

Educating The Engineer of 2010 at Rensselaer

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“Design Engineering: Bringing back creative practice into
engineering education”
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Mark Steiner, Director of Core Engineering/Multidisciplinary Design Laboratory
and Clinical Associate Professor, School of Engineering

Dean Nieusma, Assistant Professor, Science and Technology Studies (STS)
Department, School of Humanities and Social Sciences

Rensselaer Polytechnic Institute, Troy, NY, USA

Perspectives on Integrating Design into the Engineering Curriculum

- Design should be woven into the curriculum starting in day one
- The Humanities & Social Sciences give relevance to what we do as engineers
- Faculty must learn how to teach in a social design context

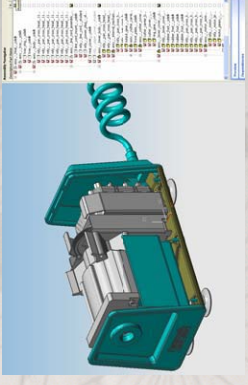
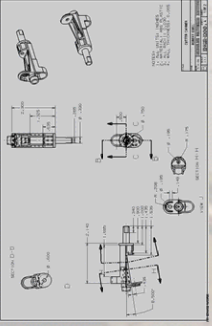
Academic Departments in the School of Engineering

1. Mechanical, Aerospace, and Nuclear Engineering
2. Electrical, Computer and Systems Engineering
3. Civil and Environmental Engineering
4. Chemical and Biological Engineering
5. Materials Science and Engineering
6. Decision Sciences and Engineering Systems
7. Biomedical Engineering

Enrollment Distribution in Engineering 2005-06 Academic Year

	First Year (740)	Senior (688)
1. Aerospace Engineering	74	55
2. Biomedical Engineering	74	54
3. Chemical Engineering	37	41
4. Civil Engineering	30	41
5. Computer and Systems Eng'g	78	90
6. Electrical Engineering	51	124
7. Electric Power Engineering	4	3
8. Engineering Physics	6	5
9. Environmental Engineering	9	13
10. Industrial and Management Eng'g	6	33
11. Materials Engineering	9	9
12. Mechanical Engineering	130	144
13. Product Design & Innovation	24	12
14. Nuclear Engineering	11	38
15. Undecided Engineering	200	--

Design in the Curriculum



- Engineering Graphics & CAD
- Introduction to Engineering Design
- Multidisciplinary Design Laboratory (MDL)
- Product Design and Innovation Program
- Inventor's Studio



MDL Milestones

- Completed 48 sponsored projects to date
- Conducted 9 sponsored projects in 2005-06
- 240 students participated on projects in 2005-06
 - Mechanical (51%)
 - Electrical & Computer Systems (30%)
 - Aerospace (7%)
 - Electric Power (4%)
 - Materials Science (4%)
 - Biomedical (3%)
 - Industrial (1%)
- Selected as Partner for the Advancement of Collaborative Engineering Education (PACE)

MDL Resources

- A showcase facility
- 6000 sq ft conference area
- 8000 sq ft shop area
- Haas Technical Center
- Web-based collaboration
- Professional support staff
- Purchasing Manager
- Shop Manager
- Multidisciplinary team of faculty
- Research university environment
- Bright enthusiastic students!



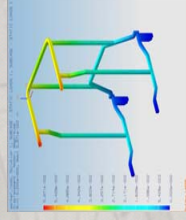
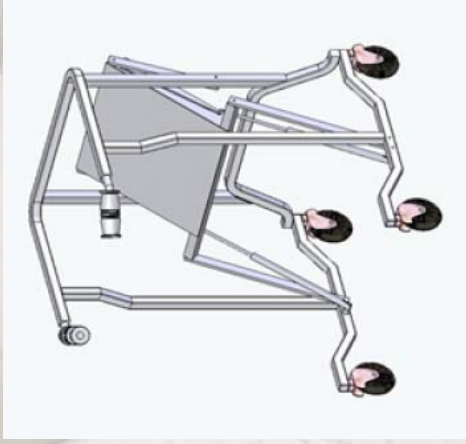
Types of Projects

- Industry
- Service-oriented
- Entrepreneurial

Industry Project: Minimally Invasive Vein Harvesting
Sponsor: Converge Medical

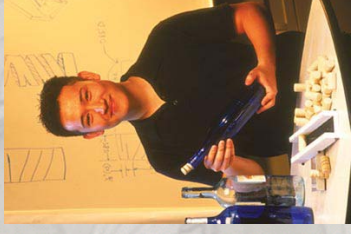
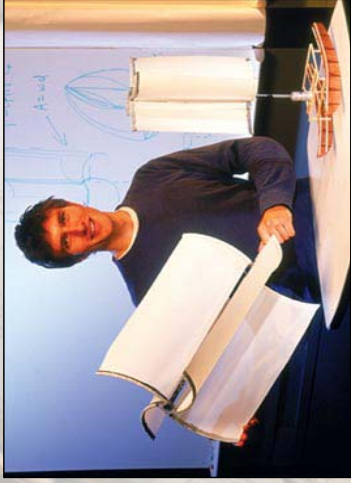


