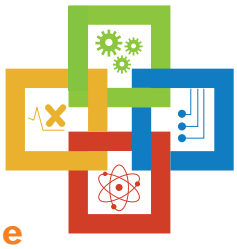
PCS edventures!™ EXPERTS IN HANDS-ON STEM EDUCATION

How to Enrich Your Classroom with *Discover Drones*: A Survey of Successful Educator Experiences



Educators across the country recognize drones as incredible machines, both inside and outside of the classroom.

From recent estimates predicting the industry to grow by over 20% by the year 2024 to providing students with a one-of-a-kind, hands-on, STEM learning tool, drones are not only redefining what education can be, but they're opening up a whole new world of career opportunities to today's learners.

In late 2016, PCS Edventures recognized the boundless potential of drones in the classroom. As a company already specializing in cutting-edge STEM enrichment programs, the Curriculum Development Team immediately recognized the emerging drone marketplace for what it was: endless opportunity. Drones are highly engaging, keeping students entertained and locked-in to each lesson. They offer new, refreshing ways to broach broad STEM subjects that were once inaccessible in most learning environments. So, PCS Edventures teamed-up with a local drone racing company to build *Discover Drones*.

Developed by world-renowned drone engineers, *Discover Drones* is the world's first modular, STEM education drone. From start to finish, the program engages students in a wide range of valuable subjects as they build, configure, train and fly a quadcopter.

For the last few years, *Discover Drones* has been innovating education across the nation. Its found a home in Career Technical Education (CTE) environments, classrooms, after-school programs, clubs, home-school settings, and just about everywhere else eager to bring hands-on STEM to students. In that time, PCS Edventures has refined the program, streamlining objectives and revamping initiatives, and now, with the help of a range of educators from a wide variety of educational settings, they've compiled a list of how today's instructors are introducing drones to their environments.

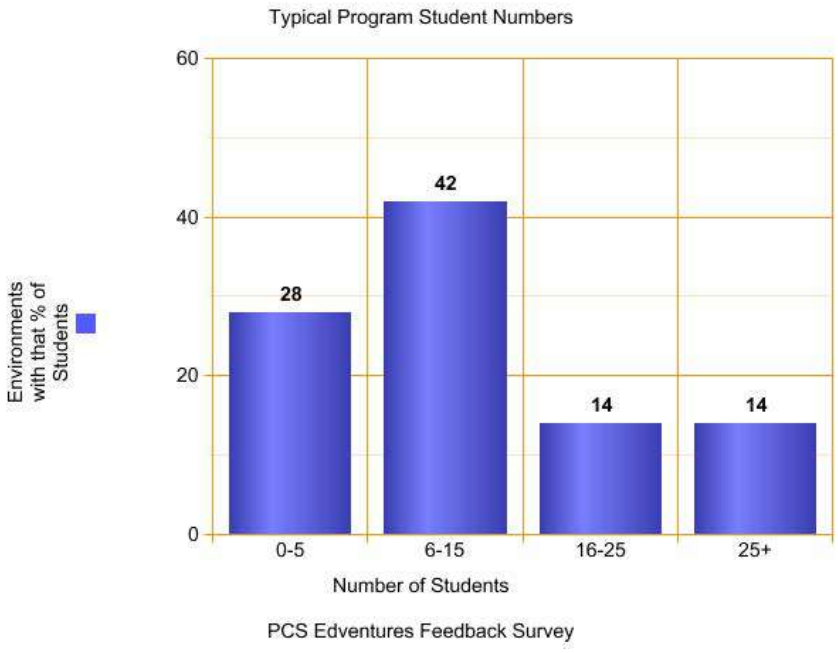
From the success to the failures, this white paper compiles the different ways educators are implementing *Discover Drones,* with answers gathered in the early summer of 2020 through a program feedback initiative. From their tips, tricks and advice to anyone interested in initiating a drone program, these are real accounts from instructors who have experienced the *Discover Drones* program first-hand.

