Broadening Interest in STEM Careers Among Rural Learners: Evidence from CAST's Take Flight Program

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Abstract

This white paper presents findings from the Take Flight project from CAST, which integrates drones and the Universal Design for Learning (UDL) framework to increase equity and access in science, technology, engineering, and math (STEM) and career and technical education (CTE). The program was piloted with over 1,100 students across 33 schools in 11 states, with 349 students completing both pre- and post-surveys. Results demonstrate statistically significant gains in students' STEM career interest ($p < .001$), drone and coding skills ($p < .001$), and STEM collaboration and growth mindset ($p < .01$). Teachers also reported a +1.6 point (~40%) gain in self-rated drone experience and strong intentions to continue implementation beyond the grant period. These findings suggest that inclusive, drone-based learning can broaden participation in STEM by providing students with accessible, engaging, and career-connected pathways.

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Program Overview

CAST Take Flight Project Description

Take Flight is a program funded by the National Science Foundation (NSF) and designed to increase student motivation, confidence, and interest in STEM careers through hands-on learning with drone technology. Built around a flexible, UDL-aligned curriculum, led by CAST (cast.org), and powered by drones designed for the classroom from Robolink, Take Flight equips middle and high school educators with the tools, training, and resources needed to bring drones and STEM exploration into their classrooms.

Educators who have participated in the program received access to comprehensive instructional materials, including:

- Programmable drone kits and supporting resources
- Six mission-based lessons designed to build technical skills in coding and drone operations
- Career-connected videos showcasing diverse professionals in drone-related fields
- Templates and supports for student presentations and portfolios (one portfolio per lesson)
- Embedded UDL strategies that provide multiple pathways for engagement, representation, and expression

Technology

Take Flight drone kits included the CoDrone EDU, an educational STEM drone for grades 5 and up. Students can pilot the drone manually, with a smart controller, or fly autonomously by programming the drone through block-based or text-based programming languages.

Designed specifically for classrooms and compatible with the REC Foundation's Aerial Drone Competition, the CoDrone EDU and supporting materials are safe, durable, and fully COPPA and FERPA compliant.

Design & Reach

As of the publication of this white paper, the CAST Take Flight program has engaged more than 1,100 students and trained more than 100 teachers in schools across 11 states. Throughout the duration of the program:

- CAST facilitated 25+ co-design sessions with educators to develop the Take Flight curriculum.
- 100+ teachers participated in Take Flight professional learning (PL) sessions.
- 1,100+ rural fifth-eighth grade students and 100+ teachers in 30+ schools across 11 states participated in the Take Flight program.
- 349 students from 23 schools in 10 states participated in the Take Flight research study and completed pre and post surveys.
- CAST facilitated 19 one-on-one teacher interviews between October 2024 and May 2025.
- There have been 6,700 views of the site and 720 unique users accessing materials and resources, demonstrating that educators are continuing to use the curriculum.
- Teachers have explored Take Flight at 12+ conferences, including national conferences such as the International Society for Technology in Education (ISTE) and the Association for Career and Technical Education's (ACTE) VISION conference.

Take Flight has reached educators and students across multiple states, including Oregon, New Hampshire, and Montana, creating ripple effects across classrooms and communities and spanning rural and underserved regions to expand access to advanced STEM learning.

Target Populations

The National Center for Education Statistics (NCES) categorizes all U.S. territories into four general locale types—city, suburban, town, and rural—each further broken into subcategories that reflect distance from urbanized areas and population size.

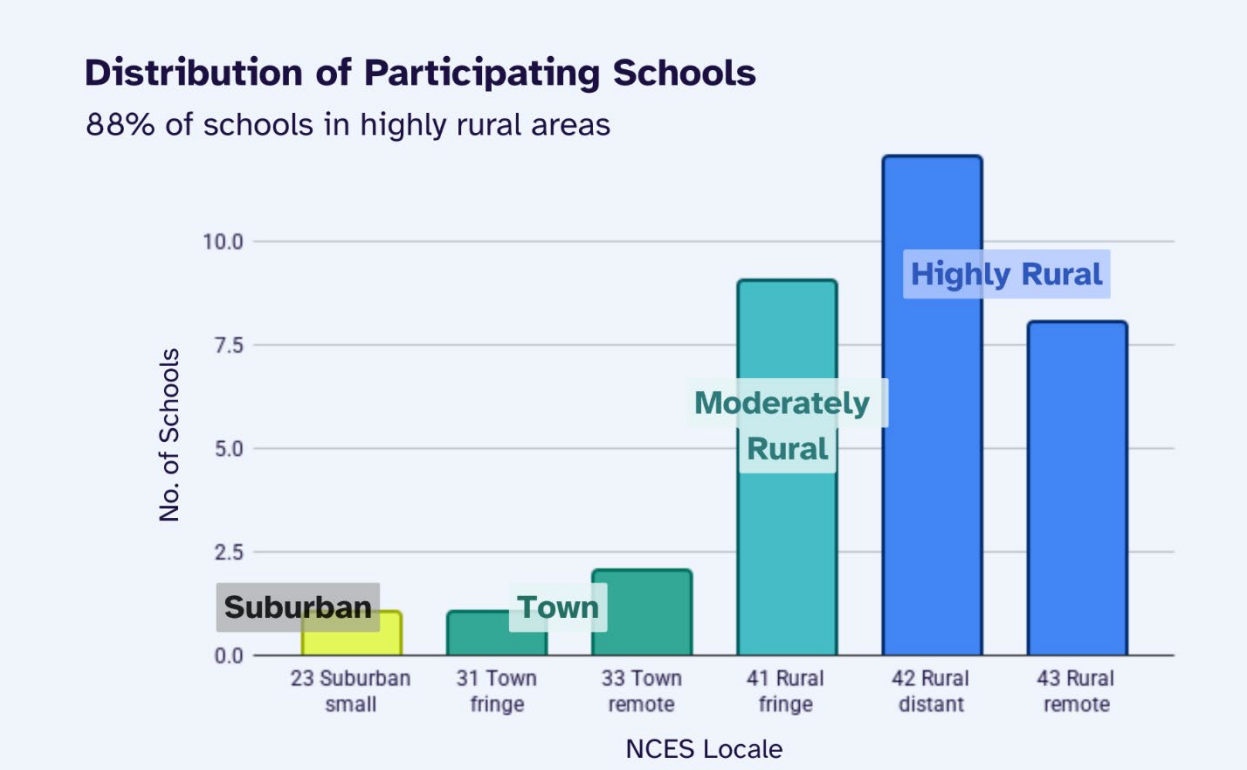


Figure 1. Distribution of Participating Schools. 88% of schools participating were in highly rural areas.

