

About this Curriculum

This curriculum is intended as a comprehensive introduction to programming using the **Tello™** family of drones. **You don't need to have any programming background to use it.** You'll be given lots of options to get your drones up and flying with custom flight missions that your students create. This curriculum can also be used as a springboard to investigate drone programming in greater detail.

For this curriculum, we are using the **Tello** drone (and all its versions) exclusively. You will need to purchase at least one **Tello** for anything to make sense. If the class is split into groups, 3-4 students can share one drone. Depending on your budget, a small cluster of 5-10 or more **Tellos** is a good fleet. They can be mixed versions (e.g., 5 of the basic **Tello**, 5 of the **Tello EDU**, etc.). With this, you'd be able to explore different programming options (see below). But it's up to you. 😊

The basic **Tello** drone is all that is needed for drag-and-drop programming, but you will need the more advanced versions of **Tello** to be able to program with text-based languages and to "swarm."

We offer **Tello drone packages** on our website with plenty of extra batteries, props, prop guards, and chargers for a successful classroom fleet. You can also purchase **Tellos** at these suggested retailers: [DJI Innovations](#), [Amazon](#), [BH PhotoVideo](#), [Crutchfield](#).



Tello



Tello EDU



RoboMaster TT

All about the *Tello™* Drone

First released in 2018, it was developed by Chinese companies [Ryze Technology](#) in collaboration with [DJI Innovations](#). *DJI* has been producing reputable consumer and professional drones for the past several years. *Ryze* developed the “kid-friendly” *Tello* drone that combines *DJI* flight technology and an *Intel* processor to create an inexpensive camera drone that also can be used to teach the basics of programming. There are currently three versions of the drone (*Tello*, *Tello EDU*, *RoboMaster TT*). We will show the commonalities and differences between them.

Tello™ basic (white)

Specifications

- Weight: Approximately 80 grams (with propellers and battery)
- Dimensions: 98mm*92.5mm*41mm
- Propeller: 3 inches
- Built-In Functions: Range Finder, Barometer, LED, Vision System, WIFI 802.11n 2.4G, 720P Live View
- Port: Micro-USB Charging Port

Performance

- Max Flight Distance: 100m
- Max Speed: 8m/s
- Max Flight Time: 13 min Battery
- Detachable Battery: 1.1Ah/3.8V

Camera

- Photo: 5MP (2592×1936)
- FOV (Field of View): 82.6° The observable area that the drone camera can see.
- Video: HD720P-30FPS
- Format: JPEG (Photo); MP4 (Video)
- Electronic Image Stabilization: An image enhancement technique that uses electronic processing to produce smooth images.

Additional

- Vision Positioning System: Consists of a camera and an infrared 3D module. This system can work in a range of 0.3m to 30m high, but its optimal working conditions are 0.3m to 6m high.
- Drone Status Indicator: LED on the front that indicates the drone’s status while in use.



Overview

The basic *Tello™* drone weighs only 80 grams, can fly for 13 minutes on its battery, is able to capture 5-megapixel photos, and can shoot HD720 video. The drone can be controlled simply using a mobile app on a smartphone (iOS or Android) or on an iPad or Android tablet and therefore doesn’t come with a controller. As an additional purchase, you can add a specific controller if you prefer a traditional RC transmitter feel. There will be more information about this controller later.

But the **Tello** in all its versions is more than a “toy drone.” The main thing that sets it apart is the *Intel* technology inside. Because the **Tello** drone uses the same *Intel* processor that handles object recognition in *DJI* drones, the **Tello** has the capability to respond to hand gestures — just like *DJI*’s more high-end drones. It can even land in your hand and take off by being tossed in the air.

When flying in calm conditions, such as indoors, the **Tello** is incredibly stable and holds its position, making it very easy to learn how to fly. However, because it is so lightweight, the drone doesn’t fly as well in slight wind or breezy conditions.

Equipped with a high-quality image processor, the **Tello** drone shoots incredible photos and videos. For its low price, it has a better camera than more expensive drones in its category. **Tello** has two antennas that make video transmission extra stable. The drone records the video directly to your mobile phone, so you don’t have to store it on a memory card. Because it’s on your phone, it’s very easy to instantly upload your video online to social media.

The standout feature of **Tello** is the fact that you can program it to perform specific routines. This is the first time *DJI* has formally gotten into the “drones for education” department, something other competing drone companies have been doing for years.

