Is Design Education Preparing Product Designers for the Real World? A Study of Product Design Graduates in Ireland

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Abstract

This study aims to identify professional product design roles. It presents the results of a survey of 251 graduates from undergraduate product design courses. Data was gathered about graduate's job descriptions; the companies that employ product designers and the postgraduate education taken. The objective was to show how design practice has evolved and the effect that this has had on product design as a discipline. The results highlight the cross over between design disciplines, the integration of product designers across different industries and the variety of roles that product designers undertake. Implications for product design education are discussed and recommendations are presented.

Keywords: Product design, Design disciplines, Design education, Design practice

1 Introduction

The demands on design practice in the twenty-first century are significantly different from those of the past (Wormald and Rodber 2008). The nature of product designer's work has changed but there is little updated information on the employment roles of product designers. (Yang et al. 2005). Design has evolved from a narrow focus on aesthetic to include other areas such as services, branding, business strategy and technology (Design-Council 2007, Maciver and O'Driscoll 2010). The borders between design disciplines have disappeared with the different areas of design extending into each other. To date product design education has only been concerned with the physical components of products but today's designers also need skills in a broader range of disciplines and fields that are impacting on product design (Wohlfarth 2002, Weightman and McDonagh 2006). The shift is towards user centred design, strategic planning, innovative product development, sustainable product development and interdisciplinary collaboration (Beucker 2004, Kolko 2005, Grasso and Martenelli 2007).

The innovation process traditionally incorporated design at the later stages mainly for styling purposes but the practice of design has been evolving within New Product Development (NPD) with a move towards design driven innovation where the designer is at the core of the process to provide leadership and ideas (Veryzer and de Mozota 2005, Dell'Era et al. 2010, Perks et al. 2005). Designers need the cognitive skills involved in the execution of the design process, along

with skills, such as negotiation, problem solving, acceptance of responsibility for outcomes, interpersonal skills and project management (Lewis and Bonollo 2002). Companies are looking to designers to deliver innovation, establish brands and improve systems. They are using designers more strategically across their business to help them grow and compete more successfully in global markets (Burns et al. 2006).

As design becomes more embedded in society new practices are emerging (Broadbent and Cross 2003). Findeli (2001) describes the replacement of products by services which shape and impact on our way of life in areas such as health, education, leisure and food. Service design and design for sustainability are currently the fastest growing areas of design. The emphasis around people's needs or societal needs, involves new skill to address larger scopes of inquiry (Sanders and Stappers 2008).

Many problems faced now by designers are ill defined and require techniques beyond what is achievable by one discipline (Cross 2006, Jonassen 2008, De Vere et al. 2010). As a result designers are working on a broader set of design problems involving complex systems and working as part of interdisciplinary teams with the integration of specialist expertise where needed (Moritz 2005, Wohlfarth 2002, Dym et al. 2006). In order to create products that enhance the users experience and meet the needs of users this inter-relational approach is required and followed by progressive design companies such as IDEO, Ziba and Smart Design (Veryzer and de Mozota 2005). There is also a growing emphasis on ethnographic and observational research. Observing people using products and services can lead to the discovery of unmet and unarticulated needs which can lead to a break-through in innovation (Cooper and Evans 2006). The importance of prototyping at all stages of the design process, from rough mock ups to more detailed prototypes has been realised to solve complex problems, communicate, persuade and open up new possibilities of discovery (Kelley 2001).

Despite industry advances there is a belief that education is not supporting these opportunities and that product design students are not well prepared with the knowledge and skills required for employment when they graduate (Yang et al. 2005). Evidence has shown that currently there is no great link between design practice and design education (Roald 2006, Gajendar 2003).

There has however been a drive to advance design education as a result of initiatives from the UK and Irish governments and associated agencies to promote innovation and creativity in business (Cox and Dayan 2005, Intertradeireland 2008). In a review of the design sector in Ireland a report carried out by Intertradeireland (2008) found a level of cross over between the

professions. 41% of those who provide product and industrial design services also provide other services such as interior and exhibition design while 34% also engage in communications and graphics. The report suggests that while Digital and Multi Media and Communications Graphic design are expected to grow a decline is expected in the area of Product and Industrial Design due to a fall off in the development of products in Ireland with companies outsourcing design and manufacturing to other countries.

