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

**Edwin Odom, Steven Beyerlein,**
**Russ Porter, Adrian Gomez, Lloyd Gallup**

**Department of Mechanical Engineering**
**University of Idaho**

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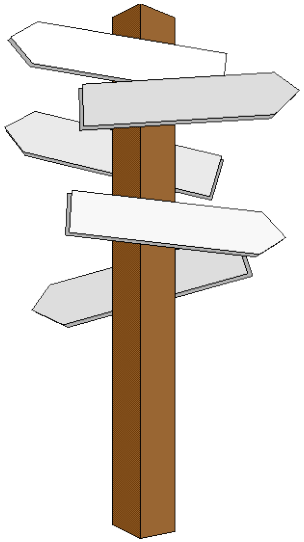
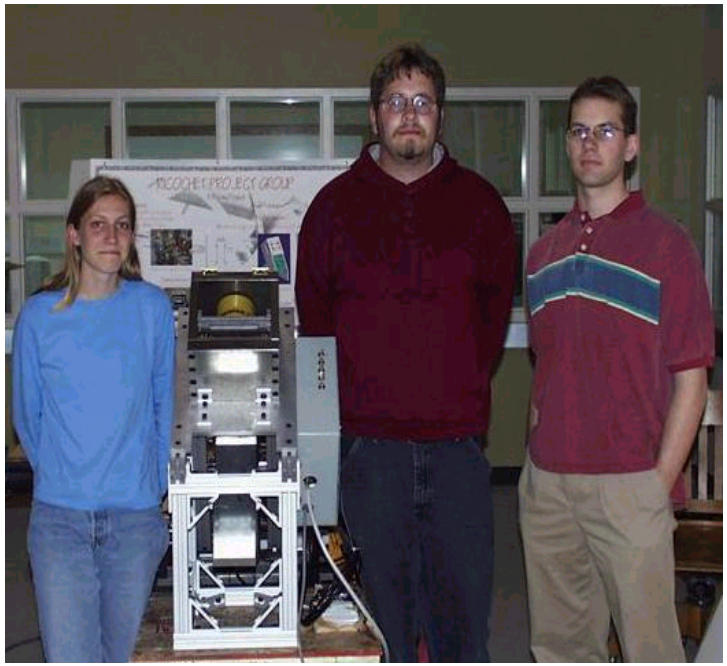
# Today's Outline



