EDUCATING DESIGN PROFESSIONALS IN THE 21ST CENTURY

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ABSTRACT
Recent research indicates that skills, knowledge and creativity (SKC) share equal importance for professional designers (Guo, 2011). This is also true of graduate designers (Zerillo, 2005). The design of the curriculum, teaching, learning and assessment strategy is therefore crucial in preparing students for professional practice.
An experiment was conducted to identify whether the current BSc Product Design Engineering (PDE) programme offered by Liverpool John Moores University (LJMU) adequately prepares students for employment in the design industry. The findings showed that the current programme's design and teaching and learning approach needs to be re-evaluated if it is to satisfy students' intellectual growth and prepare them for careers in the product design sector.

Keywords: Product design, design education, industrial design, product design engineering.

1 THE CHANGING ROLE OF DESIGN AND ITS IMPACT ON EDUCATION

Porter (1998) provided a theory as to why some nations are more competitive than others, and equally why some industries are more advanced than others. The model of determinant factors in national advantage has become known as "Porter's Diamond" (Figure 1) which suggests that the 'home base' of an organisation plays an important role in shaping the extent to which it is likely to achieve advantage on a global scale.

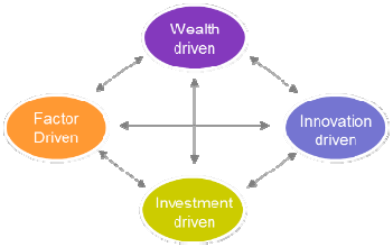

Figure 1. Porter's Diamond (Porter, 1998)

If one applies a representative example of the business planning and design process to the different stages of Porter's Diamond model the resulting output suggests that 'design thinking' has an increasingly significant role in informing business strategy at successive stages. Since much of Western industry is at the innovation-driven and wealth-creation stages of Porter's model, design might be expected to play a key role in business development with clearly outlined objectives. In contrast, the emphasis is placed more on infrastructural changes in developing countries.
Consideration of the business versus design processes model across these stages illustrates the dilemma facing design within emerging economies. Often, design is perceived to be of little benefit to business strategy at earlier stages of economic development, where primary concerns are the exploitation of manufacturing capacity and the development of capability via technology transfer and skills development. Innovation is often not recognised and contributes little to an economy focused on 'catch-up'. In this scenario, industry – especially at senior management levels – is unlikely to perceive value in design and will be unlikely to contribute to its development as a profession with status equal to other disciplines such as management and engineering (Williams and Guo, 2006).
Given the observations above, it is apparent that design plays a different role in the different phases of industrial development. In a developed economy design informs strategies in business planning and

creating more diverse roles and career opportunities; whereas a developing economy design is perceived as having low value.

Cooper (2004) represents the evolution of the role of design as a timeline within New Product Development (NPD) that in the 2000's design came to mean:

- creative: driving a more central role for designers (Stamm, 2003)
- holistic: incorporating a broader array of tasks to support the whole NPD effort (Turner, 2000)
- direct generation of customer information (Leonard- Barton and Rayport, 1997)

She also outlined the skills that required by contemporary role of design include:

- functional specialism: traditional design skills and aesthetics, visualisation and technical skills
- team-based abilities: interfacing and communication skills
- design-centred abilities: business, research and observation; and project management
- multidisciplinary-thinking and knowledge-transferable ability

Together with in-depth knowledge in respect of:

- design issues (e.g. aesthetics and human factors)
- manufacturing (e.g. material and manufacture processes)
- brand and business strategy awareness.

Within the context of reducing local manufacturing bases in Europe and other regions (Curedale, 2003), it is anticipated that there will be an impact on the demand for traditional product design skills. This may lead to a change in the profile of students from a vocational to a more academic orientated skills set. The UK in particular operates a mass design education policy which requires a thriving student population and design industry in order to survive (Bolton, 2006).

