

SKYSCRAPER MASTER TEACHER ADVANCED WORKSHOP: A PROJECT-BASED LEARNING EXPERIENCE

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ABSTRACT

The Skyscraper Master Teacher Advanced Workshop was developed as part of the CDIO in Aerospace Engineering Education with funding through NASA's E.2 Innovation in Aeronautics Instruction (IAII-08).

The overall goal of this workshop is to introduce faculty members to project based learning as a pedagogical approach. In particular, the workshop is intended to help them learn through first-hand experience how to promote students' ability to describe, anticipate, and plan for some of the realistic factors encountered in an engineering project. The workshop draws on engineering and scientific disciplinary knowledge and provides a context for introducing a variety of personal and professional skills through project based learning activities.

<u>Activity</u>	<u>Timeframe</u>
Introduction	10
Conceive Phase	35
Journal Completion	10
Design Phase	35
Building Inspector Review/Journal completion	15
Debrief Conceive/Design Phases	10
Implement/Operate Phase w/ Judging	50
Journal Completion	15
Debrief Implement/Operate Phases	10
Introduction to Implementing PBL activities	15
Develop local PBL Exercise	45
Group discussion of PBL Exercises	10
Workshop Evaluation and Debrief	10
Total	4.5 hours

1. Learning Objectives*

- 1.1. Recognize when disciplinary knowledge can be applied to a design
- 1.2. Identify additional knowledge required to design and analyze a proposed structure
- 1.3. Anticipate and plan for factors encountered in an engineering project
- 1.4. Explain ways in which critical thinking, creativity, problems solving and experimentation are required in designing and building the proposed structure

- 1.5. Describe the importance of dividing tasks among team members aligned with their respective strengths (e.g., leadership, analysis, design, manufacturing) and the benefit of designating a team leader
 - 1.6. Describe the need for good documentation of designs and implementation processes
 - 1.7. Explain the challenge of and trade-offs necessary to meet the requirements and regulations within the fixed budget and timeline
 - 1.8. Describe the benefits of conducting research and development testing without unduly delaying the manufacturing process
 - 1.9. Realize the importance of designing structures with quality and the safety of the public in mind
 - 1.10. Accept the need to be fair-minded in competitive situations
2. Student Instructions
 - 2.1. Project overview
 - 2.2. Learning objectives
 - 2.3. Learning activities including the task, customer requirement, regulations, analysis to support the design, project engineering considerations, and cost of materials
 - 2.4. Learning Assessment
3. Instructor Guide (provided for Master Teachers)
 - 3.1. Project overview
 - 3.2. Learning outcomes
 - 3.3. Learning organization including preparation, time, and other information (keyed to the Student Instructions)
 - 3.4. Team structure, organization and management
 - 3.5. Resource Requirements
 - 3.5.1. Facilities - space and furniture requirements
 - 3.5.2. Materials, supplies, tools and other supplies
 - 3.5.3. Instructor roles including technical support
 - 3.5.4. Safety and Risk Mitigation
 - 3.6. Modification of learning activities including possible omissions and modifications
 - 3.7. Assessment guidelines and materials
4. Resources Requirements
 - 4.1. Space and Furniture
 - Overall workshop room requirements – at least 600 sq ft with moveable furniture
 - Participant furniture
2 – 30” x 8’ rectangular tables (or 8-10 person round table) and 8 chairs *per team*
 - Instructional furniture
2 - 30” x 8’ tables for construction materials
1 - 30” x 8’ table for banking, sales & custom cutting
1 - 30” x 8’ table for handout & refreshments (optional)

- Computer station plus LCD projector and screen
- 4.2. Materials and Supplies
- \$2000 in printed currency in the following denominations and quantities per team

<u>Denominations</u>	<u>Amount/team</u>	Quantities		
		<u>1 Team</u>	<u>2 Teams</u>	<u>5 Teams</u>
\$1	\$50	50	100	250
\$5	\$150	30	60	150
\$10	\$200	20	40	100
\$20	\$100	5	10	25
\$100	\$500	5	10	25

Bundled in \$1000 for each team to spend; \$1000 for the Bank to *make change*

- 1- 16" x 16" piece cut from 3/16" x 32 x 40 foam board **per team**
@ \$4.00 for box of 10 sheets
- 60 sharpened wooden pencils (for fasteners) **per team** (240 for 4 to 5 teams)
@ \$2 for a pack of 12 at Office Depot
- 1 - 2" x 2' x 8' sheet extruded polystyrene foam **per 2 teams**
@ \$15 for 1 - 2" x 2' x 8' sheet

Cut to the following sizes and number of pieces:

<u>Size (inches)</u>	<u>2 teams</u>	<u>5 teams</u>
24x9	2	4
12x12	4	8
8x8	9	18
6x6	12	24
4x4	18	36

- 4.3. Tools
- 1 - 18" to 24" hot wire cutter, e.g., Woodland Scenics Hot Wire Foam Cutter, \$30 from Tower Hobbies
<http://www3.towerhobbies.com/cgi-bin/wti0001p?&I=LXKT85&P=ML>
- 4.4. Handouts
- Student Instructions-1 per student
 - Building Permit-1 per team
- 4.5. Optional Supplies
- masking tape
 - graph paper
 - pad of paper for journal

Relevance – This workshop addresses nearly all of the CDIO Standards in helping to prepare master teachers to development and implement Project-Based Learning Experiences.

Submission Category - Advanced Workshop

Keywords - project-based learning, active learning, faculty development