The Take Flight project focused heavily on schools in rural areas, with 29 out of 33 participating schools (88%) in rural areas:

- **Rural: Fringe (Code 41) –** Schools located within five miles of an urban area with 50,000+ people, or within two and a half miles of an urban area with fewer than 50,000 people.
- **Rural: Distant (Code 42) –** Schools situated more than five but less than or equal to 25 miles from a large urban area, or between two and a half and 10 miles from a smaller urban area.
- **Rural: Remote (Code 43) –** Schools located more than 25 miles from an urban area with 50,000+ people and more than 10 miles from one with fewer than 50,000.

The Challenges of Rural STEM CTE

One-third of U.S. schools are rural. Rural students often have fewer opportunities to explore STEM careers due to geographic isolation, have limited access to advanced coursework or extracurriculars, and are less likely to be employed in STEM fields (Rush-Marlowe, 2024). CTE programs in rural districts can also lack access to resources, technical equipment, trained instructors, and industry partnerships for providing students with real-world application of skills.

These rural communities represent one of the "greatest, yet underexploited, opportunities for STEM education to impact workforce development" (Campos Research Study, 2014). Although rural youth perform comparably to peers on measures of academic proficiency, they are 60% less likely to pursue STEM majors or career paths (ACT, 2017; Kittleson & Morgan, 2012; National Rural Education Association, 2016; Versypt & Ford Versypt, 2013). Reasons for this disparity include inequitable access to engaging STEM learning experiences, under-resourced classrooms, geographical constraints, few STEM mentors, and

sparse STEM career exploration options (CEOSE, 2024; Drescher et al., 2022; Riegle-Crumb, et al., 2017; Lawal, 2024; Saw & Agger, 2021).

Rural learners also often experience psychosocial barriers related to exclusion, stigma, and self-doubt that undermine their views on the relevance of STEM to their lives, their self-efficacy beliefs about STEM, and prospective futures involving STEM (Harris & Hodges, 2018; Kastelein, 2018). In particular, rural learners experience what STEM educational researcher Sharon Fraser and colleagues (2021) call "dislocation from STEM education," where school STEM is of questionable relevance to the goals of living and working in one's community and achieving financial stability in an enjoyable job (Kier & Blanchard, 2021; Sherman & Sage, 2011). In rural contexts, "STEM career intent and attainment is tied not only to STEM achievement and motivational factors but also to STEM learning contexts and opportunities," including exposure to locally accessible careers (Saw & Agger, 2021).

Addressing inequities in rural STEM education requires not only new resources but also a coordinated effort among schools, policymakers, and external partners. As Harris and Hodges (2018) explain, "Neglecting to provide satisfactory STEM education to rural populations does not only negatively impact the country's ability to compete in the global economy, but it unjustly neglects rural populations." They call for external sources of support to "come together and address the lack of resources rural schools receive," and to ensure that STEM education is approached in a locally relevant and equitable way.

Rural educators in the Take Flight program cited both socio-economic barriers for their students and lack of curricula and related resources for teachers as barriers to STEM:

> I'm trying to think of any students in the classroom who might consider themselves on the outside of a possible STEM career. Whether they come from an economically disadvantaged background, or they've been told they're not smart enough—I want every student to feel like this work is for them.
>
> **– Take Flight Teacher Participant**

Improved program structures alone are insufficient to broaden rural participation in STEM. Rather, affirming STEM identities by building STEM confidence (i.e. learners' belief in themselves as a "STEM person" who can find success in a STEM career, e.g. Dou, et al., 2019) is essential.

Research shows that dilemmas related to STEM identity and perceived confidence in belonging in STEM environments can be addressed through interventions that focus on increasing feelings of competence in specific STEM skills or showcase how learners' values are aligned with STEM careers (Zander & Ertl, 2023). Contextualized learning through cultural and place-based relevance has shown positive impacts on students' performance on standardized tests (Tutal, 2023) as well as their development of a STEM identity and pursuit of STEM fields of study (Chow-Garcia, et al., 2022; Dabdoub, et al., 2023).

Take Flight expands access to STEM and CTE resources as one part of the solution. The program's impact also depends on student engagement; cultivating curiosity, confidence, and belonging so that rural learners can envision themselves not just participating in, but shaping, the future of STEM.

Key Themes & Practices

Take Flight demonstrated that highly engaging classroom tools like drones paired with UDL-informed practices, curriculum, and professional learning (PL) can spark meaningful interest and help rural middle schoolers visualize themselves in future STEM pathways. At the post-study survey, 63% of learners said that they believed they could have a career that involves STEM compared to 56% at the pre-survey. What follows is a discussion of the factors and strategies shaping the CAST Take Flight program and driving impact.

UDL-Informed Strategies for Student Engagement

Engagement in Take Flight was especially transformative for rural middle school students, who might not otherwise encounter cutting-edge technologies. As evidence of the impact of Take Flight, 43 students at the post-study survey selected Strongly Agree to the item "I want to take high school classes that will help me get a STEM Career" compared to 27 at the pre-study survey, representing a 58% increase.

