Building Relationships by Engaging High School STEM and CTE Teachers

Piedmont Virginia Community College
Team

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1. Program Motivation

History and Motivation
Hmmm...

What was the best class or who was the teacher you learned the most from? Why?
2. Teacher Development

Skill and Passion-based learning with teachers
Tools for Learning
Community Space
“...incorporating several different tools into one PBL and challenging students to engineer projects that incorporate working parts.”

-B. M.
Maintenance
“I am more likely to try things that I am not an expert in and to let the student's interest drive the narrative.”

- Frances R.
Develop for Learning
Student Impact
“Being around other teachers with more experience and ideas, sparked new ideas.”

-Nancy M.
Ideas for Learning
Collaboration
“We pursued some projects that were new for our teacher, and watched him troubleshoot and learn alongside us. I feel empowered to open more experiences to students and the teachers with whom I work, and go after the learning together.”

-Stephanie P.
Excitement for Learning
Purposeful Sharing
We are providing multiple sessions throughout the school year to build skills and community around tools and technology in Albemarle County. These short courses provide teachers with the confidence and basic knowledge to try new things with students! Feel free to sign up for all, or just one or two topics. Each class is open to all grade levels and will be relevant for elementary, middle, and high school.

**Wednesdays, 4:30–6:30pm @ Murray High School**

**Intro to Maker Education**
Wednesday: September 5, 12, 19
Introductory course that focuses on teaching educators new tools, techniques, troubleshooting, and curriculum implementation. Come learn what making is all about!

**Electronics & Microcontrollers**
Wednesday: September 26, October 3, 10
An introduction to basic coding, electronics, and control using popular tools like Arduino and microbits. Learn how these can enhance your students’ project ideas and build a relationship between multiple technologies.

**3D Design and Printing**
Wednesday: October 24, November 7, 14
Design 3D models on a computer using free software that is accessible to you and your students. Learn the basics of computer-aided design (CAD), 3D printer maintenance, and how to print successfully!

**Thursdays, 4:30–6:30pm @ Murray High School**

**Intro to Hand Tools & Machines**
Thursday: September 6, 13, 20
Introductory course for teachers looking to develop basic skills in power tools and woodworking machines. Teachers will focus on safe use while building a small project with miter saw, jig saw, table saw, band saw, sanders, and a variety of hand tools.

**Laser Cutter**
Thursday: September 27, October 4, 11
Learn how to design 2D shapes and products that are optimized for the laser cutter. Teachers will learn about maintenance and explore features of laser cutters while developing a project around this tool.

**Computer Numerical Controlled (CNC) Machines**
Thursday: October 25, November 8, 15
Teachers will design 2D and 2D models, control a cutting or milling machine, and build physical and accurate models. This course serves as an introduction to CNC and the software involved.

Contact [Eric Bredder](ebredder@pvcc.edu) & [Dom Morse](dmorse@kt12albemarl.org) to register or if...
3. Outreach

Connecting communities
Tech Tour
Hosting Community Events
PVCC Recruiting
“Thank you for organizing manufacturing day! Our students didn't know anything about it but now are eager to go to PVCC!”

- Caroline B.
  HS Career Coach
Manufacturing Day
Schools + Business
K-Highest Ed

WOMEN IN STEM
SPEAKER SERIES

Join us as Jennifer Chiu, Associate Professor at UVA, shares her career journey and research in STEM Education.

TUESDAY, OCT. 16 | 4:00 p.m.
Main Building Auditorium (M229)

PROFESSOR JENNIFER CHIU
University of California, Berkeley, Ph.D., Education in Science, Mathematics and Technology, 2010
Stanford University, B.S., Engineering: Product Design, 2000

Hosted by the Manufacturing and Electronics Technology Program.
For more information contact Katie Thach at kthach@pvcc.edu.

The event is supported by the National Science Foundation Grant No. 1827156.
Disclaimer: "Any opinions, findings, and conclusions or recommendations expressed during this event or in event material do not necessarily reflect the views of the National Science Foundation."
“I am now genuinely interested in manufacturing as a future career choice for me... What started as a way to skip school turned out to be a wake up call about my near future.”

- WAHS Student
High School Outreach
The Takeover
Project-Based Learning Modules:

We are in the process of developing project-based learning (PBL) modules that exemplify some of the learning targets and skills we are building here. Below are some of the materials and design files you can use to get started. Check back frequently as these will be updated throughout the remainder of the grant period.

SOLDER EXHAUST FAN - OHM'S LAW
Students design the circuit and schematic while building an enclosure for a solder exhaust fan. This project looks at Ohm's Law through building a practical tool for future use. This project is generally taught in the introductory electronics courses to familiarize students with basic components, tools, and how to calculate the correct values for the parts of your fan made from common computer case fans. This tool is used in further classes and can be easily modified. The basis for this project allows students to experience and play with Ohm's Law and see the direct impact it has on the designed circuit. All the materials and design files are located within the Github page.

BEARINGS FROM SCRATCH - TOLERANCE AND EFFICIENCY
Students create a simple, yet tedious look into simple bearing manufacturing. Students develop an algorithm to manufacture multiple bearings. The bearings are generally laser cut and made with small airsoft pellets, BBs, or balls. The examples in this project show how important tolerance is when manufacturing parts. Students can design a machine using the bearings and look at its efficiency in design. All of the design files are located within the Github page.

RELAY & EL EXTRAVAGANZA - PCB MANUFACTURING
Students build a small relay board that can trigger another device with varying voltage from a low voltage microcontroller. The current board is can be milled or etched by hand and connects with common parts found online easily. Students will use the board to talk to a variety of applications. The example deals with EL wire since it is a safe and interesting look at converting AC/DC voltages and controlling them via output on a microcontroller. The Micro:Bit is a great learning tool that can easily be used to introduce a variety of topics within this project module. All of the design files are located within the Github page.

INTERNET OF MOTORS - WIRELESS MOTOR CONTROL
Students build the basis of a linux-based server to control motors and build a circuit that can be managed using Python and a simple motor driver. Students will be introduced to small board computers, motor control, server setup, and Python scripting. The introductory process and setup are documented and tested. From here students can add different sensors, outputs, and control algorithms in order to build a robust and cheap wireless control system. All programs, scripts, and schematics are posted on the Github page.

GREENHOUSE TEMPERATURE CONTROL SYSTEM
Students will build the basis for a temperature controlled system that is controlled by a simple microcontroller and temperature sensors. The output of the system is a resistive heater and fan to help monitor airflow, heat adjustment, and read out the temperature in a greenhouse. This
Ball Bearing Tests in OpenSCAD:

```
// ball bearings.scad

// Module declarations

module ball Bearings(
    radius, // radius of the ball bearing
    height, // height of the ball bearing
    type // type of the ball bearing (e.g., ball, roller)
)
{
    // Definitions for the ball bearing
    // ...}
```

![Image of ball bearing design in OpenSCAD](image_url)
Shared Resources
Pure Excitement

Katy Noelle Scott @katynoellescott · Oct 20

#MakerEd educators need to abandon the Columbus mentality, “I have robot, you shall learn,” says @Radio_Kah_Reem at #MakerEdConvening. Just because you like robots doesn’t mean students do — focus on creating a modular #Makerspace where interest-based learning can happen. #equity
Hmmm...

What is the most exciting thing you are doing right now with students?
Questions?

Resources: