

# Somewhere Over the Rainbow is a Custom Weather and Climate Science Curriculum for K-12 Schools, 4-H and Agricultural Education Programs

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## NEED FOR INNOVATION

The United States Global Change Research Program (2009) stated

- Citizens who understand climate and can apply their knowledge in careers and communities are desperately needed.

Rogers et al. (2013) suggested that

- Academia should focus more on better understanding the physical and social sciences, as well as quantifying impacts of weather, climate and water on society.

Dooley and Roberts (2020)

- "There is a need for innovation in curriculum and educational practices to help prepare future leaders to address complex problems."



Figure 1. "What's in the box" Tempest Home Weather Station

## PURPOSE & OBJECTIVES

The purpose of this study was to investigate how a custom weather and climate science curriculum can be effective in South Carolina K-12 classrooms, 4-H groups, and agricultural education (FFA) classes.

This curriculum aims to enhance K-12 students' understanding, engagement, and retention of key concepts related to weather and climate science.

### Objectives

1. Measure students' knowledge acquisition and retention by evaluating pre- and post-curriculum assessments.
2. Evaluate curriculum design of the weather and climate science curriculum by assessing the structure, aligning with the educational standards, and determining its coherence.
3. Examine students' learning experiences by using multiple teaching resources, such as multimedia materials and hands-on activities.
4. Assess the impact of real-world relevance and applications within the curriculum on students' perceptions of the subject matter.
5. Evaluate teacher knowledge and perceptions of the subject matter pre- and post-curriculum use.

## SPONSOR

### Myrtle Beach Public Service Initiative Endowment - Research & Education Innovation Awards

- The purpose of the fund is to
  - To provide for a public service initiative to
    - "Build Capacity in South Carolina's Grand Strand" and adjoining inland counties
  - Address aspects of growth and issues such as...



The Environment



Land & Controlled Growth



Property Rights

## PARTICIPATING GROUPS

Table 1. Pilot groups divided by regions and grades in South Carolina

Region of SC School/Group/County	Grade Level	
Coastal	Battery Creek High (FFA), Beaufort	9 – 10
	Beaufort 4-H, Beaufort	6 – 8
	Horry 4-H, Horry	6 – 8
Midlands	Blythewood High School, Richland	10 – 11
	Gilbert High School (FFA), Lexington	9 – 10
Pee Dee	SC Governor's School for Science and Mathematics, Darlington	11 – 12
Piedmont	SC Governor's School for Agriculture (FFA), McCormick	10 – 12
Upstate	Langston Charter Middle School, Greenville	6
	Youth Leadership Academy, Pickens	7

## PHASES

- Five days of lessons and hands-on activities (Fig. 3) modified from existing curricula in U.S. states with a coastline and National Agriculture in the Classroom Curriculum Matrix:
  - Introduction to Weather Stations (Fig. 1)
  - The Carbon Cycle
  - Why Climate Matters & World Population
  - Renewable Energy (Fig. 2)
  - Biomass & Biogas
- Created a Canvas homepage under Clemson's Extension website to house curriculum
- Created kits for participating teachers and transported to schools/Extension offices

## PHASES (CONTINUED)

- Student participants:
  - 23-question mixed methods pre- and post-surveys created on Qualtrics
  - Assigned a score value of 30 total available points
- Teacher participants:
  - 26-question mixed methods pre-survey using Qualtrics
  - 11-question guided interview protocol for teachers to record answers on Zoom after each lesson
  - Incentive for participating in pilot:
    - Provided ~\$1,000 curriculum kit, including Tempest weather station (Fig. 1) for the school, with all materials to keep after pilot concludes
    - School (Table 1) is recognized for participating



