Library of Student Authored E-Resources for Just-in-Time Learning in Capstone Design

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Today’s Outline

1. JIT Learning in Capstone Design
2. JIT Learning Infrastructure
3. E-Resource Philosophy
4. E-Resource Development Process
5. Existing E-Resources
6. Impact on SME Competencies
Capstone Design Experience
year-long university/industry collaboration surrounding open-ended, real-world projects
Challenges in Product Realization

Early Prototyping, Drawing Package Formation, Vendor Selection, Design for Manufacturing, Fabrication, Assembly, Testing
Knowledge Management Issues in Capstone Design

- Annual turnover of personnel
- Increasing student numbers
- Escalating project complexity
- Diverse project requirements
- Declining hands-on experience
- Evolution of hardware/software tools
- Limited span of control by instructors
Step 1: Idaho Engineering Works
Stewards of Design & Manufacturing Infrastructure

- Graduate Student Mentors
- Design Faculty Members
- Professional Staff
- Alumni in Regional Industry
Step 2: Lean Manufacturing Elective
hands-on, 3-week, summer short-course

- Become familiar with lean concepts and see sources of waste in a small shop setting
- Learn standardized work procedures for common mill and lathe operations
- Contribute to a visual workplace through point kaizen project
Step 3: Mindworks Laboratory
www.webs1.uidaho.edu/ele/mindworks

• Hardware Artifacts
• Vendor Catalogs & CDs
• Machine Design Templates
• Student-Authored E-Resources
• Self-Directed Project Learning
E-Resource Philosophy
adapted from Greenfield Coalition

• Faculty and professional staff need to play a central role in creating the learning environment.

• Whenever possible, real-world linkages and local context should be used to enhance learning.

• Learning is most compelling and enduring when students and faculty share responsibility for outcomes.

• Learning is social, requiring group processing of new ideas for comprehension and application.
E-Resource Development Process

**Needs Analysis**
Specify behavioral outcomes ➔ *mentors, faculty, and staff*
Recognize local context ➔ *student authors*

**Design Specifications**
Propose objectives ➔ *student authors*
Approve objectives ➔ *mentors, faculty, and staff*

**Develop Skills and Scripts**
Deliver training ➔ *students, mentors, faculty, and staff*
Create quick references and storyboard ➔ *student authors*
Provide formative assessment ➔ *mentors, faculty, and staff*
E-Resource Development Process

Resource Production
Film and edit video $\rightarrow$ student authors
Maintain E-resource library $\rightarrow$ mentors/faculty/staff

Just-in-Time Use
Identify situations/prompts for use $\rightarrow$ mentors/faculty/staff
Prepare for design/manufacturing activities $\rightarrow$ student users
Debrief student users $\rightarrow$ mentors/faculty/staff

Continuous Improvement
Survey about strengths & improvements $\rightarrow$ student users
Establish priorities for revision $\rightarrow$ mentors/faculty/staff
Current E-Resource Catalog
E-videos, E-posters, E-templates, E-tutorials

Shop Safety
Shop Orientation
Shop Tool Inventory (15)
Drilling & Tapping
Feeds & Speeds
Finishing a Part
Tramming a Mill
CNC Lathe
CNC Mill

Measurement Devices (4)
Heat Treatment
Anodizing
Welding (3)
Rapid Prototype Machine
Drawing Package Formation (3)
Machine Design (15)
Advanced CAD Tutorials (5)
Capstone Assessment Tools (5)
Step Drills

Purpose:
The step drill is used to drill a hole in thin metal, such as sheet metal. A normal drill will try to lift sheet metal off of the table and spin it.

Safety:
• Secure/Clamp work piece.
• Debur edge to prevent cuts.

Steps for Use:
1. Determine diameter of hole desired.
2. Insert appropriate step drill into drill press.
3. Determine depth required to achieve the diameter.
4. Drill to desired depth to achieve diameter.
5. Clean up

Available Step Drill Sizes

<table>
<thead>
<tr>
<th>Min ∅</th>
<th>Max ∅</th>
<th>∅ Step size</th>
<th>Depth between step</th>
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<td>1/2</td>
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</table>

Table 1. Available step drill sizes.

Figure 1. Step drill location cabinet 2

Figure 2. Typical Step Drills

Vendor: http://www.MSC.direct.com
Impact of E-Resources on Manufacturing Competencies

Rubric for Skill Development

0 – unfamiliar with skill
1 – able to explain importance of skill to others
2 – able to perform skill with extensive coaching
3 – able to perform skill with minimal coaching and independently learn more as needed
4 – able to solve problems and teach others
## Impact of E-Resources on Manufacturing Competencies

<table>
<thead>
<tr>
<th>Skill Area</th>
<th>Authors (30)</th>
<th>Mentors (8)</th>
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<td>4</td>
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<tr>
<td>Shop Cleaning</td>
<td>2 → 3.5</td>
<td>4</td>
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<tr>
<td>Tool Storage</td>
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<td>4</td>
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<tr>
<td>Mill Operations</td>
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<td>Lathe Operations</td>
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<td>CNC Coding</td>
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<tr>
<td>Part Drawings</td>
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<tr>
<td>Tolerancing</td>
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