

# **PREPARING PRODUCT DESIGN STUDENTS FOR WORKING IN THE GLOBAL PRODUCTION ENVIRONMENT THROUGH PRACTICAL LEARNING**

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## **ABSTRACT**

Universities have identified the internationalisation of the curriculum as an integral part of higher education. The aim is to prepare students to perform professionally and socially in the global work environment. This ability has been described as ‘cultural intelligence’, enabling graduates to work positively and productively within culturally diverse work situations that may be very different to those they experience locally.

In practical terms this involves engaging students and staff in international based experiences that allow for the exchange of expertise and cultural norms to enhance a common understanding of attitudes and behaviours affecting professional and social practices.

In product design there is a discipline specific necessity to effectively communicate complex object ideas, detailed 3D specifications and aesthetic information with clients and manufacturers around the world and work collaboratively to ensure that the integrity of the design is maintained throughout its development. This may involve the designers going overseas but frequently it involves communicating via the web. This paper documents a practical example of introducing students to working with international partners (in this case manufacturers) by commissioning prototypes from a range of overseas suppliers. Consideration of the student experiences and product outcomes suggests how to prepare future students to operate successfully in collaboration with overseas prototype production partners. The aim is to provide a contribution to the internationalisation of the design curriculum supporting the development of the ‘cultural intelligence’ of the graduate for global professional practice.

*Keywords: Internationalisation, curriculum, prototyping, additive manufacturing*

## **1 INTRODUCTION**

Designers operate in an increasingly international environment, both in responding to a market opportunity and in working with overseas manufacturers and suppliers. The implications for product design educators impact the management of learning experiences both with regards generic student learning and in discipline specific terms. Just as businesses have had to become internationalised to operate in an increasingly global market, so education managers have increasingly had to address how to prepare their students for a global work environment by providing opportunities to experience – and develop understanding within - aspects of a global learning environment [1]. This is based on increased global interdependence politically, economically and environmentally, the increased mobility of students, and a perceived market demand for graduates who are ‘internationally-knowledgeable and interculturally-competent’ [2]. As Sinkovics points out, these competencies are still evolving in business as well as education and teaching strategies are still under development, but rationale for the internationalisation of undergraduate programs are still publicised, for example at Griffith University, Brisbane: ‘our belief that the acquisition of global awareness and an understanding of the diversity of cultures and societies on our planet is an integral part of education. It is essential to the development of global citizenship and our aim to equip our graduates for work in an international, multi-cultural, and multi-lingual environment.’ [3]

## **2 INTERNATIONALISATION OF THE CURRICULUM**

By 1995, 37 out of 38 Australian universities had already included policies of internationalisation in their corporate plans [4] and the OECD's Centre for Educational research and Innovation (CERI) defined international curricula as having 'an international orientation in content, aimed at preparing students for performing (professionally/socially) in an international and multicultural context, and designed for domestic students as well as foreign students' [5].

There are two main drivers for the internationalisation of the higher education curriculum; the first is about providing a relevant educational experience for international students. Haigh [6] discusses the idea that the 'Internationalisation of the curriculum is the process of designing a curriculum that meets the needs of an international student body,' and challenges course developers to 'design a curriculum that serves global rather than national priorities, which does not rely on prior knowledge of local provenance, where students from all sources share equal opportunities for advancement in an inclusive learning environment and which serves to introduce stay at home students to the demands of an increasingly multinational world of work.'. The second driver is to ensure graduates can contribute to a work environment that is becoming increasingly global [7]. For example, the Academic Board at Adelaide University, Australia, defined the internationalisation of the curriculum in 2008 as 'a curriculum with an international orientation in content, aimed at preparing all students for performing (professionally/socially) in a global context' [8].

### **2.1 Cultural intelligence.**

The term 'cultural intelligence' is one used by universities to underpin their approach to internationalisation. They define this as 'the capacity of individuals to adapt to different people from diverse cultures and the ability to manage this interconnectedness harmoniously and productively [9]. Product design students have long studied 'cultural referencing' as part of design, that is the identification of indicators of a sub-group that support the unification that group. Although the indicators themselves may be as straight-forward as a dominant influence in the production of form, the use of colour, pattern or shared recognition of signs and symbols (semiotics is part of the visual communication curriculum), the related cultural values are more complex. In a study of culture-oriented product design, culture was been defined as a 'shared set of basic assumptions and values with the resultant behavioural norms, attitudes and beliefs which manifest themselves in systems and institutions as well as material and non-material elements.'[10]. For Product Designers working increasingly in a world of different cultures the abilities to establish cultural parameters, read cultural framing and understand the impact of values and accepted norms of practice on interactions and expectations for professional outcomes is essential. Yet Moalosi et al highlight a lack of 'in-depth research and appropriate methods to assist designers on how culture can be consciously integrated in product design.' This is two fold, firstly for designers working in international markets and secondly for designers for whom part of the supply chain for their product is overseas. For designers addressing international markets, a successful product will be based on a deep understanding of the impact of a cultural framework on the perception and use of a product and its components. In the paper 'Culture Oriented product design' Moalosi et al discuss the layers of meaning and social practices that are manifest in good design and argue that 'values integrated in products give users their cultural identity'. If the designer is working with an international partner, for example a manufacturer for the production of a product, social norms such as accepted professional practices, embedded in cultural values need to be identified and their implications understood for positive outcomes. This is based both on the accepted values of the culture the designer is from, in terms of issues such as working conditions and sourcing materials, and in managing communication throughout a production process to ensure outcomes meet expectations. If this international experience provides the context for the graduate attributes that relate to product design students, then educators need to provide opportunities for students to develop those attributes.