Students therefore need to be equipped with complementary skills to prepare them for a variety of roles in industry. Multidisciplinary education was also recommended for designers with visiting design professionals to connect design education with professional practice (Design-Council 2007, Cox and Dayan 2005).

There have been some advances in design education and new disciplines of design have emerged. 'Interaction design' was first introduced in the late 1980s and is offered as a program of study in some colleges and universities. 'Service design' started to take prominence in 2006 due to the first service design conference, Emergence 2006, held by Carnegie Mellon University's School of Design. 'Transformation design' was introduced in 2006 in a White Paper, published by the UK's Design Council. Each of these new disciplines incorporates several of the traditional design disciplines within it and many of these disciplines overlap (Stappers 2006). For example, service design integrates graphic design, information design and interaction design. Transformation design is about participatory practices and user-centered methods to address social and economic issues. It uses the design process to promote collaboration amongst a wide range of disciplines and stakeholders (Burns et al.2006).

There is much research and effort to advance design education with a move towards more student centred activity based learning approaches focusing on self directed learning, collaborative learning and learning related to practice (Perrenet et al. 2000, Dym et al. 2006, Yang et al. 2005). However some believe that design education is lagging up to ten years behind current design practice (Weightman and McDonagh 2006). Many product design courses are centred on the craft based Bauhaus style studio course and place an emphasis on aesthetics and form, teaching skills such as rendering and styling.

Davis (2008) suggests that the shift in the output of design points to a need for research into the methods by which we design and that a criteria must be established to judge success. In the expanding and diverse role of the product designer it is necessary that design education equips student designers with transferable skills to tackle the diversity of design problems, the front end

of design problems and prepare students for change (Wormald and Rodber 2008). Thus it must move from being teaching-centred to a learning-centred environment which enables students to experiment and to develop their own potential in and beyond academic programs (Lee 2006).

In order to gain an understanding of the role of product designers a survey was carried out amongst product and industrial designers to determine the nature of the businesses employing designers, the positions held and the type of post graduate education being taken. The aims of the survey were to:

- Identify the range of disciplines where product designers work.
- Establish the important areas of design.
- Determine the types of industries that are employing product designers.
- Find out the percentage taking postgraduate education and the nature of the courses undertaken.

The paper is structured as follows; first there is an introduction to the key growth areas of design. This is followed by an outline of the research method used. The results of the survey are then presented. The paper concludes with a discussion on the challenges that these developments create for design education. This paper is of benefit to educators of design programs in defining the scope of emerging design practice and can help to develop improved educational programs for teaching product design. It is of further benefit to students in terms of career planning and to employers who are hiring designers.

2 Research Method

A survey was carried out on 323 graduates who had completed industrial design and product design courses in Ireland between 1990 and 2009. Responses were received from 251 graduates giving a total response rate of 78%. Of the seven institutions in Ireland that have product design degree programs, four were involved in this study. The National college of Art and Design (NCAD), Institute of Technology Carlow (IT Carlow) and Institute of Technology Sligo (IT Sligo) were selected on the basis that their industrial design courses are long established and well recognized in Ireland. The Product Design and Technology course at University Limerick (UL) is more recently established, with 2007 being the first year of graduates. All four courses are spread geographically throughout the country. A brief

questionnaire was sent by email to the graduates asking for details of their employment, the nature of the businesses where they were employed and the title of their position. Graduates were also asked to detail any postgraduate education undertaken.

Two hundred and fifty one graduates responded and the following is the break-down:

- 107 respondents (43% of sample) were from NCAD; this was made up of 85 graduates who responded to the survey and an additional 22 respondents from the NCAD graduate network directory.
- 46 respondents (18% of sample) were from U.L.
- 9 respondents (4% of sample) were from IT Carlow.
- Information on 89 graduates (35% of sample) was provided by IT Sligo.

Table 1 outlines the breakdown of respondents per year from each institution who responded to the survey. Each institution had between 14 and 26 graduates per year.