While project-based learning can make STEM classes more engaging and effective across racial and socioeconomic groups and reading levels (e.g. De Vivo, 2022; He & Schneider, 2023; Saavedra & Rapaport, 2024), some students may face physical and cognitive challenges to full participation (e.g., Rutherford, et al., 2015; Sukhai & Mohler, 2017). For example, the need to physically manipulate objects in a lab lesson can be a barrier for students with restricted movement. Teachers' ability to effectively motivate and guide students in project-based learning can also present a substantial barrier for learning (Harris, et al., 2014). Attitudinal and systemic barriers such as stigma around appropriate accommodations or inadequate support systems result in the further exclusion of learners (McDougall, et al., 2004; Thurston, et al., 2017).

This is where UDL, an educational framework developed by CAST, becomes essential for the successful implementation of programs like Take Flight.

Incorporating UDL principles into curriculum and professional learning (PL) is a proven strategy to ensure all students and teachers can interact with each component effectively. The basic premise of UDL is that barriers to learning occur during interaction with the curriculum (i.e., challenges lie within the environment rather than in the capacities of the learner). UDL ensures that the curriculum is designed to account for human variability without compromising rigor or expectations.

Through UDL-informed practices, teachers can overcome the challenge and inefficiency of identifying specific individuals and instead tailor instruction to ensure all learners feel confident and connected in STEM environments (Izzo & Bauer, 2015; Kreider, et al., 2018). UDL-informed instruction and technology has been shown to improve student achievement and attitudes in STEM fields (Izzo & Bauer, 2015; Nasri, et al., 2021). See the table below to better understand how UDL was purposefully embedded in the Take Flight drone program.

Table 1. UDL Alignment of Embedded Moves in the Take Flight Program.

Take Flight Move	UDL Connection	How the Move Leverages UDL
Learning goals displayed and reinforced: Each slide deck and training resource included multiple ways for educators to display the learning goal and multiple reminders and activities to reinforce it.	**Checkpoint 6.1:** Guide appropriate goal-setting	By displaying goals in multiple formats and revisiting them across lessons, Take Flight helps educators ensure that all learners understand expectations, fostering clarity and supporting sustained engagement.

Take Flight Move	UDL Connection	How the Move Leverages UDL
Connecting new learning to prior knowledge: Slide decks and materials provided explicit prompts and language to help educators link drone concepts to students' previous lessons or their own experiences.	**Checkpoint 3.1:** Activate or supply background knowledge	This move activates prior knowledge and builds meaningful connections, ensuring new content is anchored in learners' existing understanding to deepen comprehension.
Teaching vocabulary in multiple ways: Educators were encouraged to teach and display drone-related vocabulary using multiple modalities, including having students write their own definitions.	**Checkpoint 2.1:** Clarify vocabulary and symbols	Offering multiple representations of key terms and letting students construct personal definitions supports deeper understanding and reduces language barriers for diverse learners.
Providing multiple means of representation: Lessons included videos, discussions, texts, and articles to help students understand drone concepts.	**Guideline 1:** Provide multiple means of representation (**Checkpoint 1.1:** Offer ways of customizing information)	By presenting concepts through varied media, Take Flight removes barriers and ensures that learners with different strengths and preferences can access and process information effectively.

Take Flight Move	UDL Connection	How the Move Leverages UDL
Showcasing diverse professionals: Videos featured drone professionals from a wide range of backgrounds who shared both their growth and struggles in entering the field.	**Checkpoint 8.1:** Heighten salience of goals and relevance	Highlighting diverse role models and authentic challenges makes STEM careers relatable, fostering identity-building and increasing learner motivation, especially for students historically excluded from STEM.
Creating purposeful groups and building community: Educators were encouraged to form intentional learning groups and were provided strategies for community-building.	**Checkpoint 8.3:** Foster collaboration and community	Structured collaboration supports peer-to-peer learning, builds belonging, and creates a safe, inclusive classroom culture—a foundation for student engagement and risk-taking.
Embedding growth mindset activities: Each of the six lessons included explicit activities designed to build self-efficacy and cultivate a sense of belonging in STEM learning.	**Checkpoint 9.1:** Promote expectations and beliefs that optimize motivation	By normalizing mistakes and focusing on persistence, Take Flight reinforces a growth mindset, empowering students to see challenges as opportunities for learning.
Flexible student portfolios: Students could create portfolios to document their drone learning and missions in print or virtual formats.	**Checkpoint 5.1:** Use multiple media for communication	Offering students choice in how they document and showcase learning ensures equitable participation and allows learners to leverage strengths and access resources in ways that work best for them.

Take Flight Move	UDL Connection	How the Move Leverages UDL
Guided presentation templates: The program included templates to support learners in developing presentations showcasing their drone projects and missions.	**Checkpoint 5.3:** Build fluencies with graduated levels of support for practice and performance	Structured templates provide scaffolds that help students organize and communicate their ideas confidently, while still allowing for personalization and creativity.
Nurturing joy and play: Students were encouraged to take photos, design games, and share their creations with each other, sparking curiosity and community engagement.	**Checkpoint 7.3:** Minimize threats and distractions **&** **Checkpoint 7.2:** Optimize relevance, value, and authenticity	By incorporating play and celebration, Take Flight reduces anxiety, increases joy, and boosts intrinsic motivation, helping students take pride in each accomplishment while deepening their engagement.

UDL-Aligned Curriculum, in Teachers' Words

For many educators, Take Flight sparked a shift in both mindset and practice. Teachers described becoming more intentional in their instructional design, more aware of the "teacher moves" that influence access, and more reflective about how to reduce barriers for all learners thanks to the program and curriculum. As educators shared in survey responses:

> This program has changed the way I teach and the way my students learn. It's one of the most impactful things I've implemented in my classroom.
>
> After working on Take Flight, I am way more aware of the teacher moves I make in regards to the instructions I give and the way I introduce topics in order to take into consideration any barriers a student might have as they come to the program. I spent more time tying any activities that I did with students to STEM

> careers, communication, collaboration, and breaking complex problems down into manageable parts.