The service-based UK industry focuses on branding and service design; which requires research and conceptual thinking skills; hence education may cover broad range of SKCs, but avoid over emphasis on industry- based skills, e.g. packaging and retail promotional design skills (Bolton 2006).

A decline in the number of undergraduate product design courses has led to increase 3D design courses and post graduate programmes (Bolton, 2006). It is proposed herein that design in higher education should seek to balance skills, knowledge and creativity whilst respecting both student and employer aspirations and expectations.

Given the above state of design in both industry and education, educators need to ensure that their design-related programmes of study meet the aim of producing work-ready product designers. It is therefore paramount that the design of such curricula is done with the aim of improving and enhancing the teaching and learning approaches within a programme.

The principle aims of this research are twofold. Firstly the authors propose a link between industrial expectation and graduate competencies as measured through the metrics of skills, knowledge and creativity. Second we examine the existing competencies of a small sample of current students at this institution as measured against industry expectation. The output of the experiment herein shall be used in creating a new MDes programme designed to "fill in the gaps" identified through this research.

2 INDUSTRIAL EXPECTATION

Expectation in Western higher education institutions and industry appear to differ, as graduates struggle to satisfy their employers' desire achieving good academic standards. Design graduates are full of ideas, but they often do not fully understand client needs.

Employers cannot find the right level of really good skills right across their companies in the UK (Sands, 2009). A significant number - 21% - of design consultancies interviewed by the UK Department for Education and Skills in 2002 said they were 'not at all satisfied' with the skills of the graduates they were employing (UK Design Council, 2005). It is getting worse in general according to a recent investigation (BBC News, 2013). 52% of UK graduates lack employment skills, in particular communication and team based skills. Just 20% of employers believe that the graduates they recruited possess suitable employment skills. Aside from a lack of design skills, literacy and mathematical ability, they pointed to a lack of business awareness. Employers suggested more use of visiting lecturers and studio-based activities, including the type of collaborative and team working that is common in consultancies (UK Design Council, 2005).

Consultancies in the US seek technical skill sets that can add value to the team and produce fee-based hours of work. Companies generally look for someone who can quickly cement a position on the team, they do not like to recruit students and then spending time on further training, as training people is expensive, and by the time newly hired employees are productive, they usually leave to get a better job.

In today's cost conscious world, technical experts are necessary to leverage efficiencies in each item on the assembly line. An in-depth knowledge of production methods and markets at each stage of the NPD process are considered pillars of appropriate design. Understanding the means of production includes interpreting a client's instruction or design brief. Design skills, knowledge and creativity are essential, but not enough. The ability to manage, liaise with clients and apply real-world experience are also considered essential skills by most employers (Zerillo, 2005).

3 EXPERIMENTAL PROCEDURE

An experiment was developed and run within the BSc Product Design Engineering Programme at Levels 4 and 5 in the School of Maritime and Mechanical Engineering, April to May 2013 with the principle aim of measuring student attainment against the design industry's expectations. Although we acknowledge the sample size for the experiment is very small, we are necessarily restricted by the size of the respective cohorts given that we are specifically analysing LJMU's Product Design Programme in respect of the aforementioned metrics of skills, knowledge and creativity.

The experiment aimed to identify how well students apply knowledge and skills at each level. Additionally it explored whether the current curriculum design helped the students' intellectual growth in terms of skills, knowledge and creativity, in respect of the following:

- Research skills
- Visualisation/presentation skills
- Communication/leadership skills
- Material/manufacturing knowledge
- Product semantics/ ergonomics
- Product aesthetics knowledge
- Awareness of branding
- Multi-disciplinary thinking ability
- Creativity

The above competencies are embedded into existing mark schemes at levels 4 and 5. Thus, when students are graded in their coursework they are effectively marked against industry's expectations. In other words, the experiment is a relative measure of student skills, knowledge and creativity against industry's requirements.

The theme for the experiment was that of a mobile phone design. This was chosen as it is a common product that almost everyone can associate with and is of relatively low complexity (in terms of design) and higher complexity in terms of functionality, product identity, user lifestyle and ergonomics.

Eight students were invited to undertake the experiment supervised by the author[1]. There were two teams of two students at each level. The students were representative of each level in terms of their academic ability. The total project duration was 10 hours. To help keep students focussed on key criteria, decisions and activities this total time was broken down into five two-hour sessions. Questions were posed at the beginning of each session to prompt participants to engage in the planned activities.

4 ANALYSIS OF RESULTS

Figure 2 shows that the level 4 students possess similar levels of knowledge and skills. It is also noted that the performance of each pair of students was identical in the following areas: visualisation, communication, leadership skills, material/manufacturing, product ergonomics knowledge and multi-disciplinary thinking ability.

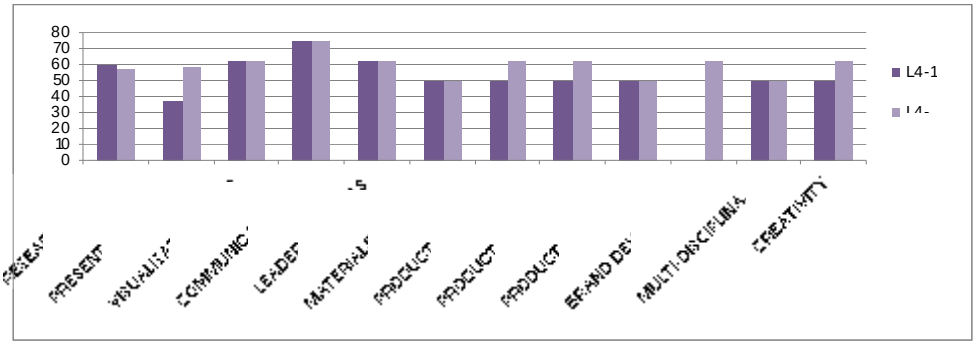

Figure 2. The comparison of two group of students' performance at level 4

Significant differences are observed in the areas of product semantics and aesthetics knowledge and creativity, in particular presentation skills and brand development knowledge.
One explanation for the difference could be that the students have different academic backgrounds - the subjects that the students studied pre-University where, typically, presentation skills, aesthetics and brand development would be taught as part of a subject such as art or design.
If a baseline of 60% is taken as being a good standard for each area assessed, the results also suggest that most students have a good level of skills such as visualisation, communication and leadership, knowledge of materials, manufacturing, product economics and multi-disciplinary thinking ability. The latter two may have been obtained before entering higher education; the former two via modules delivered as a part of their programme of study at LJMU.
In contrast it is evident that students demonstrate a significant difference in most aspects at level five (Figure 3). From this data it could be deduced that the HE provision at level five in some areas hindered students' intellectual growth. One possible cause for this is that the teaching and learning approaches were not appropriate in respect of meeting this goal.

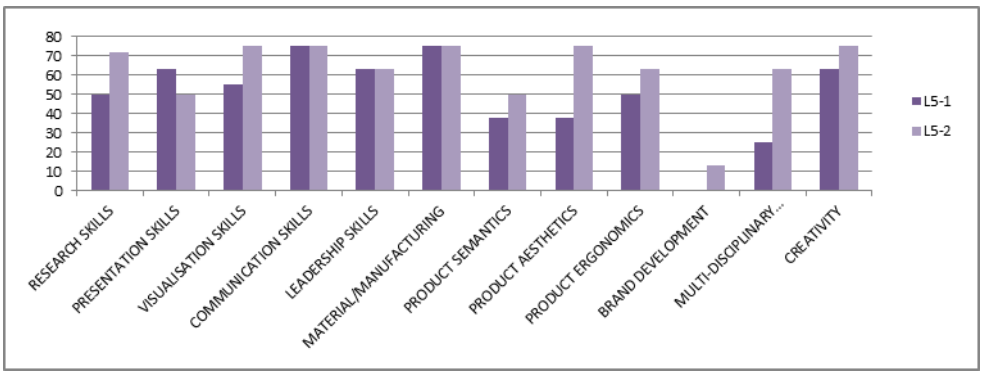

Figure 3. The comparison of two group of students' performance at level 5

As can be seen from Figure 4, it is evident that students' skills and knowledge incrementally grow from level four to level five. Significant gains are shown in aspects of research and visualisation skills, product ergonomics knowledge and in particular, presentation skills, manufacturing, product aesthetics and creativity. Thus, the students apparently show good intellectual growth between levels 4 and 5 in these areas.

