ENGINEERING AND COMPLEXITY:

THE ROLE OF STUDIO LEARNING?

Patricia Culligan
Professor & Vice Dean of A
School of Engineering & Applied
Sciences, Columbia University
OVERVIEW

- Engineering and Complexity: Urbanization
- The Nintendo and Observational Lessons
- Complexity + The Nintendo = The Studio?
- Studio Learning & Examples
- Assessment Methods
ENGINEERING AND COMPLEXITY:
21ST CENTURY URBANIZATION CHALLENGES
THE WORLD IS URBANIZING...

By 2030, two out of three people will live in an urban environment, with most of the explosive growth occurring in developing countries.
COMPLEX URBANIZATION CHALLENGES

- Interlinked infrastructures
  - Water
  - Energy
  - Waste
  - Transportation

- No models for sustainable urban environments
- Uncertainty in design conditions
  - Climate Change Impacts
  - Urban Economic Conditions, etc
- Human behavior.....
THE NINTENDO:
OBSERVATIONAL LEARNING LESSONS
THE SALVATION TO PROPOSAL DEADLINES....
NINTENDO GAME LESSONS

- Learner is engaged
- Learning is by doing
- No long-term consequence to trying and failing – experimentation is encouraged
- Collaborative learning is valuable
<table>
<thead>
<tr>
<th>Traditional</th>
<th>Nintendo</th>
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<tr>
<td>Grade Oriented</td>
<td>Goal Oriented</td>
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<tr>
<td>Limited opportunities for different approaches</td>
<td>Multiple tries permissible</td>
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<td>Individual effort rewarded</td>
<td>Collaboration beneficial</td>
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<td>COMPETITIVE LEARNING ENVIRONMENT</td>
<td>SAFE LEARNING ENVIRONMENT</td>
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THE ARCHITECTURAL STUDIO: USE IN ENGINEERING EDUCATION
MODELS OF STUDIO PEDAGOGY

- Problem based design
  - Real problems
- Learner centered & Product Driven
  - Breaks down barriers between student and teacher – introduce complexity beyond student knowledge
- Encourages collaborative problem-solving
  - Mix disciplines within Studio
- Includes multiple perspectives
  - Bring in external perspectives
ENGINEERING STUDIO SEQUENCE

- **Engineering for Developing Communities**
  - Freshman to Junior Undergraduates: Clients in Developing Communities

- **The Urban Ecology Studio**
  - Senior Undergraduates to M.S., joint with GSAPP: Clients in low income NYC Communities

- **IGERT: Solving Urbanization Challenges by Design**
  - PhD students in SEAS and GSAPP
BASIC METHODOLOGY

Community Alliances

Community goals

Interdisciplinary Studio

Studio results

Community goals

Site & project scope

Community input/feedback

Community discussion

Refined project

Research/Education/Innovation
STUDIO SEQUENCE

• Project introduction
• Map the “site” – desktop study
• Site visit; Meet client
• First formulation of problem causality
• Design solutions Feedback
• Visualization of solutions
GO-GREEN EAST HARLEM

- Client “Go-Green East Harlem” Community Organization
- Concerns; High childhood obesity; High pediatric asthma; Economic development
- Site 5th Avenue to East River; 96th St to 135th Street
- 16 Engineering Students; 8 Urban Design Students; 2 Professors; 2 Professionals
URBAN FARMING

2- Structure

Scaffolding

Light Ceiling

Led Lights

Harvesting Birds

Polycarbonate and Aluminium external body
ASSESSMENT METHODS

- Product produced
- Community feedback
- Written questionnaires
- Exit interviews
- External review
- Student journals
- Tracking students beyond graduation
CHALLENGES & OPPORTUNITIES

Challenges
• Managing community relationships
• Perceived value of pedagogy and scale-up of the approach
• Funding for scale-up of the design outcomes

Opportunities
• Building on student interest to be engaged in “engineering that matters”
• Meeting imperative for interdisciplinary Engineering Education
• Manageable complexity