



TechXcite: Discover Engineering



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Co-PI: Dr. Paul Klenk



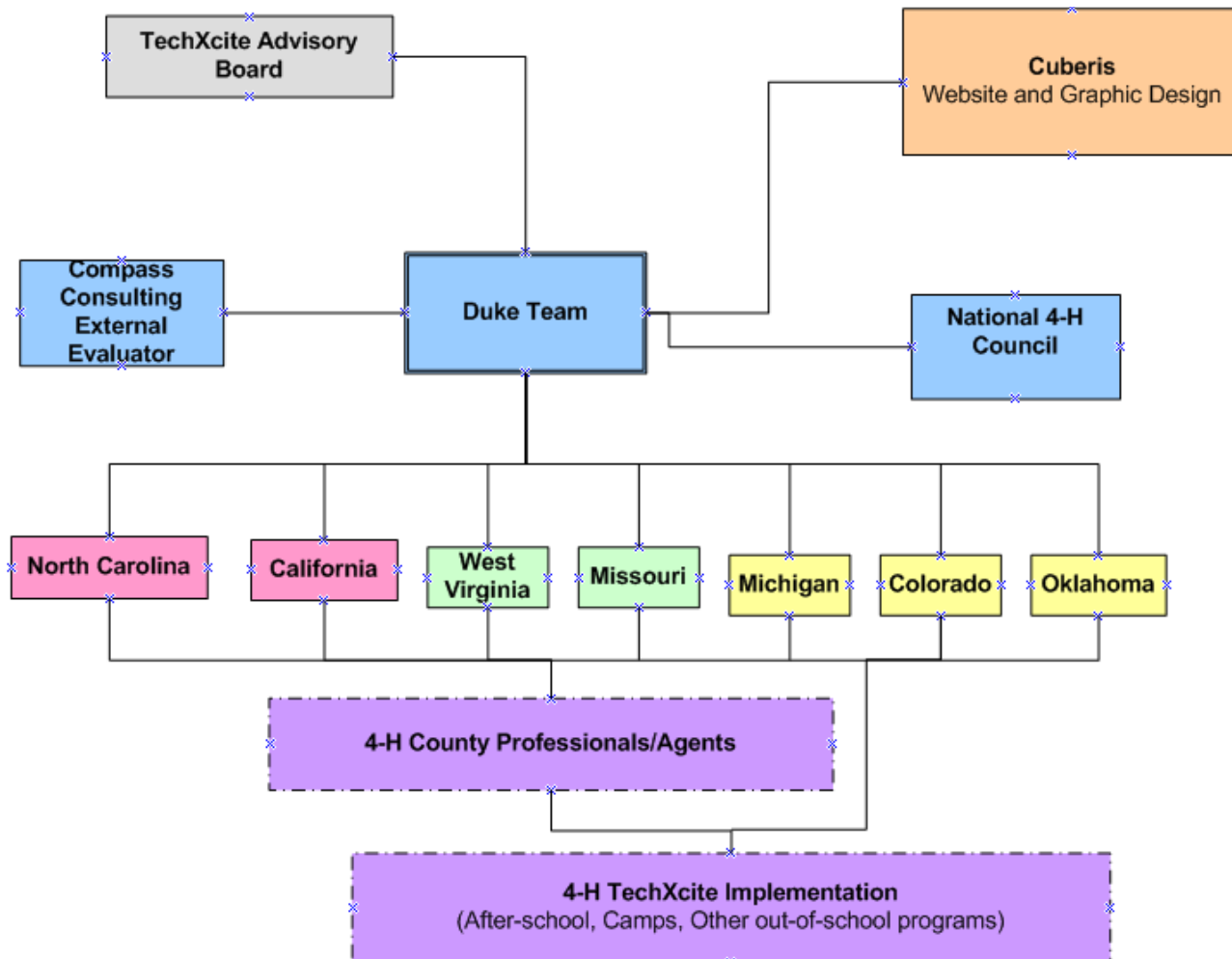
Duke University Pratt School of Engineering
Durham, NC



TechXcite Overview

TechXcite is a partnership between the Pratt School of Engineering at Duke University, the National 4-H Council, and State 4-H offices in seven states. Directed by Drs. Gary Ybarra (PI) and Paul Klenk (Co-PI), the TechXcite program builds on their successful Techtronics after-school engineering program in Durham, NC, by training informal science education providers in 4-H supported out of school programs across the country to implement similar engineering learning modules. Through these trainings and modules, TechXcite is building capacity for teaching STEM subjects among 4-H after-school providers and encouraging youth, especially in rural settings, to pursue STEM careers.

