

A Dream Green Team

The InnovationSpace program at Arizona State University demonstrates the benefits of taking a transdisciplinary approach to sustainable product development

By Dosun Shin, Prasad Boradkar and Adelheid Fischer

The appearance of new products is a lot like a fast-paced round of musical chairs. New products bump old ones from the shelves at a dizzying tempo.

In this competitive climate of new product innovation, some argue that devoting resources to sustainability concerns is a pricey diversion that may be good for a company's cache and conscience but an anchor on creativity and the bottom line. The InnovationSpace program at Arizona State University turns this thinking on its head. Using environmental strategies that are integrated into the program's transdisciplinary curriculum, InnovationSpace has demonstrated that sustainability can become a driver that lowers the environmental profiles of products without sacrificing innovation.

InnovationSpace is an entrepreneurial joint venture among the College of Design, Ira A. Fulton School of Engineering and W.P. Carey School of Business at Arizona State University. Now in its fifth year, this transdisciplinary education and research laboratory assembles teams of students from business, engineering, industrial design and visual communication design to develop products that create market value while serving real societal needs and minimizing impacts on the environment.

An increasing body of new research suggests that this kind of sustainability-based education is in greater demand than ever. *Sustainability* is a word that is "on the lips of nearly all chief executives," say authors Elizabeth Woyke and Maha Atal in an October 2007 *BusinessWeek* article. According to Woyke and Atal, "Companies are feeling real pressure from Wall Street to reduce environmental liabilities, from European customers demanding planet-friendly products and from younger new hires who take green issues seriously."

Mounting consumer concerns also has prompted businesses to take greater heed of social and environmental issues. For corporations, "contributing to the greater good," says business writer Christine Arena, "is more than a marketing tool—it is a marketing advantage." Research bears this out. A meta-analysis of 52 studies, published in the 2001 issue of *Business & Society*, examined corporate social responsibility over the past three decades and found that the "higher a firm's corporate social performance the lower its financial risk."

To make sure these concerns are represented in board room decisions, a wide range of companies, from Dow Chemical and General Electric to Home Depot and General Motors, have added chief sustainability officers to their C-Level

Suites. According to an article published in the July 3, 2007, issue of the *New York Times*, these new environmental chiefs “are exploring partnerships with vendors and customers to create green products—and they have the power to close the deal. They are also getting a vote—often, the deciding vote—on product research and advertising campaigns.”

As sustainability continues to make company priority lists, business leaders “are racing about looking for designers, managers, and strategists who are knowledgeable about building sustainable products and implementing processes,” say Woyke and Atal.

Unfortunately, product development education has not entirely kept pace with the needs of industry. With some notable exceptions, students continue to be trained in disciplinary silos. Lacking a more wholistic framework for problem solving, this kind of atomized education often falls short of adequately addressing the complex problems presented by sustainable development.

InnovationSpace is built on the premise that a traditional, discipline-specific education no longer provides enough expertise or variation in thinking to handle the difficult challenges of 21st century new product

development, particularly sustainability. The goal of InnovationSpace is to present strategies that engineering, business and design students can use to produce sustainable product concepts that have anticipated—and met—the rigors of real-world challenges on multiple fronts. The effort requires transdisciplinary teams in which boundaries between knowledge and perspectives are integrated.

Integrated Innovation

Central to the InnovationSpace curriculum is a new model of product development known as Integrated Innovation. Using this model, students systematically explore and resolve four key questions:

- a. What is valuable to users?
- b. What is possible through engineering?
- c. What is desirable to business?
- d. What is good for society and the environment?

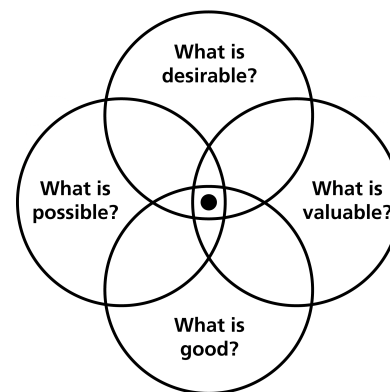


Fig. 4: Integrated Innovation Model

The Integrated Innovation model prompts students to think about sustainability in unexpected ways. For example, by asking the question “What is valuable to users?” the student teams probe real—rather than superfluous--human needs. Any product solution that meets these needs, however, must be examined against the question “What is good for society and the environment?” Even the most environmentally benign products are not sustainable in the long run if, for example, they rely on child labor in their manufacturing or serve only select consumers who can afford them. Answering these questions within the checks-and-balance framework of the Integrated Innovation model helps students understand the dynamic tensions that are inherent in balancing the needs of individuals, society, corporations and the environment.

