INTERNATIONAL DESIGN STUDIO PROJECT: AUSTRALIAN FINDINGS ON PREPARING INDUSTRIAL DESIGN STUDENTS FOR THE GLOBAL EMERGING ECONOMY

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ABSTRACT
Following a presentation in the previous EPDE 08 Barcelona Conference, this paper reports on the progress and Australian findings relating to an international collaborative and distributed design studio project extending over four years between universities in Australia, the Americas and later interested parties in Europe. Primarily the project was run from a third year industrial design studio unit at University of Western Sydney and later it benchmarked Australian students with counterparts elsewhere in Canada (Alberta University) and Chile (Metropolitan University of Technology). While this is an ongoing project still to reveal more results and further joint assessment with partners abroad, this paper builds on previous conference papers explaining more precise structural and technical details to extrapolate lessons learnt and offer some of its main outcomes to others for consideration.
Thanks to using latest design, communication, prototyping and simulation technologies, the project focused on challenges to

- Education to achieve intended learning outcomes confronted with issues of globalization, heterogeneous base and retention constrains,
- University as gatekeeper of professional standards while confronted with technological changes and new distributed professional, manufacturing and production developments,
- Research on teaching and learning, new methodologies and process relating to design, manufacturing, implementation and delivery of products and services
- Development of new dynamics of work and production through distributed means of communication and manufacturing (internationalization and globalization of design)

Keywords: Action research, applied research, criterion referenced assessment, socio technical networks, learning by doing, evidence based learning, collaborative design, creativity in education, new pedagogic paradigms, rapid product development, evaluation and assessment, inclusive design, transformative learning, sustainable design

1   INTRODUCTION
The main objective of this international design studio project is to establish whether we enable industrial design students to gain the skills and knowledge to engage with the global economy in the area of Industrial Design at a standard equal to or better than that achieved elsewhere in Australia and overseas. The view is that this is not only a local issue and it has global implications that affect first world and developing countries, north and south, east and west divisions alike. The work with our partners abroad has helped in the process of reviewing and assessing current and new design education and profession, data, tools, teaching, design and professional methodologies that contribute to the professional development of Industrial Design graduates. After four years, this project now enters its new incarnation with a number of findings in Australia that bring about both, further understanding of the current design, innovation and manufacturing dilemma and some findings that may help surviving this new economic crisis.

In fact, the present quandary does not seem to be as much one of available technology but one of implementation and its human factors implications in today's fast, globalized, interconnected and mobile world. Technology is not a neutral tool for development and progress. It cannot be disassociated from its context, history, ideology and politics. It has developed to finally catch up with

the expectations of early intellectualization about its role in society and culture. However there are still many problems for the smooth application of technological solutions [1].

It is said the technological development of the last four decades have been faster than the speed societies and cultures evolve, leaving a void in their capacity to accommodate and find a place for it beyond its mere functional related use. In a freer global market economy, design, product development and production are no longer framed by geographical boundaries. Increasingly, the creative process requires more specialized solutions coordinated by the work of multi and interdisciplinary project teams that no longer exercise their professions or trade in close by locations. There is a raising trend towards shifting and segmenting projects between suppliers, teams, production and their components according to price, labor cost and speed of delivery [2]. In addition, the modernist radical search for authenticity and the postmodernist era of individualist skepticisms have come and gone giving way to a new period of post–postmodernism also known as pseudo-modernism [3]. This period is characterized by a generation apparently free and independent, inventive and expressive, who does not seem committed to earlier visions of social change and implications related to their technological means, ignorant "of the content conveyed by it" [4]. That generation is present now as students and designers in our educational and professional systems. Furthermore, they represent a fast increasing demographic of our consumer market.

Aware of that context, the Australian component of this project runs as a design agency/studio and production environment with standard constrains and processes concerning to time, cost, negotiation, tendering, costing, development, manufacturing and implementation. The theme of the assignments is focussed on Exercise, Learning and Movement (equipment for development and maintenance of gross motor skills). The target market is early childhood 3 – 6 years old and senior citizens. Students must fit to constrains of play and entertainment, high tech manufacture – low tech application, social innovation, and sustainability. The theme was chosen to accommodate to similar needs for design agency indifferent to geography or stage of development (Australia, Canada, Chile, Germany, and Netherlands). On one side there is a reduction of birth rate and the increasing need to resolve their health (i.e. obesity, diabetes), education, socialization, etc. On the other, the population is growing older and also needs to deal with obesity, health, lifestyle, self-sufficiency and socialization issues in cost-efficient ways.