TechXcite Partners



Audiences

- Middle school aged youth, especially those in rural areas who don't ordinarily have access to curriculum from engineering universities
- Educators in 4-H supported out-of-school environments
 - 4-H county extension agents in order to build capacity
 - After-school providers, especially those without previous engineering experience
 - Providers of youth STEM workshops, clubs, camps
- Informal Science Educators outside of 4-H



Deliverable Summary

- Professional development workshops in each of 7 states in order to build capacity among 4-H extension agents and after-school providers
- Online video trainings for each of the TechXcite: Discover Engineering learning modules
- Twelve modules consisting of 4-6 activities
 - Project-based engineering design oriented modules
 - Youth explore how engineers use science and math as tools to design technology

Professional Development

Format:

- 1 day training provides background on introducing engineering design project-based learning
- Two modules are covered via hands-on training
- Trainees leave with kits for each of the covered modules

Goals:

- Provide content knowledge
- Introduce the engineering design process
- Provide pedagogical instruction in experiential and inquiry-based methods

Program Statistics

| | Current Total | End of grant Projected Total |
|---|----------------------|---|
| States Involved | NC, CA, WV, MO | NC, CA, WV, MO, OK, CO, MI |
| Educators Trained ¹ (Face to Face by Duke) | 418 | 674 |
| Kits distributed ² | 646 | 1322 |
| Youth ³ (utilizing NSF- funded kits) | 5205 | 10,155 |

[1] – Does not include instructors trained via video or by 4-H Professionals training additional personnel.

[2] – Only includes kits funded by the grant and not those bought utilizing additional funds.

[3] – Only counts the first time reusable kits are utilized.

Online Training Videos

- Based on trainings conducted with 4-H programs
- Module introduction and video for each activity
- YouTube playlist embedded on site
- Supplement the Instructor's Guide by highlighting key components
- Provides reminders on difficult parts of the module
- YouTube Channel:

<http://www.youtube.com/user/DukeTechXcite>

TechXcite Modules

- ▶ Bionic Arm
- ▶ Bioimaging
- ▶ Your TV Remote
- ▶ Wireless Burglar Alarm
- ▶ Racing with the Sun
- ▶ Cooking with the Sun
- ▶ Quest for Speed
- ▶ Rainwater Harvesting

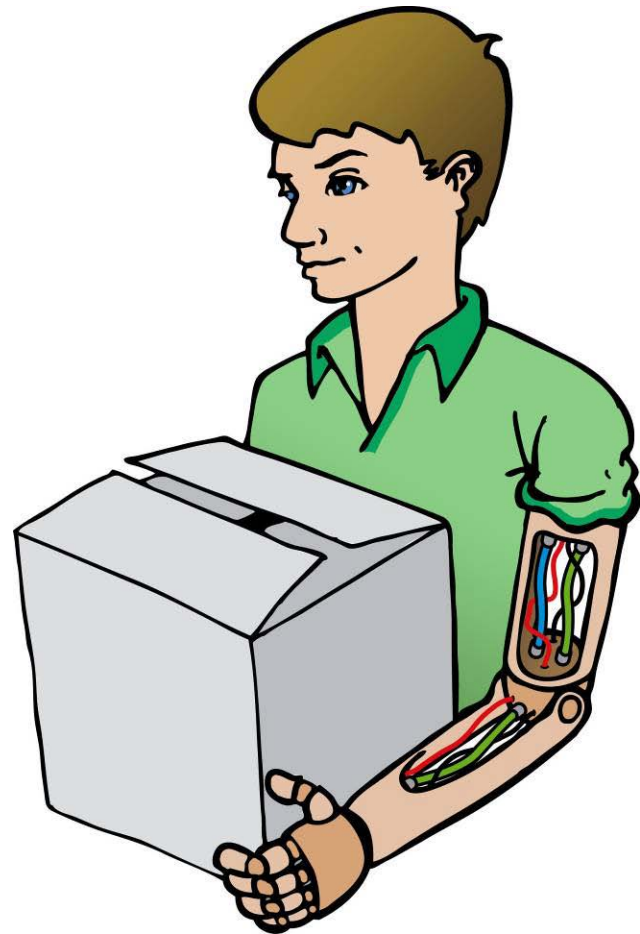
In Development:

