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## **Design and Technology – A Decade of Integrated Curriculum Development in Product Design at the University of Wolverhampton**

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### **Abstract**

This paper is a retrospective analysis of the development of an integrated curriculum in product design at Wolverhampton which brings together creative design, technology, materials, manufacture and computing.

In the late 1980s the Schools of Art and Design, Engineering, Technology and Computing decided to introduce what at that time was a new type of degree in product design with a multidisciplinary approach that drew from expertise across the institution.

The BSc (Hons) in computer aided product design which had its first student intake in 1989 aimed to develop a product designer with a richer blend of skills between design, technology and engineering, but which also put the student at the centre and developed a curriculum that fostered independent learning.

Over the last decade a group of undergraduate honours awards have grown out of the successful computer aided product design degree including a BA in industrial design, a BSc in computer aided industrial design, and a BSc in computer aided engineering design.

This paper reflects on the evolution of this curriculum in design over the last 10 years, concentrating on the following innovative areas:

1. development of independent learning to foster academic and practical design skills
2. integrating the technological and creative elements in the design project work
3. meeting future design, technological, and sociological needs through curriculum development.

### **Keywords**

design, technology, integrated, curriculum, development, Wolverhampton

### **Introduction**

This paper reflects on the development of an integrated curriculum in design at the University of Wolverhampton which over the last 10 years has led to the development of four undergraduate awards in industrial/product design.

The development started with the BSc (Hons) in computer aided product design which was first introduced in 1989 and was, at that time, in the vanguard of educational development in this design area. This course aimed to produce a creative designer with a richer blend of skills between design, technology, materials, manufacture and computing but which put the student at the centre and fostered independent learning. The success of computer aided product design or CAP D as it became known during the early 1990s led to the development of three other related honours awards, a BA in industrial design, a BSc in industrial product design and a BSc in computer aided engineering design.

Before developing CAP D, research among potential employers revealed that a new type of product design graduate would be needed to meet the future needs of industry, who could combine the knowledge of an engineer with the conceptual thinking of the industrial designer. To do this it was intended that CAP D would foster a broad range of transferable skills including design awareness, visual communication, manufacturing technology, engineering, and computing. Integrating these skills was the key. This was done by firstly developing an integrated teaching team drawn from the expertise across the institution which brought together practitioners and educationalists from different disciplines. This approach was at the time new to the institution as was the modular structure used to deliver the curriculum. Research also identified that CAP D should be predominantly a sandwich course although a three-year full time mode was also offered. These educational developments are as follows.

### *Independent learning – developing academic and practical design skills*

Design courses, particularly those developed in the art and design sector, with a strong practical base, frequently used a teaching model which has become known as ‘Sitting with Nellie’ (Swann, 1982). This concept was based on the idea of learning practical skills by sitting and working alongside the person with the most experience. It developed from the craft based industries that needed highly skilled operatives, mainly women. ‘Nellie’ was the experienced archetype and trainee operatives learned by working alongside her.

Government initiatives in the late 1980s aimed at increasing access to Higher Education have substantially increased student numbers to all disciplines, the most serious impact being to those with a practical skill base who traditionally had a low staff to student ratio. In the climate of mass education of the 1990s the concept of one to one or small group teaching in the tradition of ‘Sitting with Nellie’ is no longer sustainable. Developing practical visual and presentational skills based on drawing, and three dimensional making and modelling skills that have in the past been developed in the art and design sector through small group or one to one tuition were essential to our new course. Yet this could not be delivered in the tradition of ‘Sitting with Nellie’.

Student centred learning has been under discussion in design education for a number of years, but the climate of mass education gave it new impetus. CAP D aimed at a high student intake, and in developing the curriculum, we had to rethink our teaching and learning strategies not only to cope with the large numbers but to cope with a wide range of prior experience which included students from art and design, science and technology, direct entrants from sixth form, students from access courses as well as mature students entering from industry.

In developing our new curriculum we had to make maximum use of the modular structure of the institution which is based on a total module time of 150 hours made up of 45 hours of taught time and 105 hours of self-managed or independent learning. Each module is delivered over a 15-week semester with a weekly timetabled teaching slot of 3 hours, with 7 hours of weekly independent study. The practically based modules originally developed for CAP D and subsequently offered on the other three awards were conceived as a comprehensive package which balanced the theoretical and critical with the creative and practical, delivered on a weekly basis. The predominantly practise-based modules capitalised on weekly delivery, structuring skill-developing tasks undertaken in the students’ self-managed study time between timetabled class sessions. The weekly class sessions that promoted this activity were used to:

- introduce the student self-managed task and contextualise that task in terms of expected outcomes. Considerable visual material was used to present the teaching sessions for practical modules.
- verbally brief the students against a written brief on the task expected to be carried out
- the taught session following a task would start with a seminar discussion on the work produced which would lead into the visual presentation outlining the next task and its verbal and written briefing.