Teaching Principles of Sustainability

In his 1997 book, *Cannibals with Forks*, John Elkington proposed a definition of sustainable development that asked corporations to consider issues of social equity and environmental responsibility along with those of economic prosperity. This premise, now referred to as the triple bottom line, serves as the framework for sustainability that students use throughout the InnovationSpace course.

In each stage of the product-development process, students are introduced to sustainability methodologies that help them meet the triple bottom line. During the concept-development phase, for example, student teams use the ecodesign strategy wheel as means of improving the environmental and social performance of their product ideas. Loosely structured around life-cycle assessment, the ecodesign strategy wheel encourages students to consider low-impact materials, optimized manufacturing, efficient distribution, low-impact use, optimized product lifetime and optimized end of life. As the product concepts starts taking form, the engineering and design students make material choices, develop component specifications, calculate energy usage, among other decisions, to minimize the environmental impact of the product. At the same time, the business students start to establish parameters and guidelines for upstream and downstream supply-chain management that includes everything from the procurement of components and materials to their disposal. In the course of this research, students learn, for example, that transporting raw materials and goods by rail and water has a significantly lower ecological impact than by air. In their business plans, they also recommend that corporations align their labor guidelines for vendors with the code of conduct developed by the Fair Labor

Association. During this time, the graphic design students learn about environmentally friendly practices such as minimizing the weight of packing materials, reducing material variation for ease of recycling and specifying soy-based inks for printing.

As the design is finalized and a bill of materials is created, the engineering and industrial design students use the Okala Impact Factor Assessment tool developed by ecodesign strategists Philip White, Louise St. Pierre and Steve Belletire. The Okala process requires them to estimate the total life of the product and its packaging, calculate the weight and size of each component and compute the total expected energy usage. After some number crunching, they are able to quantify the ecological impact of the new product in Okala millipoints. The students also calculate the Okala impact of an existing competitor product by taking it apart and weighing all its components. The goal of the exercise is to compare impacts and ensure that the new design indeed minimizes damage to people and the planet. At the end, the team summarizes its efforts in the form of a list of reasonable and justifiable social and environmental claims for the product.

Throughout the execution of these exercises, students engage in an informational give-and-take in which conclusions and solutions

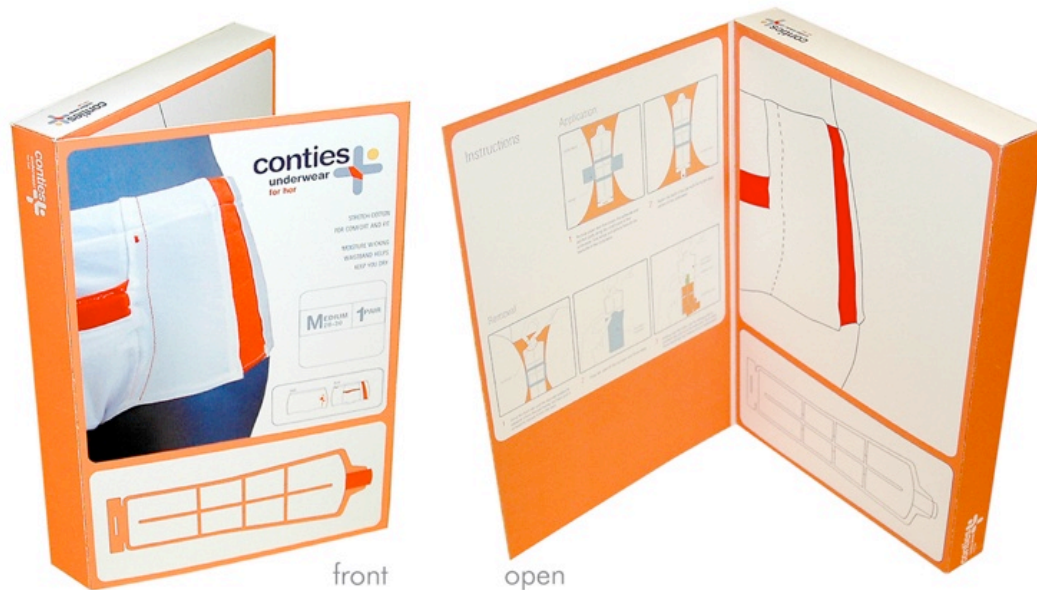
are “field” tested against the knowledge of the teams’ respective disciplines.