The project and the unit where it is taught have been considered by students as challenging and positive contribution. They have said it represents a landmark to them and identify a before and after in their learning. The unit is expected to fill any voids left from previous years, a learning leveler, since it is the last creative design studio subject before students in Design and Technology finish after three years of study and Industrial Design counterparts move to final year project (Honours, Coursework). The project is now focused in the scaling up and modulation of outcomes applied to other subjects in addition to the outcomes reported in the last presentation to E&PDE in Barcelona in 2008; such as self marking (fail, pass, credit, distinction and high distinction), group cognitive dynamics interaction, social distributed network setting up, small university funding for research, etc.

2 METHODOLOGY

The project works with a two directional methodology. Bringing inwards industrial and overseas input, and conveying outwards the typical Australian diversity of experiences, skills, ethnicity, language proficiency and background. Results so far query current creative education and partnerships within a socially relevant design context. That is an edge that is not common for Australian universities since they do not usually measure themselves beyond the academic environment (Fig. 1).

The work of students and project serves greatly from a learning by doing approach and the application of CDIO Syllabus (an acronym for Conceive — Design — Implement — Operate) by assembling and organizing content and goals through a threefold strategy: to create a structure whose rationale is apparent; to derive a comprehensive high level set of goals correlated with other sources; and to develop a clear, complete, and consistent set of detailed topics that facilitate implementation and assessment [5]. In addition, students are taken through practical techniques of new product development (NPD), hands on work on product life cycle (PLC) and product lifecycle management (PLM) by the way of idea generation, design, market launch and performance, concepts of requirement capture process (RC) and its process of identifying customer, user and product interaction, market needs, design and technical needs [6].
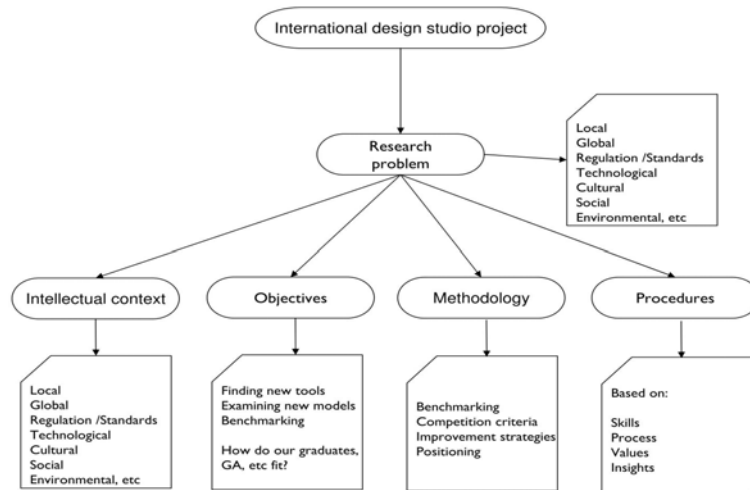
Figure 1. Project research taxonomy

Students have been given a feel of professional life with access to industrial experts and political authorities in both continents, state of the art rapid prototyping and modeling facilities. In 2005 classes started to be recorded to assist with team work, group dynamics and evaluation. Also podcasting and vodcasting of work and pertinent video clips were set through WebCT. Progressively virtual classes through videoconferencing, Skype, blogs and other facilities were set since 2006. The project pursued the creation of a 'socio-technical collaboration' brought about by concepts of 'working together apart', 'role playing', 'authorship', 'ownership' and 'intellectual capital' based on group and self evaluation and marking. Students work has been tailor made to fit each group own brief according to a criterion referenced approach with moderation, assessment and feedback. Ultimately, the goal pursued is for students to take full responsibility and ownership, develop and test their critical judgment [2]. Qualitative findings have been achieved through the application of action research methods with students' role playing and swapping positions through the evolution of the project. Different groups and individuals acted alternatively as designers, clients, students, lecturers, suppliers, manufacturers, users, markers and judges of each other and themselves with the creation of a healthy competition, ownership and critical judgement. A new team partner from Alberta University, School of Design in 2007 increased the project action participatory research potential to a five way feedback process of self assessment, blind, group and lecturer feedback, and Canadian and Chilean feedback and marking.

Essentially the project is moved by a set of rules of evidence and discourse model similar to Action Language Theory, part of new management and organizational disciplines. The work follows a movement shifting between different quadrants. In a first stage, the provider (i.e. lecturer) agrees to the customer's (i.e. student) requests or the customer agrees to the provider's offer. Different types of value, such as symbolic, pragmatic, financial and environmental are considered here. There can be agreement if there is an intersection of customer and provider concerns. Once an agreement is reached, both provider and customer commit to it and proceed to the next phase. This operation repeats as long as there is intersection between both parties' concerns and resolution until reaching agreement and moving to a next stage of request, offer, commitment, declaration of completion, assessment of satisfaction context setting (Fig.2).