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

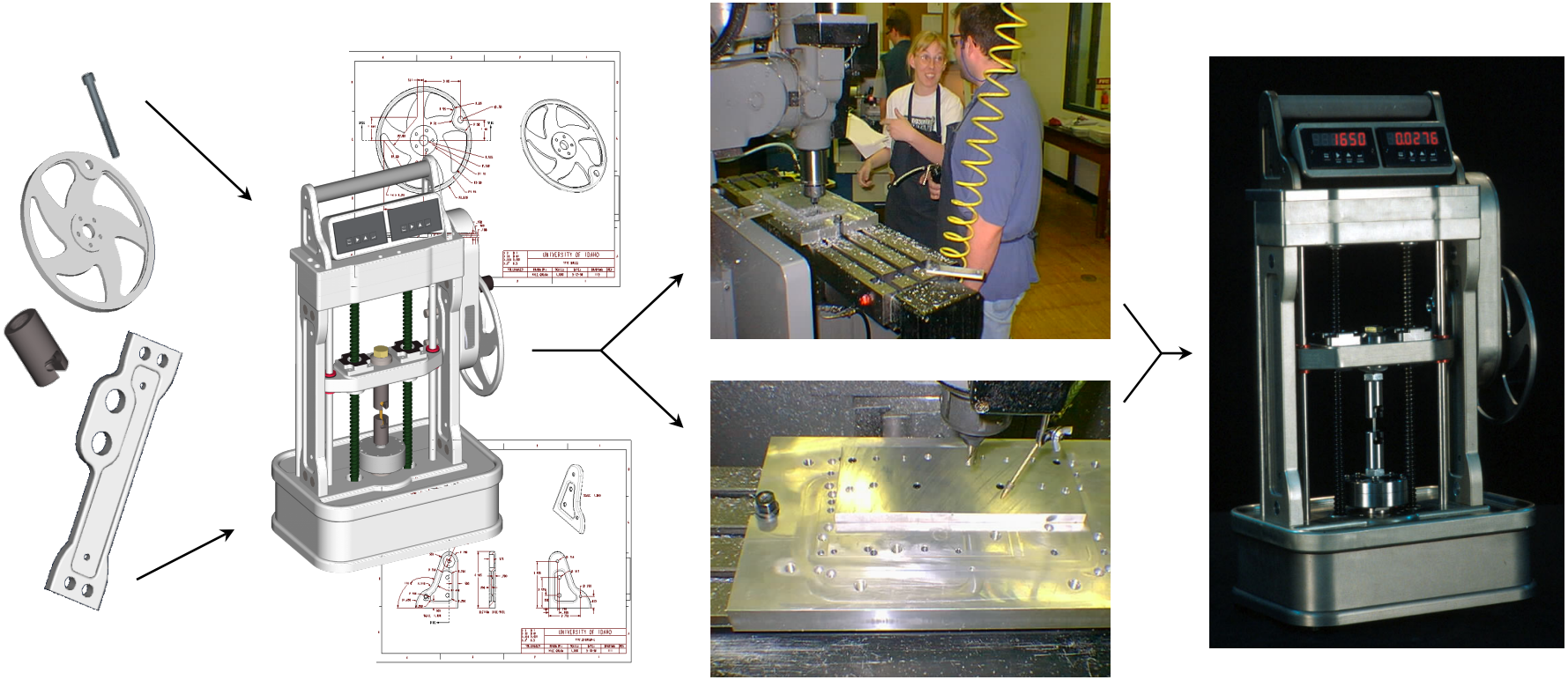
# Capstone Design Experience

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



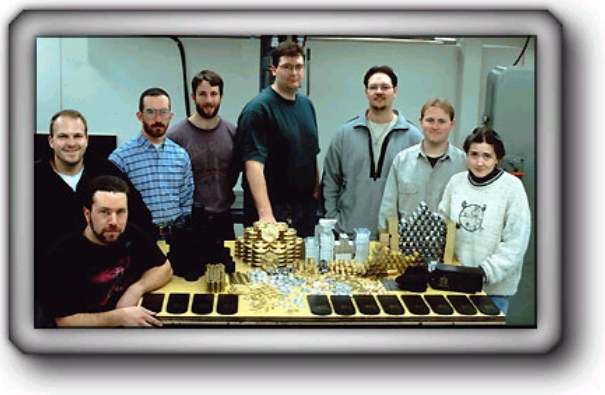
# Knowledge Management Issues in Capstone Design

- 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



Mastercam®

SolidWorks

# Step 2: Lean Manufacturing Elective

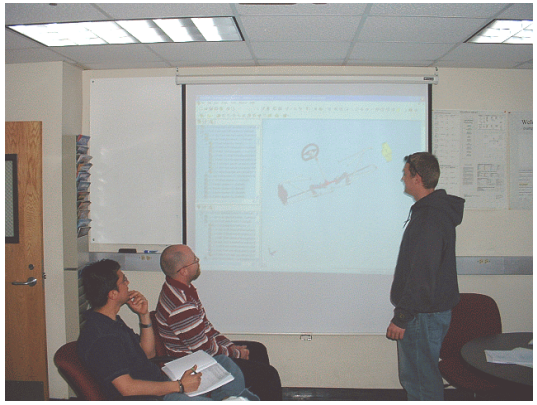
hands-on, 3-week, summer short-course

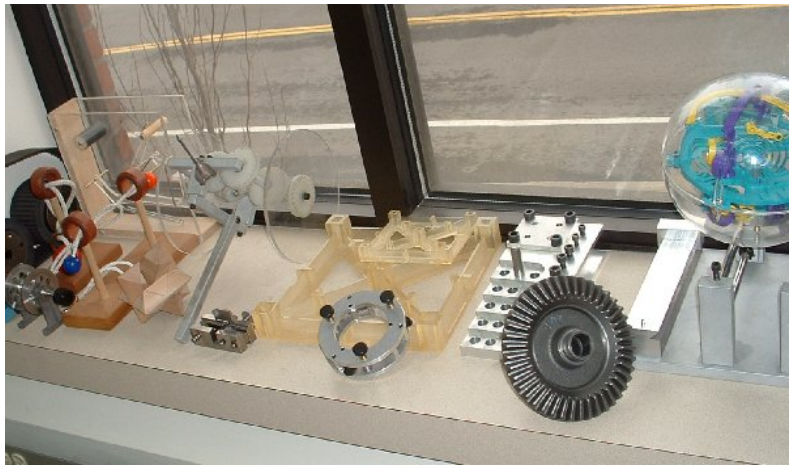
- Become familiar with lean concepts and see sources of waste in a small shop setting
- Learn standardized work procedures for common mill and lathe operations
- Contribute to a visual workplace through point kaizen project

# 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 → *student authors*
Maintain E-resource library → *mentors/faculty/staff*

## Just-in-Time Use

Identify situations/prompts for use → *mentors/faculty/staff*
Prepare for design/manufacturing activities → *student users*
Debrief student users → *mentors/faculty/staff*

## Continuous Improvement

Survey about strengths & improvements → *student users*
Establish priorities for revision → *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.


Figure 1. Step drill location cabinet 2

**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

Figure 2. Typical Step Drills

## Available Step Drill Sizes

| Min ∅ | Max ∅ | ∅ Step size | Depth between step |
|---|---|---|---|
| 1/8 | 1/2 | 1/32 | 1/8 |
| 1/4 | 3/4 | 1/16 | 1/8 |
| 1/4 | 7/8 | ~*~ | 1/16 |
| 3/16 | 1/2 | 1/16 | 3/8 |
| 3/4 | 1 1/2 | 1/16 | 1/8 |

Table 1. Available step drill sizes.

**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

| Skill Area | Authors (30) | Mentors (8) |
|---|---|---|
| Shop Safety | 2 → 3.5 | 4 |
| Shop Cleaning | 2 → 3.5 | 4 |
| Tool Storage | 0 → 3 | 4 |
| Mill Operations | 1 → 2.5 | 3.5 |
| Lathe Operations | 1 → 2.5 | 3.5 |
| CNC Coding | 0 → 2 | 3 |
| Part Drawings | 2 →3 | 3.5 |
| Tolerancing | 1 → 2.5 | 3.5 |