Institution	**1990-2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
NCAD	35	3	9	1	7	12	14	10	8	8
U.L	0	0	0	0	0	0	0	10	18	18
IT Carlow	0	0	0	0	0	0	0	5	2	2
IT Sligo	57	6	4	3	4	10	4	1	0	0
Total	**92**	**9**	**13**	**4**	**11**	**22**	**18**	**26**	**28**	**28**

Table 1 Respondents per year and institution

2.1 Survey instruments

A questionnaire was identified as the most efficient means of gathering information from a large number of graduates. The questionnaire was brief containing six closed questions and one open question to encourage a high response rate. The open ended question allowed for the opportunity to gather rich data and probe deeper into the subject area (Gray 2009). The questionnaire was sent by email to industrial and product design graduates.

2.2 Analysis

The data was organised into categories according to related areas and disciplines. This was an iterative process of regrouping and reducing the number of categories for better analysis. Using SPSS the data was analysed by conducting frequencies cross tabulations, and correlations.

3 Results

3.1 Location of graduates

The majority of those surveyed 64% were resident in Ireland with 10% in the U.K, 7% in Europe and the remaining 19% in the U.S. Canada, New Zealand, Australia and other countries. Of the sample surveyed 87% were employed, 10% were in education and the final 3% were unemployed.

3.2 Job Descriptions of graduates

The graduates surveyed were working in several different areas, see Table 2. Over a fifth of those employed (22%) were product designers, working in product manufacture, or product design consultancies. Interaction/user experience /graphic design accounted for 18% of graduates, this included graduates who were working in digital media and web design. Another 18% of graduates were working in areas not related to design. Point of purchase/exhibition accounted for 14%, while 10% of graduates worked in other areas of design including fashion, service design, furniture design and teaching. 10% of graduates had returned to study and the remaining 8% reported that they were working as design engineers. Of the complete sample 72% were working in a design related discipline.

Position	Pre 2000 (n = 71)	2000-2004 (n = 59)	2005-2009 (n = 121)	In Ireland (n = 160)	Outside Ireland (n = 91)	Total (N = 251)
Product Designer	16%	25%	25%	20%	26%	22% (n = 56)
Interaction/User-Experience/Graphic Designer	31%	20%	10%	19%	17%	18% (n = 46)
Other Non-Design	24%	7%	19%	15%	22%	18% (n = 44)
Point of Purchase/Exhibition Designer	11%	19%	12%	17%	8%	14% (n = 34)
Other Design	14%	15%	6%	9%	13%	10% (n = 26)
Student	0%	0%	21%	12%	7%	10% (n = 25)
Design Engineer	4%	14%	7%	8%	8%	8% (n = 20)
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 2 Job descriptions of graduates by year and location

Table 2 also shows the difference between the job descriptions of graduates from before 2000 to 2009. Significant differences were found between the job descriptions over time ($p = 0.00$). More recent graduates are more likely to work as product designers or design engineers and to have returned to study. The one area that has shown a marked decrease is interaction/user-experience/graphic design. One explanation for this is that more experienced designers have gained skills over time to allow them to diversify into different fields. This is supported by the rise in product design graduates taking post-graduate education in those design related fields.

Ninety-one graduates (36% of the sample) reside outside of Ireland see Table 2. There was no significance in the difference between the categories ($p = 0.158$) of those working in Ireland or abroad. The positions that designers are taking both within and outside of Ireland are very similar with some variation in the proportions. Point of purchase/exhibition design accounted for 17% of the sample in Ireland and only 8% outside of Ireland. The category other design was higher outside of Ireland at 13% compared to 9% within Ireland. This suggests that the variation of design disciplines that product designers are working in is even greater outside of Ireland.