Finding Your Audience: The Perfect Age Range & Student Size

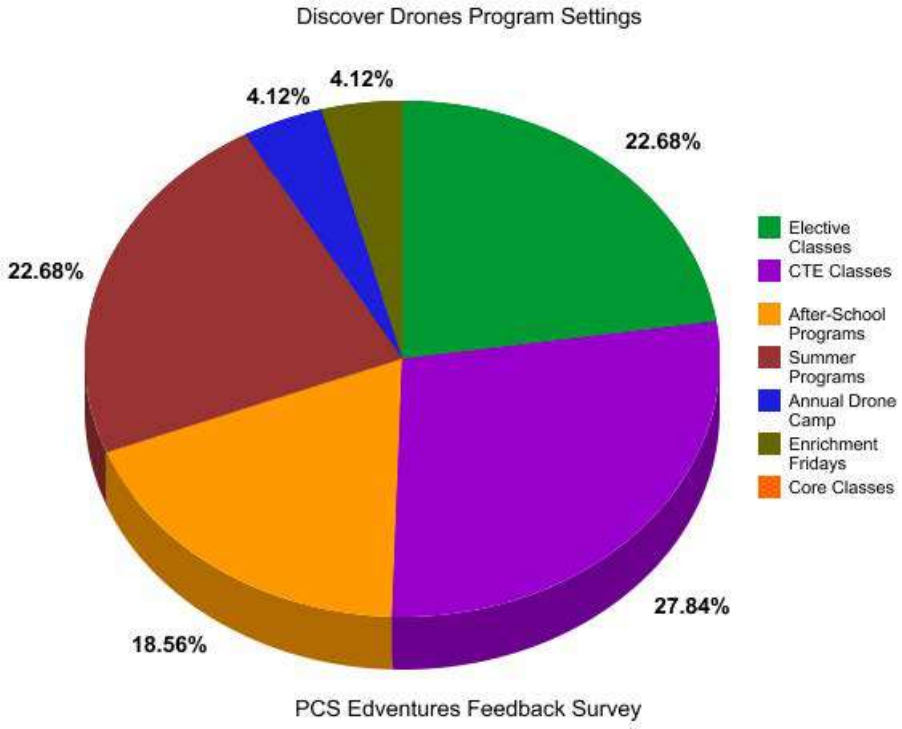
Discover Drones was initially developed for grades 7-12, and, depending on the program purchased and student-to-drone ratio, can serve anywhere from 5 to over 30 learners. From the responses received, 78% of educators are utilizing drones with middle to high school-aged students. No survey respondents are teaching *Discover Drones* at a collegiate level, however, previous orders do show its implementation in higher education.

The *Discover Drones* curriculum was developed for learners in upper-middle school to high-school classrooms and learning environments. From the language and aligned learning standards utilized in the student-driven curriculum to the concepts covered in the online learning module videos and quizzes, *Discover Drones* finds its home in a secondary education setting.

Inside of that grade band, respondents showed a wide range of program participants. Due, in part, to the varied amount of students each *Discover Drones* program is able to serve, an assumption can be made that program size is dependent on student interest, fund allocation and educator confidence.



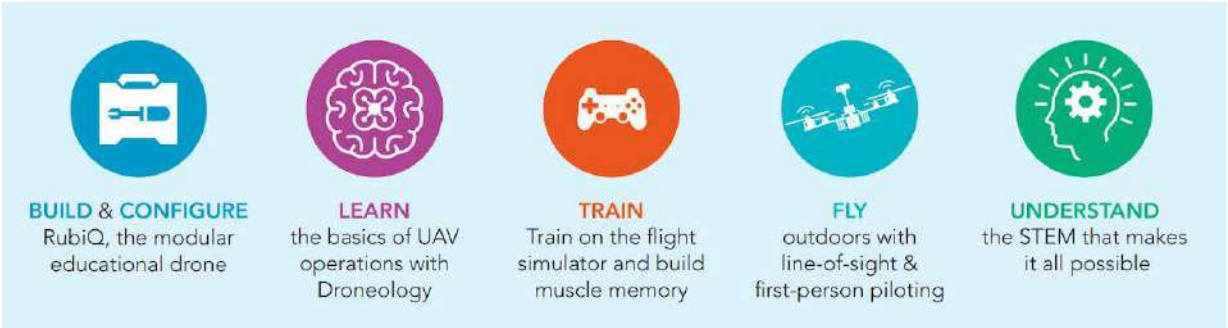
Inside the number of students participating at any given time, the feedback received also highlighted that the *Discover Drones* program is being utilized across a wide range of settings, with the majority falling into the non-core class category.



