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Come Fly
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Come Fly With Me!

Exploring the Physics of Flight Using Drone Technology

Adam Mack, M.Ed.
W.R. Thomas Middle School (6901)
adammack@dadeschools.net
Career and Technical Education
TSA Advisor
SECME Coordinator



DRONE

**For information concerning Ideas with IMPACT opportunities including
Adapter and Disseminator grants, please contact:**

Edwina Lau, Ideas with IMPACT Program Director
The Education Fund
305-558-4544, Ext. 113
Email: elau@educationfund.org
www.educationfund.org

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Come Fly With Me!

Exploring the Physics of Flight Using Drone Technology

Florida Standards and Benchmarks:

Elementary

Big Idea 10: Forms of Energy

- SC.5.P.10.2 - Energy can cause motion or create change.

Big Idea 13: Forces and Changes in Motion

- SC.5.P.13.1- Forces A
- SC.5.P.13.2- Changes in Motion AA
- SC.5.P.13.3- Forces that Move objects AA
- SC.5.P.13.4- Balanced and Unbalanced

Middle School

Types of Forces (SC.6.P.13.1, SC.6.N.1.1, LAFS.68.RST.4.10, LAFS.68.WHST.1.2, MAFS.6.SP.2.5)

- Contact Forces
- Forces Acting at a Distance

Law of Universal Gravitation (SC.6.P.13.2, SC.6.N.1.3, SC.6.N.1.5, SC.6.N.2.1, SC.6.N.3.2, SC.6.N.3.3, MAFS.6.SP.2.5d)

- Gravitational Force
- Mass vs. Weight
- Newton's Law of Universal Gravitation

Forces and Motion (SC.6.P.13.3, SC.6.N.1.3, MAFS.6.SP.2.5a, b, c and d)

- Forces
- The Effects of an Unbalanced Forces on an Object

Motion (SC.8.E.5.7; SC.8.E.5.4; SC.8.E.5.9; SC.8.P.8.4; SC.6.P.13.3)

- Develop the concept of motion
- Position
- Speed
- Velocity
- Acceleration
- Graphs of Motion

Forces (SC.8.E.5.4; SC.8.E.5.9; SC.7.N.1.5; SC.6.P.13.1)

- Develop the concept of Forces and equilibrium
- Newton's First Law

- Newton's Second Law
- Newton's Third Law
- Law of Universal Gravitation

High School

Science Standard 12 Motion

- SC.912.P.12.2, 12.3, 12.4

Math Clusters

- MAFS.912.N-Q.1

Course Goals and Objectives:

At the beginning of this unit students will be introduced to physics of flight, Newton's 3 laws of motion and the engineering design process. Students will then work with the teacher to design a flight challenge (Obstacle Course, Race Field) that they will build and use to further develop their knowledge of piloted (student flown) and autonomous (programmed) flight. Once the course is built, students will practice their piloted flight while collecting flight time data. Students will then program their drones to complete the course without the aid of a pilot and collect comparative flight time data. After analyzing data from the two forms of flight, students will discuss the pros and cons of each method and application in a real world setting using the C.E.R. (claim, evidence, reasoning) method in support of their individual positions.

Background Information & Resources Necessary for Implementation:

How do Airplanes fly?

<https://www.youtube.com/watch?v=YyeX6ArxCYI>

Introducing the concepts of flight video with brief historical background.

This Is How Drones Work

<http://time.com/3769831/this-is-how-drones-work/>

Time Magazine current event article to introduce drones.

Newton's Laws-NASA

<https://www.grc.nasa.gov/www/k-12/airplane/newton.html>

Engineering Design Process

<https://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml#theengineeringdesignprocess>

Review of Graphing Skills

Available through Explore Learning Gizmo (District portal access)

CER Template

faculty.fiu.edu/~obrieng/May19Claimsevidencereasoningtemplateelementary.docx

Vendors, Cost Breakdown, and Apps. Programming Information:

Parrot MiniDrones

<https://www.parrot.com/us/minidrones#minidrones>

Programmable Mini Drones.