Service-oriented Projects



Entrepreneurial Projects

- Wind Turbine Powered Catamaran
- Spiral Cut Strippable Cork

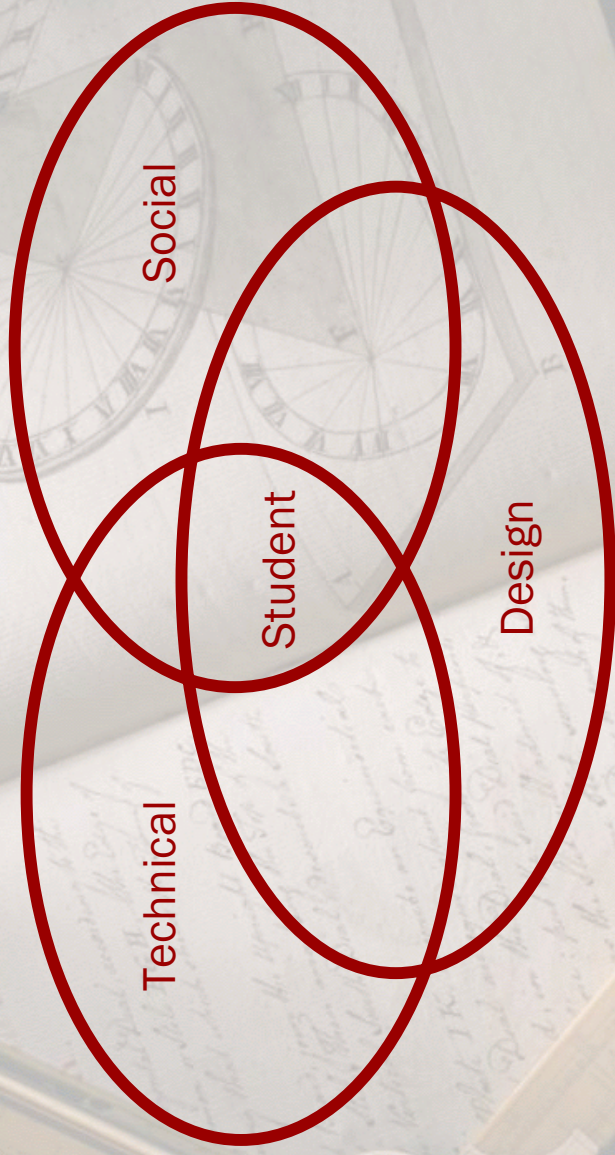


PDI Curriculum Structure

A dual degree program built around a studio design class each semester

- B.S. in Science, Technology, and Society (STS)
- B.S. in a technical area:
 - Mechanical engineering
 - Management

PDI Program Faculty Perspectives



PDI Program Status

- Started in 1999
- 15-25 students per year and growing
- Vast majority STS/mechanical engineering
- Job placement: mostly in industry, some design firms, some start-ups, and some graduate study

Vision and Guiding Values

- To produce students who can synthesize engineering, social science, and design approaches in the creation of innovative solutions to the challenges of the 21st century.
- To develop a replicable program model that provides a highly technical education with a solid understanding of design in societies across the world.
- To develop designs that take society, culture, and human potential as a nodal point of reference for design innovation.

The PDI Curriculum



Studio 1

Technical: representational charcoal drawing, vector and contour drawing, plan and section, computer tools

Design: connections and materials, open-ended design, use of models and notebooks, iteration, presentation board design

Social: need finding through user interviews, basic design research



Studio 2

Technical: rapid prototyping, sketching, perspective and exploded drawing, engineering computer programs

Design: design process, detailed needs finding, problem definition, manufacturing feasibility, product evaluation

Social: interviewing and observation, needs analysis

Gifts for RPI visitors



Studio 3

Technical: computer animation, graphic design, visualization, representation

Design: design aesthetics, form and fabrication relationship, creation of new product ideas, problem definition

Social: market research, product history, consumer trends, societal values and innovation

The Math Mat



Studio 4 (Intro to Engineering Design)

Technical: application of engineering analysis to a technical problem

Design: prototyping based on formal models and analysis

Social: customer needs analysis



Physics learning projects for high school students

Studio 5



Math and Science Learning

Technical: electronics and circuits, hardware and software design, cognitive interface, ergonomics

Design: social identities of users, participatory design

Social: ethnographic methods, analysis of products and social identities

Studio 6

Technical: economics of innovation and new products

Design: moving a product from innovation to market

Social: developing predictions of social effects, risks, safety, market potential,



Strippable wine cork



Wind turbine powered catamaran

Studio 7 (MDL)

Gen Y Saturn Features



Technical: Integration of engineering skills on multidisciplinary teams

Design: Synthesis of design skills in work with real-world clients and problems

Social: Synthesis of social science skills in problem definition and potential impact

Vein Harvesting Project



Studio 8 (Inventors Studio)

Technical: the patent process

Design: market analysis, business plans, creativity

Social: developing ideas that can do well and do good, legal dimensions



I.T.S. (Intelligent Training System), the world's most advanced live fire extinguisher training system.



Award-winning Microinfuser: a wearable, disposable infusion device intended for self-administered drug delivery.





Thoughts and Reflections

The most exciting feature of the PDI program is that from the outset it seeks to educate students to create design innovations that address society's needs in a more thoughtful and integrated fashion.