google Classroom

21st Century Themes and Skills: communication, critical thinking, media and information literacy

Differentiation/Modifications: try to translate articles to Spanish, show students how to set videos up so that subtitles appear, have main ideas highlighted for at-risk/IEP students, peer tutoring

Integration of Technology: use of the internet, use of Google Classroom, use of chromebooks/computers

SCI.HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
SCI.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
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SOC.6.2.12.D.6.a	Assess the role of increased personal and business electronic communications in creating a “global” culture, and evaluate the impact on traditional cultures and values.
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).