

Challenging Industrial Design Students to Foster Sustainable Behaviors

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Abstract: - During their time in university, students of industrial design are typically trained to improve the appearance, function and value of products. This product-centric focus of the industrial designer's work is often blamed for the proliferation of unnecessary products in the market and the promotion of such wasteful values as rapid obsolescence and conspicuous consumption. In this paper, the usual product-oriented syllabus of a third year industrial design studio course is challenged to embrace new content: that of fostering sustainable behaviors in the community through the design of product systems. Childcare centers and residential colleges in the university campus were targeted as "clients" for the students to engage in positive behavioral changes. Student reflections reveal that they enjoyed the experience of interacting with clients and working on briefs which tackle sustainability issues.

Key-Words: - industrial design, sustainable design, design education

1 Introduction

Far too many articles, books and movies have featured the sad state of our planet. One of the blaming fingers point to the mass manufacturing schemes developed since the days of the Industrial Revolution, that have encouraged factories to produce more and more, and consumers to buy more and more especially as products became increasingly affordable. The side effects of this mass consumerism include the unparalleled global extraction of materials and energy to satisfy human needs, the enormous wastes and emissions generated thereafter, all of which have been scientifically linked to climate change plus the string of ecological disasters we now experience.

Adherents of sustainable living believe that humans should rightfully question how contemporary lifestyles quickly exhaust natural resources and how these can be transformed into more sustainable ones. Reduction in resource intensity in transport, housing, energy and diet can all help achieving the goal of true sustainability. It is high time that designers of all stripes start promoting an ethical philosophy which values interdependence, respect for life and nature, and responsibility for future generations.

We used to enjoy the "common goods" – free and clean air, water, security, landscapes – but

indiscriminate human activity deteriorated them to a point that they are now in crisis and we now have to resort to "remedial goods": bottled distilled water in place of local water, faraway "tourist paradises" instead of our own natural surroundings etc[1].

The United Nations emphasizes that education is an indispensable element for helping solve our current environmental crisis and for achieving sustainable development [2]. Transformative learning can potentially spell the difference between a sustainable and a chaotic future [3]. Orr [4] asserts that "we continue to educate the young for the most part as if there were no planetary emergency". Paradoxically, Orr underscores that the climate crisis is "not primarily the work of the ignorant and uneducated", but rather of the "so-called well-educated people" [5].

Since 2005 we have entered the Decade of Education for Sustainable Development, which challenges educators into rethinking and reforming education to become a vehicle of knowledge, thought patterns and values for building a sustainable world [2]. In the Talloires Declaration, 356 university leaders from 49 countries committed to "ensure that all university graduates have the awareness and understanding to be ecologically responsible citizens" [www.ulsf.org].

The profession of industrial design (ID) is greatly implicated in the current environmental crisis. By working hand-in-hand with some manufacturers who relegate ethical responsibilities as secondary to economic profit, industrial designers can get involved in promoting a culture of product obsolescence, flooding the market with unnecessary products, and encouraging mass material consumption [6].

Over three decades ago, in one of the world's most widely read books on design, *Design for the Real World*, educator Victor Papanek exposed the potential of industrial designers to contribute to ecological damage. He sourly wrote that "there are professions more harmful than industrial design, but only a very few of them... by creating whole new species of permanent garbage to clutter up the landscape, and by choosing materials and processes that pollute the air we breathe, designers have become a dangerous breed" [7]. He passionately challenged the mainstream design profession to redirect its activities from one which fosters conspicuous consumption and rapid obsolescence to one that advocates social ethics and environmental responsibility.

It is understood that the process of transitioning to a truly sustainable society will not happen overnight: it requires a massive social transformation, or perhaps radical lifestyle changes [8]. Manzini [1] blames design for being a "dis-enabling or dis-involving agent", because it promotes products that reduce the abilities of individuals and communities to actively deal with the most diverse aspects of daily life. Design is often oriented towards increasing convenience, consequently reducing the user's participation and promoting an unsustainable passivity.