Here is a sampling of some of the concepts that have been created by InnovationSpace student teams.

Product Concept: Conties

Student Team:

Stephanie Recalde, Industrial Design; **Michael Davis**, Visual Communication Design; **Jared Hardman**, Business; **Adam Scheck** and **Anthony Pettoruto**, Engineering



An estimated one in six Americans suffers from urinary incontinence. For some, the problem is a temporary condition during pregnancy or following surgery for prostate cancer. For others, especially older people, incontinence is a distressing reality of everyday life.

Charged with creating design concepts for aging baby boomers, the student team focused on issues related to urinary incontinence. In their user research, the team discovered that incontinence is not simply an

uncomfortable annoyance but a hidden affliction with tremendous personal and societal costs. For millions of people, the embarrassment of urine leakage keeps them away from the gym, off the tennis court and out of restaurants, concert halls and movie theaters. It may even narrow or curtail employment options. The stigma of wearing bulky “adult diapers” only deepens the sense of shame. For older adults in particular, urinary incontinence can add to the obstacles that keep elders from maintaining physical health and emotional well-being. Such problems will only be compounded as tens of millions of baby boomers enter their golden years.

The goal of the team was to restore a sense of freedom and normalcy for people who suffer from urinary incontinence. Their product concept, known as Conties, is a durable, washable undergarment that is specially designed to hold up to four thin pads. Each pad features a center layer of super-absorbent gel. The team's product designer and engineers joined forces to create a system that allows users to remove soiled pads

through a front flap with as much ease as pulling tissues out of a box.

The business and visual communication students crafted a brand and marketing/communications strategy that emphasizes this simple, carefree design. And the product comes in a variety of styles and fit—from conservative cut to active wear—to meet the needs and tastes of the wide range of users who benefit from this product. Best of all, it generates only a fraction of the solid waste produced by more traditional bulky products.

Product Concept: Gels

Student team:

Claire Lewinski, Industrial Design; **Tiana Rutledge**, Visual Communication Design; **Alexandra Sonne**, Business; **David Law**, Engineering

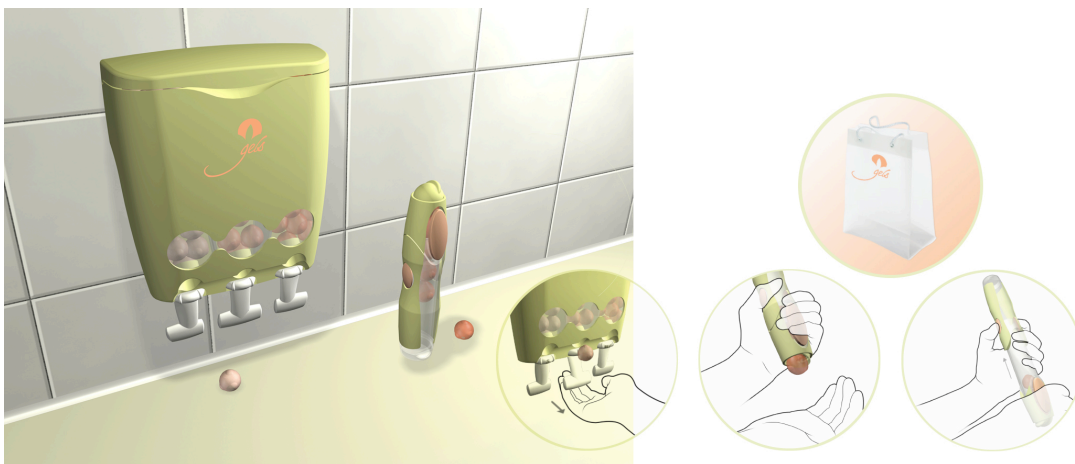


Fig. 2: Both wall-mounted and portable dispensers can be refilled with single-serve capsules of Gels shampoo, soap and conditioner.

In spring 2006 InnovationSpace was one of four design programs in the United States and Canada to win an award from the Interdisciplinary Student Design Collaborative, a competition sponsored by the Cincinnati-based corporate giant Procter & Gamble and the Industrial Designers Society of America. Four student teams developed ideas for products that would improve the lives of women over age 65.