### *Level 1 modules*

The two practical modules occurring at this level are an introduction to the contextual aspects of product design in product design studies I in semester 1 and a diagnosis of practical design skills in the design project which is part of product design studies II in semester 2. These are conceived as linked modules.

Product design studies I aimed to introduce the student to the contextual aspects of product design through a snapshot approach of the present and the past. This contextual framework is a means by which the student can assess their own practical development and position themselves in the subject. As well as being encouraged to discuss design in tutorials and seminars there are two written assignments based on personal research in product design. The first assignment gives the student the opportunity to select and critique a current product that is on the market. Assignment 2 requires an in depth research of a design area of personal interest with a choice of looking at the work of a designer, a design movement, the development of an individual product or a range of products.

Lectures on design and related issues support the independent personal research.

Product design studies II introduces the student to the theory and practice of an actual design project. Lectures on theory run parallel to the project. The theory deals with aspects of the project that the practising designer would experience including management, specification, design morphology, ergonomics and anthropometrics. The project encourages the student to undertake research, produce visual material and a sketch model as an independent learner. Project topics have included a mechanical toy, a briefcase for the designer on the move and products for an ageing society. This level 1 project is diagnostic of the entry skills of the student. It not only assesses the student's practical visual and making skills but their ability to manage a project as independent study. Any skill weaknesses identified at this level will be developed in the level 2 practical modules.

#### *Level 2 modules*

There are two level 2 practical modules, design principles in semester 1 and three-dimensional realisation in semester 2. These two modules are where practical visual, rendering, drawing and making skills identified for development in level 1 are strengthened.

Design principles introduces visual rendering and presentation skills. It assumes that students' prior experience of visual presentation is minimal and introduces the basic elements of visual technique including perspective and rendering. Again practical work is undertaken by the student independently with tasks being set on a weekly basis. The core of this module is the weekly briefing and critique sessions at which the visual exercises are set and work produced reviewed.

The three-dimensional realisation module introduces and develops model making and related three-dimensional skills through product simulation. The student is asked to pick a small domestic consumer product and simulate it as an exact block model synthesising weight, scale, colour and finish. In undertaking this brief the student learns accuracy and making skills that are an important part of product design.

#### *Level 3 module*

One level 3 module design competition completes this modular programme. This module tests the application of design visual and model making skills learned in the previous four modules in an externally generated project. External projects have included the following national and international design competitions in which Wolverhampton students have been successful:

- National Lighting Design Competition – Winner of the Phillips Design Award
- RSA Design Bursary Competition
- Plastics on the Road Competition
- BASF Design Awards Finalists 1997/8/9.

#### **Integrating the technological and creative elements through design projects**

The main integrating factor of our awards are the practical design projects which occur at each level of the course and are the vehicles that bring together and test skills.

#### *Level 1 project*

The first project module is product design studies II which has been described above. For many students this is their first experience of a design brief and is therefore diagnostic. The design briefs at this level are highly prescriptive outlining what is expected and the important elements of each project are denoted by the marking scheme. Each project is concluded with a report where the student relates design, materials and manufacturing issues as well as accounting for their overall management and approach.

#### *Level 2 projects*

At level 2 the learning process is tested in a design and make project which is part of the design practice module. This project is tackled by students working in pairs. Workload is shared for all aspects of the project. Each student group takes responsibility both for the design and manufacturing work. Projects have included:

- device for transporting a windsurfer

- small portable hand held wind anemometer for yachting and outdoor activities
- weight lifting/exercise bench
- cycle carrier for two cycles attached to the tow bar bracket of a car.

As well as the manufactured artefact, each student team is expected to submit a comprehensive report which includes research, design ideas, CAD drawings, finite element analysis, costing, materials selection and manufacturing detail.

### *Level 3 project*

The final semester of level 3 is devoted to the major design project. This project is expected to be developed to first working prototype stage which involves considerable time in workshops. Students initiate their project topic which has to be planned in detail with an agreed management plan before making is undertaken. Project topics have been wide ranging with examples being demonstrated on slides when this paper is presented.

### **Updating the curriculum – relating design to emerging social and technological needs**

During the ten years that the product design curriculum has been validated we have constantly tried to review and upgrade what we do. In extending the CAP D into three other design awards considerable time was spent discussing the impact of changing social and technological needs on Design. The post second world war consumer society has been shaped by product design with an emphasis on creating new products and markets. In developing useful products for the next century we will have to get under the skin of social, lifestyle and user needs and the relationship of these needs to technological innovation. Issues to be faced by design will include the ageing global society, disability, sustainable resources, and the twenty four-hour society.