3.3 Businesses employing product design graduates

Respondents were asked to identify the nature of the businesses in which they were employed. Table 3 categorises the nature of those businesses. A fifth of those employed worked

in non-design related businesses. Product manufacturing accounted for 17%, followed closely by design consultancies at 16%. Point of purchase/exhibition design companies employed 13% of graduates. The other four categories accounted for less than 10% of graduates each. Table 3 also shows the types of businesses that employed the graduates over time. There is no significant difference between the categories over time (p = 0.209). The number working in design consultancies was consistent but there was a decrease in the numbers working in user experience/multimedia, and a smaller decrease in those working in non-design related businesses. The product manufacture sector increased slightly, which is surprising as this area has declined in recent years (Intertradeireland 2008). One possible reason for the increase is that the manufacturing industry is recognising the importance of the role of design within its business. There is an increase in the numbers working in point of purchase/exhibition but feedback from the graduates surveyed suggests that this does not necessarily mean that this is an area that best utilises a product designers skills or is an area that product designers want to work in. Finally, consistent with Table 2, Table 3 shows a significant increase in the number of graduates returning to education.

Nature of Business %	**Pre 2000 (n = 71)**	**2000-2004 (n = 59)**	**2005-2009 (n = 121)**	**Total**
Non-Design	24%	17%	20%	20% (n = 51)
Product Manufacture	13%	19%	18%	17% (n = 42)
Design Consultancy	18%	17%	14%	16% (n = 40)
Point of Purchase/Exhibition	10%	17%	13%	13% (n = 33)
User Experience/Multimedia	18%	5%	5%	9% (n = 22)
Student	0%	0%	18%	9% (n = 22)
Engineering	9%	12%	6%	8% (n = 20)
Other Design	9%	14%	6%	8% (n = 21)
Total	**100%**	**100%**	**100%**	**100%**

Table 3 Types of businesses employing product design graduates over time

A closer study of the data revealed that a number of businesses employed more than one designer. One user experience consultancy employed 7 graduates while another product design consultancy employed 5 graduates. On examination of the services offered by those consultancies there is further evidence of the merging of the various design disciplines. While one company described itself as a product design consultancy it provided other services

including: product strategy, digital media and design engineering. The user experience consultancy also provided services including: product design, web/digital media, ergonomics and human factors. Table 4 shows a cross tabulation between the job descriptions of design graduates and the types of businesses that employ them. As expected the job descriptions of graduates are significantly correlated to the types of businesses that employ them (*p = 0.000, Spearman's rho*).

Job Description / **Nature of Business**	Product Designer	Interaction/ User-Experience/	Other Non-Design	Point of Purchase/ Exhibition Designer	Other Design	Student	Design Engineer	**Total**
Non-Design	1	6	39	2	1	2	0	**51**
Product Manufacture	30	1	1	0	1	0	9	**42**
Design Consultancy	22	14	0	0	4	0	0	**40**
Point of Purchase/Exhibition	1	0	1	31	0	0	0	**33**
User Experience/Multimedia	0	20	0	0	2	0	0	**22**
Student	0	0	0	0	0	22	0	**22**
Engineering	2	3	2	0	2	0	11	**20**
Other Design	0	2	1	1	16	1	0	**21**
Total	**56**	**46**	**44**	**34**	**26**	**25**	**20**	**251**

Table 4 Job descriptions vs. Types of businesses employing product design graduates

Most working as product designers, work in manufacturing or design consultancies. Those working as interaction/user-experience/graphic designers tend to work either in design consultancies or user experience/multimedia firms. Also, as expected, the graduates who are working as design engineers are either in manufacturing or engineering firms.

3.4 Graduates Undertaking Post Graduate Education

Of the 251 graduates surveyed 50 (20%) had taken or were in postgraduate education. There has been a steady increase in the numbers pursuing postgraduate education over time. Of those who graduated before 2000 only 5 (7%) went on to further education after completing a product design degree. Between 2000 and 2004 that figure had risen to 9 (15%) and between 2005 and 2009 the figure was at 36 (30%). The indications are that product designers want to

broaden their skills in other disciplines. This is supported in Section 3.5 by feedback from some of the graduates surveyed who stated that a degree in product design is not an assurance of work in that field and that further education is needed to increase job prospects.

Table 5 outlines the nature of the postgraduate education being taken. Courses in graphics/digital media have the greatest uptake amongst the graduates at 30%; this included areas related to interactive /digital media such as web and design communications. 12% of graduates were taking courses in education; mainly the PGCE certificate in education in the U.K. to teach design and technology in second level education in the U.K. 16% of graduates took further courses in product design while engineering courses accounted for 12%, mostly in the area of medical and biomedical engineering. Business, including marketing and entrepreneurship, accounted for 8% of post graduate education. Finally, other courses in areas such as sustainable product design and architecture accounted for the final 16%.

