Statewide Manufacturing Curriculum:

Contextualized Science Module

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FOUNDATIONS FOR DESIGN

- ✓ Instruction emphasizes learning by doing through projects and simulations; therefore, the instructor is a facilitator or learning coach.
- ✓ Each module emphasizes communication, teamwork, and critical thinking.
- ✓ Content is contextualized for manufacturing professions and their programs of study.
- ✓ Learning outcomes often require learners to meet and interact with academic and manufacturing professionals, engage in collaborative and individual projects involving authentic materials and resources, visit manufacturing and academic facilities, and complete documents and writing tasks for career paths with the guidance of learning facilitators.
- ✓ Specific units within modules may serve as precursors for additional units within the module. Many lessons and units may be repeated and expanded from one module to another.
- ✓ Self-advocacy and continual self-assessment and self-monitoring are inherent to each module while students must be introduced to, required to meet with, and encouraged to consult with program coordinator as well as academic and employment professionals.
- ✓ Site visits to manufacturing and learning facilities, guest speakers, and conferences with employment and academic professionals are integral to the relevance and value of the program for students.

ASSUMPTIONS:

- ✓ Each agency or instructor who may use these modules or this program will adapt instructional strategies, content level of difficulty, learning activities and projects to meet the needs of the program's target population and adult learners of lower and higher academic levels.

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- ✓ Referenced resources, relevant internet links, learning activities (created, suggested, attached, or referenced) will be used, modified, or omitted based on student need and restraints of class time and resources.
- ✓ This bridge program will work in established internal partnerships within the academic community as well as external partnerships/relationships in the employment community.
- ✓ Units and lessons will be adapted to fit within varying contact hours of a program.

Rationale: Modern manufacturing technology relies upon the application of a wide variety of science. Those who work in manufacturing need to be aware of these scientific principles. To be productive, manufacturing workers must be able to understand and implement the science of manufacturing processes. High performance manufacturing systems require more science-literate employees. This is imperative in order for American manufacturers to remain competitive In the global economy.

Module Description: The Contextualized Science Module offers the adult learner the opportunity to learn foundation science skills. The module presents basic science skills in many areas. The range of sciences used in the scope of manufacturing is beyond any one class. This module provides a basic understanding of scientific principles and a foundation for learning new principles specific to each industry and/or important for future learning in post-secondary education. The course covers graphing, units, Newton's Laws, friction, air pressure, work, energy, temperature, energy awareness, wave characteristics, and electrical circuits.

i-Pathways Alignment with the Statewide Manufacturing Curriculum: The lessons identified in this document have connections with both i-Pathways and the intended learning objectives identified in the Statewide Manufacturing Curriculum. The i-Pathways lessons can be used to build background knowledge, reinforce content, or provide learners with additional practice in a specific skill development.

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Module Objectives:

Students will:

- Create and interpret graphs
- Apply common metric measurement units
- Demonstrate an understanding of force, mass and acceleration
- Calculate the effects of friction
- Record observations of air pressure
- Define work and compute common equations for measuring work
- Graph temperature transfer as a function of time and calculate the specific heat capacity of materials
- Demonstrate energy awareness and calculate conservation of energy
- Plot wave characteristics
- Calculate and measure volts, ohms and amperes in series and parallel circuits

Methods of Instruction

- Lecture
- Lab experiments
- Discussions

Methods for Evaluating Student Performance

- Teacher observations
- Student created graphs
- Lab questions
- Examinations

Module Overview

A. Graph reading
B. Measurement units
C. Force, Mass, Acceleration
D. Friction

E. Air Pressure
F. Work, energy transfer and power
G. Temperature and heating
H. Forms of energy
I. Wave characteristics
J. Electrical circuits

Module Outline

1. Graph reading for manufacturing
    a. Plotting X and Y coordinates of physical properties
    b. Interpreting data from a graph plot

2. Measurement Units
    a. Length, meter
    b. Mass, kilogram
    c. Time, second
    e. Temperature, Celsius
    f. Converting between systems

3. Force, Mass, Acceleration
    a. Newton's Second Law
    b. Newton's Third Law

4. Friction
    a. Static
    b. Kinetic

5. Air Pressure
    a. Hydrostatic pressure
    b. Standard atmosphere
    c. Mean sea level pressure
    d. Boiling point of water

6. Work, energy transfer and power
    a. First law of thermodynamics
    b. Work-energy thermodynamics

c. Joule

7. Temperature and Heating
    a. Temperature scales
    b. Measuring temperature
    c. Thermodynamics
    d. Examples of temperature
    e. Heat capacities of various materials
    f. Heat engines and refrigerators

8. Forms of energy
    a. Kinetic energy
    b. Electromagnetic energy
    c. Thermal energy
    d. Potential energy
    e. Energy transformation
    f. Conservation of energy

9. Wave Characteristics
    a. Amplitude
    b. Period
    c. Wavelength
    d. Frequency
    e. Speed

10. Electrical Circuits
    a. Current
    b. Potential difference
    c. Resistance
    d. Ohm's law
    e. Series circuits
    d. Parallel circuits