- ▶ Thermostat Module
- ▶ What's a pixel?
- ▶ Engineers without Borders
- ▶ Engineering World Health



Bionic Arm Module

The Bionic Arm module introduces kids to the ways in which engineers design technology to help people with disabilities. They explore the design considerations of developing a prototype hydraulic-activated prosthetic arm to improve the quality of life for someone who has lost their arm.



TechXcite Online Materials

1. Instructor's Guide
2. Youth Handouts
3. Online Video Training
4. Materials Ordering Guides (Spreadsheet)
5. Links to additional Material



Example Module Webpage



Modules

Solar Energy: Cooking in the Sun

This TechXcite: Discover Engineering! module introduces kids to the direct use of solar thermal energy through the design of a solar oven. Finding ways to use energy more efficiently will be an important part of engineering in the 21st century. Solar thermal energy is used in solar ovens, passive solar architecture, and to generate electricity in some applications. In this module, kids do some initial experiments to explore heat transfer through radiation and conduction. Then, they learn how to locate the sun in the sky by finding the solar angle and solar azimuth at a particular time during the day. They then utilize this knowledge to design and build a solar oven.



Click the links below to access pdf files of the module:

[Instructor's Guide \(pdf\)](#) [Youth Handouts \(pdf\)](#)

Video Training

Solar Oven Module Introduction
by DukeTechXcite

0:00 / 0:53

<http://www.youtube.com/user/DukeTechXcite>

Parts List

- [Kit Inventory & Packing List](#)
- [Single Kit Order List](#)
- [Bulk Order List](#)
- [Excel Ordering File \(XLS\)](#)