From the feedback responses, one can extrapolate that *Discover Drones* can be, and is currently, used successfully across a variety of middle to high school classroom settings with a wide range of student participants.

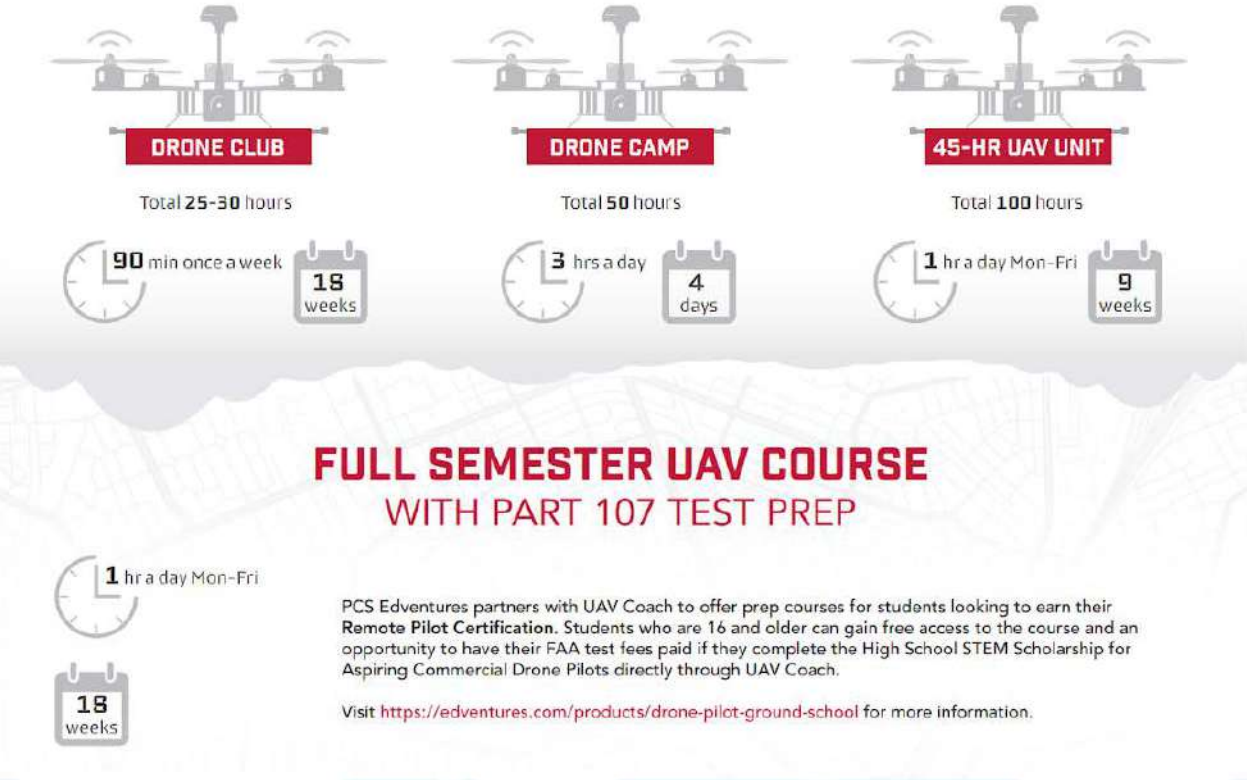
Program Length: Making the Time Count

From unboxing the modular drone to logging flight hours, the *Discover Drones* program is scaffolded like this:



The *Discover Drones* Program is substantial. For an average student to move through the entire program, from start to finish, PCS Edventures estimates at least 25 hours of pure student-to-drone interaction, and that's under the assumption that there aren't any learning hiccups along the way. At an hour a day, that's at least a month alone devoted to the program, not including any extensions or extensive flight practice. No matter if that figure seems insurmountable or easily achievable, *Discover Drones* is easily scalable to fit your particular student needs.

In the included Instructor Guide, PCS Edventures has developed four fully-scaffolded pacing options for lengthening or shortening a program, and outside of those options, our survey respondents have shown an even wider breadth of program lengths.