Caution should be heeded, however, in viewing designers solely as the root of the problem, because they are also a very rich source of creative solutions [9]. Designers have an enormous potential and opportunity to propose solutions that could mitigate the global ecological crisis, and to use the power of design to inspire people to act towards improving our natural environment and our quality of life [10].

As there can be no responsible design without a responsible designer [11], design education should be redirected to the development of an ethical designer, one who could rethink and radically "design out" design that begets environmental problems [12]. ID practitioners and students should be aware of the potential ecological and social impacts of our profession, and we should persistently aim to minimize these impacts [10]. Indeed, design education for sustainability can help

usher a promising future by transforming the industrial designers of tomorrow.

The Model Code of Professional Conduct for Designers, adopted by the International Council of Societies of Industrial Design, recognizes that every designer should "accept professional responsibility to act in the best interest of the ecology and of the natural environment" [13]. In 2001 industrial designers worldwide declared that "industrial design will no longer regard the environment as a separate entity" and that "we, as global designers shall pursue the path of sustainable development by coordinating the different aspects influencing its attainment, such as politics, economy, culture, technology and environment" [14].

2 Sustainability in Design Education

International studies on the integration of sustainable design education in architecture [15], engineering [16], interior design [17] and mixed design disciplines [18] have generally shown that sustainability issues are hardly penetrating into core design programs.

Among American ID educators, 12 percent reported ecodesign to be integrated in some fashion in their curricula [10], while in Australia an average of 12 out of every 100 credit points earned for an ID degree were found to have environmental sustainability content [19]. A study of Italian university design courses show that in the last 10 years there has been noticeable improvement in the incorporation of environmental concepts in both the theoretical and practical content, but there is no consistent educational framework for covering sustainability in the courses [20]. Recently, a survey of ID program leaders from 221 universities worldwide found that the majority of ID programs around the world include 17½ percent or less of sustainability content into their curricula [21].

At the University of New South Wales (UNSW), the learning of sustainable product development is covered within the mainstream third year course IDES3221 Industrial Design Studio 3A. Historically this course has had a focus on technical resolution, documentation to a professional standard, and working on projects with "real-world" constraints, but in 2003 the course has had an added emphasis on sustainable innovation. The course aims now included engaging students into using sustainable design as a strategic methodology for industrial design activities, as well as recognize the industrial designer's responsibility in creating less environmentally damaging solutions and lifestyles.

This integration of sustainability within the ID curriculum at UNSW is in alignment with the university's strategic vision and priorities, which affirms that sustainability is one of its eight values [22] and its belief "that the principles of environmental sustainability should underpin and genuinely apply to all activities in which we are involved" [23]. UNSW also recognizes that "sustainability, equity, and diversity are key elements in the learning and teaching planning process" [24].

Sustainable design, as we define it within our curriculum, is the design of products and systems which comply with the principles of economic, ecological and social sustainability; in other words, design that is not only economically viable but also environmentally benign and socially equitable.

Several project briefs carried out in the last four years of the third year ID studio course touched on both ecological and social-cultural aspects of design for sustainability. Typically the 14-week course engages students with three different projects, and each project runs for about 4 or 5 weeks.

2.1 Ecologically Responsible Design

Invariably known as "green design", "ecodesign" or "design for environment", ecologically responsible design is a reaction to the belief that our current global environmental crisis stems from conventional market-driven design and mass manufacture, which often fail to consider the impacts of consumerism. Through clever design informed by impact assessment, ecodesign minimizes environmental harm while maintaining quality of life.

Like most other design courses having a first go in sustainable design, our ID studio course initially concentrated solely on green design and did not cover the other sustainability aspect of promoting an equitable society.

