

GIFTS: MAJOR exposure through engineering innovations

As a first-year engineering instructor on the first day of class, someone invariably asks what discipline of engineering they should go into. Not knowing the particular background of these individuals, it is difficult to give them meaningful advice on the spot. First-year students (and their parents) have an expectation that the first-year course will “help” them decide what discipline the student should major in. However, introducing students to various fields of engineering may not be the main foci of the course, as many first-year programs have evolved towards the inclusion of curricular content such as design, entrepreneurship, writing, and/or programming. This leaves little class time to devote to presentations from each branch of engineering.

This GIFT explores the use of engineering innovations as a quick (> 5 min) way to demonstrate the varied disciplines within engineering. At the start of each class, an engineering innovation is highlighted that relates to one the major concepts of that class period. For example, if the class is about circuitry than an example related to wearable sensors would be relevant (see Table 1). These engineering innovations can be sourced from technology sites, current headlines, or even from “First Looks” in the ASEE Prism magazine (<http://www.asee-prism.org>).

A brief introduction of the subject through visual means (e.g. Powerpoint, videos), should last around two minutes, followed with a short student engagement activity. Typically, this could be a think-pair-share about applications of the innovation, classroom survey of what type(s) of engineering would work on this project, or even getting a show of hands to demonstrate who had seen the innovation previously (typically less than a quarter). This provides opportunity for students to connect to ideas that interest them, and to see the contexts by which engineers work together on similar projects.

Table 1. Example engineering innovations used in a first-year engineering course.

Topic	Innovation	Major Relation(s)*
Health	Wearable sensors that detect glucose for diabetic individuals. [1]	Biomedical, Chemical, Electrical, Mechanical
Natural disasters	Mobile-bridge based on origami, that is compact and quickly deployed. [2]	Civil, Mechanical
Design	Adaptive spoon for those with hand tremors. [3]	Biomedical, Mechanical, Electrical, Computer, CS
Energy	Potential to increase battery capacity to 400 years. [4]	Electrical, Chemical, Mechanical
Technology	Connective technology that allows remote areas to have internet. [5]	Computer, CS, Aeronautical

* This is not an exhaustive list of what different engineering majors are involved in the innovation.

While the innovations are meant to expose students to the different disciplines of engineering, there are also some additional benefits. The first being simple introduction to the myriad of applications of engineering beyond basic concepts that they have previously experienced within formal or informal environments (e.g. robotics, bridge building, physics). The innovations also have the potential to connect to current events and increase student interest. For example, recent natural disasters emphasize the need for innovations within flood control, emergency distribution, and safety. Discussing these innovations in this context get students thinking about different applications strategies when it comes to their own designs.

Disciplinary and interdisciplinary connections are also emphasized to expose students to different majors and how different areas may work on the same project. This helps to allay fears of picking the “wrong” major, and instead focuses them upon what skills they need to develop to do the work they are interested in. Lastly, exposure to cutting edge research also has the potential to increase interest in research and development and/or grad school.

References

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- [2] Y. Chikahir, I. Ario, K. Adachi, S. Shimizu, S. Zensai, P. Pawlowski, ... & J. Holnicki-Szulc, “Fundamental study on dynamic property of scissoring bridge for disaster relief,” ENOC 2017, Budapest, Hungary, 2017.
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