### **2.2 Practical teaching strategies**

For universities wishing to internationalise their curricula, the provision of study abroad / exchange programs is an accepted strategy to prepare students for performing professionally and socially in a global context. These programs may be as long as a year and usually involve regular partner institutions with accredited programs. Alternatively, there are shorter initiatives, for example the

organisation of a trip to China as part of the photojournalism course at Griffith in Brisbane. In addition, universities may encourage less formal tours, for example staff and students from the University of Tasmania, Architecture and Design course have taken part in projects such as Architects without Borders.

However, in a workshop run by Leask [11], the importance of integrating internationalisation in the curriculum was emphasised. This begins with a 'reciprocal process whereby students and staff from diverse social and cultural backgrounds exchange expertise, knowledge and experiences to enhance their understanding and capacity to effectively live and work in changing local and international communities' [3] but goes beyond it to initiatives that enable students to be actively involved in student centred learning with an international component.

In product design, developments in communication technology have led to the innovative use of global design studios [12] as a teaching tool, allowing for 'real world' communication between students from universities on different sides of the globe. The 'real world' nature of the project allows for a 'significant' learning experience for the students, defined by Fink [13] as an effective learning experience for deep learning. This interaction suggests a model of work design students – and design professionals will engage with in the near future. Virtual studios that allow stakeholders, including clients and manufacturers, to participate in internationally will improve the reciprocal process of exchange that universities have suggested will enhance capacity to work with partners from other cultures.

Until the cost constraints and technological issues are brought under control for all universities, alternative teaching strategies have to be explored that can make a contribution to the internationalisation of the product design curriculum. Specific teaching strategies for implementing internationalisation in the curriculum have been suggested. Based on the publications [8] by the Adelaide Academic Board, these include:

- Set tasks that require students to discuss, analyse, evaluate information from a range of international sources
- Use experiences of international students as a tool to inform learning of all students in the course/class

In addition to the driver of internationalisation, educators are working within the requirements of student centred learning for the development of significant learning experiences. For this reason, tasks need to have meaning to the individual students and change their perspective as well as improve their knowledge and understanding.

### **3 STUDENT PROJECTS**

In product design there is a discipline specific necessity to effectively communicate complex object ideas, detailed 3D specifications and aesthetic information with clients and manufacturers around the world and work collaboratively to ensure that the integrity of the design is maintained throughout its development. This may involve the designers going overseas but frequently it involves communicating via the web. This paper documents a practical example of introducing students to working with international partners (in this case manufacturers). This includes the commissioning of prototypes from a range of overseas suppliers by product design students, in different materials and using different processes. The student experiences and product outcomes are evaluated, identifying issues for designing learning experiences, leading to implications for preparing the students to operate successfully in collaboration with overseas prototype production partners. The aim is to provide a contribution to the internationalisation of the design curriculum supporting the development of the 'cultural intelligence' of the graduate for global professional practice.

#### **3.1 Prototype Communication**

For students, creating full working drawings appropriate to the prototype maker most suitable for the item being developed is challenge enough when working with local makers. Creating working drawings to be read overseas by a maker for whom English is a second language adds another layer of pressure. Checking the availability of appropriate materials in that country, understanding the processes required as they are executed there, knowing the availability of hardware (such as specialist hinges) all involve finding information from international sources and therefore meet the teaching strategy for a set task supporting internationalization as suggested above. Dealing with queries via

email is more difficult than discussing issues face to face and has implications for teaching content to address the peculiarities of the medium.

Beyond the practicalities, there are cultural norms that affect choices made. For example, in the box model shown below, the student had a vision of a promotional product that reflected his projected profile that he described as 'cool and smooth'. His model was made in Korea. He did not specify a particular timber and he asked for a 'black finish', again without specifying, as he found it difficult to understand the manufacturing capabilities and material availability from their web site.