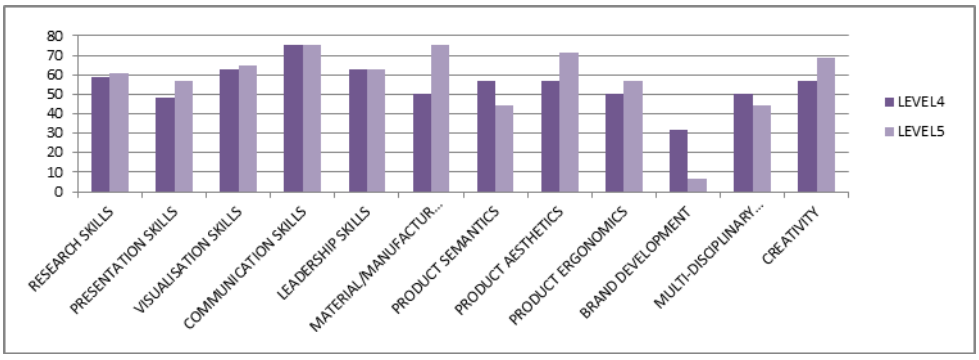

Figure 4. The comparison of two group of students' performance between levels of 4 and 5

However, a number of anomalies are apparent in communication and leadership skills: the students appear to demonstrate no significant progress between levels. Other retrograde changes are apparent in aspects of product semantics and brand development and in multi-disciplinary thinking, where there is a clear decline between levels four and five. It appears likely that these areas are not being adequately covered in existing modules.
Issues arising from the preliminary results include:

- Level 4 students may have different academic backgrounds, pre-University

- Level 5 students perform significantly differently after almost two years study within the current programme
- Some students at level 5 made no progress and even regressed in some areas.

The above results suggest that the current programme design and teaching and learning approach will need a rethink if it is to satisfy the students' intellectual growth in future. The development of a new curriculum and teaching and learning methods should perhaps take students' prior knowledge into account rather than simply relying on tutor's own experience and knowledge (Prosser and Taylor, 1994).

Research indicates that a skills-driven programme emphasises skills-based teaching, matching the graduate with the existing needs of business. This approach is more suitable for manufacturing-based economies. In contrast, a knowledge-driven education that values student career aspirations is designed to satisfy a student's career sustainability and also meet the *long-term* needs of business (Guo, 2011). Thus the educator serves two masters: students and business (Zerillo, 2005).

The UK's service-based design industry has evolved with an emphasis on brand, conceptual thinking, design strategy and management which requires a broader range of skills and knowledge, and demands graduates work on activities as part of a team (Bolton, 2006).

5 CONCLUSION

Reflecting on the results of the experiment and specifically in regard to LJMU's PDE offering, it is the authors' contention that, in order to fully satisfy both Western (UK) industry needs and students' career aspiration, the existing three-year programme may not be the ideal vehicle in producing graduates with an ideal balance of skills, knowledge and creativity. In order to endow students with that balance, a new postgraduate programme is proposed.

The new programme should equip the students with not only the ability to design, manufacture and test design solutions; but also with a firm knowledge of business strategy and branding with provision for appropriate work experience. On completion of the course, students should have acquired an in-depth knowledge of research methods, project management, leadership skills, brand and business strategy awareness and multidisciplinary thinking. This should fully prepare students for high-flying product design oriented careers in the knowledge-driven economy of the 21st Century.

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