Necessary Skills Now

An Implementation Guide for Embedding Employability Skills into Technical Instruction

Prepared by the Center for Occupational Research and Development

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Project Partners

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The Necessary Skills Now Modules: Background and Overview

Over the past three years, the *Necessary Skills Now* (NSN) project, an initiative (DUE #1501990) funded by the National Science Foundation's Advanced Technological Education program, has supported integrated instruction around employability skills in two disciplines—Cybersecurity and Advanced Manufacturing.

A key component of the project involved community college faculty members partnering with employers to develop 10 project-based learning modules embedding employability skills and technical course content within industry scenarios. The project adopted this integrated approach in an attempt to teach employability skills within the context of how students will encounter and/or apply them in the workplace. The integrated approach also addressed concerns of many faculty who said they did not have time to teach stand-alone modules on employability skills in addition to their technical course content.

To guide their work, faculty/employer teams used a six-step process for creating integrated curriculum developed by CORD during the U.S. Department of Education-supported *STEM Transitions* project. Each of the resulting modules focus on several of the following employability skills, identified as critically important by the NSN project's industry advisory board and supported by business literature from both targeted disciplines.

In-demand employability skills identified by *Necessary Skills Now* include:

- **Teamwork** (working with others to complete a collaborative, goal-driven effort)
- **Problem-Solving** (using critical-thinking to handle and resolve unforeseen circumstances)
- **Verbal Communications** (listen, speak, and present to peers, superiors, and customers)
- **Written Communications** (read and professionally express oneself in business reports, correspondence, etc.)
- **Dependability/Work Ethic** (deliver work on time reliably, confidentially, and ethically, even under duress)
- **Planning and Organizing** (efficiently tackle tasks considering company goals and resources, legal restrictions, schedules, quality, safety, etc.)

Integrated Project Modules

Five modules are available for each of the two targeted disciplines – cybersecurity and advanced manufacturing. The modules are:

- Self-contained, workplace-relevant, classroom-ready materials
- Designed to address multiple employability skills
- Aligned to technical content already taught in the program
- Built around industry scenarios

Included within each module is implementation guidance tailored to the scope of the project's problem and related activities, the tools and resources provided, and, in the case of advanced manufacturing, the equipment required.

All the files related to a module are packaged together and available for download on the *Necessary Skills Now Network* web site. Links to each discipline's modules are provided below, along with a brief overview of each module's contents, courses appropriate for integration, employability skills addressed, and estimated duration. Further details are available in each module's Project Overview, provided on the web site.

Cybersecurity Modules

Each cybersecurity module includes:

- Overview, including equipment list
- Teacher summary
- Student materials
- Rubric
- Handouts, as applicable

Project 1. Product Analysis

Students 1) make product selection recommendations in light of known threats and vulnerabilities 2) using the *Common Vulnerabilities and Exposures (CVE) Details* website. Each team 3) analyzes known vulnerabilities of three products (e.g., Google Chrome, WordPerfect, Microsoft Outlook), and 4) delivers a presentation summarizing their findings and recommendations.

Applicable courses: Security+

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications

Estimated time required: 2 hours

Project 2. Incident Response

Student teams 1) review an organization's incident response policies, procedures, frameworks, roles/responsibilities, and then 2) analyze the findings to 3) develop an incident response questionnaire. Using their form, they 4) complete an investigation of an incident and 5) report on an incident.

Applicable courses: Security+

Employability skills addressed: Teamwork, Problem solving, Written communications

Estimated time required: 1-2 hours

Project 3. Security Awareness Campaign

Student teams 1) examine existing security awareness programs using web research of actual organizations, and 2) develop a survey to measure awareness of the issues found in their research, to query employees of a fictitious organization. Students then plan, develop, and present the details for an awareness campaign to address select initiatives listed by the company CISO.

Applicable courses: Security Awareness, Cybersecurity Essentials, Security+

Employability skills addressed: Teamwork, Verbal communications, Dependability/Work ethic, Planning and organizing

Estimated time required: 1-2 hours

Project 4. Security Policies

Student teams 1) examine the purposes for an organization's information security policies, and 2) identify the differences between policies, standards, guidelines, and procedures. Students then 3) create information security policies to mitigate existing vulnerabilities exposed by a third-party audit.

Applicable courses: Security+

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications

Estimated time required: 2 hours

Project 5. Physical Security

Student teams respond to a request from the school administrator for 1) a plan to address the physical security of their student-run datacenter, which 2) includes a classroom network supporting 3) coursework and 4) security-based competitions, and 5) addresses the need to support remote access.