Strategies and tools outlined in ecodesign manuals [25, 26] were mostly used to help students learn design for environment and understanding impacts of products at various phases of their lifecycle. These strategies include prescribing materials with lower environmental impacts (non-toxic, low embodied energy, renewable, recycled or recyclable, etc), designing for recycling or reuse, efficient usage of energy or water, lightweighting, transport volume minimization, dematerialization, consideration of disassembly and recyclability, lengthening product life, optimization of distribution, cleaner production, and so on. Environmental assessment was also learned via such

tools as the MET (materials-energy-toxics) matrix and simplified LCA (life cycle analysis). A half day is often devoted to a hands-on exercise in disassembling small appliances and doing an LCA calculation, in order to gain an understanding of the individual material and energy contributions to the total ecological impact of a product.

As studio design projects within the course, the challenge was to come out with solutions which are less ecologically impacting than their reference products, particularly by using significantly less nonrenewable resources and generating fewer emissions "from cradle to grave". In presenting projects students argued for the "greenness" of their design solutions. The creative outcomes of these ecologically responsible design projects are discussed elsewhere [27].

3.2 Socially Responsible Design

As the years went by, the studio started to include projects that were focused towards societal sustainability. This third pillar of the "triple bottom-line" sustainability model tends to be under-discussed since the spotlight is often on the economic and ecological aspects of sustainable development.

Socially responsible design is a broad topic encompassing such global, national, regional and local issues as crime reduction, quality education, health improvement, social inclusion, fair trade, government responsiveness, economic policy, and ecology [www.sociallyresponsibledesign.org].

The social responsibility projects tackled in IDES3221 are certainly not the usual types covered most ID studio degree programs. In 2003, we worked on innovating toilet facilities in schools, and the following year on preempting criminal behavior through design. In 2005, just 2 months after the deadly Indian Ocean tsunami, the class worked on generating creative yet practical solutions for disaster preparedness, response, relief and reconstruction. In 2006, students created innovative street furniture elements that help give public spaces their "sense of place", making them more meaningful and more pleasurable for the users of those public spaces. These projects are reported in another paper [27].

From 2004 we started to consider the emerging phenomenon of sustainable "product service systems" (PSS), which is an "innovation strategy shifting the business focus from designing and selling physical products only, to selling a system of products and services which are jointly capable of fulfilling specific client demands" [28]. Because of their potential in offering dematerialized solutions

and in enhancing resource productivity, there has been considerable discussion that PSS could lead to ecological or social sustainability benefits, though not necessarily automatically.

3.3 Enabling Sustainable Behaviors

Since 2006 the focal point of the third year ID studio shifted towards empowering the community to adopt behaviors that are more sustainable, both in a social and environmental sense. This new studio approach was inspired by the “enabling sustainable solutions” methodology proposed by Manzini [1], in which an integrated system of products, services and infrastructures is used to empower individuals and communities to achieve results and solve problems using their own skills and abilities, in a sustainable way. These “social innovations” are driven more by behavioral changes than by technology or market changes, and typically emerge from bottom-up processes rather than top-down. This system tends to have a low material and energy intensity in production and consumption, and restores and regenerates people’s contexts of life.

The intention for these new “enabling solutions” projects in the studio is not just about coming out with a design solution that has reduced ecological burdens in its manufacture, use or disposal: the design itself is already expected to be “green”, as all designs should be. The task is about designing a product or system that helps people change their current unsustainable attitudes into ones which are more positive. An added criterion is that the design should not carry out the sustainable behavior automatically for the users, but should empower people to do the sustainable acts themselves. Manzini refers to such designs as “super-kits” or “sets of tools for new capabilities” [29].

To start the projects, students were given readings, lectures or workshops on behavior change strategies [30], on product service systems [28], on technical means for making the home less environmentally impacting [31], on radical design-orienting scenarios for sustainable everyday living [32], and on facilitating discussions.

The readings on behavior change provided the grounding that people don’t engage in sustainable activities partly because they perceive that there are significant difficulties or barriers associated with engaging in it, or believe that it is simply easier to continue to engage in their present behavior [30]. Moreover, people are naturally attracted to behaviors which offer the most benefits while presenting few barriers.

In 2006 students were allowed to freely choose which segments of the community to target.

