



Research Experiences for Teachers (RET) Enhancing Teacher Knowledge and Skills in Modern Manufacturing

TITLE: Manufacturing Basics

By: John Gerzik 7/11/2022

john.gerzik@bryanisd.org

(979)255-8185

Supported by: David Reynolds

Title: CTE Director

School and address: Bryan CTEC
6753 Mumford Rd. Bryan, Texas 77802

Date: 7/11/2022



Research Experiences for Teachers (RET) Enhancing Teacher Knowledge and Skills in Modern Manufacturing

TITLE: Manufacturing Basics
By: John Gerzik 7/11/2022
john.gerzik@bryanisd.org
(979)255-8185

Supported by: David Reynolds
Title: CTE Director
School and address: Bryan CTEC
6753 Mumford Rd. Bryan, Texas 77802
Date: 7/11/2022

David Reynolds
7-26-22

Budget TBD.

Overview/Motivation

A need for skilled manufacturing workers is prevalent in our society. The Career Technology Education Complex (CTEC) was created to provide early manufacturing experiences to high school students. CTEC aims to create skilled workers and researchers for advanced manufacturing. Students will get exposed to many manufacturing techniques. One new idea is to use microscopes to view the properties of a 3D printed part. Also, the use of a profilometer (surface tester) will help the students understand how different machining process can lead to different finishes. The use of calipers is important in the manufacturing classroom. Being able to quickly take precise measurements is a key requirement for students in engineering.



Proposed Curriculum Plan

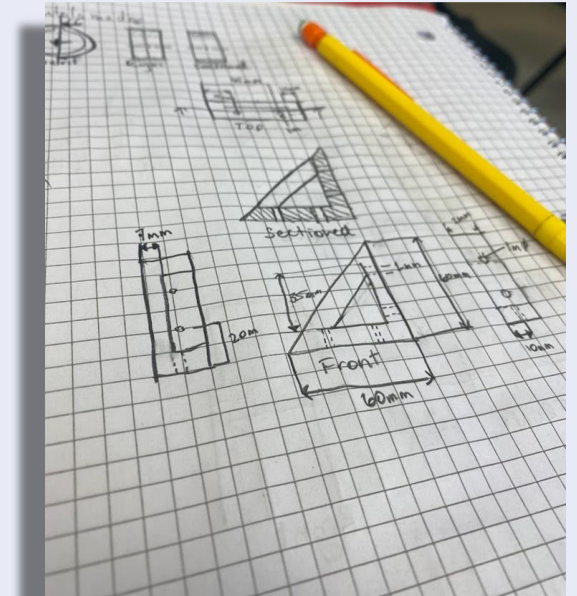
(12 Weeks/2 hours a day - To be used for the next 3 years) High School Juniors and Seniors

- Hands-On Project Learning:
 - Have labs for the following:
 - Metrology
 - Measure different known items with dial calipers. Measuring created parts from the mill and lathe. Measure Internal Diameter (ID) and Outer Diameter (OD) of Parts.
 - Use a profilometer to measure surface roughness. Students will learn that parts can be made with different thickness of cuts and types of tools used. These different processes will lead to different surface roughness.
 - Technical Drawings
 - Hand sketching and computer aided drawings(CAD). Students will demonstrate proficiency in drawing technical drawings by hand first and then given a chance to learn how to do it with the aid of CAD software like Fusion 360 or Autodesk Inventor

Surface Roughness Tester
Sketches

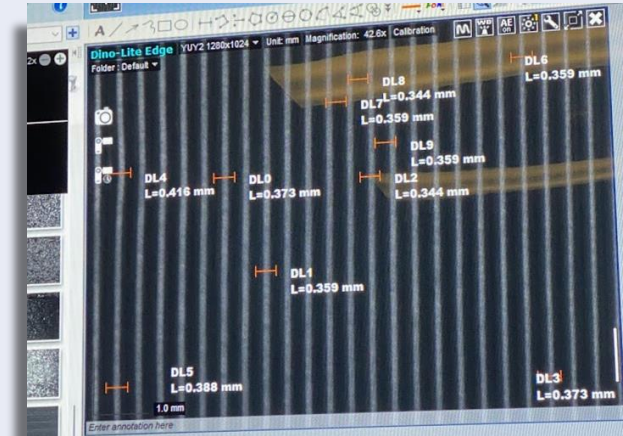


Hand



Proposed Curriculum Plan Continued...