Before Take Flight, educators reported struggling to connect theoretical STEM concepts with practical applications that resonated with their students. The curriculum's hands-on, flexible design—rooted in UDL principles—helped them create multiple pathways for engagement, representation, and expression. As several educators shared:

> Some of my students who don't always thrive in a lecture-based classroom are the ones leading drone operations. It's incredible to see their confidence grow.
>
> Overall, my Take Flight experience has been wonderful. Previously I utilized LEGO® Robotics during class. The students were less engaged. When asking the class why they are enjoying the drones more, they responded with 'Working with the drones is exciting and easier for me to understand when it comes to coding. I am having fun using them.
>
> It was a good reminder to make connections between concepts and lessons, and how the skill or information would be used in a career or the real world - even how small skills can be transferred to jobs you wouldn't connect them to initially.

One teacher, from Mississippi, described the Take Flight program as phenomenal, emphasizing how much she learned alongside her students. "I could take what you gave me and knowing my kids, I could reshape and soften the corners so it would totally hit my kids." She appreciated the flexibility of the curriculum, allowing her to adapt it to her students' needs. The teacher noted that the program helped students develop essential soft skills—

skills she observed were lacking since COVID-19. "Doing the drone program has really helped expose my kids to those soft skills," she remarked.

In addition, she particularly appreciated the career videos. They fit well with her state curriculum and provided insight into career pathways that her students had not considered. "It flowed well into what I was doing and added more than me just having them do a webquest or scavenger hunt. ″She appreciated the curriculum's alignment with state career clusters, which allowed her to integrate it seamlessly with her state standards. "The career videos filled in gaps where I couldn't get a guest speaker."

She also appreciated the public speaking components of the curriculum because they aligned with her required state standards. She created her own public speaking rubric to go along with the Take Flight program in her class. This same teacher described how the program spurred student interest in STEM. Students eagerly participated in building a city with drones, an activity that drew attention from other classrooms. This enthusiasm led to increased student interest in TSA activities, with students demonstrating their learning during 7th-grade lunches. "We had other people coming to see the city and they wanted to see what the kids were doing, ″she shared.

Take Flight's UDL-informed curriculum–paired with embedded PL–helped teachers ensure that students with diverse strengths, interests, and needs could meaningfully participate in STEM learning.

Drones as a Highly Engaging and Collaborative Solution for Rural Learners

For Take Flight, hands-on drone activities were particularly effective at leveling the playing field in rural classrooms. Teachers observed that even students who typically

struggled academically or had limited prior exposure to STEM took leadership roles in coding and piloting drones. Nearly 70% of students at the pre-study survey said that they believed what they were learning about drones in the course would be important for them to know. Girls and students with disabilities showed especially strong gains in drone skill development.

Why Drones? A Disruptive and Multidisciplinary Classroom Tool

Drones help educators engage students on three levels—challenging traditional STEM industries and identities, bridging multiple disciplines, and increasing students' value of and confidence in their own STEM potential.

Drones are positive disruptors

Drones are not only reshaping STEM industries—they also carry the potential to dismantle stereotypes and redefine what it means to succeed in STEM. They serve as a vehicle for delivering a new message about STEM identity to rural youth.

- **A technology that challenges the status quo:** Disruptive technologies like drones and advanced robotics are transforming work and the global economy, bringing innovations across all industry sectors and requiring workers to develop new competencies for success at the Human-Technology Frontier (Malyn-Smith et al., 2017).
- **Real-world industry impact:** The ability to move beyond line-of-sight operations has already transformed industries from firefighting to construction (Huber, 2024). Packages are now being delivered by drone across Europe, Australia, and Africa, and Amazon recently received FAA approval for U.S. drone deliveries (Palmer, 2024).

- **Breaking STEM stereotypes:** The drone labor force is still new enough that traditional STEM stereotypes have not yet solidified. By linking drones to STEM careers, educators can introduce technology-rich learning experiences without the barriers often associated with long-standing STEM fields.

Classroom drones are multidisciplinary

Drones can be used to teach specific technology and science concepts, introduce students to a wide variety of STEM careers, and can be utilized cross-curricularly.

- **Integrated STEM learning:** The Take Flight curriculum focused on the cognitive knowledge and skill development necessary to fly drones, by introducing students to the key STEM concepts assessed in the FAA Part 107 licensing exam, including:
    - weather (e.g., atmospheric pressure, humidity)
    - load and performance (e.g., balance, stability, center of gravity)
    - radio communications
- **Multiple, flexible ways to fly:** Classroom drones like CoDrone EDU can be piloted manually or programmed with both block-based (Blockly) and text-based (Python) programming languages.
- **Diverse career fields:** Drones can expose students to a variety of STEM applications including:
    - geographic mapping
    - weather forecasting
    - shipping and delivery
    - disaster management
    - wildlife monitoring

Students who completed the Take Flight program and learned to code Robolink's drone to fly autonomously strengthened both their confidence and competence in STEM—factors directly linked to career aspirations (expectancy-value theory; Wigfield & Eccles, 2000).

Drones boost students' interest and confidence in STEM. Helping students develop drone skills through Take Flight supports their STEM career aspirations by increasing both their expectancy for success and the value they assign to STEM pathways, as explained by expectancy-value theory.

Expectancy-Value Theory

- **Expectancy for Success:** Through hands-on drone activities, students gain technical skills and see themselves mastering complex tasks like programming flight paths, interpreting aerial data, and troubleshooting. As their confidence grows, they begin to believe they can succeed in STEM fields. Survey data showed that increases in drone interest predicted increases in STEM career interest and confidence ($p < 0.05$), evidence that drones and the Take Flight program serve as an effective entry point for engaging students in STEM career exploration and development.
- **Task Value:** Take Flight also makes STEM relevant and meaningful. Students see how drones connect to real-world applications in industries like forestry, agriculture, emergency response, and construction–all significant fields for rural communities. This connection increases the perceived utility value of STEM careers while sparking intrinsic interest and curiosity. Take Flight students increased their knowledge of relevant STEM careers, with 56% saying they knew about many careers that use drones at post-test compared to 26% at pre-test.

By simultaneously building competence and relevance, Take Flight helps students envision themselves in STEM futures and strengthens their motivation to pursue those careers.

The Importance of Pairing Curriculum and Professional Learning

High-quality curriculum and sustained PL are most effective when implemented together, creating lasting improvements in both teaching practice and student outcomes. Take Flight embodies this evidence-based approach—using a flexible, UDL-aligned curriculum paired with embedded professional learning to transform how educators design and deliver STEM instruction.

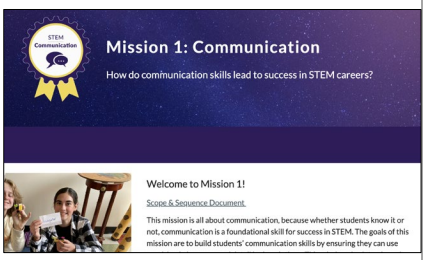
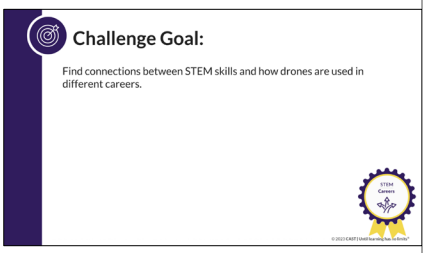
Take Flight Curriculum Overview

Take Flight's curriculum was co-designed with educators and is broken into 6 missions (or lessons), with two to three challenge activities per mission.

- **Mission 1:** Communication
- **Mission 2:** Collaboration
- **Mission 3:** Technical Skills
- **Mission 4:** Coding
- **Mission 5:** STEM Career
- **Mission 6:** Putting It All Together

Each mission also includes one student portfolio and one landing assessment. The entire curriculum takes roughly 10 weeks (or three months) working at a pace of 45 minutes per week.

Table 2. How Each Curriculum Component Works.

Curriculum Component	How It Works
Missions 	There are six missions or lesson modules in Take Fight. The mission themes focus on communication, collaboration, careers, technical skills, and more. The Take Flight curriculum culminates in Mission 6 with students sharing what they learned.
Challenges 	There are two to three challenges or activities per mission. The challenges are presented as downloadable Google slide decks. They provide the structure teachers need to introduce content and activities. Teachers can present the decks, delete slides, print them, or do whatever meets the needs of their class best.
Student Portfolios 	Students create a portfolio for each of the six missions. The portfolio is where students compile and collect information, data, evidence, images, and reflections. Students use this information to create their final projects, in Mission 6.
Landing Assessments 	At the end of each mission is a Landing Assessment. This Assessment consists of a multiple choice quiz, a few open-ended questions, and invitation to share artifacts. After completing each mission assessment students receive a downloadable certificate of completion.

Curriculum-Based Professional Learning

Meta-analyses consistently demonstrate that pairing high-quality curricular materials with sustained professional learning drives significantly greater student achievement than implementing either alone (Alicea, et al., 2025; Chu, et al., 2022, Taylor, et al., 2015). A large-scale literacy initiative in California showed significant gains when curriculum shifts were thoughtfully paired with substantial PL investments (Novicoff & Dee, 2025).

Take Flight embodies this evidence-based approach. By combining the flexible, research-driven curriculum outlined above with educator support, coaching, and collaboration, the program creates curriculum-based professional learning (CBPL) experiences that change how educators design and deliver STEM instruction.

Rural teachers are often unable to attend traditional professional learning because of limitations in funding and geography (Baker-Doyle, 2017; Kelly & Antonio, 2016; Trust, et al., 2016). Educators at Take Flight participating schools could take part in PL sessions for up to 30 educators. Each full-day PL session immersed educators in the same hands-on, collaborative learning environment that their students would later experience. Working in small groups, educators:

- Coded and flew drones, completing the same inquiry-based activities their students would encounter.
- Explored practical STEM applications of drone technology, from environmental mapping to emergency response.
- Connected classroom learning to real-world STEM career pathways.

During lunch, educators heard directly from local professional drone operators who shared insights into emerging drone careers in sectors such as natural resource management,

construction, agriculture, and public safety. These sessions helped educators envision concrete ways to connect classroom learning with local workforce opportunities—a central goal of the Take Flight program.

The UDL-based curriculum allowed rural teachers to adapt instruction across varied ability levels, making STEM accessible to every student in the room. Rural teachers participating in Take Flight reported that professional development equipped them with skills they had never used before—such as drone assembly and coding—and gave them confidence to bring these experiences to their students.

As one rural STEM coordinator explained, in a post-study survey:

> All along you think you're going to use Take Flight and change these kids' lives, but actually the curriculum is changing us—the teachers. It changed everything I thought about when I delivered STEM to students. Now I'm such a stronger teacher. Sure, the curriculum might impact those 18 kids in my class, but change a teacher and now every person who comes into contact with me—all the kids for the rest of my career—because of Take Flight, they are all getting a deeper experience.

With Take Flight CBPL approach, teachers who once struggled to connect theoretical STEM concepts with real-world application now design lessons that are relevant, inclusive, and empowering. One of the program's most powerful features is how it turns curriculum implementation into professional learning. This job-embedded learning model prepares educators to:

- Experiment with UDL-aligned strategies while teaching the Take Flight program.

- Reflect on student outcomes and make responsive adjustments.
- Learn from peers through embedded PL videos and educator-based suggestions and guidance.

The result is a sustainable shift in how teachers design learning, ensuring that the principles of equity, flexibility, and inclusion are woven into everyday practice.

Impact and Findings

Across implementation sites for the study, qualitative and quantitative data show that Take Flight successfully engages both students and educators in new ways of learning. Thousands of middle school students and teachers experienced deeper STEM engagement through Take Flight's hands-on drone activities, UDL-aligned curriculum, and thoughtful professional learning.

Through Take Flight, educators learn to recognize variability in student needs and strengths, focusing not only on academic growth but also on self-confidence, problem-solving, teamwork, and critical thinking.