Applicable courses: Cybersecurity Essentials, Security+, Network Security

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications

Estimated time required: 2 hours

Manufacturing Modules

Each advanced manufacturing module includes:

- Module Instructions
- Student Activities Overview
- Resources (Slides, resource documents, student handouts, rubrics, solutions, calculation tools, and so on)

Project 1. Batch Mix System for Polyisocyanurate Foam Insulation

Student teams 1) use flow charting and mind mapping to create a control diagram and program for a new batch mix process described in the scenario, 2) apply a design methodology (IDEAL), while 3) documenting and presenting their work and data.

Applicable courses: Intro to PLC Programming, Intro to Programmable IC Controllers, Intro to C++ Programming, LABVIEW (or similar)

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications, Dependability/Work ethic, Planning and organizing

Estimated time required: 3-4 class sessions

Project 2. Building a Drone

Student teams use a kit to complete several phases that include 1) design, 2) building, and 3) safe testing of a working (flying) drone capable of performing real-time inspections of inaccessible locations. The project concludes with 4) a formal presentation.

Applicable courses: Intro to Electronics, Solidworks Fundamentals, Industrial Safety, Intro to Quality, Materials and Process 1, Intro to Machining, Soldering

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications, Dependability/Work ethic, Planning and organizing.

Estimated time required: 4 months

Project 3. Statistical Quality Control

Students work in teams 1) serving as project technicians, working through four stages of activity to 2) measure and validate data from actual packaging materials (either purchased or supplied by a partner employer).

Applicable courses: Quality Control, Production/processes, Metrology, Rapid prototyping, Supply chain

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications, Dependability/Work ethic, Planning and organizing

Estimated time required: 10-15 hours

Project 4. Design/Production of a BMX Bicycle Pedal

Student teams 1) complete the design and apply basic quality control to 2) manufacture BMX bike pedals, with stages involving 3) CAD/CAM tools, 4) CNC programming and operation, 5) QC measurements and analysis involving statistical quality control, and then 6) deliver a presentation of the design and test results.

Applicable courses: Intro to AutoCAD, Fundamentals of Engineering, courses in Advanced Technology, Manufacturing, and Quality Control

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications, Dependability/Work ethic, Planning and organizing

Estimated time required: 10-12 hours

Project 5. Puzzle It Out

Student teams develop and execute production processes and procedures over several stages to 1) plan, 2) manufacture, and 3) assemble aluminum 6-piece Burr puzzles, teams typically 4) cooperate to manage and schedule limited equipment, and finally 5) present the production plans and results.

Applicable courses: Manual and/or CNC Milling, Blueprint Reading, Metrology, Intro to Manufacturing Engineering, Manufacturing Quality, Intro to LEAN Manufacturing

Employability skills addressed: Teamwork, Problem solving, Verbal and Written communications, Dependability/Work ethic, Planning and organizing

Estimated time required: 10-20 hours (depending on number of teams and available machines)

Faculty Resources for Creating Integrated Projects

In addition to module development, the *Necessary Skills Now* project designed and delivered faculty development workshops to help instructors from technical disciplines beyond cybersecurity and advanced manufacturing create their own integrated curriculum projects in partnership with local employers. The workshops were designed to help faculty:

- Identify intersections of technical and employability content within a program of study
- Partner with employers to develop authentic industry scenarios
- Design an effective integrated project

Key resources used in the workshops are described below.

Developing Your Own Integrated Projects

The NSN project adopted the **6-Step Process** for developing integrated curriculum used by CORD on numerous federal projects. For this guide, a brief distillation of the process used by our teams to create integrated projects is provided below.

Before developing integrated projects, gather employer feedback on key employability skills. Using the templates described below, follow the **6-Step Process**:

1. Identify technical and employability skills for integration
2. Group topics for possible projects
3. Prioritize topics into project ideas
4. Develop real-world/industry scenario and activity ideas
5. Draft integrated project using NSN template
6. Pilot with students and revise as needed

Using the Templates

Several templates are provided that can help guide your development work:

- The **Synopsis Template** can guide brainstorming for Steps 1-4.
- The **Skills Matrix/Topic Matching Tool** allows you to organize potential topics for integration as noted in Step 2.
- The **Scenario Development Form** can be used directly with local employers to gather authentic workplace scenarios for Step 4.
- The **Integrated Project Template** outlines the essential components for developing a comprehensive project as noted in Step 5.

Note: A "project" can be a single lesson or a multi-session project. It's up to you and dependent on your course schedule and desired learning outcomes.