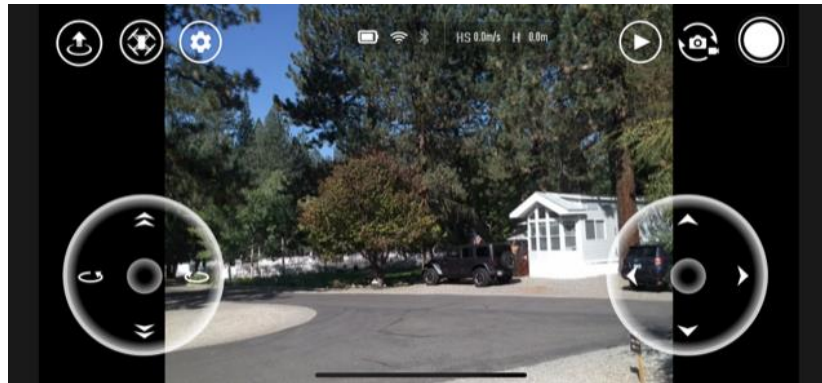
The basic drone can utilize **Scratch** or [DroneBlocks](#) as coding platforms. They are “drag-and-drop” programming languages targeted at younger learners. Essentially, you can program the drone to fly certain directions based on the “code” you have written (you actually drag code command “blocks”). If you opt to use **Scratch** or **DroneBlocks** to control the drone, then you can control it from your computer. **DroneBlocks** can also be programmed from a mobile device. We will discuss these programs in greater detail in the curriculum.

The Tello App

The downloadable **Tello App** makes everything easy. Even if you’re new to drones, you can just grab your mobile phone and fly with the intuitive control system. Impressive maneuvers can be performed with just a tap on the screen.

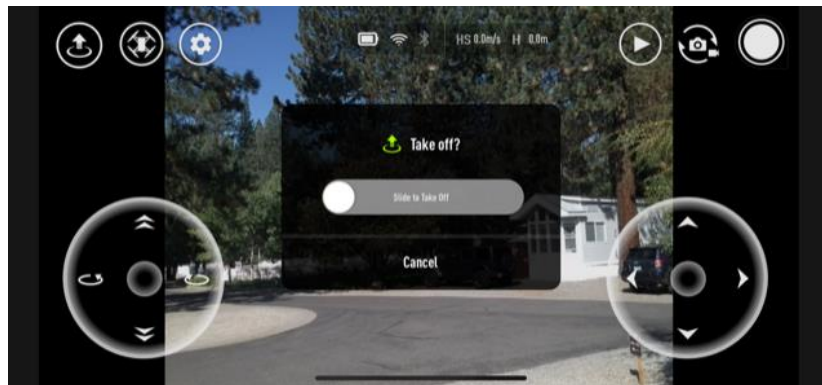


In the app’s screen interface, we see both joysticks to control the drone and what the drone’s camera is capturing. In this same interface, we see data such as battery strength, whether it is connected to the *Wi-Fi* or *Bluetooth™*, and height and speed indications. We can also see buttons for photo and video recording.



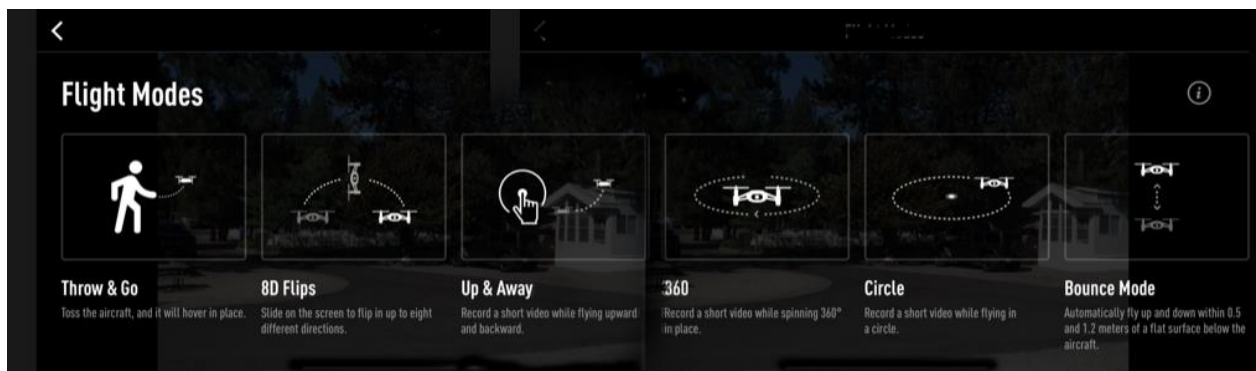
We can access functionalities such as takeoff and landing by sliding the screen's scroll control.

different



And we can access the different flight modes:

- **Throw & Go:** You can throw the drone to a position in the air where it will hover.
- **8D Flips:** Flip in 8 different directions.
- **Up & Away:** Record a short video while the drone moves away and rises.
- **360:** Record a short video while rotating 360°.
- **Circle:** Record a short video while flying in a circle.
- **Bounce Mode:** Fly automatically between 0.5 and 1.2 meters.