In their design concepts, students paid special attention to the need for reducing solid waste, both in the housing of their products as well as in shipping and packaging. One team, for example, called for shipping its product in a box made of starched fabric. A simple laundering transformed the box into a reusable linen tote bag. Another team compressed sunscreen lotion into small, pressurized cartridges that could be loaded into a portable, palm-sized device and dispensed in an easy-to-use foam, thereby eliminating the need for large plastic bottles.



Fig 3: When laundered, the starched linen packaging for a vitamin diffuser known as Aruna turns into a reusable tote bag.

One of the most ingenious ideas for reducing packaging waste came from the developers of a product known as Gels. The student team discovered that older adults, especially those with arthritic hands, find tiny, travel-size containers for personal care products difficult to refill and handle in the shower. Their solution? Single-serve capsules of shampoo, conditioner and body wash. The Gels capsules dissolve in water on contact to provide a no-spill, hassle-free way to transport and use these products. Travel dispensers allow users to carry up to ten capsules at a time, eliminating the need for bulky collection of tiny bottles. Best of all, Gels' premeasured doses help to reduce product waste and eliminate the excess packaging that is generated by personal-size products currently on the market. The team's business students developed the potential for greater market share by drafting

plans for the installation of bulk Gels

dispensers in both hotel and home environments.

Product Concept: Current

Student Team:

Susan McKinney, Industrial Design; **Matthew Thibault**, Visual Communication Design; **Alan Burruel**, Business; **Zach Pirtle**, Engineering

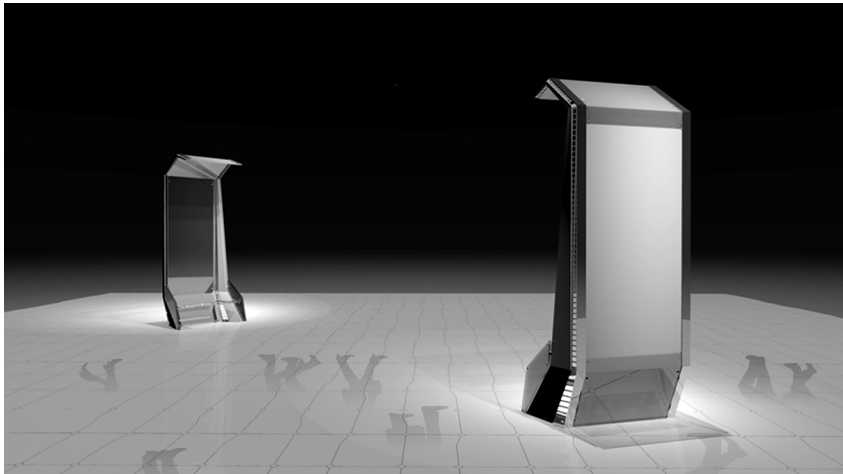


Fig 3: The Current project harvests energy from the human traffic in public spaces. Prominently placed kiosks serve as recharge centers for portable electronic devices as well as educational displays about energy conservation.

Since 2006 the Center for Nanotechnology in Society at Arizona State University has sponsored three student teams to explore socially redeeming and environmentally responsible uses for emerging nanotechnologies.

Among the most innovative ideas to be formulated under this partnership is a product concept known as Current. In this project, the team tackled a growing

worldwide crisis: the need for cheap, clean and abundant energy.

Noting that the global appetite for energy is expected to increase by 57 percent over the next two decades, the team's engineer devised an ingenious new system for using human activity to generate electrical power. The Current project calls for embedding nano-enabled piezoelectric wires into floor tiles in highly trafficked public places such as airports, train stations, shopping malls

and public plazas. The weight of pedestrians bends the wires, thereby creating tiny pulses of energy that can be harvested and converted into electricity. Some of this energy is made available through kiosks that double as recharge ports for electronic devices such as cell phones, mp3 players, computers and cameras. The kiosks, whose form and user interface were created by team's product designer and visual communication designer, also offer interactive displays that educate users and

onlookers about energy use and conservation, much like the dashboard panel on the Toyota Prius. Gauges designed for easy readability, for example, make the invisible consumption of energy tangible to users of consumer gadgets. The kinetic imagery on Current's display panels also add visual excitement to public spaces and, like the display gauges, serve to raise awareness about the need for energy conservation.