### *Design and the ageing global society*

Rising life expectancy and declining fertility are producing a world populated by older rather than younger generations. In fact the world is getting older and will never be young again. In many industrialised nations the older generation will in future hold up to 75% of national discretionary incomes, that is money available for purchasing non-essential luxury goods such as top of the range cars, second homes and financial products. Not only will the older generation have the wealth but the health to enjoy that wealth.

At present manufacturers appear to be catering for the physical decline aspects of ageing using design to provide all manor of disability products such as mobility trikes, chair lifts, specialist bathrooms and accessories. Both manufacturers and designers have as yet failed to see the potential of future markets in this area where this sector of society will be composed of the post second world war baby boom generation for whom design has created and catered for their developing lifestyle in youth and middle age and who will expect design to cater for their needs into old age.

### **Design and disability**

Although disability has been linked to ageing physical impairment, it can occur at any age. During the 1990s we have started to see disability move into the centre of the political stage particularly in terms of equal opportunities and anti-discrimination.

The UK and American Disability Discrimination Acts of the 1990s have developed a new awareness to the needs of the disabled with legislation making public funds available to improve the environment and lives of these members of our society. The urban environment has seen an improvement in specialist parking for the disabled, increased wheelchair access and improved toilet facilities in buildings, and Braille slabs and crossings for the visually impaired, but this is only a start.

Awareness to both ageing and disability is now part of the design curriculum at Wolverhampton through the module 'Human Factors in Design' common to all four undergraduate awards. At undergraduate level we have already undertaken project work on swimming aids for cerebral palsy sufferers and portable physiotherapy equipment to help the relief of cystic fibrosis. These issues are also part of our post graduate research culture with a PhD being undertaken in the design of furniture for young arthritis sufferers, while at post doctoral level, a joint project, with the School of Health Sciences, is looking at the design of toys for

babies born pre-term. We see both design for ageing and design for disability as areas not only to be addressed by our curriculum but growing international design areas of the next millennium.

#### *Design and sustainable resources*

This is an old but important issue in which design has a role to play. Design has been guilty of encouraging the 20th century throw away society. It is through design education that we can effect a paradigm shift as far as waste is concerned. Recycling and environmental and sustainable resource issues are now central to all student project work at Wolverhampton. We now expect these issues to be considered and addressed.

#### *Design and the emerging twenty four-hour society*

The concept of the twenty four-hour society put forward in the 1990s by Martin Moore-Ede has today become much more a reality through advances in information technology.

The development of personal communication systems, the cellular phone, the fax and e-mail, means we now live in a world that never stops. We can now communicate more easily, quickly and cheaply on a global scale than was dreamt of a quarter of a century ago. The 'global village' is now a reality. Instant communications have spawned service industries to support the twenty four-hour lifestyle. We have access to our money day and night through credit cards, hole in the wall cash dispensers, telephone and computer banking and to allow us the freedom to spend it we have the introduction of seven-day opening and television and Internet shopping. Shopping has now become the major pass time of industrialised societies.

Against this background of availability on demand at any time we have a global workplace demanding a work force on a twenty four-hours a day, three hundred and sixty five-day basis. The old concept of office or opening hours no longer exist. Career security and a job for life has gone. Politicians inform us that we should expect a number of careers during a working lifetime.

Within the instability of the twenty four-hour society, lifestyles are changing and design has a role to play in informing those lifestyle changes.

#### **Summary and conclusions**

The practically based modules described in at the beginning of this paper build confidence through direct experience. Believing that 'success builds success' each module aims at the student achieving attainable goals. A number of interesting observations concerning our approach have come to light from students. Using independent learning to promote the development of practical skills the students find it less inhibiting to work away from the classroom situation. Away from the classroom and the gaze of their peer group, students feel they are free to experiment and learn by making mistakes with no fear of being ridiculed in making a mess. Producing work in this way, they feel, promotes achievement and independent decision making. Seminar discussions at the start of each teaching session were felt to be constructive and to inspire confidence to achieve.

The level 1 and level 2 modules are a prelude to the level 3 design competition and the final design project modules. Students feel that design competition tests the standards of achievement in the professional context of and externally set and judged project. Success in external competitions over the last few years gives confidence to both students and staff that work meets national standards.

At level 1 the project that is part of product design studies I is purely diagnostic. The level 2 project in design practice tests the student skills in working as part of a team. Each team member acts as critic of the work of their partner.

The final project modules are a summation of the students' abilities at the end of the course and bring together theoretical and practical skills.

Considering social issues such as ageing, disability, sustainable resources and the 24-hour society in the context of design challenges both staff and students and encourages pro-action as opposed to reaction to important issues. Debating and questioning such issues allows them to be the leaders of innovation and the future development of product design as a discipline.

**References**

Moore-Ede, M. (1993) *The 24 Hour Society*, London: Piatkus

'Sitting with Nellie' is a teaching concept that was adopted by Art, Design and Craft Courses. The concept was penned by Cal Swann.