Step 1: Skills Matrix/Topic Matching

- Identify technical and employability skill topics for possible integration; use the Skills Matrix/Topic Matching Tool to brainstorm points of intersection.
- Review and prioritize project topics based on relevance to industry needs and emerging trends.

Step 2: Skills Grouping

- Organize technical and employability topics into groups of skills that might logically be addressed by a project.
- Expect some concepts to be applicable to more than one project idea.

Step 3: Brainstorm Project Ideas

- Using the skills grouping from step 2, draft a list of project ideas.
- Employer(s) will suggest workplace contexts for each project idea; faculty will support instructional design including how the project could be taught, where in the course it will be used, what barriers may exist, what outside resources might be needed, what will students find the most engaging, etc.
- Discuss pros and cons of each project idea; select one idea for development.

Step 4: Scenario Development

- Create a real-world/industry scenario and a short description of associated activities (using the project synopsis).
- Brainstorm ideas for activities that correlate to the scenario and the targeted technical and employability topics.

Developing authentic workplace context is an important part of contextualized instruction and integrated curriculum design. Industry scenarios provide students with relevant connections to the technical and employability skills presented in a project.

Scenario Development Form

Use as a starting point and customize as needed. The form offers you a self-contained resource to:

- Share with employers how scenarios will be used to enhance student skills
- Provide an example scenario
- Gather company information
- Gather a scenario description, skills addressed, and desired outcomes from employers

Step 5: Draft Integrated Project

- Build on the scenario and synopsis to develop a draft of the complete, self-contained project.
- Use the NSN template to guide drafting each component.
    - Project Overview
    - Key Concepts Addressed/SLOs
    - Equipment/Materials List
    - Scenario
    - Teaching Strategies
    - Activities
    - Resources
    - Assessment Tools

Step 6: Pilot with Students and Revise as Needed

Looking at the Big Picture

During our faculty workshops we discussed the benefits of using an integrated approach to instruction and the specific benefits of combining student learning objectives from both the technical and employability skill domains. An integrated approach:

- Promotes both depth and transfer of knowledge.
- Capitalizes on the natural relationships between subjects and disciplines, reinforcing knowledge and skills.
- Provides deeper and more meaningful instructional experiences through increased intersections.
- Provides more breadth of context, demonstrating to students a wider perspective of content relationships.

As a project team, we offer the following advice to faculty considering embedding employability skills into their technical instruction, or doing so at a deeper level:

- Identify priority employability skills for your discipline. What do your local employers say are the most critical employability (or "soft" skills) new hires are lacking?
- Assess where you're already teaching employability skills and look for opportunities to enhance instruction and measure its impact.
- Remember that one size doesn't fit all. Each community, set of employers, and technical program is different. Programs vary significantly in how curriculum is organized and how much flexibility you may have within your instructional sequence. All of this will affect the approach you use to embed employability skills.
- Remember that many approaches are valid. Use the one that works for your program and local workforce needs. Start small by modifying an existing lesson. Add one or more of these:
  - ✓ Industry scenario
  - ✓ Project or problem-based learning activity
  - ✓ Authentic assessment
  - ✓ One employability skill at a time
- Model good workplace practices. Create a workplace culture with workplace expectations in your classroom. Reinforce this culture throughout your program by advocating for employability skills instruction among your colleagues.

Encouragement from the Field

Feedback from cybersecurity instructor that participated in NSN field testing:

"The activities were well laid out. The project was very different than anything my students have been exposed to before. As an instructor I don't use many project-based assignments because I didn't know how to. This project helped me understand more about how to deliver and develop project-based assessments. I believe when I deliver this content again it will go flawlessly."

Feedback from advanced manufacturing instructor that participated in NSN field testing:

"Students that had not engaged with each other are now talking in the halls and at breaks. Students now are more inclined to discuss, not argue. Some students took on roles of becoming more helpful to those that needed a bit more help but were too shy to ask for assistance. After the project, students exhibited more confidence in their skills and ability. Students improved their ability to problem solve. Instead of saying, 'I don't know' or uselessly changing multiple variables, students showed a propensity to study the problem and work through the most probable cause to the least probable, changing one thing at a time."

Feedback on teamwork activities from students that participated in NSN field testing:

- "It was great working with a team member who is receptive, honest, and cares about doing a good job."
- "It takes more than just communication."
- "I treat this like a work-related project, where no matter what happens, things need to be done."
- "It's not ideal to be living in a shell when you need to communicate with your group."
- "It really brings the social side out of people who aren't social to begin with."