Additional Resources

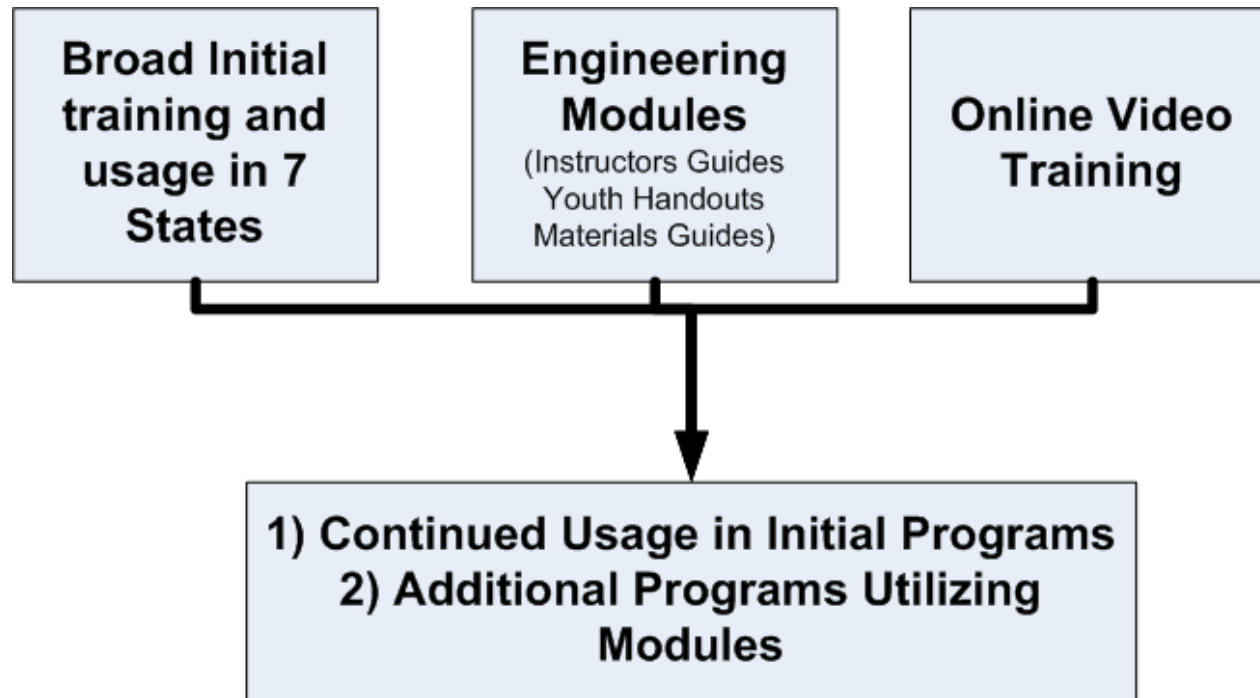
click items below to expand

- Solar Ovens**
- Conduction/Insulator/Radiation**
- General Solar Energy**

This curriculum is currently being piloted and has not been approved by National 4-H Council. If you have suggestions or would like more information, please contact us at techxcite@duke.edu.

<http://techxcite.pratt.duke.edu>

Sustainability



We are beginning to see this already in NC and CA with state and local leaders ordering kit resupplies and telling us they are writing TechXcite Modules into STEM grants.

Project Impacts on Youth

In Focus Groups, students were enthusiastic about:

- The hands-on experiments and activities because all we do in science class in school is fill out worksheets. We learn more and understand better when we get to see how things work.
- Doing experiments to see if they turn out the way you thought they would.
- It was fun.
- Learning new things.
- Testing out your brain and having to think a lot.
- Learning about how and why things work.
- Working in groups and helping each other.



Project Impacts on Educators

| Survey Question | Response | SP2010 | | F2010 | | SP2011 | | Overall | |
|--|-------------|--------|---|-------|----|--------|----|---------|----|
| | | % | # | % | # | % | # | % | # |
| The program curriculum is of very high quality. | Somewhat | 0% | 0 | 4% | 1 | 0% | 0 | 2% | 1 |
| | Very much | 50% | 8 | 31% | 8 | 17% | 3 | 32% | 19 |
| | Completely | 50% | 8 | 65% | 17 | 83% | 15 | 67% | 40 |
| As a result of participating in the training my knowledge of science and engineering concepts related to these modules improved greatly. | Not at all | 0% | 0 | 4% | 1 | 0% | 0 | 2% | 1 |
| | Very little | 0% | 0 | 4% | 1 | 0% | 0 | 2% | 1 |
| | Somewhat | 6% | 1 | 12% | 3 | 6% | 1 | 8% | 5 |
| | Very much | 50% | 8 | 35% | 9 | 33% | 6 | 38% | 23 |
| | Completely | 44% | 7 | 46% | 12 | 61% | 11 | 50% | 30 |
| As a result of participating in the training program my knowledge about engineering in general has greatly improved. | Not at all | 0% | 0 | 4% | 1 | 0% | 0 | 2% | 1 |
| | Very little | 0% | 0 | 4% | 1 | 0% | 0 | 2% | 1 |
| | Somewhat | 19% | 3 | 8% | 2 | 11% | 2 | 12% | 7 |
| | Very much | 44% | 7 | 46% | 12 | 39% | 7 | 43% | 26 |
| | Completely | 38% | 6 | 35% | 9 | 50% | 9 | 40% | 24 |
| I am able to define what engineering is more easily as a result of the training I received. | Not at all | 0% | 0 | 4% | 1 | 0% | 0 | 2% | 1 |
| | Somewhat | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 |
| | Very much | 6% | 1 | 12% | 3 | 17% | 3 | 12% | 7 |
| | Completely | 38% | 6 | 38% | 10 | 28% | 5 | 35% | 21 |
| | | 56% | 9 | 46% | 12 | 50% | 9 | 50% | 30 |

Contact Information

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www.techxcite.org

TechXcite and JumpstartingSTEM Webinar:

<http://stem.afterschoolnetwork.org/techxcite>



TechXcite Advisory Board

- **Chair: Martha Cyr**, Professor, Mechanical Engineering, Worcester Polytechnic Institute
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- **Jim Barber**, Former Director, LearnNC (Retired)