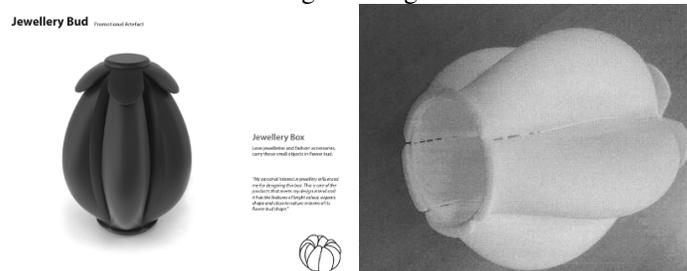


*Figures 1 and 2. Language difficulties created a mismatch between intention and outcome*

The student's assumptions that the manufacturer would interpret his instructions as he intended were based on the notion that there would be a shared understanding of the function of his 'promotional product' within the aesthetic ideas embedded in the written description he had provided of the 'impression' of the product. Instead of specifying the timber, or a specific finish, he chose instead to have the words 'to be finished to a high standard' translated onto the drawings. However, the term proved ambiguous and translated more closely to 'decorate to a high standard'. The completed model was made from MDF with a high gloss lacquer finish (both of which have negative associations in western design culture), with carefully cut and set in pink and blue abalone butterflies on the lid. The student had also included a logo based on his initial, the letter B, that he assumed the maker would recognize as a letter. Instead the maker treated the form as abstract and set it into the surface of the box lid in reverse. This project illustrates beautifully the dangers of not fully resolving a product, of translating instructions and of making assumptions about shared understandings of abstract ideas based on cultural norms.

### 3.2 Learning through making

Until five years ago, additive manufacturing was too expensive to be used as a teaching tool in the development of student models. Since then the cost of additive manufacturing methods, such as selective laser sintering, has halved at conventional suppliers. However, in addition, a new service bureau model has emerged that brings additive manufacturing within reach as a teaching tool. Shapeways [14], initially based in Holland but recently relocated to the US, is an online facility outsourcing additive manufacturing. In a comparison between a quote from a conventional in-house supplier and Shapeways, the cost of Shapeways was less than a quarter of the alternative and included free shipping. Shapeways currently has around 150,000 products online, with an estimated 10,000 new products being added each month. 1000 can be customised. They sell approximately 3000 products per week (with an average price of \$14) [15]. Price is determined by material and volume and is low enough that students can learn through making mistakes.



*Figure 3. Student centred learning through the correction of mistakes*

In Figure 3, the student specified wall thicknesses that were insufficient for the material chosen, leading to failures in the integrity of the wall. Shapeways did not charge the student for the unsuccessful model, but did make it without checking on its viability that then allowed the student to fully understand the results of the mistake. Ordering online through an impersonal service medium has the benefit on anonymity in testing ideas, building confidence, but difficulties cannot be discussed and addressed so if a student does not know how to address an issue, there is no provision to evolve solutions.

### 3.3 Design development

As a student develops a design through directed technical and ergonomic research and testing, competitively priced additive manufacturing allows for the refinement of ideas through evolving model design. In the model in Figure 4, draft angles could be worked out and checked prior to commitment to an injection molding jig, and in the nylon model on Figure 5, economies in the use of volume of material could be tested for their effect on function and strength, reducing the final cost of the item from \$40 per item to \$32 per item.



Figure 4 and 5. Low prototyping costs allow for refinement models

### 3.4 Undermining the learning benefits of the activity

The pill box shown in Figure 6 was manufactured in Korea at a cost of \$800 for 6. There were problems with the drawings that the manufacturer corrected without consulting the student. Similarly, the product in Figure 7 was initially specified by the student as an 'injection molded prototype'. This contradiction in terms was addressed by the maker who created a model from stainless steel and wood, again without consulting the student. Although this model worked to an extent as a visual model, the functional aspects of the model could not be tested on the model provided and it may have been that an alternative form of working model would have been more beneficial to the student. However, a lack of communication, combined with a substantial personal budget in both cases undermined the learning benefits of either project.



Figures 6 and 7. Problems of mistakes being corrected at a distance

## 4 CONCLUSION

As recent publications, such as Flannery's 'Here on Earth' ([16] highlight the importance of interconnectedness for the future development of the global economy, social responsibility and sustainability, the internationalisation of the role of the designer will need to be reflected in teaching strategies in product design education. This imperative will grow as the impact of developments in additive manufacturing is increasingly felt in the product design discipline over the next decade [15] and the landscape of product design altered with more on-line and co design projects. Students will need to understand the cultural referencing of their product designs and also the cultural norms that will affect production in different countries. Learning opportunities that allow students to interact with international markets and manufacturing can help develop those understandings. As the student projects here show, the commissioning of prototypes from overseas suppliers is now a practical proposition. However, as the project examples also show, supporting teaching content will need to include intercultural understanding and communication as it specifically relates to manufacturing, and the projects themselves be controlled to ensure the students gain the maximum benefit from the experiences and do not distance them from the decision making processes of prototype production with the miles that the prototypes themselves travel.

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