Figure 2. Lesson 4 - Renewable Energy Kit Materials by L. Hood 2025

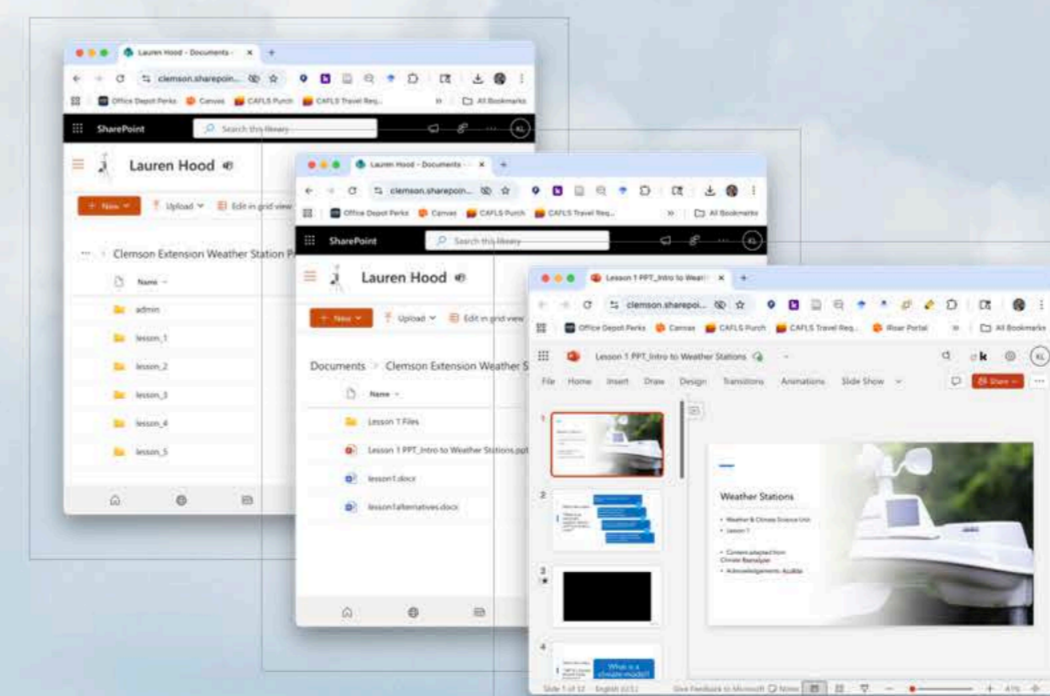


Figure 3. Pilot curriculum housed & run out of Microsoft OneDrive

## FINDINGS

- Across all groups (N=9) in this pilot study, a gain in knowledge was found between the pre- and post-test assessments, ranging from a 28% to 82% increase, with average increase of 54.8%.
- Educator ratings of each lesson and activity
  - Lesson 1: 4.0, Activity 1: 4.0
  - Lesson 2: 4.2, Activity 2: 4.6
  - Lesson 3: 3.6, Activity 3: 2.6
  - Lesson 4: 4.2, Activity 4: 4.2
  - Lesson 5: 4.2, Activity 5: 4.4

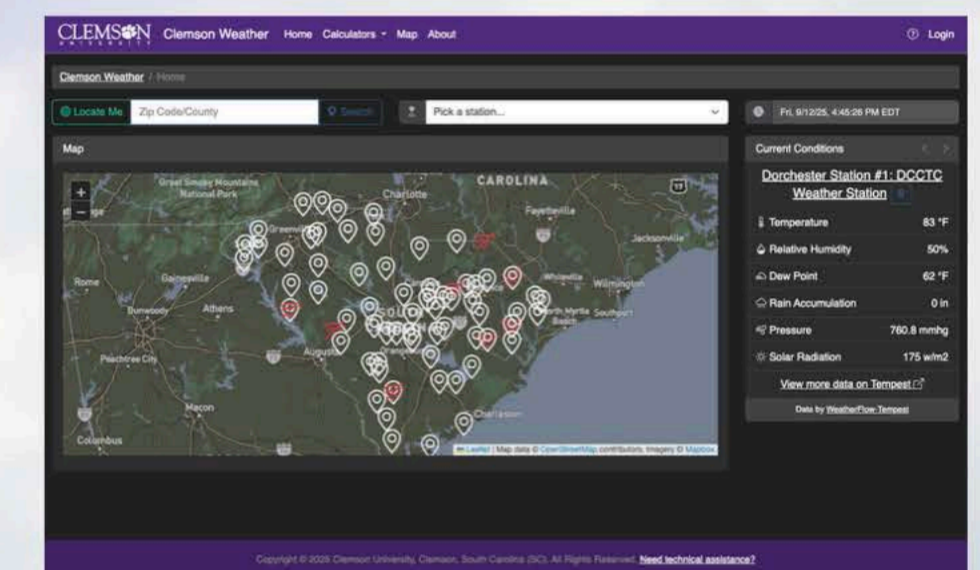


Figure 4. Clemson Weather Station Data Website

## FUTURE PLANS

- The weather stations purchased for this project are registered with the Clemson Extension weather stations and will contribute to the statewide weather collection initiative (Fig. 4).
- It is our hope this curriculum will aid in teaching students new information or reinforcing information they have already been taught.
- It is also our hope this curriculum kit will be helpful for teachers in that they do not have to assemble the materials themselves for similar future lessons.
- Create or regenerate relationships between schools, 4-H and FFA groups across South Carolina with Agricultural Education at Clemson University.

## COSTS

- The kits in the pilot are valued at approximately \$1,000 each (storage totes, Tempest weather stations, activity materials, printed pages, etc.).

## REFERENCES

Dooley, K. E., & Roberts, T. G. (2020). Agricultural education and extension curriculum innovation: The nexus of climate change, food security, and community resilience. *Journal of Agricultural Education and Extension*, 26(1), 1-3. <https://doi.org/10.1080/1389224X.2019.1703507>

Rogers, D. P., Tsirkunov, V. V., & Tsirkunov, V. (2013). *Weather and climate resilience: Effective preparedness through national meteorological and hydrological services*. World Bank Publications.

U.S. Global Change Research Program. (2009). *Climate literacy: The essential principles of climate science*. January 22, 2024. <https://www.climate.gov/teaching/climate>