Post Graduate Course	**Pre 2000 (n = 5)**	**2000-2004 (n = 9)**	**2005-2009 (n = 36)**	**Total (n = 50)**
Graphics/Digital Media	60%	11%	31%	30% (n = 15)
Engineering	0	22%	19%	18% (n = 9)
Product Design	40%	11%	14%	16% (n = 8)
Other	0	56%	8%	16% (n = 8)
Teaching	0	0	17%	12% (n = 6)
Business	0	0	11%	8% (n = 4)
Total	100%	100%	100%	100%

Table 5 Numbers taking post graduate courses over time

Table 5 also shows the range of post graduate courses taken over time. There is a significant difference between the courses taken in the different time periods ($p = 0.025$). Some new courses have emerged and there has been an increase in the uptake of others since 2005. Designers who graduated since 2005 are for the first time taking courses in business and teaching. The teaching of design at second level has given rise to those taking the PGCE courses in the U.K. since 2005 with 5 (2%) of all graduates employed in this area. There has also been a marked rise in the numbers taking courses in graphics/digital media since 2005.

A comparison between the post graduate courses taken and the job descriptions of designers is shown in Table 6. There is a significant correlation between these variables (*p = 0.037, Spearman's rho*). Graduates working in design are most likely to take post graduate courses.

Post Graduate Course / **Job Description**	Product Designer	Interaction/ User-Experience/	Other Non-Design	Point of Purchase/ Exhibition Designer	Other Design	Student	Design Engineer	**Total**
Graphics/Digital Media	4	4	0	1	1	4	1	**15**
Engineering	0	0	0	0	0	7	2	**9**
Product Design	2	0	2	1	0	3	0	**8**
Other	2	0	0	0	2	3	1	**8**
Teaching	0	0	0	0	2	4	0	**6**
Business	0	1	0	0	0	3	0	**4**
Total	**8**	**5**	**2**	**2**	**5**	**24**	**4**	**50**

Table 6 Job descriptions vs. Post graduate courses

3.5 Additional Feedback from those Surveyed

Some of those who were surveyed from NCAD provided comments and opinions that provided useful insights into their education and roles in industry. Several people surveyed believed that it was very difficult to get a product design job.

> "It's tough to get work with a design company in Ireland…I'd advise your students to keep their skill set flexible, learn how to use graphics and animation programs and study basic practical business."

This is confirmed by the study which shows that experienced designers are more likely to be in employment with full employment for those who graduated between 2000 and 2004 while 5.8% who graduated since 2005 were unemployed with another 18.2% in education.

Several stated that it was necessary to branch into other fields.

> "I think it is really difficult to find an actual product design job in Ireland so we industrial designers must branch out."

Many of those surveyed were taking postgraduate education to improve job prospects.

> "I worked in the area of display (point of purchase/exhibition) in two companies. This is not at all what I wanted to do so I returned to do a master's in Interactive media."

> "I found that the range of jobs available for industrial design graduates was limited that is why I went on to do a masters."

But not all respondents believed that postgraduate education was going to improve job opportunities.

"I decided to do a master's (computer aided engineering design)…Some of the modules we are studying are design management, product design techniques, product modelling and visualization and CAED systems. These are useful tools but I feel when I emerge the problem will remain the same."

Graduates felt that there were many jobs that a product designer could do but that the industry was not doing enough to promote the value a designer can bring.

> "There are many jobs a product designer can do but Industry does not know or want to know this. They seem to want mostly technically trained mechanical design engineers…The design profession does not shout loud enough, is poorly represented and greatly overlooked and undervalued."

It showed that those in product design jobs were not necessarily prepared for the role.

> "From the first week I started working I noticed that there was going to be a very sharp learning curve in getting up to speed in the real world. Obviously no graduate is going to start a job fully equipped to take on the challenges of working as a designer and there will always be a sharp curve but I do think there could be a lot done to improve."