According to the survey responses, educators are implementing *Discover Drones* in anywhere from a one-week drone intensive to a full-year program, with the most prevalent respondent program lengths being:

- Year (35%)
- Semester (21%)
- Month (21%)
- Less than a Month (23%)

In follow-up questions, respondents were asked to rank their program success, with those educators implementing *Discover Drones* over a longer period of time finding a higher level of success and student interest. This isn't to say that a short amount of time with *Discover Drones* is detrimental to learning, but for those instructors running shorter programs, their level of success was more determined by educator preparedness rather than student time spent with the drones. Inside of those, time of year and ability to get outside of the classroom to fly played a major role in program success.

Making the Commitment: Preparing to Teach Discover Drones

At a minimum, it takes educators over 20 hours of pre-implementation work to be ready to start teaching *Discover Drones*. This includes time to install all the software, allocate student devices, create accounts, charge batteries, register drones, study laws, etc. — it takes that long to do all the behind-the-scenes work that will allow your learners to engage with the drones with minimal hiccups. Outside of those 20 hours, it can take anywhere from 5-15 additional hours of flight time for an instructor to feel fully comfortable piloting a drone.

Unlike a traditional ready-to-go PCS Edventures kit, *Discover Drones* requires a time commitment from the instructor prior to actually teaching the program. Like learning to drive a car, the classes and simulations are great practice, but until you get actual flight time under your belt, a drone is going to feel foreign and your movements will be uncertain.

In order to mitigate the uneasiness between both instructor and student, it's important that the person leading the program feels comfortable flying a drone. It's not a requirement to be a professional, race-level pilot, but knowing how to effectively fly a drone, what each switch on the control does and how to take control of a situation fluidly is key to a successful program.

In response to the feedback question, "How much time did you spend preparing to teach the program?", those educators that allocated over 30-40 hours preparing to teach *Discover Drones* found it much easier to implement the program than those who did not.

In every case of an instructor spending over 30-40 hours in preparation, they rated their overall experience with the program a 4 or 5 out of 5, and their student involvement and successes were rated higher than those who did not spend enough time preparing.

The *Discover Drones* program is not something that can be taken on a whim. It requires proper planning, pre-introduction preparation and practice. However, by laying the proper groundwork, *Discover Drones* can open doors, career pathways and foundational STEM experiences for today's learners.

The Student Benefits of Learning with Drones

Drones engage students through a fun, innovative and interactive STEM platform. At their very soul, they are incredible machines that make learning an engaging experience for everyone involved.

As Brandi M., a middle school teacher said,

Students have benefited in numerous ways through the Discover Drones program: develop a love of drones, career interest in the drone industry, interest in drone racing, interest in mentoring underprivileged students in special education, interest in drones in the military, interest in drones in law enforcement and EMS and recreational drone use. I have watched students that struggle in school, in core classes and who are disinterested in school in general, but this program has spiked their interest in school, and they take as many drones classes as they can; they even want to be aides for drones classes!

Discover Drones increases student STEM awareness, opens learners to new career pathways and bridges the gap between difficult concepts by utilizing hands-on manipulatives.

Joel E., a Tech Center instructor, said, *"with Discover Drones, our youth members engage in STEAM experiences such as robotics, coding, electronics and physics by building and learning how to pilot a drone. Furthermore, it prepares them with the skills for possible careers piloting UAVs."*

Drones are hands-on, engaging machines that provide multiple opportunities to practice the soft skills necessary to succeed in today's workforce, including communication, interpersonal skills and systems thinking. Drone piloting skills can lead to lucrative career opportunities, and drones engage students in captivating STEM content like aviation, robotics, materials science, programming, electronics, engineering and more. *Discover Drones* is invigorating education across the country, changing student STEM interests every step of the way.

Changing STEM interests with Discover Drones

Discover Drones provides students and CTE spaces with enhanced STEM learning opportunities. From challenging learners to devise ways to solve global issues with the help of drones to becoming seasoned pilots with a myriad of new, career and degree-focused trainings and experiences, *Discover Drones* gives students hands-on knowledge of one of the fastest-growing markets and technologies. With this drone program, learners gain a substantial head-start on drone careers in agriculture, digital media, information technology, computer science and programming.

