

TEACHING DESIGN AND ENGINEERING: A REVIEW OF PRODUCT  
DESIGN ENGINEERING PROGRAMS OFFERED THROUGH THE  
FACULTY OF DESIGN, SWINBURNE UNIVERSITY OF TECHNOLOGY.

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**Key Words:** *Industry, Experiential learning, Design, Engineering, “cultural Engineering”*

**Introduction**

Traditional Industrial Design courses consider the design of products, services and systems within a context of understanding changing social issues, aesthetic sensibility and an understanding of Design history and art history and related practices<sup>i</sup> while traditional Engineering courses empower students to fully investigate new materials, emergent technologies and Engineering tools.<sup>ii</sup>

The challenge for our new Product Design Engineering course is to take the best of both and educate tomorrow’s product designer.

**Objectives of the research:**

- To reflect upon a decade of teaching a new hybrid undergraduate course – Product Design Engineering (BEng) and its more recent post-graduate extension (MDes).
- To suggest when Engineering and Design should be taught together as an integrated subject and not side by side in parallel.
- To reflect upon nomenclature and inter-Faculty opportunities.
- To reflect upon our inter-disciplinary and inter-Faculty teaching programs which aim to break down the perceived schism between Design and Engineering, and
- To teach Design and Engineering together, as Product Design Engineering, in an experiential learning<sup>iii</sup> environment.

**Methods:**

What the National School of Design (now the Faculty of Design) did in setting up Product Design Engineering:

1. Reviewed alternative educational models
2. Responded to industry need
3. Met IEAustralia accreditation
4. Finally, set up the program

Industry demand for graduates capable of understanding, managing and working within complex hybrid Design and Engineering environments provided the initial impetus behind the

development of the Product Design Engineering undergraduate program<sup>iv</sup>. The Institute of Engineers Australia (IEAUST) provides a valuable service in ensuring University programs meet the mandatory requirements for IEAUST accreditation and subsequent license for graduates to practice as fully qualified Engineers. The Faculty of Design has through synergies with the Faculty of Engineering and Industrial Sciences, within the Swinburne University, developed and tested an experiential learning model in which teaching and learning material is supported by a studio based lecturer from each Faculty. Whilst experiential learning (Design studio) is supplemented with modes of learning derived from a traditional Engineering paradigm, the Design studio is positioned as an environment in which theoretical elements are validated via application to industry based projects, user needs and applied research.

Within both the undergraduate and postgraduate context, the development of appropriate graduate attributes forms the basis for the continual repositioning and refinement of program content. Industry connectivity is positioned as paramount and takes its form in a variety of manifestations; lessons learnt from the undergraduate program, have been transferred and trialed within a postgraduate context.

While the extent, nature and value of History and Cultural Studies, and the use of the fine arts (such as experimental freehand drawing classes), within Design education is an ongoing conversation, its role within a traditional Engineering educational context is almost non-existent. The extent to which such a knowledge base differentiates Product Design Engineering graduates from conventional Engineering graduates is of primary importance, its role as a catalyst for understanding the value of emotive elements crucial to successful new product development both compliment traditional Engineering knowledge and have helped to ensure graduate employability within a wide range of Industrial sectors.

Conversely, Industrial Design graduates traditionally lack an ability to transfer and track concepts to the production stages of the new product development process; a stage previously dominated by Engineering graduates.

And so the student selection process is critical as candidates must demonstrate an ability to utilize both sides of the brain. Whilst undergraduate applicants can demonstrate this through the choice of subjects selected at school, postgraduate Engineering applicants are often challenged by entering experiential learning environments and an alternate paradigm. PDE offers:

- increased student demand, especially among young women
- increased student employability
- increased industry relevance
- increased Engineering rigor than is given to traditional Industrial Design students

#### **The approach or method used:**

- To merge History and Theory and cultural “studies subjects” from the Industrial Design program and the use of the fine arts (such as experimental freehand drawing<sup>v</sup> to enrich Design outcomes) with Engineering
- To merge theory and practice in the studio via a “new Design Nexus<sup>vi</sup>”.
- To reflect upon our inter-disciplinary and inter-Faculty teaching programs which aim to break down the perceived schism between theory and practice, and cultural

Engineering and mechanical Engineering, and so to give a fuller educational experience.

- To prepare students for industry and/or postgraduate study.

The New Design Nexus describes the series of parameters within which, we believe, all Designers must now operate. All design disciplines, whether Industrial Design or Product Design Engineering or Interior Design can be defined as “cultural Engineering.”<sup>vii</sup>. Put simply, all involve the planning and manufacture or building of consumer goods and services and spaces for the enrichment of human life. The Faculty of Design takes a blue-sky approach to anticipating the needs of tomorrow's society and providing appropriate Design responses. This approach may be defined as a New Design Nexus, a new way of Designing, taking into consideration the needs of a changing demographic, sustainability and new technologies. An awareness of Design history and art history and cultural studies and “art” methods of drawing and visualising Design outcomes helps facilitate these aims.

A three-way conversation occurs between student, the Engineering staff and the Design staff within a mutually respectful environment, facilitating the conceptual development and refinement of more appropriate products, spaces and services.

- Interdisciplinary studios: Industrial Design and Product Design Engineering are taught together at various levels of the program beginning with first year, reflecting current industry needs within both an Australian and global context.
- Interdisciplinary and inter-Faculty staff: Staff teaching into both Industrial Design and Product Design Engineering include, for example, a lecturer with a PhD in Design History. Product Design Engineering students travel each week to a nearby Swinburne campus to be taught alongside Engineering students to be taught by Staff from the Faculty of Engineering.
- Industry relevant topics: Choice of studio topics reflect industry and cultural needs – and have included female Product Design Engineering students re-imagining and re-designing various pieces of medical equipment<sup>viii</sup>, to products and services appropriate for different demographics (surfwear) demanding detailed awareness of past and current design trends, shapes, colours, patterns, graphics for surfboards.

