Advanced Manufacturing Education
Lincoln County, North Carolina

History
Working to meet the needs of industry, Lincoln County responded to concerns over the imminent shortage of skilled workers by developing an advanced manufacturing educational program. It is a collaborative to improve the skills of the future workforce, increase the pool of knowledgeable workers, specifically youth, and is a textbook example of aligning education and industry to improve the existing workforce.

Lincoln County Schools offered manufacturing leaders the opportunity to design a curriculum to address needs specific to local manufacturers. Top manufacturing leadership, with input from apprenticeship trainers and industry engineers, developed a mechatronics curriculum, to provide the necessary basic skills for a graduating senior to be "operator ready" upon completion.

Lincoln County Schools also responded to this urgent concern by building upon current STEM initiatives with the addition of Engineering is Elementary and CyberKids Robotics at the elementary school levels. The middle school Technology Education program, consisting of Introduction to STEM, Robotics, and Introduction to Manufacturing, is offered at all middle schools as a precursor to the high school advanced manufacturing program.

The $1.5 million Advanced Manufacturing program is fully funded by grants received from the North Carolina Golden Leaf Foundation ($200,000), the Timken Foundation ($635,000) and the remainder from Lincoln County Schools.

The collaborative efforts resulted in the first classes of Advanced Manufacturing I offered to students in the fall of 2014. The curriculum is the first localized course option developed in Mechatronics to be approved and adopted by the state of North Carolina. The Career & Technical Education Advanced Manufacturing program has now expanded to include three courses and will add the fourth and final Advanced Manufacturing course next school year. Students who complete the Advanced Manufacturing program have the opportunity to transition into one of four Career and College Promise pathways (an additional program is pending). Career and College Promise pathways are college courses that students have the opportunity to take during high school that provide dual credits and lead to a certificate and/or an associate's degree.

New in 2016
Through funding support by the Robert Bosch Community Foundation, LEDA engaged a Canadian group, EdgeFactor, to bring their media expertise to Lincoln County and promote to students and teachers the future of manufacturing as a career choice.

Edge Factor produces cinematic films and TV shows that highlight teams of manufacturers working together with technology to impact lives and build our world. Based on these stories, eduFACTOR creates accompanying resources such as technology and career pathway videos, CNC and 3D printing projects, soft skills, event resources, virtual field trips, interactive classroom and STEM activities, tools to reach parents, CTE success videos and much more.

Edge Factor's storytelling approach provides leaders in industry, education and government with a powerful resource to impact their community and inspire the next generation of advanced manufacturers and CTE graduates. These resources are made available through a membership-based library on www.eduFACTOR.org.

The Bosch Foundation grant ($49,500) purchased the: 1) licensing to make these tools available to four middle and five high schools, 2) the analytic program for continuous monitoring and provide metrics to

the program allowing educators to maximize the training tools available, 3) provided training for teachers from all county middle and high schools for program use and ongoing support in accessing challenges facing each school and trouble-shooting, and 4) funded a kickoff event for eduFACTOR to introduce the program to all 8th grade students and all high school CTE students as well as a parents.

EduFactor will be used to support the advanced manufacturing curriculum and potentially reach over 5,000 students enrolled in middle and high school Career & Technical Education classes throughout Lincoln County Schools.

Purpose

As more emphasis is placed upon STEM careers and STEM education, educators, industry officials, economic development leaders must continue to work collaboratively to look toward to the future at new initiatives and opportunities. Visiting our German industrial partners is invaluable as we continue to monitor and adapt our existing programs as well as anticipate new programs in order to respond to fluid workforce needs.

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OVERVIEW OF WORKFORCE INITIATIVE

Purpose:
Lincoln County partners responded to concerns over the imminent shortage of skilled workers by bringing education, industry and economic development leadership together to develop a high school curriculum specific to mechatronics and advanced manufacturing.

Participants:
Top manufacturing leadership, with input from apprenticeship trainers and industry engineers and curriculum providers, developed a mechatronics curriculum, to provide the necessary basic skills for a graduating senior to be "operator ready" upon completion.

Funding:
The $1.5 million program is fully funded which includes grants received from the North Carolina Golden Leaf Foundation for $200,000, the Timken Foundation for $635,000 and the remaining $665,000 from Lincoln County Schools.

Implementation:
Beginning in the spring of 2015, the first Advanced Manufacturing I class was offered in one school. Currently, Advanced Manufacturing I and II is offered in all four high schools and levels III and IV are being taught at the Lincoln County School of Technology.

Elementary Introduction:
Engineering is Elementary
Cyberkids Robotics

Middle School Options:
Introduction to STEM Education
Robotics Education
Introduction to Manufacturing Education

High School Course Outlines:
Advanced Manufacturing I
- Intro to Advanced Manufacturing
- Math for Technicians I
- Power Tools
- Mechanical Fasteners
- Mechanism Technology
- Hand Tools
- Electrical Systems
- Supplemental-Employability Skills

Advanced Manufacturing II
- Introduction to Lean Manufacturing
- Industrial Safety-Lock Out Tag Out
- OSHA 10 Hour Certification
- Lubrication for Technicians
- Mechanical Measurement and Quality Control

Fundamentals of Electronics
Supplemental-Lubrication for Technicians

Advanced Manufacturing III

Advanced Electronics
Sensor Application Technology
Fundamentals of Electro Pneumatics-3
Advanced and Electro Pneumatics 4
PLC Technology 3: Controlled Pneumatic Systems
PLC 1: Fundamental of Ladder Logic
PLC 2: Advanced Ladder Logic
Mechatronic Systems Integration-Project Work

Advanced Manufacturing IV

Robotics and Material Handling 1
PLC 4-PLC Controlled Hydraulic Systems
Hydraulics Technology 1-Fundamentals of Hydraulics
Hydraulics Technology 2-Fundamentals of Electro-Hydraulics

Career and College Promise Pathways offered by Gaston College

Electrical Systems Technology (18 credit hours)

DC/AC Electricity
Industrial Wiring
Motors and Controls
NEC Calculations
Electrical Machines

Note: courses taken in this certificate program may be applied toward the Diploma and Associate in Applied Science degree in Electrical Systems Technology

Electronics Engineering Technology (16 credit hours)

Precalculus Algebra
Circuit Analysis I
Digital Electronics
Analog Electronics I

Note: courses taken in this certificate program may be applied toward the Diploma and Associate in Applied Science degree in Electronics Engineering Technology

Mechatronics Engineering Technology (17 credit hours)

Introduction to Automation
Circuit Analysis I
Industrial Safety
Precalculus Algebra
Manufacturing Processes I
Manufacturing Processes I Lab

Note: courses taken in this certificate program may be applied toward the Diploma and Associate in Applied Science degree in Mechatronics Engineering Technology

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Welding Technology (15 credit hours)

Blueprint Reading
Symbols and Specifications
Cutting Processes
GTAW TIG
GMAW MIG/FCAW/Plate

Note: The courses taken in this certificate program may be applied toward the Diploma in Welding Technology.

Industrial Systems Technology (*pending*) (16 credit hours)

Basic PC Literacy
DC/AC Electricity
Hydraulics/Pneumatics
Industrial Safety
Intro to Maintenance Procedures
Pumps & Piping Systems

Note: The courses taken in this certificate program may be applied toward the Diploma and the Associate in Applied Science degree in Industrial Systems Technology.

Apprenticeships available to Lincoln County School students:

Apprenticeship 2000
Apprenticeship 321
Apprenticeship Catawba