By participating in the course, respondents overwhelmingly agree that *Discover Drones* changes student STEM interests for the better. They said,

- “Students are much more interested in engineering and physics principals.” Brennon C.
- “They are more comfortable taking on new challenges and learning new things.” Doree T.
- “Most of our students are juniors and seniors. Over the course of the year, I've seen many become more interested in studying or pursuing STEM careers after high school. A few students are interested in becoming certified drone pilots. A few are in the process of designing independent studies for next year so they can continue to learn about and use drones.” Kathy C.

Of all responses received, 93% said *Discover Drones* had a positive impact on student STEM interests.

Educator to Educator Advice

At the end of the feedback survey, PCS Edventures asked all participants to share some advice they would give any colleague looking to implement the *Discover Drones* program.

- “BE PREPARED. I don't think I did that well and it was not because of the material.” Nancy O.
- “Be willing to invest a lot of time to become familiar with the material, and competent enough to fly and teach others to fly the drones (common errors, troubleshooting, and so on).” Rich S.
- “I would tell them to not be scared, and just go for it. The program is intimidating, I completely understand, and have felt the same way. However, it is the program at our school that students "fight and claw" to enroll in, and it has increased excitement in an area of school that many kids never find.” Brandi M.

Putting it all Together

When you combine all the educator responses submitted to the feedback survey, some pretty obvious connections can be drawn. At the absolute center, *Discover Drones* is a potent program, primed to invigorate any learning environment. It opens new career pathways, allows students to engage with STEM in new, meaningful ways, guides learners through a hands-on, multifaceted approach and has a positive impact on student STEM perceptions. Even the instructors who didn’t rank their experience with the program as positively as other respondents still noted the constructive effects *Discover Drones* had on their learners.

However, to host a truly successful program and to get the most out of *Discover Drones*, PCS Edventures and the instructors with experience teaching the course all agree that success and educator pre-implementation practice and preparedness are directly connected. For your drone program to succeed, you need to allocate enough time to work through the curriculum, learn the laws surrounding drone flight and log enough flight hours to be comfortable in the role of piloting coach. By ensuring you’re fully ready to teach the course, *Discover Drones* can do incredible things.

Discover Drones Student Success Stories

- "I had an 8th grade student come into the very first Drones class I taught, and he was SO excited to be in the class. He soaked up the information, devouring everything he could learn about drones. He was one of the best pilots I had. He went on a field trip with Science Club to INL and competed in a drone piloting competition where he won a small drone. He was required for his Advanced Language Arts class to prepare a presentation during an open house, and he chose to do his on drones, demonstrating his skills in the gym. He also participated in the Drones Summer Camp, and was ecstatic to learn a drone racing pilot from Thrust UAV was coming to fly with them. During the camp he was able to fly one of the Riot racing drones we own, and did fantastic. He wants to go into a career in drones, and has been looking into the Drones program at ISU after graduation. This program truly opened his eyes to an industry he would not have the resources to participate in without *Discover Drones* in middle school. He is currently enrolled in the engineering program at the high school, and still flies drones as often as possible." Brandi M., Idaho

- "I had a very shy girl in the program that came out of her shell and grew with great confidence from learning and operating the drone. She saw herself as having more skills than some of her peers and began to help them." ~ Doree T., Montana

- "Drones were new for all of our students. They know what drones are but had no experience with them. It was cool to see all them succeed, especially those kids who thought they wouldn't be able to fly well or would mess up the build. My favorite success story is a student is who is smart but does not put much effort into school. In the past, he has skated by with D's because he wants to pass but doesn't want to do much more than that. Building drones near the beginning of the year was a motivator for him. He is acing our class and has grown as a leader. He is our best flyer and does an amazing job of supporting the students who are nervous about flying. He is working on designing an independent study for next year where he can build his own little racing drone and help in our class." ~ Kathy C., Washington

- "One student went on to become proficient enough with his personal drone to be granted permission to fly over and record video of the local Huckleberry Festival Parade. He then edited the video and posted it on Facebook." ~ Rich S., Idaho

- "I had one student who wants to be an aerospace engineer now and work with drones. I had a few girls who would not give up on their drone and problem solved until they got it to fly right. It was a fun day." ~ Connie S., Idaho

- "I was able to establish a flying field on my campus and collaborate with local/ state law enforcement to promote drone culture." ~ Brian G., Texas

For more information on *Discover Drones* or the indoor mini-drone programs offered by PCS Edventures, visit **edventures.com/discover-drones**

edventures.com

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