DESIGN EDUCATION: ENSURING COURSE CONTENT AND DELIVERY IS RELEVANT TO THE NEEDS OF INDUSTRY.

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ABSTRACT
This paper proposes we take a close look at the role and the content of Design Technology education across secondary and higher education. For four decades the subject has grown in content, to the extent that many now fail to recognise what the objectives of the subject are. Embedding Design Technology in the National Curriculum in 1988 failed to give the subject an identity to which creative practitioners could associate themselves. We must question the relevance of the curriculum content and whether we are restricting individual creativity and entrepreneurial skills in a curriculum structure in secondary and higher education that fails to deliver on many key aspects of design and business skills required by industry today.

Keywords: Curriculum, pedagogy, aptitude, role-play, 'V' Model

1 HISTORICAL CONTEXT

The first signs of Britain's decline as an industrial and manufacturing power could be detected as far back as 1867 when we first witnessed a decline of awards following the 1851 Great Exhibition. Penfold [1] first described this decline as being directly attributed to the poor 'technical instruction and provision of educational systems'.

In most British secondary schools Design Technology (DT) is now only offered 8% of the teaching timetable. The subject is expanding rapidly and struggling to retain many of its traditional craft-based activities whilst adapting to recent developments in rapid prototyping materials and processes, sophisticated interaction design requirements, electronics, and CADCAM. DT is fast becoming a fragmented subject that is difficult for students and employers to understand. The currency value of the subject is being undermined and students are ill prepared to study design at higher education levels or indeed apply their knowledge to industry requirements.

Radical changes to the content and delivery methods used at secondary and higher education are required. Key design skills demanded by industry are very different today, consumer requirements are changing rapidly, legislation is demanding new attitudes, technology is developing exponentially and many students find it difficult to perform in all disciplines. Studies with leading employers comment that the content of today's DT and product design syllabus 'has little relevance for them'. At higher education levels too, some leading manufacturing companies and design agencies are forced to 're-educate graduates so that they are best able to meet the needs of their clients'. Whilst the Product Design programme at the University of Wales Institute, Cardiff (UWIC) is setting 'national standards', this proposal recommends further focussing of the DT and

product design curriculum to make the subject and its qualifications at secondary and higher education levels relevant to the needs of today's employers. Less attention on 'invention and making' and a new format where greater prominence is given to ethnographic research, creativity, sociology, psychology, sustainability, product legislation, individual attributes and core communication skills. This will give the programme a unique and stronger identity and make the courses attractive and relevant. Research is already underway between the Design and Technology Association, the Welsh Joint Education Council, Technology Alliance Wales and The Department for Education, Lifelong Learning and Skills (DELLS) who have responsibility for the curriculum in Wales and its recommendations may have serious implications for the development and delivery of product design education across Britain.

2 STATE OF THE NATION

Britain's economy is predominantly small to medium enterprises (SME's) based on service industries. The manufacturing base that once employed many thousands has long since gone due to the decline in the decline and Japanese and Korean multi-national teletronics companies. Predominantly small businesses remain offering added value products and services. These companies require design graduates with key skills that supplement or compliment skill gaps in the company. The 'multi-disciplinary' label attached to the design industry has been replaced with a requirement for specific skills in creativity, form development and innovation, lean manufacturing tools and quality processes, strategic business planning, consumer-focussed design services and a knowledge of government legislation and compliance initiatives.

Delivery of the product design subject will continue to evolve and work undertaken at UWIC challenges preconceptions of traditional design processes. The staff is prepared to face the risk of failure by debating taboo subjects and challenging the status quo. For example: this proposal recommends assessing individual students at level two through a recognised aptitude tests which determine personal learning disposition and personality strengths.

Which are the key skills required by design businesses today? With many of the traditional manufacturing industries lost to higher technologies, the emphasis usually imposed on designer-maker is being surpassed by a need to fulfil complimentary skills, consumer and market knowledge. Historically, our greatest strength has been creativity, communication, invention and improvement, and this is where the focus of future courses should lie. The emphasis on CADCAM should be questioned: leading employers describe virtual reality and CADCAM has as an 'expensive, unnecessary gloss – where this time could be better spent developing better ideas.' Competitive mass manufacturing will be the domain of China, India and subsequently South America. In Britain we are good at adding value, innovation and communicating yet so few graduates find a product design related job in the Britain, further supporting the case to shift away from generic skills to targeted design talent. Undergraduate design education has seen a significant shift in programme focus to providing transferable skills and that masters level courses are the way for graduates to specialise in a particular attribute within the design process. With so few design graduates gaining design-related employment a move to focus on explicit key skills at undergraduate level is essential.

