From Ivory Tower to Fantasy Castle
A Design Case Study of Industrial Collaboration

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***Abstract* – KTPs, Knowledge Transfer Partnerships, is Europe's leading programme helping businesses to improve their competitiveness and productivity through the better use of knowledge, technology and skills that reside within the UK knowledge base.**

Part funded by the government and lead by staff at The University of Northampton, design competence is being developed for the retail division of a charity providing medical and palliative care.

A product design graduate has been employed to research, plan and implement a new product design methodology by designing 3D novelty giftware products, decorative items and toys. Learning and teaching at the university has been enhanced through exposure to highly current solutions to new markets and regulatory requirements, amalgamating the KTP experience into live teaching.

Students at the university see an operation involving manufacturing overseas, with some parts made by automated process, shipping from the Far East and UK distribution. The paper exemplifies a case study of a design and prototype development of a range of toys that the charity might sell through its chain of shops.

BSc Product Design level one students have to develop the technical, physical and visual requirements for miniature dolls houses, creating component drawings and models for prototype production using CAD and Rapid Prototyping.

The paper aims to discuss the relative merits of undergraduate projects briefed by industry, furthering staff development and leading to undergraduate placement opportunity.

Index Terms – Design, China, Knowledge Transfer Partnerships, Prototype

INTRODUCTION

The design division of the University of Northampton (TUoN) runs a number of courses in 3D Design, most appropriate in the context of this KTP is the BSc Product Design, which has been running since 1994. The programme has had numerous European industrial sponsors for design projects over the years, but a collaboration with Sue Ryder Care offered exposure to the Chinese manufacturing base, and the management of international projects with language and cultural challenges.

A product range of dolls houses already existed (and was marketed as "Hickleton Collectors Club"), see Figure 1.

FIGURE 1
THREE STORY DOLLS HOUSE KIT

The products had been successfully retailed through the charity's chain of approximately four hundred shops within the UK, however, all the dolls house designs had been bought in from Chinese trade fairs, as "Sue Ryder" had no in-house design capability.

The Operations Manager of Sue Ryder recognized this lack of capability and made the initial contact with The University of Northampton to investigate how it might be possible to bring this competence into the company, and in so doing was informed about the details of the UK Knowledge Transfer Partnership (KTP) scheme.

HOW DOES A KTP SCHEME WORK?

It is funded by UK Government organisations - led by the Department of Trade and Industry (DTI), Knowledge Transfer Partnerships involve the forming of a partnership between a company (here Sue Ryder Care) and an academic institute (the knowledge base partner, here The University of Northampton), enabling rewarding and ongoing collaborations with businesses who require access to skills and expertise to help their company develop, see Figure 2.

FIGURE 2
KNOWLEDGE TRANSFER PARTNERS

The partnership also involves the employment of one or more recently qualified graduates (associates) to facilitate this transfer of skills and expertise. The associate is supported (typically weekly meetings) by an academic supervisor, which provides academic direction to the associate, who works within the company on a project of strategic importance, here the focus is 3D giftware.

A formal application was then made to the DTI, requesting project funding, based on the joint submission of a comprehensive proposal document. The application was successful in 2006, and recruitment of an associate was then undertaken; in terms of lead time from initial discussions with Sue Ryder to appointment approximately nine months had elapsed, which is fairly typical for this scheme.

The use of the KTP initiative allowed, through the employment of a graduate designer – the associate, the embedding of a new product design (NPD) methodology within Sue Ryder Care. This is a strategy designed to exploit the associate's creative skills and deliver an enhanced income stream that can be fed into the charity's care operations, helping disadvantaged individuals who often suffer from severe medical problems.

In terms of academic tangible benefits it was decided that during the implementation of the NPD methodology, and the creation of the "Fantasy Castle", a parallel project would be run with the first year undergraduates enrolled on the University's product design course. The initial brief linked contextual studies and model-making by setting the task of developing an Art Deco dolls house, a themed design not available anywhere within the UK market. The research for this project was undertaken by initially arranging a field trip to the Victoria and Albert Museum of Childhood in Bethnal Green, London, see Figure 3.