Tello is super safe to fly indoors with its software and hardware protections. With a single tap, it can take-off and land automatically. Its vision positioning system facilitates precise hovering. With **Tello's** high-capacity battery, it offers an impressively long flight time (13 minutes), giving it one of the longest

flight times in the mini-drone category. And when the battery gets low, alerts will go off. Also, even if you lose the connection, the **Tello** can still land safely thanks to its *failsafe* protection.

Programmable with Drag-and-Drop

You can learn the basics of programming while having fun. As mentioned before, by using **Scratch** or **DroneBlocks**, you can program your own flight patterns with the **Tello** basic. There are even more advanced programming options in the other versions of **Tello**. You will find **Tello** the smallest and smartest drone around.

The drone comes with propeller guards, a battery, a micro-USB cable, a propeller removal tool, and 4 extra propellers. You should definitely purchase extra batteries (suggested minimum of 3 per drone) because the flight time is only 13 minutes maximum, and the charge time is about 90 minutes.

So, if you want a powerful, capable, and fun drone, the basic **Tello™** is for you! It has all the functionality described above and still allows you to experience its programming capabilities using “drag-and-drop” options. Education-wise, it would be great for elementary grades on up.

Tello EDU™ (black)



The **Tello EDU™** drone is a slight “step up” from the basic version. It has all the same specifications and features of the basic **Tello** drone but adds more programming capabilities. With the **Tello EDU**, students can easily learn programming languages such as **Scratch**, **DroneBlocks**, **Tello SDK**, **Swift**, **Python**, and **JavaScript**.

You can also write code to command multiple **Tello EDUs** to fly in a “swarm.” It is an impressive and programmable drone perfect for education. The **Tello EDU** Drone is an ideal companion for students engaged in STEM-based learning.



Mission Pads

The **Tello EDU** drone comes with four tables or pads. These tables are known as “**Mission Pads**.” The **Mission Pad** is a 15x15 cm square table that serves as a pattern that can be identified by the **Tello EDU** drone. Each side contains a unique pattern composed of:

- **Planets:** different patterns that indicate the ID
- **A rocket:** follow the direction of the x-axis
- **An ID:** number between 1 and 8



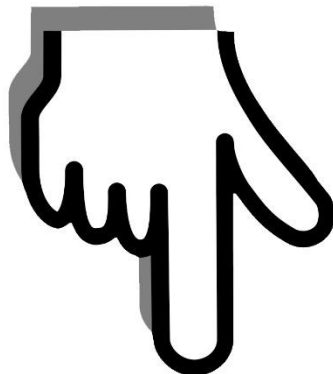
For advanced programming, the **Mission Pads** are a fantastic option for increased precision. They not only serve as guiding points, but as trigger mechanisms. Program with the specific information within each **Mission Pad** to expand your options and push the limits of **Tello EDU**. You can write code that will enable your aircraft to recognize each **Mission Pad's** unique ID, as well as perform aerial acrobatics. Control a swarm of **Tello EDUs** and bring your imagination to life!

Tello SDK 2.0

The **Tello EDU** drone has a “**Software Development Kit**”, which serves as the basis for the development of the different applications that can be carried out. On the Internet, you can find a [user guide](#) created by *Ryze Technologies* which explains how to make the connections, all the different commands that the drone accepts, and how to reset it to return to the initial mode.

Script Programming with Tello EDU

To run a script, it's necessary to connect the computer to the **Tello EDU** drone. To do this, you must connect to the **Tello EDU Wi-Fi** network. The name of the **Wi-Fi** network, by default, can be seen on your available **Wi-Fi** choices or inside the drone when the battery is removed. It's possible to change the name of the network and add a password to prevent any stranger from taking control of the drone. Scripting languages include the **Tello SDK**, **Swift**, **Python**, and **JavaScript**.






Optional RC Controller (additional purchase)

The drone can be controlled simply using the mobile app on a smartphone (iOS or Android) or on a tablet. However, if you prefer a traditional RC transmitter feel, Ryze recommends using the [GameSir T1d](#) controller. It's very simple to connect through *Bluetooth™* within the **Tello App**, and you can use the controller's joysticks to take control of the drone. There's also a nifty holder for your phone to view the live video while flying. This option might give the pilot a more secure feeling of control.

Connecting the *GameSir T1d* to the *Tello App*

NOTE: You cannot connect the *GameSir* controller to the *Bluetooth™* dialogue of your phone. It can only connect via the **Tello** mobile app. Follow the steps below to connect.

1. Enable *Bluetooth™* on your phone.
2. Turn on the *GameSir T1d* controller.
3. Start the **Tello App** on your phone.
4. Tap the gear icon  (left of center at the top of the screen).
5. Tap "*Bluetooth controller settings*".
6. Tap on "*GameSir T1d controller*" and you will get confirmation "*Connected*".

The *GameSir* controller will be connected and ready to use with the **Tello**.