For Educators

- **Increased Confidence:** Teachers reported feeling better prepared to integrate STEM-focused, hands-on learning into their classrooms. "Amazing resources and training on how to teach drones in a hands-on way...it made me feel equipped to bring this into my classroom with confidence."
- **Shift in Practice:** Educators embraced UDL strategies, offering students multiple ways to engage, explore, and demonstrate their learning. "It's not that they can't do it—just that you feel the boys are so much more confident and quick. The videos and missions helped shift that."

- **Professional Growth:** Participation in Take Flight PL created opportunities for teachers to collaborate, share strategies, and build local STEM networks. “This program has totally changed my life. We have purchased drones many times, but we never had a viable curriculum like we do now. I am grateful for my participation in this program. I am a way better teacher because of this program.”
- **Community Building:** Educators developed cross-school networks and launched after-school drone clubs, extending learning opportunities beyond the classroom.

For Students

- **Higher Engagement:** 11-percentage point increase in students’ agreement with items on interest in drones, including "I know about many careers that use drones” and "I think what we will learn/are learning about in take flight will be useful in my future career

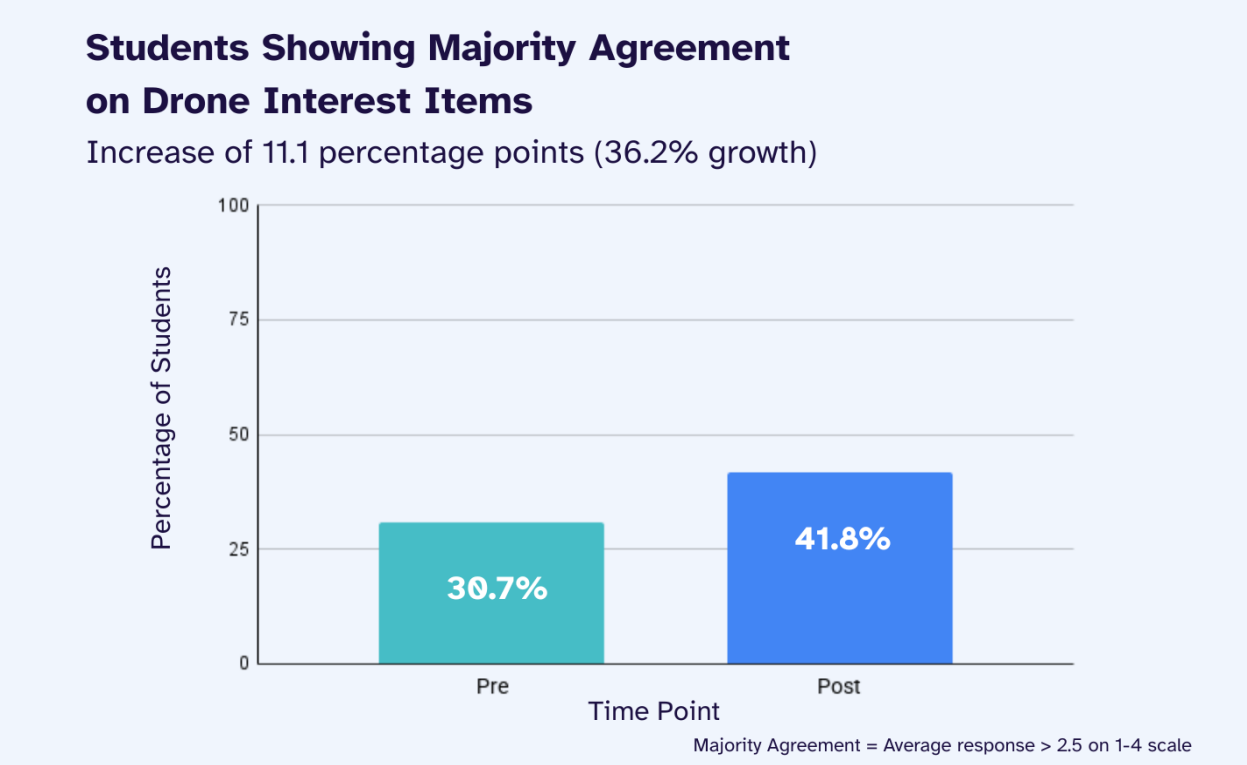


Figure 2. Students Showing Majority Agreement on Drone Interest Items. Increase of 11.1 percentage points (36.2% growth).

- **Increased STEM Motivation:** 9-percentage point growth in students' agreement with positive STEM career interest and confidence statements, including "I believe I can have a career that involves STEM" and "I want to take high school classes that will help me get a STEM career."