Technical skills were considered to be important for product designers. The cross pollination between design and engineering was considered to be important as skill sets are changing. Respondents felt that product design needed to be a multi-faceted discipline, relevant and

informed, utilizing the latest technology to communicate with engineering and manufacturing disciplines.

> "This sounds obvious but I literally had to learn the basics of moulding when I started …I don't think the graduates need to know the nitty gritty of moulding but it would be useful to know at a high level what the different constraints are. I think that in the end this would make for more credible designs from students that have some grounding."

Other opinions were that design thinking, and sketching were essential core skills.

> "A key area where I think a lot of student work falls down is in the product story. In college we relied too heavily on styling and the latest trends than focusing in on what the core message is."

3D modelling was also considered to be an important tool but with caution.

> "3D modelling is obviously an important skill that must be learnt but it is also important not to rely on this. ….. The end design on a project being the result of my 3D modelling capabilities as opposed to my design intention

4 Discussion

The aim of this paper was to identify professional product design roles. Although this study was carried out on graduates from product design courses in Ireland, 36% of those were resident outside of Ireland showing that the results have relevance to a global perspective. The findings have revealed that graduates of product design courses work across a diverse range of disciplines with as few as 22% describing themselves as product designers. The other disciplines employing product design graduates are: user experience/interaction/graphic design, engineering and point of purchase/exhibition design. The study also showed that design consultancies and manufacturing companies are the major employers of product design graduates. Most of the consultancies provide a range of design services of which product design is but one and many product design graduates have expanded into other design disciplines within those consultancies. This trend has also been reflected in the nature of the post graduate courses taken by graduates with a significant correlation between the courses taken and the job descriptions of designers in

industry. These findings highlight the emergence of new disciplines such as service design and the versatility required of product designers to be able to work across diverse industries and design roles. The positions available to product design graduates are limited with many graduates not using their undergraduate degree working either in unrelated employment or unemployed. There is also a steady increase in the numbers pursuing postgraduate courses to acquire new skills and improve employment prospects.

A report by Design Business Ireland (2010) highlighted the effect of the downturn in the economy with businesses confirming that they needed to diversify to survive. The report also stated that the design services sector can add value by supporting the innovation process at an earlier, more strategic level. A number of emerging sectors have been identified where innovation can be better exploited including services and public procurement. The design sector was seen however to be lacking skills in business and research necessary to support the innovation process (WDC 2009).

> "A better understanding of how people design will certainly inform design pedagogy".
>
> (Dym et al. 2006)

Although the influence of the Bauhaus model has been significant, these modes of learning have generally continued and design has largely been neglected by educational theorists (Lee 2006). Contemporary debate around design education suggests a period of transition (Buchanan 2001, Niederhelman 2001, Lee 2006). An exchange between education and practice is long overdue (Rothstein 2005).

The results of the study have shown that product design graduates believe that design education must be more aligned to the demands of industry and facilitate them with flexible and transferable skill sets to take advantage of other design roles. Other disciplines such as interaction design, interface design, user experience design and sustainable design are not an extensive part of the curriculum and few schools are adopting the trend towards interdisciplinary teamwork that takes place in industry (Yang et al. 2005).

Design is a social process and constructivist theories of learning recognize that learning is a social activity. Collaborative and active learning through projects that integrates multidisciplinary specialists and end users, is also an approach that better facilitates the solving of today's complex design problems (Seidel and Godfrey 2005). Design education should be refocused on teaching designers to function in multidisciplinary teams emphasising the complex process of inquiry, learning and decision making through working collaboratively using several

languages (Dym et al. 2006). Links with industry to create real world design projects are crucial to the education of designers (Breitenberg 2006, Cardozo et al. 2002) as industry problems are very different from the types of problems normally used in education (Jonassen et al. 2006).

To fully utilize the expanding role of design and to gain credibility in business, the results show that designers need further training in areas such as business and marketing strategy, to cope with new demands.

The shift to the design of services, digital media and user experience and has been shown in the findings and Findeli (2001) believes that it is possible to transfer the methodologies developed for the design of products to the design of other areas such as services emphasizing the need for transferable skills. This may be achieved by emphasizing the development of basic knowledge, including analysis, synthesis, interpretation, creation, assessment and criticism. The findings also show that more experienced designers are working in the more diverse roles suggesting that the skills to diversify were required over time in industry. This indicates a need to promote the capacity in students for lifelong learning which is seen as necessary (Broadbent and Cross 2003, Levy 1990).

