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| **General Lesson Information** |
| **Title:** Programming Tello Drone 1/3 |
| **Overview:** Students will use DroneBlocks to learn the basic principles of programming by following along with the provided tutorials. DroneBlocks is a block-based programming langue allow students to develop a better understanding of how programs operate. From following the tutorials, the students will be able to program the Tello drone to move using preset commands sent from their scripts.  **Setting:** This lesson should be taught indoors in a spacious room with access to computers that have Wi-Fi connection capabilities.  **Intended group size:** Students will need to be equally separated into groups based on the number of available Tello drones. |
| **Intended grade:** 9-12 |
| **Approximate Time of Lesson:**  Introduction to Tello Drone Programming 20 minutes (18.54)  Advanced Tello Programming with DroneBlock 50 minutes (49:52)  Total time of 1 hour and 9 minutes (1:08:46) |

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| **Researcher Biography** |
| **Name & Professional Title:** Matthew See Student Researcher, Casey Calamaio Research Engineer  **Affiliation:** Rotorcraft Systems Engineering and Simulation Center (RSESC) at University of Alabama in Huntsville (UAH)  **Contact Information:** [mss0045@uah.edu](mailto:mss0045@uah.edua) and [clc0941@uah.edu](mailto:clc0941@uah.edu)  **Brief Description of Research Interests:** The goal of our research is to determine how drones and other advanced technologies could be incorporated into an educational environment to assist with students developing their computer literacy skills. |

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| **Associated Standards and Objectives** |
| **Content Standards**: Digital Literacy and Computer Science DLIT (2018) Grade:9-12  **Computational Thinker**  **Algorithms**  3. Differentiate between a generalized expression of an algorithm in pseudocode and its concrete implementation in a programming language  c. Distinguish when a problem solution requires decisions to be made among alternatives, such as selection constructs, or when a solution needs to be iteratively processed to arrive at a result, such as iterative “loop” constructs or recursion.  **Programming and Development**  9. Demonstrate the ability to verify the correctness of a program.  b. Collaborate in a code review process to identify correctness, efficiency, scalability and readability of program code.  **Citizen of Digital Culture**  **Digital Identity**  19. Prove that digital identity is a reflection of persistent, publicly available artifacts.  **Global Collaborator**  **Digital Tools**  25. Utilize a variety of digital tools to create digital artifacts across content areas. |
| **Primary Learning Objectives:**   1. Students will be able to create a script that sends the Tello drone movement commands using DroneBlocks. 2. Students will be able to utilize math calculations to create values used in the code. 3. Students will be able to follow along with online materials to learn how to operate and unknown program. |
| **Additional Learning Objectives:**   1. Students will learn about how drones are used in the modern world 2. Students will learn about the field of aerospace and a brief history of it 3. Students will learn about proper drone safety and regulations |

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| **Preparation Information** |
| **Total Duration:**  The length of lesson preparation will be affected by the number of computers or laptops that need to have the software download and the internet download speed. A good assumption of time is roughly 10 minutes with the ability to work on multiple different devices simultaneously. The batteries of the Tello drones should also be fully charged before the lesson. The batteries take 1.5 hours to fully charge and provide 13 minutes of flight time however flips cannot be performed under 50% battery life. |
| **Materials and Resources:**   * Computers, Laptops, or tablets that have Wi-Fi connection capabilities and internet access * Adding the Google Chrome DroneBlocks app extension to the computers * Tello EDU drones   Optional   * Extra batteries * Battery charging station * Proper battery storage items |
| **Technology Resources Needed:**  [Google Chrome DroneBlocks Extension Download](https://chrome.google.com/webstore/detail/droneblocks/nbfahmffcopanponfpkefngbijhbnffa/related?hl=en-US)  [Introduction to Tello Drone Programming Tutorial](https://learn.droneblocks.io/p/introduction-to-drone-programming-with-tello)  [Advanced Tello Programming with DroneBlocks Tutorial](https://learn.droneblocks.io/courses/enrolled/369052) |
| **Background and Preparation:**  Before the start of the lesson the computers or laptops being used need to have the DroneBlocks Google Chrome extension installed on them. The Teacher should also review the example code to understand what it is doing so they may assist students who may be confused. |

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| **Procedures and Activities** |
| ***Engagement:*** The teacher will start with the introduction slides explaining what the Tello EDU is, some information about what a UAV is, and the research project. Students should be then broken into groups evenly based on the number of Tello EDUs that are available.  ***Main activity:*** The main activity will have the students follow along with the “Introduction to Tello Drone Programming” and “Advanced Tello Programming with DroneBlocks” tutorials on DroneBlocks. The end goal for the students should to be able to command the Tello to autonomously navigate through an obstacle course.  ***Wrap up and Reflection:*** Students should understand how to use block programming languages to write scripts to command the Tello to preform different actions. They also will understand how the programs run in a defined order.  ***Final product/Summative evaluation:*** Students will have different scripts that will send commands to the Tello allowing it to operate autonomously. Having an obstacle course would provide a clear goal of what students should be attempting to complete. |

**Attachments:**

**Possible Places to Purchase the Tello EDU**

[Oriental Navigation Tello EDU](https://www.dji-robomaster.com/tello-edu.html)

[Oriental Navigation Tello EDU Boost Combo](https://www.dji-robomaster.com/tello-edu-Boost-Combo.html)

What we recommend

Tello EDU

Charging Hub

3 batteries

Spare propellers

Blue Tooth handheld controller