In all cases, sustainability and appropriate material and manufacturing choices, responsiveness to changing human needs and new information communication technologies have been explored.

#### **An indication of the nature of the main findings:**

Engineering and Design supported one another within Product Design Engineering – neither was prioritised by either students or educators. During their studies, several Product Design Engineering students perceived they were becoming researchers (social researchers, new material and digital technology researchers) and Designers of new services and systems and not just makers of objects. This was in marked contrast to those Engineering students who typically graduate as excellent Engineers but have no interest or knowledge of social issues or history. Or Industrial Designers who are limited by a lack of Engineering skills.

The studios have acted as a vehicle for the development of transferable skills, appropriate for both local and global needs. The ‘new Design nexus’ has increased international

employability (in terms of both the quantity and quality of opportunities). Alternative (Design related) career paths can also be evidenced from a review of recently graduated students. The Faculty has, as a consequence, a growing number of Industrial Design doctoral students funded by industry and government.

## **Conclusion**

Whilst the undergraduate program supports the appropriateness of delivering teaching and learning material associated with Engineering and Design as a shared activity, initial manifestations capitalizing upon a parallel educational model were less successful within a postgraduate manifestation. However, the transference of an experiential learning environment to a postgraduate context was successful and aided in the development and refinement of an alternate postgraduate model: a tandem approach based upon delivering Design at Masters level to graduates of Engineering degree programs.

Product Design Engineering graduates have emerged as both competent Engineers and Designers<sup>ix</sup>. They have also, helped to define a new industry sector, one that only Product Design Engineering graduates can occupy: Product Design Engineering has now established itself as a profession in its own right<sup>x</sup>. And the new Product Design Engineering students become great team players able to work with “Design” and “Engineering” colleagues.

Industrial Design, Critical Theory and History and the use of the fine arts (such as experimental freehand drawing) should be included in Engineering Degree programs; it is possible to do so and still meet the mandatory requirements necessary for EIAUST accreditation. The art and Design history and cultural studies subjects within the Product Design Engineering programs can give Engineers a better awareness of current social issues, including changing demographics, sustainability and an appreciation for the history of the discipline.

Product Design Engineering can attract increased female student numbers over traditional Mechanical Engineering.

Finally, some of the Engineering rigor should be reinvested in Industrial Design courses such as an awareness of new technology, and higher Engineering level capabilities.

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<sup>i</sup> The authors are unaware of any Industrial Design undergraduate courses in Australia or internationally teaching Engineering content to IEAUST (or equivalent) levels

<sup>ii</sup> The authors are unaware of any Engineering undergraduate courses in Australia or internationally teaching Design history and art history nor freehand drawing with an “art” emphasis. While it is true Monash University in Melbourne offer Double Degrees in Engineering and Design, these degrees are taken separately, in parallel, by the student, are never integrated into the same degree as is the case with PDE.

<sup>iii</sup> Experiential learning is often described as “learning by doing”. It has always been central to Design and art education, but is new to the teaching of Engineering. Swinburne University of Technology has moved to embrace experiential learning in all of its Facultys. A restructure of our education provision has been authored by Associate Professor Margaret Mazzolini, Director, Curriculum Development, and Professor Dale Murphy, Deputy Vice Chancellor (HED) entitled *Curriculum Framework Project* (November 2004). They aim to renew learning and teaching approaches by “trailing experiential learning and promoting active learning & cross disciplinary approaches...”

<sup>iv</sup> Swinburne University of Technology staff worked closely with industry and the Glasgow University/ Glasgow School of Art to establish the initial manifestation of Product Design Engineering. See the following website for information about Glasgow:  
<http://www.mech.gla.ac.uk/Undergrad/Handbook03/>.

<sup>v</sup> Lectures are given showing artists including Georges Seurat, Henri Matisse, Vincent van Gogh, Egon Schiele and Juan Gris, using non-design “art” materials such as charcoal, ink, watercolour, gouache, cut paper and non-design “art” techniques such as frottage and collage. The projects of experimental Designers who follow their lead are then discussed. These lectures are followed by experiential workshops in which the artists, designers, and their use of art materials and techniques is emulated by the student and applied to current PDE studio projects.

<sup>vi</sup> This phrase was first coined by Dr Lyndon Anderson in a paper given to in a paper given to Graphic Design Teachers Association. University of Melbourne, in 1998.

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It is a succinct definition of Industrial Design which has now been embraced by the Faculty.

<sup>viii</sup> In the case of one recent final year female student, the hard medical machines were “feminised” through the use of less interventionist user interaction with the machinery which made it seem less threatening. The final design of the machinery was softer in shape, graphics and colour.

<sup>ix</sup> The Swinburne University of Technology website provides a full description of the Product Design Engineering program: <http://domino.swin.edu.au/cd31.nsf/Open/PDE50>

<sup>x</sup> Swinburne University of Technology is currently connected to a variety of Cooperative Research Centres, many of which are linked to the development of emergent technologies. The Product Design Engineering program has been instrumental in providing inter-Faculty research teams capable of delivering high-end applied research through CRC linkages. Also, internationally and locally, the discipline has a growing body of literature in academic journals such as *Journal Of Product Innovation Management*, *Research in Engineering Design* and *Journal of Engineering Design*, and books such as Karl T. Ulrich and Steven D. Eppinger *Product Design and Development* (McGraw-Hill 1995, 2000, 2004).