3 COLLABORATION

Future developments in design education will require close collaboration with a range of disciplines including sociology and psychology to enhance research effectiveness, consumer appreciation, creativity, cognitive and communication skills. Key skills and personal attributes of designers and entrepreneurs must be developed. They must be imaginative, persuasive, tenacious, literate, optimistic, extrovert, problem-solvers, confident, focussed, motivated, decisive, and resourceful individuals.

This paper argues the case to specialise not generalise product design education. Businesses are seeking graduates with more and more specialist skills to compliment in-house knowledge or to supplement knowledge gaps. Once the domain of postgraduate courses there is a case for equipping undergraduates with focused creative knowledge. The basic skills are changing: the core knowledge of manufacturing processes, materials, CADCAM and model making are best served by being outsourced. Industry needs confident designers or can respond quickly with commercial acumen.

4 CURRENT ACADEMIC PROVISION

UWIC's product design programme objective has been rationalised to 'meet the growing need in modern manufacturing industry for innovative product designers who, with the aid of appropriate specialist tools and techniques, can design good quality, reliable products which also meet customer expectations of cost effectiveness and aesthetic appeal'. The focus here is on 'specialist', 'design', 'tools and techniques'. Arguably, the programme objective has been misinterpreted – we need to design but we don't necessarily need to make. Once a suite of five-degree routes offering specialism in electronics and multi-media, the programme now consists of just two traditionally named pathways for a BA or BSc in Product Design. Industry feedback indicated that most small to medium sized (SME) industries would benefit from BSc students who had a more all-round understanding of technology and engineering rather than a specialism in either electronics or mechanics. This is reflected in the current course aim of the BSc Product Design course 'to produce graduates who can apply the principles of design methodology, together with an understanding of engineering and technology to produce designs for innovative products which meet customer demands for quality, reliability, cost effectiveness and aesthetic appeal'. Again, the emphasis can be placed on process. A process, which identifies a need, confirms the need through research and provides a detailed product specification for the creativity and development stage. The 'making' stage should be outsourced. The structure of the new courses is based on experimental pedagogical work of Wilgeroth and Hewett [2] and is based on the introduction of series of sequentially delivered 'super modules' [figure 1]. These super modules integrate much of the previous course content into larger, closely related coherent units of study.
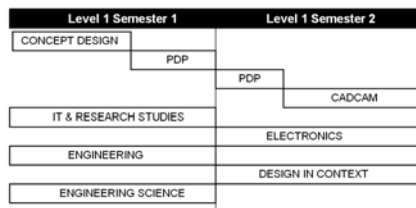

Figure 1. Super Module Delivery

This system quickly exposes students to all relevant disciplines and experiments with multi-disciplinary problem solving and teamworking. The modular delivery is now primarily based on the use of large, sequential 'super modules' supported by smaller, linear modules. The super modules are used to deliver the core of the design content and the linear modules to deliver the specialist topics that differentiate the courses. The super modules also provide the vehicle for larger more coherent projects and help to spread the assessment load throughout the year.

The effectiveness and appropriateness of the current undergraduate curriculum was confirmed by subject experts from an IED validation panel in 2005 and can be evidenced by comments of external examiners who comment on the 'national standard' of some of the final year projects, commendations in the RSA national design competition and other leading European design competitions. But with our industry changing so rapidly, the curriculum must be continually refined and updated to meet the changing needs of industry and to take advantage of new and developing technologies and approaches to design. As Western Europe finds it increasingly difficult to compete with China, India and Vietnam to produce products cost-effectively, our focus on CADCAM and production methods is misjudged and should be replaced with expert knowledge on creativity and innovation, design research communication, sustainable and ethical approaches, industry related legislation and compliance.

5 FUTURE PROGRAMME CONFIGURATION PROPOSAL

The Institution of Engineering Designers has itself reported on the significant growth in demand for product designers in industry with creative skills, which indicates the good prospects for graduates of degrees in product design. This paper recommends an emphasis on niche design skills and individual qualities in addition to core design process knowledge.