Figure 2. Atom of work: Rules of evidence and discourse model (based on F. Flores model [7])

3 FINDINGS

Industrial design has been heralded for more than two decades as one of the most important key disciplines to have fundamental effect in a country economic growth due to its gravitational effect within the current pushing and pulling of local, regional and global power. It is said, the proper use of industrial design can make the difference for industrialized countries; so they can keep their hegemony in front of newly industrialized and emerging economies. Manufacturing industry alone is no longer sufficient to keep abreast of competition.

That raises questions whether it is the role of universities to be gatekeepers of professional standards while confronted with technological changes and new distributed professional, manufacturing and production developments. Understandably, that is a challenge for those institutions in Australia since it is said "we continue to live in an 18th century social system while having 21st century forces of production at our disposal" [8]. In addition, there is a division among the ones in favour of university and industry collaboration on one side and the others against it because some say academia should care about teaching the basic principles and standards. Subsequently, some would prefer teaching creative practices in isolation from the socio-technical and economic context.

On their part, students have noticed those different trends and compared them against the information produced by the project, its social network interaction and the work and support received by participants in other parts of the globe. As a typical generation growing up in a consumerist post-modernist era, they are very smart reading the big picture and discerning quickly what is beneficial for them because they are generally time poor at university and want to get value for money,. Furthermore, a number of them have questioned the currency of academic standards and whether the basic skills they pursue are the same as the traditional skills a design school teaches them. While still in progress, the analysis of ethics approved oral and written surveys has shown that group attitude before starting this design studio unit ranged from believing in the mark as the ultimate reward for learning (a persistent high school teacher dependency habit) and aesthetics ("the only thing that matters is if the model [prototype] looks good, not that it works") to apprehension relating to the real benefits their learning may represent in comparison with outside industry demand. Fortunately, students' involvement in the project has turned many into valuing successful industrial design as a systemic solution in an equation formed by process, product, person (i.e. designer, client, student, and user) and context. That relative change of heart in students seems to be the result of following a user-learner focus approach as recommended by Biggs and Tang [9] and in addition the opening of the project to them. They can appropriate and develop it, assess and mark performance and quality of learning together with the lecturer and according to identifying assessment criteria they have helped creating for themselves, other individuals and groups.

The project intends to break away from both old student dependencies to the lecturer, a master/apprentice relationship students have when coming to the unit and the pursuing of aesthetics that is still prevalent in many Australian design schools. There, schools and lecturers continue to function as an extension of a fine arts environment where the ability to make the object is *the rigueur*. Aesthetics, while important, is not the end purpose of industrial design. Often aesthetics occupy the centre of design discussions when there is a lack of purpose and evidence of clear design solutions. On the other side, the information age needs to be fully acknowledged beyond mere manual or computing skills. One thing clear coming out of this project is that teaching of basic design needs re-interpretation. Design fundamentals need to be expanded and actualized from the classical design schools such as the Bauhaus. The clearer it becomes for students there is a disparity between the teaching received by educational institutions and the pace of development in technology when they compare institutions, curricula, etc, the quicker they run the risk of becoming alienated, disengaged and disenfranchised again from each other and by the establishment they are in; a lack of institutional identification and representation (school, workplace). The project acts promptly to avoid stagnation by keeping a professional design studio agency pace following similar steps to other successful design studio projects such as the one mentioned by Lewis and Bonollo (2002). However, the tasks of clarification, concept generation, evaluation and refinement, detailed design of preferred concept and communication [10] happen in the first 4 weeks of a semester. The same process used to take 14 weeks previously. Subsequently, the remaining 9 weeks are occupied in experimentation and applied research with the expectation that a number of prototypes (simulation and physical) will be developed before a final submission.

The project has achieved good results thanks to findings relating to basic and traditional skills according to age and role (i.e. lecturer, student). While no one denies the importance of learning basic principles of design such as following a brief, deductive skills, sketching and drawing techniques (rendering, painting), hand model making and text based documentation (reports, essays, etc) for the profession, students belonging to the Net generation seemed more comfortable with computers and technology based solutions, inductive skills preferring to discover instead of being told and visual literacy. The project is an open space to learn both deductive traditional skills and new indutctive skills according to task and requirement. Further validation to that predicament was found in the social sciences where different disciplines reach similar conclusions. "Whether the Net Generation is a purely generational phenomenon or whether it is associated with technology use, there are a number of implications for colleges and universities. Most stem from the dichotomy between a Net Gen mindset and that of most faculty, staff, and administrators" (Table 1) [11].

