COURSE: Creation and Evaluation of Drones: Coding with Tello

Designed for learners in Grades 9-12.

COURSE DESCRIPTION

Students analyze and apply how Unmanned Aerial Vehicles (drones) work and can be used to solve real-world problems. Students will integrate algebraic thinking, programmatic knowledge, and use programming skills to navigate the Tello Drone using the Droneblocks app.

LESSON SEQUENCE AND LEARNING TARGETS

Lesson One: Introduction to Drones
❏ I can understand how a drone is flown and the laws that affect their operation.
❏ I can understand how block coding can be used to give instructions to machines.

Lesson Two: Flying Drones Safely
❏ I can compare scenarios for safe and unsafe drone operation.
❏ I can consider the reasons why drone laws would be enacted.

Lesson Three: Block Coding Drones
❏ I can identify components of block programming language.
❏ I can construct and follow a set of sequential instructions.

Lesson Four: Coding with Loops
❏ I can compare sequences and loops in block coding.
❏ I can translate loops in code from natural English instructions into block-based code.

Lesson Five: Delivery Abstraction
❏ I can understand the steps of a drone delivery.
❏ I can construct a simulation of a drone delivery.
❏ I can consider the effectiveness of

Lesson Six: Investigating Sensors
❏ I can compare the information collected by drone sensors to information gathered by human senses.
❏ I can program drones to simulate the flight paths that

Lesson Seven: Using Operators
❏ I can simulate a real world flight by coding a flight pattern to scale.
❏ I can convert metric units for flight into imperial units.

Lesson Eight: Using the Camera for Data Collection
❏ I can compare and contrast the relationship between drones and other tools to capture information.
❏ I can design a flight scenario to capture

| simulated delivery routes. | would utilize sensors not currently included on the drone. | | relevant scientific information. |

Lesson Nine: Understanding Range
❏ I can test the range of the drone in 3 dimensions and record data about the effective range of the drone.
❏ I can plot, in abstraction, a flight pattern that takes range and battery life into account.

Lesson Ten: What's Next?
❏ I can imagine a future where drones are used to solve more problems.
❏ I can consider current laws regulating drone usage and their impacts on public safety as usage increases.

COURSE OVERVIEW AND PACING GUIDE

Lesson	Learning Targets	Materials Needed	Pacing (60 min.)
Introduction to Drones	❏ I can understand how a drone is flown and the laws that affect their operation. ❏ I can understand how block coding can be used to give instructions to machines.	Tablets with Droneblocks installed Tello Drone	**Engage:** What is a Drone? (10 min.) **Explore:** Drone Laws and Usage (15 min.) **Explain:** Block Coding with Drones (15 min.) **Elaborate:** Drone Coding Example (15 min.) **Evaluate:** Learning Review (5 min.)
Flying Drones Safely	❏ I can compare scenarios for safe and unsafe drone operation. ❏ I can consider the	- Measuring tape or ruler/yardstick	**Engage**: Introduction to Drone Safety, and Operation (5 min.) **Explore**: Considering the Laws (15 min.)

	reasons why drone laws would be enacted.	- Classroom whiteboard and markers	**Explain**: Deciding How to Use Drones (15 min.) **Elaborate**: Constructing Drone Applications (20 min.) **Evaluate**: Learning Review (5 min.)
Block Coding Drones	❏ I can identify components of block programming language. ❏ I can construct and follow a set of sequential instructions.	- Drone Sequence Activity - Classroom whiteboard and markers	**Engage**: Introduction to Block Coding (5 min.) **Explore**: What is Coding (15 min.) **Explain**: Building Sequential Instructions (15 min.) **Elaborate**: Drone Sequence (20 min.) **Evaluate**: Learning Review (5 min.)
Coding with Loops	❏ I can compare sequences and loops in block coding. ❏ I can translate loops in code from natural English instructions into block-based code.	- Tello Drone - Classroom whiteboard and markers	**Engage**: Sequences vs. Loops (10 min.) **Explore**: Building Loops (15 min.) **Explain**: Natural Language vs. Code (15 min.) **Elaborate**: Execute Code (15 min.) **Evaluate**: Learning Review (5 min.)
Delivery Abstraction	❏ I can understand the steps of a drone delivery. ❏ I can construct a simulation of a drone delivery. ❏ I can consider the effectiveness of simulated delivery routes.	- Tablets - Tello Drone - Stopwatch - Classroom whiteboard and markers	**Engage**: Defining Work(5 min.) **Explore**: Drone Delivery Steps (10 min.) **Explain**: Variables in Drone Deliveries(15 min.) **Elaborate**: Simulate Flight Plans (25 min.) **Evaluate**: Learning

			Review (5 min.)
Investigating Sensors	❏ I can compare the information collected by drone sensors to information gathered by human senses. ❏ I can program drones to simulate the flight paths that would utilize sensors not currently included on the drone.	- Tablets - Tello Drone - Classroom whiteboard and markers	**Engage**: What is a Sensor? (10 min.) **Explore**: Humans vs. Machines (15 min.) **Explain**: Abstraction in Application (10 min.) **Elaborate**: Flight Simulation (20 min.) **Evaluate**: Learning Review (5 min.)
Using Operators	❏ I can simulate a real world flight by coding a flight pattern to scale. ❏ I can convert metric units for flight into imperial units.	- Classroom whiteboard and markers	**Engage**: Flight Plan (5 min.) **Explore**: Creating a Map (15 min.) **Explain**: Determining Scale (10 min.) **Elaborate**: Plan the Code (25 min.) **Evaluate**: Learning Review (5 min.)
Using the Camera for Data Collection	❏ I can compare and contrast the relationship between drones and other tools to capture information. ❏ I can design a flight scenario to capture relevant scientific information.	- Tello Drone - Classroom whiteboard and markers	**Engage**: High Tech Science Tools (10 min.) **Explore**: Drones in the Environment (15 min.) **Explain**: Flights for Observation (10 min.) **Elaborate**: Manual vs. Simulated (20 min.) **Evaluate**: Learning Review (5 min.)
Understanding Range	❏ I can test the range of the drone in 3 dimensions and record data about the	- Tello Drone - Measuring Tape	**Engage**: Understanding the Signal (10 min.) **Explore**: Manual Test Flights (15 min.)

	effective range of the drone. ❏ I can plot, in abstraction, a flight pattern that takes range and battery life into account.	- Classroom whiteboard and markers	**Explain**: Range Determination (10 min.) **Elaborate**: Flight Modifications (20 min.) **Evaluate**: Learning Review (5 min.)
What's Next?	❏ I can imagine a future where drones are used to solve more problems. ❏ I can consider current laws regulating drone usage and their impacts on public safety as usage increases.	- Tello Drone - Stopwatch - Classroom whiteboard and markers	**Engage**: Drones Doing Work (5 min.) **Explore**: Math of Work Expanded (15 min.) **Explain**: Future Work (15 min) **Elaborate**: Considering Future Applications (20 min.) **Evaluate**: Learning Review (5 min.)

COURSE PREPARATION

Students will be planning and flying missions with the Tello Drone. Make sure the drones are fully charged before each class period and that the Droneblocks app is loaded on tablets or other mobile devices.