Table 1. Skills comparison

Historical Designers Skills	Future Designers skills
Creativity	Creativity techniques
Aesthetics	Ethnographic research
Materials	Psychology and sociology
Manufacturing processes	Innovation and creativity
Team working	Communication skills
Multi disciplinary skills	Life cycle design
CADCAM	Sustainable and ethical issues
Model making and prototyping	Design aptitude
	Business planning
	Market forecasting and observation
	Legislation and compliance
	People and management skills
	Personal qualities

The inclusion of aptitude testing for creativity is being considered as part of this proposal. The Myers Briggs Type Indicator [4] and the Torrance Test [5] are typically used to measure not only the number of alternative solutions that people can suggest but the uniqueness and quality of their creativity. Creativity is linked to key skills and qualities including flexibility, tolerance of ambiguity or unpredictability. Graduates will develop imagination and a sense of how design can make a direct contribution to the quality of life. Each student can be encouraged to develop areas reflecting their own special interests and aptitudes. Pugh's design process [3] can still be adopted for this

new programme, but new areas given greater prominence. This proposal, defined by the 'V' Model [figure 2], is unique in many ways: the design process and basic design problems are still introduced during the first year, but increasingly complex needs and role-play activities can be introduced throughout the second year. The final year can employ group projects based on the personal attributes of team players. For example: those with strong literacy and verbal qualities can communicate the design to others. Individuals confident with interaction can manage the creative team. Computer enthusiasts can control the CAD technology. The creative members can manage the idea generation tools and those good at illustration can generate forms and communicate the design graphically. This multi-disciplinary approach can be more authentic to the future role of product designers and meet industry's needs more closely and thus the assessment needs to measure individual contributions to the problem.
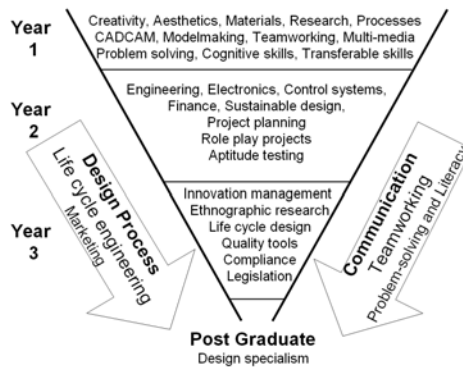

Figure 2. 'V' Model academic acquisition

6   ROLE PLAY PROJECT OBJECTIVES

The need for greater realism in undergraduate design projects is being driven by professional consultancies that claim they need to 'retrain graduates in order to perform competently' as soon as they walk through the door. Role play will enable students to take full advantage of cross-disciplinary opportunities and learning processes and experiences. Exposing students to more authentic design problem situations will enable them to implement key aspects of their role. In particular, problem solving tools, decision making and communication skill and the ability 'to demonstrate, rather than tell about, what they know and can do' [6]. These three factors alone encompass a broad range of personal and academic skills involved in the determination of and resolution of creative problems. Furthermore, role-play will commit graduates to:

- Implement the product development process to specific problems
- Employ various creativity techniques and evaluation matrices.
- Communicate the process and solution
- Develop key skills including effective teamwork and management skills
- Act professionally.
- Improve visual literacy and observation techniques
- Aid group problem decomposition
- Develop awareness of trading environments, ethics, various software tools, presentation making, project management and technical writing can be explicitly addressed
- Employ cognitive skills to communicate solutions effectively and persuasively

7 THE PROBLEM WITH ASSESSMENT

Bateson suggests that role-play scenarios present evaluation difficulties where iteration and ambiguity are the typical [7]. How do you assess adeptness, communication skills, and process management skills that are as crucial as technical competence? Our assessment methodology is directly linked to the learning outcomes for the module and strategic marking guidelines. Changes will be required to assess individual performance. The only meaningful and reliable assessment method for individual contribution is frequent peer and module leader assessment and regular oral and written contributions.

CONCLUSION

Despite our product design programme been revalidated in 2005 by the IED and University of Wales the programme could remain unchanged for a further five years. But global changes in the economy and the environment will force major amendments to the structure and delivery of product design across Britain. The radical changes proposed in the 'V' Model attempts to address the changing face of design education and emphasises aspects of individual personality attributes and core competencies whilst retaining fundamental transferable skills such as communication, problem solving and teamworking at the heart of a traditional design process. Students will graduate equipped to undertake and manage creative design projects with challenging innovative content and contribute as a team player bringing unique skills and knowledge to tomorrows leading exponents of a product innovation service.

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