"What Can Solids Modeling Eliminate from Engineering Graphics Education?"

February 12, 2001
Personal Background

- **Traditional education**
  - High school drafting
  - 2 semesters college engineering graphics

- **Practical experience**
  - CAD at John Deere
  - Manager of Engineering in Ohio

- **8 years college professor**

- **2 years teaching engineering graphics**
Engineering Graphics at St. Ambrose University

- Industrial Engineering Program (ABET accredited)
- One semester engineering graphics
- Up to 1998
  - Traditional approach
  - No CAD
- Student focus group results
  - Need CAD Experience
1998 Engineering Graphics

Changes

- Changed instructors
- Drafting tables removed
- Maintained EG theory
- Added CAD component
- Adopted solids-modeling philosophy
Books and Supplies

- Solidworks98 training manuals, Volume I and Volume II (Detailing and Assembly)
- Syllabus: [http://web.sau.edu/rjerz/Ambrose/IE 110/ie110.htm](http://web.sau.edu/rjerz/Ambrose/IE 110/ie110.htm)
Implementation

- Theory of engineering graphics
  - Lectures
- Hands-on CAD
  - Labs
Criteria for Elimination of Components

- Outdated
- Not applicable with CAD
- Too much effort
- Too much time
- Costs too much
Educational Components to Eliminate
Establishing a Need for CAD

- Educational debate
  - Fundamentals
  - Sketching
- No industry debate
- Solids modelers
Instrument Drawing

- Pencils
- Vertical & horizontal Lines
- Circles
- Ellipses
- Angles
- Scales
- Templates
Geometric Constructions

- Parallel and perpendicular lines
- Finding the center of a circle
- Drawing tangent circles, arcs, and lines
Parallelism and Perpendicularity
Intersections

Manual

Solidworks
Tangencies
Tangencies

Solidworks
Tangencies
Descriptive Geometry

- Science of graphical representation of spatial relationships of points, lines, and planes
- Geometry
- True length, size, angle
- Revolutions
CAD - Replaces Descriptive Geometry

Manual

Solidworks
CAD - Replaces Descriptive Geometry

In Solidworks, just point and measure!
Lettering

A GOOD DRAFTSMAN WILL NEVER LETTER WITHOUT GUIDE LINES.

SPACE BETWEEN LINES USUALLY FROM 1/8 TO TOTAL HEIGHT OF LETTERS.

A DETAIL WILL OBTAIN RESULTS

(a) (b) (c)
Lettering
Multi-view Projection

• E-Drawing
Creating Axonometric Drawings

Manual

Solidworks
**Oblique Projection**

- A faked projection (simulated isometric)
- Eliminates need to draw ellipses
Section Views
Drawing Nuts & Bolts

Manual

ToolboxSE
Results

• Students like the course
• Students gain CAD experience
• Students get exposure to engineering graphics concepts
• An important engineering tool has been added to student’s toolkit
Future Ideas

- Increase link between CAD and EG
- Increase link with manufacturing processes
- Dimensioning & Tolerancing
  - ANSI Standard Y14.5M-1994
- Design intent
- Drawings and auxiliary views
- Assembly drawings
  - Bill of materials
  - Tolerance analysis
- Analysis (FEA, kinematics & dynamic)
- Cost Analysis
Discussion