Through interviews during the research phase, students attempted to understand common habits among community members and determining “unsustainability” gaps which could be bridged.

Many exciting student proposals resulted from this 2006 project, all enabling members of the community to contribute towards sustainable living:

- simplified system for sharing tools, equipment and appliances with neighbors, by Wing Yin Lam and Katrina Cheung.
- electronic transaction receipt that eliminates need for printing paper receipts and facilitates consolidation and monitoring of expenditure and consumption, by Christopher Smith and Richard Munitz.
- family shower timer that encourages competition between family members as to who can take the shortest shower, by Mitchell Brown and Renee Mathers.
- do-it-yourself “drip kit” for fixing leaking faucets and showerheads and clearing sink blockages, with an illustrated instruction manual, and offering a cash-back scheme off the household water bill via the government’s water conservation program, by Ainslie Asher and Shane Calnan (Fig. 1).



Fig. 1. Kit enabling householders to fix their own leaks and save water from going down the drain.

Recognizing that the university is a community in itself, the project was expanded in 2007 to involve seven UNSW-operated entities on the main campus in Kensington. With the support and keen facilitation of the UNSW EcoLiving Centre and its EcoColleges initiative, the studio was able to enlist the participation of the four childcare centers (Honey Pot, House at Pooh Corner, Kanga's House, and Tigger's Place) and three residential colleges (Basser College, Philip Baxter College, and Goldstein College) on campus in a move to brainstorm ideas for reducing the ecological footprints of their units and for overcoming stumbling blocks to fostering new sustainable behaviors. Alliance with the UNSW Environment

as possible and who are prepared to accept limited variety and customization.

- “slow” solutions that help those who are prepared to bring their personal abilities into play and to commit the necessary time and attention to achieve a high level of quality.
- “co-op” solutions that help to obtain results based on collaboration between different actors, which require personal commitment and especially a spirit of enterprise and organizational capacity.

Periodic comments and suggestions from the project cooperators, tutors, peers, and “clients” endowed students with directions on their endeavors and shape them into highly-resolved realistic solutions. [It should be noted that the CCs and RCs are collaborative partners in this project but are not “real” clients, since they do not have the means to engage in real product development or manufacturing of the student proposals. All of them were however interested in the creative proposals and were very helpful in providing feedback to make the proposals work within their contexts.]

During the concept stage, numerous proposals initially focused on devices which will help provide information, promote awareness or improve attitudes. However, since many studies show that simply providing information rarely results in real action or changes in behavior [30], these awareness-type proposals were redirected towards ones which are likely to dynamically involve and engage community members towards truly understanding the consequences of their actions. From this discernment it is anticipated that they would adopt less environmentally damaging behaviors.

The final design solutions were detailed in technical drawings and fully-finished appearance models, which were displayed in a public exhibition with the “clients” and other UNSW staff in attendance. During the exhibition, students presented their work not only to tutors but also to at least two peers for assessment.

The student proposals can be generally categorized into three clusters: energy-saving, water-saving and waste-reducing. Some of the most innovative solutions to help preschool children to engage in sustainability include:

- A symbolic flower-shaped sensor on the kids’ desks, by Christopher Barlin. When the petals of this sensor close due to the room getting too little natural light, the kids would prompt their teachers to open the blinds to let natural light in.
- A faucet that draws water from a finite reservoir, whose contents have been foot-

pumped by the kids, by Andrew Bezzina. The reservoir filling process educates children to conserve, to work for their needs in a fun way, and to respect the water they produced and not waste it.

