

**Integrating Drones into Extension Education: Measuring the Impact of Training on Operational Knowledge and Confidence Among Louisiana 4-H Extension Agents**

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## Introduction

The U.S. agricultural drone market reached \$1.35 billion in 2022 and is projected to expand at a compound annual growth rate of 25.0%, reaching \$5.89 billion by 2030 (Grand View Research, 2023). This explosive growth reflects the transformative potential of drone technology in modern agriculture. Drones are revolutionizing precision agriculture by enhancing efficiency, accuracy, and sustainability in farm management. They enable high-resolution crop monitoring through multispectral and hyperspectral imaging, allowing for early detection of plant stress, diseases, and pest infestations, which leads to timely interventions and increased yields (Guebsi et al., 2024). Their ability to provide real-time data on crop health, soil moisture, and nutrient levels optimizes irrigation, fertilization, and pesticide application, reducing input costs and environmental impact (Rejeb et al., 2022). AI-driven drone analytics further enhance decision-making by automating data analysis for site-specific crop management while reducing labor costs.

Despite these advantages, significant knowledge gaps persist among agricultural extension professionals. De Koff's (2017) study highlights the lack of structured UAS training for adults and youth, despite the growing demand for drone technology in agriculture and STEM education. Additionally, limited research on farmer familiarity with drones, absence of standardized curricula, and lack of FAA-certified educators create barriers to adoption. These challenges emphasize the need for targeted training, policy alignment, and structured programs to effectively integrate drones into extension education. This paper introduces the Agricultural Career Exploration Drone (ACED) project for youth, a comprehensive training program providing extension professionals with drone operation skills, regulatory knowledge, and hands-on flight experience. This initiative addresses critical knowledge gaps to accelerate agricultural drone technology adoption and prepare youth with in-demand technical skills for emerging career opportunities in precision agriculture and related fields.

Research Objective: To determine the effectiveness of a drone training workshop in increasing Louisiana 4-H extension agents' drone operation knowledge and confidence in flying drones.

## Methodology

This study employed a pre-post survey design to evaluate the impact of drone training workshops on Extension Agents' operational knowledge and confidence in drone operation. The program was implemented across three Louisiana regions—Central, West, and Southwest or Northeast, ensuring diverse participant representation of and comprehensive regional coverage. Participants comprised of 46 Louisiana 4-H Extension Agents selected based on their involvement in Extension programming and interest in integrating drone technology into their agricultural outreach work. The implementation process followed a structured organizational approach: the 4-H STEM coordinator initially contacted regional directors to arrange workshops, secured approval from regional coordinators, and then coordinated with extension personnel to finalize workshop logistics. The training workshops regimen included: (1) Comprehensive instruction on drone regulations and legal requirements (2) Preparation for and completion of the Trust exam. (3) Hands-on flight training with Co-drone Edu & Exo-mini drones. (4) Practical experience with drone cage assembly to replicate youth-focused drone activities and competitions. Upon completion, participants evaluated their training experience through a standardized assessment form. Each region received a complete drone equipment package

containing 10 Co-drone Edus & 1 Exo-mini drones, 50 batteries, 5 adapters, a drone cage, drone cases, and batteries ensuring sustained program implementation capacity.

### **Results/Implications**

A dependent samples t-test was conducted to compare pre- and post-workshop measurements of 4-H agents' knowledge of drone operations. The results indicated a statistically significant improvement in their knowledge following the training ( $t_{df(40)} = 15.103, p < .001$ ). Post-workshop responses ( $M = 4.24, SD = 0.49$ ) were significantly higher than pre-workshop responses ( $M = 2.10, SD = 1.04$ ), demonstrating a substantial increase in understanding.

Similarly, 4-H agents' confidence in flying drones showed a statistically significant increase ( $t_{df(40)} = 12.563, p < .001$ ). Before the workshop, confidence levels were ( $M = 2.20, SD = 1.10$ ), which increased by 1.90 points, resulting in a post-workshop confidence score of ( $M = 4.10, SD = 0.49$ ). This indicates that after training, 4-H agents felt significantly more confident in their ability to operate drones.

The results in this evaluation study suggest that the drone training workshops were effective in enhancing both operational knowledge and confidence among 4-H agents. This increased competency equips agents to confidently lead drone-related Extension activities within their respective parishes, leading to greater parent involvement in drone-related activities and encouraging older 4-H members to mentor and train younger participants.

### **Future plans/Recommendations**

We plan to conduct an additional drone training workshop for the Northwest region to further improve 4-H Extension agents' skills and confidence as well as expand drone technology in extension program activities. For those looking to implement a similar program, we recommend selecting a knowledgeable and engaging trainer, encouraging 4-H agents to take the TRUST certificate exam, and incorporating practical drone flight exercises to provide real-world experience. Additionally, securing support from 4-H administration at the parish or county level will help motivate agents to participate. Lastly, adequate funding is essential to purchase drone equipment, ensuring that both agents and 4-H members have ongoing access to hands-on practice. These steps will help create a sustainable and impactful drone education program within 4-H Extension.

### **Costs and resources Needed**

Budget included:

- Drones: CoDrone EDU- \$2039.99 set of 10, Exo-Mini- \$799
- Accessories: Batteries 50 for \$10 each, Adapters 5 at \$30 each, Drone case-\$120, Drone Cage(with Velcro)~\$350
- Venue: \$0 (Held at Extension Office)
- Refreshments: Provided by the Extension Parish Office
- Trainer: Paid by grant

## References

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