The results of the study also show a rise in the numbers taking postgraduate education and with the current economic downturn this number is likely to rise. There is an opportunity for design educators to provide post graduate courses to develop the skill sets required. Some colleges in recognition of the changes to design practice have started to offer business skills, complex problem solving techniques, collaboration and interdisciplinary education. As design boundaries are disappearing hybrid courses have emerged to combine more than one discipline. For example the MFA in Media design (Art Centre College of Design, U.S.) combines communication and interaction design (Burdick 2007). The Koln International School of design offers a multidisciplinary course across thirteen areas of design called “Integrated design”. The Design for Industry Program at Northumbria University uses a project-led approach across a range of design disciplines, from products, services, and systems to blue sky research. There is a view however that this will create generalist designers without specialized skills (Heskett 2002). In response to the need for an integrative approach to innovation TU Delft offers an MSc; ‘Strategic Product Design’ translating corporate strategy and market opportunities into product development portfolios. The D-school at Stanford provides multidisciplinary design thinking methodologies for business professionals. Design Thinking is a process that has been adopted by other disciplines to apply creativity to any problem to discover new opportunities. While design

thinking has promoted the use of design methods to non designers there is a risk that designers may become redundant in their own discipline confirming the need for educators to teach designers broader skill sets.

Many contend that individuals must have a combination of both specialist and generalist skills (Gregory 2009). Generalists may be very good at doing many things, but typically are not at the same expert level as specialists. Specialists have great depth of experience in specific areas but may be limited in career opportunities. IDEO believes that to operate within an interdisciplinary environment, individuals need strengths in two dimensions described as the "T-shaped" person. On the vertical axis, individuals need to possess a depth of skill that allows them to make tangible contributions to a project. The top of the "T" is referred to the design thinker which incorporates empathy for people and for other disciplines (Brown and Wyatt 2010).

One possible model is to incorporate generalist and specialist skills within a program. This could be achieved by introducing students to a general course and then facilitating them to specialize in a particular area for a final portion of their studies. The generalist part of the program would introduce transferable skills in problem solving, design thinking and processes, applicable to any design discipline, with the latter part of the program allowing students to specialize.

A second model is to run student projects that involve interdisciplinary collaboration with other courses and industry partners. A third model is to adopt an approach to education that gives students a self directed and reflective learning role to enable them to tackle the diversity, uncertainty and complexity of design problems (Martinsuo 2009). Lawson and Dorst (2009), advocate that design is a learning process through iterative cycles of gathering knowledge about a design problem and experimenting with different solutions. In this cycle of 'propose-experiment- learn' the designer learns to arrive at a solution (Lawson and Dorst 2009). This model may be achieved by adopting a problem based learning (PBL) model where the focus is on real world problems and students learn transferable skills through collaborative problem solving. PBL assumes that students will master the content in the course of solving a meaningful problem (Jonassen 2010). The emphasis is on the process as opposed to the outcome and tutors act as facilitators to promote critical and creative thinking and reflection. Case studies may also be used to support more ill structured problems through case based reasoning (CBR) which is a constructivist model of learning that refers to reasoning based on previous experiences to solve a new problem using the experience of solving similar problems (Kolodner et al. 2003).

5 Conclusions

The study highlights the importance of aligning design education with evolving design practice. Designers do not feel sufficiently skilled and have difficulty in achieving positions despite potential opportunities in newer areas such as service design and design leadership. Along with specialist skills designers will need generalist skills in areas such as business, communication and negotiation. As designers are now immersed in the front end of the design process, skills in the area of research such as ethnography and observation are critical. Three educational models have been proposed including; generalist versus specialist approaches, interdisciplinary education, design thinking, problem solving skills and self directed learning models such as Problem Based Learning, to compliment the more traditional methods of the Bauhaus.

Further research is necessary to examine if these findings are representational outside of Ireland. Research is also necessary in the area of design education to develop and evaluate teaching strategies that further align design practice and education.

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