- A worm farm garden pot formed by colorful interlocking bricks, to motivate children to get hands-on experiences in composting, planting, harvesting, by Xiao Xi Ju.
- A fish-shaped faucet with a gauge and color-changing eyes to indicate unsustainable zones and a bell to signal appreciation that the tap has been properly closed, by Kenneth Seeto.
- A retrofit drip switch which allows kids to easily pause the water flow while scrubbing hands with soap, instead of having to rotate the tap controls, by Dat Huynh.
- An aquarium-like tank near the kids’ sink troughs, by Simon Taylor. Filled at the beginning of the day, it visually demonstrates the finite water supply available to the kids.
- A plant growing system that engages children in natural processes and the importance of water, by James Wansey.
- A light switch system which allows room users to control which areas to light up rather than have the whole room unnecessarily lit, by Daniel Connell.
- A temperature-sensitive graphic display that can be clipped on existing water taps, to aid kids in visualizing the volume of water running while they wash their hands and to prompt them to turn the tap off after they’re done, by Jessica Chee [Fig. 4].

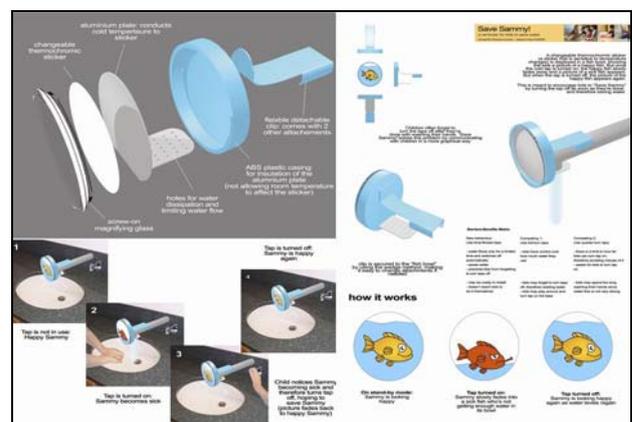


Fig. 4. Thermochromic display on taps show kids to use just the right amount of water for hand washing.

Childcare directors and staff responded optimistically to the solutions presented. Their major

comments centered on the aspiration that the proposed solutions would teach children responsibility for their day-to-day actions, and that they would continue these learned sustainability skills at home beyond the childcare hours.

For the residential colleges, some of the solutions students came up with:

- A wireless induction charging plate, so college residents can recycle energy in a fun way, by Eugene Cheong.
- A silicone frog that reminds a shower user of the amount of hot water being used, by changing color from green to red to symbolize the deteriorating health of a native animal, by Antony Grimes.
- A shower platform tank which collects the wash water and cuts off the hot water supply once the maximum shower volume is reached, by Xinnia Sutanto.
- A push-down plug and volume indicators on wash basins to make residents conscious of the amount of water used during their hand washing tasks, by Min Chung Kong.
- A chain-operated valve that temporarily switches off the water flow of a shower when the user needs to shower and soap, by Stanley Raguine.
- A lighting system for the college dining hall, which senses shared human presence to increase or decrease the brightness of the light, by Silvani TanLiang. This encourages residents to sit in tables in larger groups to obtain the optimum brightness to eat their food comfortably while saving energy and facilitating social interaction.
- A door-chain and light-switch system that required residents to power off the lights otherwise they wouldn't be able to leave their bedroom, by Kristina Golla [Fig. 5].



Fig. 5. Door chain on light switch can only be removed when light is powered off.

Most of the student proposals strongly factored in the budget constraints of the clients, and students

worked hard to ascertain that their solutions are not cost-prohibitive and do not require substantial infrastructural renovations to get them installed. Some of the residential colleges had undergone renovations just recently and therefore proposals which required reinvesting in massive installations were discouraged. Many students thus directed their efforts into retrofit solutions that were easier and less costly to implement.

Students were asked to critically reflect on their learning journey. These reflections generally show an appreciation of the challenges in contributing design solutions that would promote a better society and a more sustainable environment. Many commented positively on their experience of interacting with “real” clients outside the studio and on the “real-world” nature of the briefs.