Summary of Differences Between *Tello™* and *Tello EDU™* Drones

	Tello	Tello EDU
Specifications and Features	As listed above	Same as basic Tello
Color	White	Black
Programming: Scratch	Yes - Drag-and-Drop	Yes - Drag-and-Drop
Programming: DroneBlocks	Yes - Drag-and-Drop	Yes - Drag-and-Drop
Programming: Swift	Yes – <i>Swift Playgrounds</i> app (<i>Apple</i> devices only)	Yes – <i>Swift Playgrounds</i> app (<i>Apple</i> devices only)
Programming: Tello SDK	No	Yes - Text
Programming: Python	No	Yes - Text
Programming: JavaScript	No	Yes - Text
Swarms	No	Yes - several drones needed

With its **Tello SDK** option, the **Tello EDU** has support for drone “swarms.” A drone swarm is a group of drones that can make decisions based on shared information. A great example of drone swarms is the *Intel* drone display used in the Olympics, the Superbowl, and other venues in the last couple of years. Another great example is the [drone swarm used over the Bellagio fountains](#) ([YouTube link](#)). Obviously, you need more than one drone for a drone swarm.

If you plan to focus mainly on drag-and-drop programming, then the basic **Tello** is a fantastic choice. It’s fun to fly on its own and will provide a great experience in the **Tello App**. If your budget allows and you want to get into more advanced programming, the **Tello EDU** gives the option of additional programming languages and the ability to support drone swarms. The **Tello EDU** is only slightly more in cost than the basic **Tello**.

RoboMaster TT™ (Iron Man red)



The **RoboMaster TT (Tello Talent)**, developed by *DJI Education* and released in 2021, is an update to the popular **Tello EDU**. It is an eye-catching “Iron Man” red and has the noticeable addition of a programmable **LED** light and dot-matrix screen. The drone can perform a string of movement and light commands that can be programmed by the user. It can also perform coordinated movements in a swarm of **RoboMaster TT** drones. This powerful educational drone makes coding simple and accessible to help introduce you to the world of drones and **AI (Artificial Intelligence)** programming.



Being expandable, the **RoboMaster TT** comes with a modular *Extension Board* that allows you to adapt many third-party sensors. The open-source **RoboMaster SDK** (Software Development Kit) is based on **Python 3.0** and supports **Arduino**, **MicroPython**, **Scratch**, graphical programming, and other methods. With plenty of coding options and the ability to experiment with a variety of sensor types, you will be able to create all sorts of new drone applications.

Product highlights:

- Compact aerial quadcopter with HD camera designed for drone and AI education.
- Includes open-source controller with **LED** light and dot-matrix screen.
- Works with **Tello** and **Tello EDU** apps.
- Drone swarm: program and control multiple **RoboMaster TT** drones at time.
- Obstacle-sensing technology helps avoid collisions.
- Lands safely and automatically if you lose connection.
- Low battery indicator lets you know when it's time to land.
- Flies up to 17.9 miles per hour.
- Maximum flight distance: 328 feet; Maximum flight height: 98 feet.
- Flight time: 13 minutes (drone); 8.5 minutes (controller and screen installed).
- Open-source **RoboMaster SDK** (Software Development Kit) based on **Python 3.0**.
- Supports graphical programming, **Arduino**, **Micro Python**, **Scratch**, and other programming methods.
- 14-pin (2x7) extension board lets you connect, debug, and supply power to third party sensors for additional drone applications.
- Supports I2C, UART, SPI, GPIO, and PWM sensor interfaces.
- Station Mode lets you connect multiple **RoboMaster TTs** to the same Wi-Fi router and control them.
- Use included **Mission Pads** as guide points and trigger mechanisms.
- **LED** indicator can be programmed to change color and flashing frequency.
- 8x8 programmable dot-matrix screen connects to open-source controller.
- Adjustable overall and single-**LED** brightness.

In the Box:

- Rechargeable battery
- Open-source controller w/ dot-matrix display/distance sensing module.
- Extension board.
- 12" micro-USB to USB cable.
- 8 Propellers (4 pre-installed).
- 4 Propeller guards (pre-installed).
- Propeller removal tool.
- 4 Mission Pads.
- Quick Start Guide.

The **RoboMaster TT** is the most expensive of the **Tello** models but offers the greatest programming options and expandability. If you plan to explore these advanced capabilities, then this is the drone for you.



Protective Cages

For added safety in the classroom, you might want to consider using protective cages for your drones. Here are two options:

- PGYTECH Protective Dome Cage for all **Tellos**.



- CYNNOVA Flat Propeller Guard for all **Tellos**.



(These prop guards are available on our website).

Summary:

Drones are a powerful tool to help you inspire and teach many different areas of STEM/STEAM education. Drone curriculum encourages students to explore topics such as aviation, aerodynamics, weather systems, technology, robotics, engineering, and math. Drones and their applications get students excited to learn while having fun!