Tynker App for Programming MiniDrones

<https://play.google.com/store/apps/details?id=com.tynker.Tynker&hl=en>

Parrot AR Drone 2.0 (Advanced)

<https://www.parrot.com/us/drones/parrot-ardrone-20-elite-edition#parrot-ardrone-20-elite-edition>

How to Program AR Drone 2.0

<https://www.instructables.com/id/Autonomous-AR-Parrot-Drone-20-Flying/>

Extended Learning Opportunities:

NSTA Article “From Droughts to Drones”

http://www.nsta.org/store/product_detail.aspx?id=10.2505/4/sc15_053_02_50

NSTA Reports April 2016 Pages 8-9

“Using Drones to Enhance STEM Learning”

<http://static.nsta.org/pdfs/nstareports/nstareports201604.pdf>

Obstacle Course Design Resources and Ideas

FAU UAV Championship 2017 – Game Manual

This manual is published by Florida Atlantic University and contains a description of a suggested flight course. The course is made with PVC materials and requires a PVC cutter and adhesive. On page 31 of the manual, it shows a photograph of a typical design and set-up. There are other examples and images easily found using an Internet search.

<http://www.fauuav.org/>

Materials: May be purchased through any Home Depot

Unit Implementation Timeline
Recommend 3 Weeks (regular schedule, not block)

Topic	Time Required
Introduction to The Science of Flight	2-3 days
Engineering Design Process	1 day
Building of Obstacle Course	3-4 days (1 for Planning & Design / 2-3 for Building)
**Piloted Flight Exercise & Data Gathering	1 day
**Drone Programing	2-3 days
**Autonomous Flight Exercise	1 day
Data Analysis and Debriefing	1 day

**These timeframes don't take into consideration the time that the Teacher needs to become familiar with the programming software and drone operation. It is highly recommended, that enough time is allotted to become proficient in order for students to receive the maximum benefit from their experience.

Teacher: Adam Mack
Week of:

Subject: Career and Technical Education

NGSSS	SC.6.P.13.2, SC.6.N.1.3, SC.6.N.1.5, SC.6.N.2.1, SC.6.N.3.2, SC.6.N.3.3,	SC.8.E.5.7; SC.8.E.5.4; SC.8.E.5.9; SC.8.P.8.4; SC.6.P.13.3, SC.912.P.12.3	SC.8.E.5.4; SC.8.E.5.9; SC.7.N.1.5; SC.6.P.13.1	SC.68.CS-CS.2.2 SC.8.N.1.2	MAFS.7.RP.1.2 MAFS.K12.MP.5.1 MAFS.K12.MP.1.1
OBJECTIVES	Introduction to the Physics of Flight	Interpret and apply Newton's 3 Laws of Motion	Newton/Law of Universal Gravitation (continued)	Introduction to the Engineering Design Process	Review of Graphing Skills and Data Analysis
ESSENTIAL QUESTION(S)	How does anything stay up in the air? (Planes, helicopters, birds, insects, etc.)	How can you tell if the forces acting on an object are balanced or unbalanced?	How does the saying "What goes up, must come down" apply to the force of Gravity applied to objects?	What is Engineering and what does an engineer do? Is an engineer a type of scientist?	How does graphing help engineers interpret test results? When do you use quantitative data vs. qualitative data?
OUTLINE OF ACTIVITIES	<p>Cooperative Activities Gizmo Interactive Activity (Tech) Lecture/Discussion Practice/Text/Worksheet Project/Presentation Reading/Writing Review Technology</p>	<p>Cooperative Activities Gizmo Interactive Activity (Tech) Lecture/Discussion Practice/Text/Worksheet Project/Presentation Reading/Writing Review Technology</p>	<p>Cooperative Activities Gizmo Interactive Activity (Tech) Lecture/Discussion Practice/Text/Worksheet Project/Presentation Reading/Writing Review Technology</p>	<p>Cooperative Activities Gizmo Interactive Activity (Tech) Lecture/Discussion Practice/Text/Worksheet Project/Presentation Reading/Writing Review Technology</p>	<p>Cooperative Activities Gizmo Interactive Activity (Tech) Lecture/Discussion Practice/Text/Worksheet Project/Presentation Reading/Writing Review Technology</p>
INSTRUCTIONAL PROCESS	<p>Before showing the video, the Teacher will probe student understanding of the concept of flight and construct a KWL chart as a class.</p> <p>Students will be introduced to the Physics of flight by watching a short video documentary film.</p> <p>Resource Link: https://www.youtube.com/watch?v=YyeX6ArxCYI</p> <p>After which there will be a discussion and information will be added to the KWL chart.</p> <p>Teacher will present students with required vocabulary for the unit</p>	<p>The teacher will review Newton's 3 Laws of Motion using a PowerPoint slide presentation and an Interactive from NASA</p> <p>Resource Link: https://www.grc.nasa.gov/www/k-12/airplane/newton.html</p> <p>Students will demonstrate understanding by scoring a minimum of 80% during a Kahoot It challenge.</p> <p>https://create.kahoot.it/#quiz/f93e6d99-a65a-4eba-afea-d7f2b8686457</p>	<p>Continuation of yesterday's lesson on Newton's Laws of Motion.</p> <p>Students will be exploring the Law of Universal Gravitation by demonstrating that gravity is a force than can be overcome. (ex: ability to fly)</p> <p>Using laptops (or PCs), students will visit the PBS sight and experiment with the interactive program to gain a more concrete understanding of the relationship between gravity and objects that are affected by its influence.</p> <p>Resource Link: https://www.pbslearningmedia.org/resource/ess05.sci.ess.eiu.moonorbit/why-doesnt-the-moon-fall-down/#.WY-J64qQyXo</p>	<p>The teacher will introduce the engineering design process while students take notes from the presentation.</p> <p>Students will then construct a foldable to represent the engineering design process. Once completed, they will glue to their interactive notebook and keep for future reference.</p> <p>Resource Link: https://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml#theengineeringdesignprocess</p>	<p>Teacher will project the Explore Learning Gizmos Graphing Interactive on the Promethean board.</p> <p>Students will be given the accompanying handout to complete as the teacher selects students to come up to the board and solve for the exercises.</p> <p>Students should demonstrate proficiency of graphing to be ready for data collection phase of this unit.</p> <p>Resource Link: https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=625</p>

