Using Community-Based Learning to Teach STEM

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Jack McGourty, Promiti Dutta, and Tim Cross
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Columbia Engineering’s Mission

Columbia University’s Fu Foundation School of Engineering and Applied Science seeks to educate socially responsible engineering and applied science leaders whose work results in the betterment of the human condition, locally, nationally, and globally.
CTICE Twin Missions

**Education**
- Support Columbia Engineering School’s mission to educate technologically adept and socially engaged students
- Enable students to solve complex problems and design innovative solutions that are culturally and contextually appropriate

**Community**
- Support capacity building and economic development in Harlem, Washington Heights, and Upper Manhattan
- Leverage strong community relationships to increase educational and entrepreneurial opportunities for community members
Program Areas

- Columbia Student Courses and Programs
- Workforce Development
- CTICE
- Columbia-Harlem SBDC
- Youth Programs
Our Community-Based Learning

- Project Based
- Team Based
- Interdisciplinary
- Client Driven
- Community Focused
# STEM (Technical) Courses

<table>
<thead>
<tr>
<th>SCHOOL OR DEPARTMENT</th>
<th>COURSE</th>
<th>DESCRIPTION</th>
<th>SERVICE-LEARNING COMPONENT</th>
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<tbody>
<tr>
<td>Engineering School (Core Course)</td>
<td>First-Year Design Course</td>
<td>Teaches principals of engineering design, computer modeling, and professional skills</td>
<td>Teams complete design projects for community clients in areas of assistive technology, urban problems, and educational issues</td>
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<tr>
<td>Engineering School (Civil Engineering)</td>
<td>Engineering for Developing Communities</td>
<td>Teaches “engineering that matters” in the context of under-privileged and developing communities</td>
<td>Students work on international projects in conjunction with Engineer Without Borders</td>
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<tr>
<td>Engineering School and Graduate School of Architecture, Planning and Preservation</td>
<td>Urban Ecology Studio</td>
<td>Investigates specific urban problems, such as waste management or rehabilitation of a canal, in a studio environment</td>
<td>Course faculty develop research projects in New York City, which they investigate with students in an intensive studio environment</td>
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<tr>
<td>Engineering School and Columbia Business School</td>
<td>Integrated Product Design</td>
<td>Tutorial for advanced undergraduates &amp; graduate students in engineering, physical sciences, etc.</td>
<td>Graduate Engineering, GSAS, and Business students work on community design projects</td>
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First-Year Design Course

STEM Course Content

- Four-credit Columbia Engineering core course required for all incoming undergraduate students
- Fully integrates community-based learning into the design curriculum
- Teaches applied design skills:
  - Alias Maya
  - Auto CAD
  - Microsoft Project

Project Areas

- Assistive Technologies
- Urban Technology Problems
- Educational Challenges

Students in First-Year Design Course undertake more than 70 projects per academic year
First-Year Design Course

Professional Skill Development

- Working in teams
- Managing projects
- Researching customer and market needs
- Solving open-ended problems
- Budgeting
- Communicating
First-Year Design Course

Pedagogical Techniques

- Individual Weekly Reflections
- Team Design Journals
- Professional Developer
- Team Video Review and Analysis
- Peer Review
- Advisor and Client Feedback
First-Year Design Course

Sample Project: Sandwich Holder
First-Year Design Course

Sample Project: Wheelchair Swing
First-Year Design Course

Sample Project: Guitar Hero
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