Here are some reflections of the students:

- “I feel I have learnt a lot through out this project. As a designer it was good to be able to learn and design through the learning of sustainability because it is such a big part of our industry. I believe that sustainability is the way of the future. In future projects sustainable ideas and systems will definitely be in the front of my mind, in terms of the materials and systems involved in a product.”
- “This project has taught me the importance of interaction with the client, and how invaluable this experience can be. The fact that this assessment was based on a real-life situation is priceless compared to other assessments. I think that any design project can be easy if you're excited about your idea and if you're confident you can help someone with your ideas, and in this project I felt that way.”
- “This whole project has made me become much more aware of the environment and how vital it is for us designers to design sustainable products because of the mass production nature of the industry. Throughout the project I found myself making an effort to try and make a difference: separating paper, bottles, food scraps in the rubbish etc. I've even had all the light bulbs in my house changed to the energy saving type (all 37 of them)!”
- “To be honest, I was not all too excited about the brief at the beginning of the project. I had this notion where designing for a sustainable community was something that was somewhat bland, unexciting and, as one of my lecturers would have expressed,

pedestrian. However, once my research group got into the momentum of our findings, it was exciting when we were able to identify real world problems and find a way to solve these problems through design. It was at this moment that design and the brief itself became not just a task that was bland, but something altogether different. I treated it like a puzzle, a riddle, a game, where the aim was to somehow convince and change attitudes through clever design. As a designer, I have come to realize through this brief that designing is not purely all about what the designer wants, but rather what the designer can contribute to creating a better future. In our generation, that future lies in sustainability and designing for a more sustainable future. Personally, this road of sustainability is definitely the road I would love to travel down as an accomplished designer one day and I believe that my journey down that road has begun here..."

4 Discussion & Conclusion

Judging by the results of the innovative studio learning process, the Enabling Sustainable Behaviors projects could be said to be reasonably successful. Transformative learning occurred not only amongst the students but amongst the "clients" as well. One of the CC directors commented that after taking the students through the site visit she became more vigilant with the lights and water being unnecessarily kept running. Transitioning towards a more sustainable society certainly would take long, but could be jump-started through learning activities such as this studio project.

In spite of running almost completely against the grain of conventional product designing, students were able to challenge themselves with behavioral change designs and did relatively well. It is very likely that this could not have been achieved if the students were designing only within the confines of the studio and not "working" with and getting feedback from the external collaborative partners. The difference between designing in response to conceptual briefs and solving real-world problems is immense, and the student reflections certainly show that they favor working on real-world problems with real (or quasi-real) clients.

The projects were able to introduce all participants in this process to several student-centered approaches to teaching and learning for a more sustainable future: experiential learning,

enquiry-based learning, community based problem solving, and learning outside the classroom [34]. Students were able to engage in conscious critical thinking, investigation, active investigation, generalization, problem solving, decision making, reflection, and peer assessment. The experiences, knowledge, skills and attitudes they gained can be readily applied to new situations and to future project briefs.

The outcomes of this studio exercise are promising and motivates us to run this for another time. It was however a lot of hard work for myself as course lecturer-in-charge, having to orchestrate the projects and coordinate with a lot more externalities compared to, say, making the students respond to a hypothetical competition brief. The project required numerous planning meetings and exploratory discussions with the collaborators, as early as the year before this project was run. The public exhibition of the student works also required looking for some program funding and organizing the event.

The experiences gained from these sorts of projects show that students appreciate the challenging nature of briefs with aspects of sustainability and participatory design, and their reflections point toward a growing desire to be more responsible future practitioners in the industrial design community.

The third-year studio has been an opportune spot within the four-year industrial design curricula to actively engage and influence young minds about their future responsibilities to the planet and to the people, when they practice as design professionals. The work that these new industrial designers will generate will have an enormous impact on the future, and it is our duty as their mentors to empower them with authentic learning and ensure that they conscientiously grow with the belief that they should actively be part of the sustainability solution, not the problem.

As the Earth Charter's preamble states: "We stand at a critical moment in Earth's history, a time when humanity must choose its future." [35] As educators of the designers of tomorrow, we should actively see to it that this future holds great promise for the generations to come. It is our job to inculcate in the next generation of designers an understanding of their strategic roles in the future: that of thinking and creating solutions which not only advance a better quality of life for human society but uphold a more habitable world as well.

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