Home Learning	Watch the video again and study the vocabulary words introduced during class.	Students should review notes taken during PowerPoint presentation if their Kahoot It score was below 80%		Review the Engineering Design process	
ASSESSMENTS	Class Participation Class Work Discussion (contribution) Group Project Homework Journaling Observation Oral Presentation Portfolio Projects Review Rubric Teacher Observations Test / Quiz Other:	Class Participation Class Work Discussion (contribution) Group Project Homework Journaling Observation Oral Presentation Portfolio Projects Review Rubric Teacher Observations Test / Quiz Other:	Class Participation Class Work Discussion (contribution) Group Project Homework Journaling Observation Oral Presentation Portfolio Projects Review Rubric Teacher Observations Test / Quiz Other:	Class Participation Class Work Discussion (contribution) Group Project Homework Journaling Observation Oral Presentation Portfolio Projects Review Rubric Teacher Observations Test / Quiz Other:	Class Participation Class Work Discussion (contribution) Group Project Homework Journaling Observation Oral Presentation Portfolio Projects Review Rubric Teacher Observations Test / Quiz Other:

VOCABULARY		CRISS L.A. STRATEGIES	EQUIPMENT & TECHNOLOGY	
Motion Direction Speed Distance Time Forces Contact force Applied force Friction Gravity Air resistance		Concept mapping Drawing / Illustrations Highlighting K-W-L Charts Power Notes Q-A-R Sticky Notes Study Cards Summarizing Think-Pair-Share Two Column Notes Venn Diagrams	Equipment	Technology CPALMS Discovery Learning Edgenuity Gizmos NBC Learn PowerPoint / Prezi Promethean Board PBS Learning Media Internet sites: • • • • •

D.I. / ESE / ESOL Strategies:				
Alternative Assessment	Directed Activity	Highlight	Outlines/Checklists	Other
Control Vocabulary	Extended Time	Individualized	Peer Tutor	
Cooperative Learning	Graphic Organizers	Manipulative	Step-By-Step Instructions	
Demonstrations	Guided Inquiry	Oral Repetition	Visual Aids	



Apply for an Ideas with **IMPACT** Adapter Grant!

All Miami-Dade County public school teachers, media specialists, counselors or assistant principals may request funds to implement any project idea, teaching strategy or project from the 2017 Idea EXPO workshops and/or curriculum ideas profiled annually in the ***Ideas with IMPACT*** catalogs from 1990 to the current year, 2017-18. Most catalogs can be viewed on The Education Fund's website at educationfund.org under the heading, "Publications."

- Open to all K-12 M-DCPS teachers, counselors, media specialists
- Quick and easy reporting requirements
- Grants range from \$150 - \$400
- Grant recipients recognized at an Awards Reception

To apply, you must contact the teacher who developed the idea before submitting your application. Contact can be made by attending a workshop given by the disseminator, communicating via email or telephone, by visiting the disseminator in their classroom, or by having the disseminator visit your classroom.

Project funds are to be spent within the current school year or an extension may be requested. An expense report with receipts is required by Friday, June 1, 2018.

APPLICATION DEADLINE:
December 13, 2017
Apply online at educationfund.org

For more information, contact:

Edwina Lau, Program Director
305.558.4544, ext. 113
elau@educationfund.org



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