

# Abstract

- ◆ **There is little information on biomedical engineering related design projects for freshman introductory design courses (cornerstone courses.)**
- ◆ **This poster will present an overview of potential sources for such projects.**

# Introduction:

Design challenges in a freshman level introductory course can serve to introduce a student to the design process early in their career. A good experience can lead to increased retention and interest on the part of the students. Finding the right personnel to man such a course, and finding the right design challenges, is necessary for a good experience. This poster will address the latter challenge.

# Method 1

Go beyond your teaching team: The entire engineering faculty at Vanderbilt University were surveyed by the faculty in charge of the freshman introductory engineering course for design projects. This course covers the use of Excel, MATLAB, VRML programming, and very basic web page design, and concludes with a project and a project fair. Example projects proposed and skills needed are posted in the next panel.

## ... example design projects

### Topic

Bone Density  
Peripheral Vascular Diseases  
Bioreactor design  
Fiber optic design  
Assistive devices  
Spider web site  
Free electron system  
Prosthetic arm  
Rooftop wheelchair design  
Reaction rates  
Cough monitor

### Skills needed

Excel analysis  
Literature survey  
Literature survey  
Literature survey  
Rough design layout  
Web design  
Literature survey  
Literature survey  
Mechanical design  
MATLAB analysis  
Device specification

# Method 2

**Steal from the Senior Design course:**  
Another suggested source of design projects is the current senior level design course. Some projects can be scaled down for introductory purposes, some can indeed be solved by freshman design teams, and some are already at the right level. Some example suggestions from the senior design course at Vanderbilt (taught by this author):

## ... example imports from senior design

- ◆ Several projects at a local school for the severely handicapped involve rudimentary mechanical design skills.
- ◆ The local Cerebral Palsy foundation often has a list of needs for individual clients, such as a need for a ramp or other aids.
- ◆ VRML programming, often used in freshman design courses can be used to design teaching programs for basic anatomy or function, such as visualization of the heart.

◆ A lecture or two on safety and the need for guarding, warning, etc. can form the basis for many student projects on campus safety. This can involve the suggestion for relocation of walkways away from driveways to correction of falls and trip hazards.

◆ If you are located near or have access to a Rehabilitation Hospital there are often several specific tasks that need to be done for a specific patient or procedure. (See the physical therapists.)

◆ Your local children's museum likely has needs for educational exhibits or software packages...

◆ Your course web site might use updating or generation in the first place, give this task to a freshman design team.

# Method 3

**Have your students develop PowerPoint teaching modules:** A very good way to combine design and a learning experience is to have your students develop PowerPoint instructional modules based upon chapters in a designated text, such as the course text. Any material which can be absorbed and abstracted by freshmen students is useful.

*See, for example*

*<http://www.bae.ncsu.edu/research/blanchard/www/465/>*

# Method 4

**Go with your background and strengths: Go with your personal strengths in proposing student design projects. An exemplar of this is the work done by Dr Openshaw at the Iowa State University in the freshman design course he instructs. His mechanical engineering background shows up in the design project listing he posts for the class, which includes redesign of a tractor, redesign of a spoon, wheelchair adaptation, bowling ball ramp redesign, etc.**

*See, for example:*

*<http://www.eng.iastate.edu/openshaw/engr170/maindesign/fall01/descriptions.htm>*

# Method 5a

**Do a web search: The use of the term “freshman design projects” and variations on this theme will bring up a number of sites that can be inspected for Biomedical Engineering content:**

*See, for example:*

*<http://www.bme.jhu.edu/courses/580.111/pastprojects.htm> is the web site for the Johns Hopkins freshman design projects from past years*

*<http://www.lf.psu.edu/> is the learning factory website at Pennsylvania State*

*<http://www.asee.org> for generic articles on freshman design, using the search term “biomedical engineering design”*

*<http://fie.engrng.pitt.edu/> The Frontiers in education web site*

# Method 5b

Do a literature search:

See, for example

**The International Journal of Engineering  
Education (Especially V17 issues 4 & 5)**

**The Journal of Engineering Education**

# Summary and Conclusions

Examples of freshman design projects relating to Biomedical Engineering may be found in the literature, but as may be read above, the information is scattered. One common thread is that the design projects in general are genuinely at the freshman level, with projects involving one or more the following list of attributes:

## ... sources

**Suggested sources for design projects are your fellow faculty, projects posted for the capstone design sequence, your community, current textbooks and articles, your own strengths, and web and literature searches.**

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## **... attributes**

**Web page design**

**PowerPoint presentation design of educational material**

**Excel data analysis and display**

**Literature survey and abstraction or decision making**

**Elementary mechanical design for rehabilitation or related needs**

**Device specification**

**MATLAB modeling**

**VRML modeling**

**Educational display generation**

**Basic observation of unsafe situations**