Table 1. Generations highlight trends

	Matures	Baby Boomers	Generation X	Net Generation
Birth Dates	1900–1946	1946–1964	1965–1982	1982–1991
Description	Greatest generation	Me generation	Latchkey generation	Millennials
Attributes	Command and control / Self-sacrifice	Optimistic / Workaholic	Independent / Skeptical	Hopeful / Determined
Likes	Respect for authority / Family / Community involvement	Responsibility / Work ethic / Can-do attitude	Freedom / Multitasking / Work-life balance	Public activism / Latest technology / Parents
Dislikes	Waste / Technology	Laziness / Turning 50	Red tape / Hype	Anything slow / Negativity

Mindful of that dichotomy there was a move to implement strategies and dynamics matching up university directions with current students' attitude and skills since when compared to previous cohorts: "they develop hypertext minds, they leap around. They lack linear thought process and many times the ability to or piece information together from multiple sources" (Table 2) [12].

Table 2. Net Gen skills and pedagogical principles comparison

Net Gen attention and attitude [12]:	SEVEN PRINCIPLES [13]: Technology as Lever / Good Practice (Chickering)
Attentional deployment: Selective quick attention shift between tasks according to interest	Encouraging Contacts Between Students and Faculty
	Developing Reciprocity and Cooperation Among Students
Ability to read visual images: Intuitive visual comm **Visual-spatial skills**: Virtual and physical integration	Use of Active Learning Techniques
Fast response time: Quick response and expectation of quick response in return	Giving Prompt Feedback
	Emphasizing Time on Task
Inductive discovery: Learning through discovery	Communicates High Expectations
	Respects Diverse Talents and Ways of Learning

4   CONCLUSION

Certainly the new paradigms of knowledge development create enormous pressure on students and professionals (academic and industry) to perform at higher levels. National frontiers and discipline boundaries are now blurred requiring more extensive scope and depth of expertise to stay in the game. At this stage the project has made evident a number of facts that affect creativity, innovation and design besides implications related to monetary issues. Some of them are similar to other global and virtual team projects such as difficulties relating to local and distributed virtual teams and dispersal of design processes with no seamless transition from traditional means of work, issues of long-term planning, lack of knowledge of current tools and communication technologies, experience about how to share ideas, documentation, interpersonal skills, etc. [14] There is the need of new paradigms of innovation to overcome the upcoming changes brought about by technology. Instead of recreating already done research and structures, it is imperative to generate new design structures, methodologies, and creative research that could build upon and extend further from old findings and experimentation [12]. The participants of this project, lecturers and students, are progressing in this venture by developing new argot of distributed design collaboration, their own ways of communication and distributing information that fit particular needs of personalization, mixing and re-mixing of content, entertainment and subculture. Taking upon measures of performance indicators such as the encompassing study on design studio practice and assessment carried out by de la Harpe et al (2008), this project works with the process, the product, the person [15] and adds his/her context

(university, internal, external, local, international, social, cultural, geo-political, etc) as the amniotic fluid keeping the system alive. It goes beyond the focus of traditional university testing such as CEQs focused exclusively on academic matters internal to a university environment. Those assessments do not take into account the fact that professionals interact with society — there are no references to professional endeavors involving negotiation, problem solving, interpersonal skills, project management, capacity for autonomous action [10]. The international design studio project is coming up with its specific repertoire of hard (cognitive) and soft (non cognitive) skills, building strength in their participants on top of weaknesses uncovered by comparison, sharing and collaboration. This year 2009 will be one of consolidation of outcomes, community and network of practice (Fig. 3, 4).
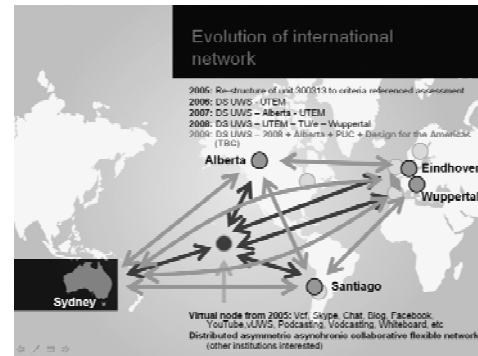

Figure 3. Custom House, Sydney Circle Quay   Figure 4. Network of Practice proposal for 2009

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