- Teaching Fusion360 designing phone stands.
 - Students will explore different given parameters to print a phone stand
 - We will then print 3 student designs using different infill density, layer heights, and support patterns. During this step also teach the students the difference between ABS (high heat tolerance and needs well ventilated area) and PLA (low heat tolerance and made from natural materials)
 - Take the 3 different parts and cut them open and view the support patterns using a ultrasonic frequency cutter.
 - Use a USB Microscope and Software to analyze the 3D printed parts.
 - Give students the opportunity to make design changes and print their different variations.
 - They will also optimize the printing process with the parts they learn earlier.



Budget/Purchase Needs

#	Description	Quantity	Unit Cost (\$)	Source
1	Dino-Lite AM411T-MS35B 1.3 MP, 10x-50x, 220x - Handheld Digital Microscope	2	\$428.00	https://bisd.link/rK0Cem
2	Fowler 52-008-707-0, Premium Dial Caliper with 0-6"	5	\$75.70	https://bisd.link/wJN1Kt
3	The Wondercutter S, Precision Cutting Using 40,000 vibrations per second,	1	\$390.00	https://bisd.link/JF140Q
4	Mitutoyo 178-561-12A Surface/Portable Surface Roughness Tester	1	\$2,100.00	https://bisd.link/VcsINB
		Total	\$3,724.50	

USB Microscope



amazon.com

Dial Caliper



amazon.com

Ultrasonic Cutter



amazon.com

Profilometer

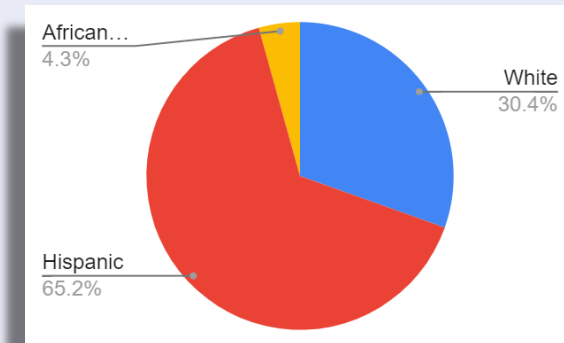
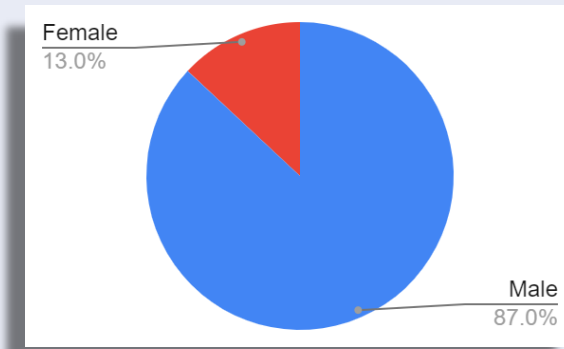


amazon.com

Assessment and Impact



- How to measure Success?
 - Standard Assessments (Pre Test and Post Tests)
 - Metrology, Technical Drawings, Additive Manufacturing
 - Part analysis (Checked by the Teacher)
 - Use Dial Calipers to measure the parts
 - Use the profilometer to measure surface roughness of multiple print types and surface finishes of machined parts.
 - Thickness of cuts
 - Speeds and feeds of tool
 - Different types of tools
- Student Impact
 - 40-60 students per year will be exposed to this program
 - 65.2% Hispanic
 - 30.4% White/Caucasian
 - 4.3% African American.
 - 13% Female
 - Each year I have over 50% student enrollment into post secondary education. Currently 4 students from my program are attending Texas A&M engineering departments.
- Contests - We will compete at SkillsUSA which is a trade competition.
 - SkillsUSA - Trade Competition
 - Additive Manufacturing (CAD DRAWING)
 - Milling Specialist



CTEC Class 2021-22 School Year



Desired Outcome

- Students will be exposed to different manufacturing techniques, including, but not limited to the following; Additive Manufacturing, Metrology, and technical drawing. Skilled trades and advanced manufacturing is needed within our country and community. Several companies in town have contacted the Career and Technical Education Complex (CTEC) and told us that they needed experience machinists and engineers. That is why CTEC is training high school students to go into these fields.
- CTEC wants to increase the percentage of high school students that are trained as skilled manufactures and can take their education to the next level and do research in advanced manufacturing.