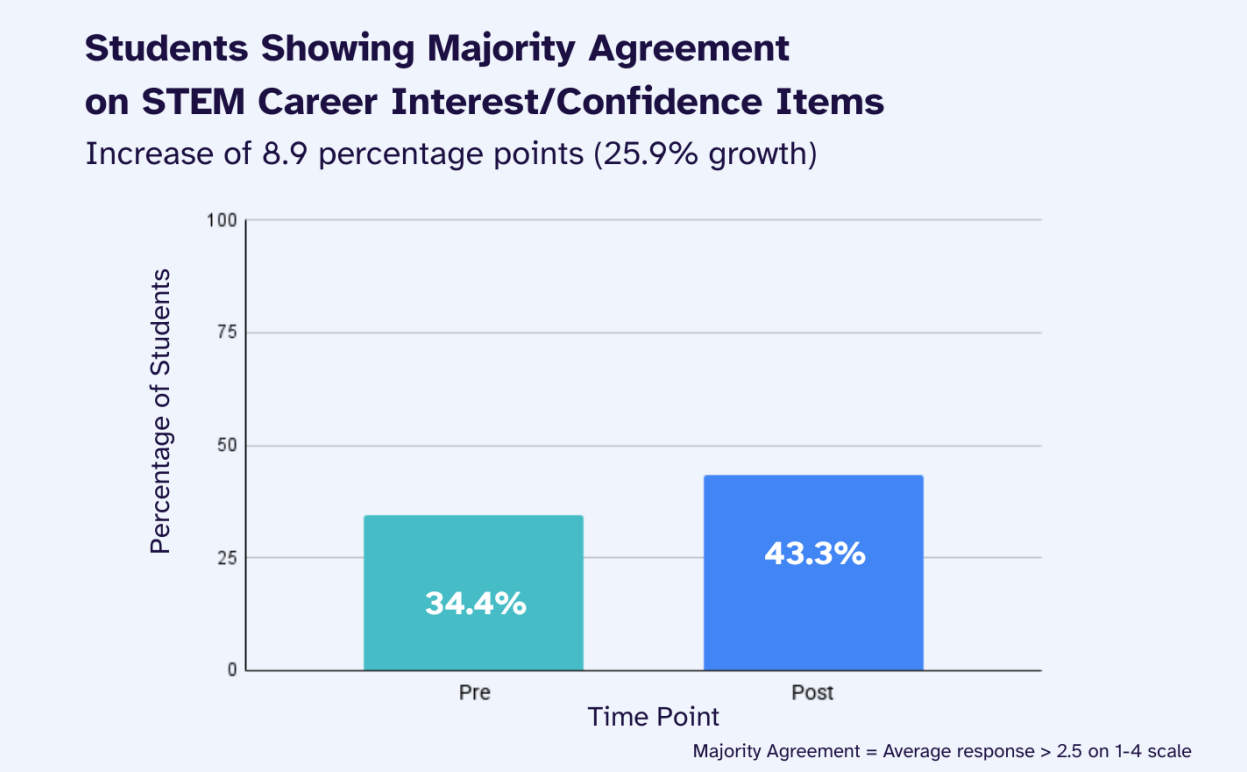


Figure 3. Students Showing Majority Agreement on STEM Career Interest/Confidence Items. Increase of 8.9 percentage points (25.9% growth).

- **Skill Development:** 50-point increase in students' agreement with statements on drone skills, including "I can map airspace and create flight plans", "I can fly a drone in a box shape", and "I can write or use code comfortably to complete a task."

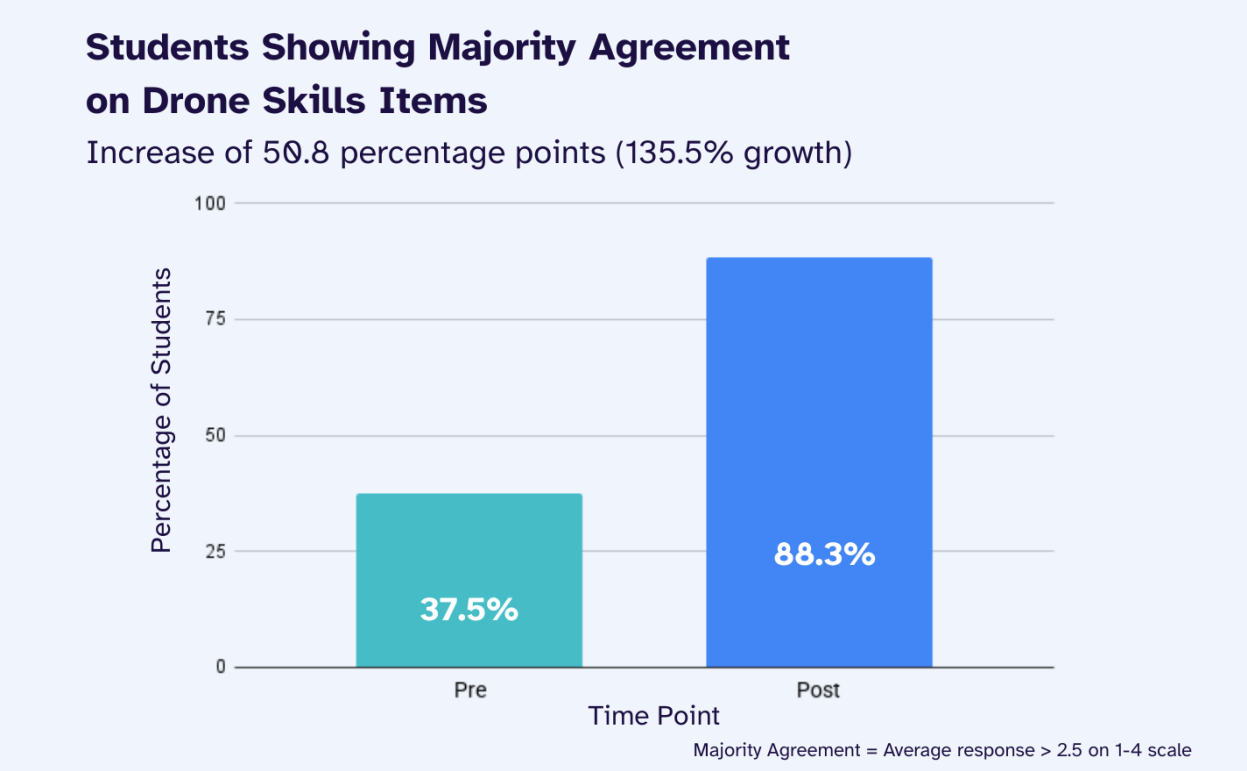


Figure 4. Students Showing Majority Agreement on Drone Skills Items. Increase of 50.8 percentage points (135.5% growth).

- **Career Awareness:** Students connected classroom learning to real-world workforce pathways through diverse professional stories and local guest speakers. “I’ve had students tell me they’re considering careers in aviation, engineering, or even drone operations because of this program.”

The outcomes from Take Flight have been transformative in rural communities. Educators are rethinking their approach to barriers in STEM education and students previously disengaged from STEM are seeing boosted confidence and expressing new interest in aviation, engineering, and drone operations as potential careers.

By pairing high-quality curriculum, hands-on classroom tools, and curriculum-based professional learning, Take Flight can drive both instructional transformation and student

success in rural and under-resourced areas where access to advanced STEM opportunities are limited.

Replication and Expansion Recommendations

Take Flight addressed STEM and CTE opportunity gaps in rural areas by providing accessible technology, open-access curriculum, and PL tailored for educators serving remote communities. The following recommendations are intended to guide schools, districts, and state partners seeking to replicate or build upon the Take Flight model to expand STEM and CTE opportunities for rural learners and beyond:

- Prioritize investments in STEM/CTE programs that reach rural and underserved communities.
- Secure funding for drones, professional learning and other materials needed to implement Take Flight through Perkins V funds; which specifically allow UDL-based professional learning and programs to be funded.
- Provide teacher professional learning that equips rural educators with emerging technologies and strategies for inclusive instruction.
- Ensure career-connected content highlights locally relevant applications (e.g., drones in agriculture, forestry, and emergency response).
- Maintain open access to curriculum and resources so rural districts can continue programs independently after initial funding.

Oregon Use Case: Expanding STEM Engagement Through Take Flight in Oregon

In addition to the schools, educators, and students who participated in the CAST Take Flight program and study, 74 rural teachers in Oregon are using Take Flight at the elementary level through a partnership with Oregon STEM Hubs.

Take Flight trained 74 Oregon STEM Hub teachers in 2025, reaching 300–500 additional students across rural communities. Teachers rated PL "3.8 out of 4" and highlighted the program's flexibility and real-world career connections. One Oregon teacher described drones as "the kind of STEM that gets kids hooked early," underscoring the program's power to transform instruction and inspire future career pathways.

In Oregon, the Take Flight program provided educators with hands-on experiences, cutting-edge curriculum, and professional learning opportunities designed to bring drone technology and STEM career pathways into classrooms. Through a partnership with Oregon STEM Hubs, educators gained access to CoDrone EDU drone kits and related resources, either by receiving their own classroom kits or by checking out kits made freely available through their regional STEM Hubs.

Over the course of five full-day PL sessions held across the state, 74 educators were trained to code, fly, and integrate drones into classroom instruction.

Educator Perspectives

The response from Oregon educators was overwhelmingly positive, with participants describing the training as:

- “One of the best [PLs] I’ve ever attended.”
- “Loved it and can’t wait to use these resources in my classes.”
- “Amanda is an incredible presenter and teacher. I felt empowered and inspired.”
- “One of the best [PLs] I’ve been to and I can’t wait to get our drone club started!”
- “Today was very well planned and executed. The pace was perfect and talking with other teachers was very beneficial.”
- “Awesome—hands-on, time to collaborate. Very useful! I will be able to use this [PL] in my classes next year.
- “This has been one of my all-time favorite [PLs].”

Educators appreciated not only learning new technical skills but also the modeling of effective instructional strategies they could adopt in their own classrooms:

- “As much info and skills that I gained about drones, I also took notes and learned about how to lead a very engaging and cooperative training day.”

Participants also offered thoughtful feedback, such as including direct links in addition to QR codes and providing more time to experiment with drones, underscoring the program’s culture of collaborative improvement and responsiveness.

Catalyst for Classroom Innovation

Beyond technical skills, the Oregon PL sessions helped educators reimagine how they approach STEM instruction and student engagement. The Take Flight curriculum’s design, rooted in UDL principles, provided flexibility for educators to adapt lessons to diverse learners while maintaining rigor and relevance.

By experiencing the activities themselves, educators reported feeling more confident, better prepared, and excited to integrate drones into their teaching. Educators in Oregon expanded the use of Take Flight beyond Middle School - integrating and adjusting the lessons for afterschool environments and younger learners including one educator who brought Take Flight into a K-2nd grade summer program.

Figure 5. Children in a K-2nd grade summer program engaging with Take Flight curriculum.

> I wanted to let you know that I just finished using the Drones curriculum and supplies with my students. I teach STEAM to the 200 K-2nd grade students at Warrenton Grade School. I easily adapted the CAST Take Flight curriculum for their ages and it went SO WELL! The students loved it and picked up the technical skills so quickly. It was perfect for the end of the year too because students had to show that they could follow all the directions each day in order to be trusted with

> the drones so everyone was highly motivated to watch the great career videos, listen to instructions, and follow all safety rules.

Figure 6. A student in the K-2nd grade summer program flying a drone.

> I loved it so much that I will be doing it again for grades 3-5 in summer school! Thank you again SO very much for the training, the curriculum, the supplies, and the opportunity to do something so wonderfully impactful for my students and my school.

Several Oregon schools began planning after-school drone clubs and new STEM modules following the PL sessions, demonstrating the program's role as a catalyst for innovation in both classroom instruction and extracurricular programming.

By combining a high-quality, UDL-aligned curriculum with CBPL, Take Flight empowered educators to transform their instructional practice while expanding STEM access for students across Oregon.

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About CAST & Robolink

Take Flight is a free adaptable school curriculum program made up of 6 Missions or modules developed by Learning Scientists at CAST, the organization that founded Universal Design for Learning (UDL). The Take Flight project was funded by the National Science Foundation.

Through Take Flight, middle school teachers have access to the curriculum, tools and resources they need to integrate drones into their STEM curriculum to help their students develop STEM skills and increase their motivation to pursue STEM careers.

This team-based, experiential curriculum is intended for all middle school students, with particular design features to foster girls' confidence and STEM skills, address stereotype threat, encourage engagement and persistence, and bridge the gender gap in STEM.

CAST partners with states, districts, and schools to build understanding, design strategies, and support the implementation of Universal Design for Learning (UDL), accessibility and inclusion, professional development, and more.

Learn more at cast.org and the Take Flight project page.

Robolink creates career-launching drones and learning experiences for grades 5 and up. CoDrone EDU, the drone of choice for classrooms and the Aerial Drone Competition, enables students to program with Blockly and Python and build future-ready skills from their very first flight. Robolink is trusted by over 7,000 schools and partners with leading institutions including the US Army JROTC and the REC Foundation.

Visit robolink.com to learn more.