FIGURE 3
VICTORIA AND ALBERT MUSEUM OF CHILDHOOD

The appointment of the associate (on a fixed two year contract in the first instance), followed a practice based selection process, including portfolio review, where the industrial partner was heavily involved.

The associate, whilst working for the company, remains technically an employee of the University, and is the beneficiary of considerable management training opportunities provided "free" by the DTI. The associate is also expected to enroll on and engage with a National Vocational Qualification (NVQ) level 4 qualification in business management, and could also include a higher degree programme, a MPhil.

Whilst the KTP project proposal defined the primary focus of the associate, the work undertaken at the outset is that of company familiarisation. The existing working practices being monitored, leading to suggestions on how they could be improved.

Following the initial period of familiarisation, a rapid movement to clarify technical specifications being supplied to the Chinese manufacturing companies was identified as being critical. Due to language, time and cultural differences the accurate transfer of information was identified as a problem in the existing process, and steps to improve communication were introduced.

Improved Communication to Manufacture

Thereafter, all model production requests had to have clear dimensional information specified, colour ways including Pantone colour swatches were stipulated, and assembly instructions, where appropriate defined.

A solid modeling CAD system was purchased (SolidWorks) on behalf of the associate, and put into operation within Sue Ryder Care, with a view to eliminate misunderstanding of these manufacturing requests.

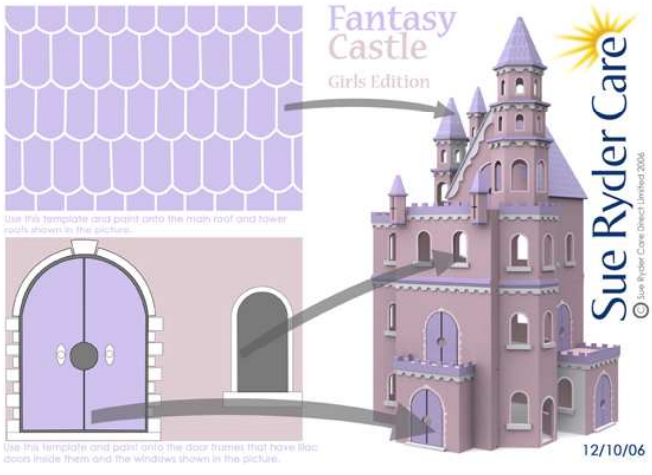

FIGURE 4
COLOURWAY AND INFORMATION SPECIFICATIONS

FIGURE 5
DIMENSIONAL INFORMATION SPECIFICATIONS

The improved communications resulted in a considerable improvement in quality of the shipped units received from China, who in turn had implemented a complimentary CAD system to accept the geometry. Following a period of approximately six months the associate had the opportunity of traveling to China to visit the manufacturing plant, some images of the "labour intense production line" are shown in Figure 7.

The visit to China also stimulated two further realisations, the first being concerns about company confidentiality and the second about sourcing the products, both clearly being inter-related.

It is common practice to allow clients free access to view the production facilities in China, hence any new design being introduced is inevitably disclosed to the commercial competition. A strategy of releasing only aspects of any new design was then identified as essential to retain the "first to market opportunity". As the original designs were bought in, modifications to make them more appropriate for Western markets were problematic, hence, resulting from this visit it was decided to "Reverse Engineer" (produce accurate computer based solid models) some of the volume sellers. The creation of precise 3D geometry thus allowed subtle changes to be defined accurately, and to source different parts from a range of suppliers, hence improving confidentiality.

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TEACHING AND LEARNING BENEFITS AND CHALLENGES

A typical engineering and design course in the UK is structured to allow for a project with a live client, such as a manufacturer in the region. First of all, a suitable partner company has to be identified, contacted and importantly be prepared to work on a jointly developed and appropriate project. There is also the challenge in achieving outcomes that fit the programme of learning (as defined by the curriculum, and the associated module specifications which describe the Award Map).

As Lund and Budny summarize [1] these challenges can be summarized as:

1. Determining what the students should expect to learn from the course, as well as the processes through which they will achieve these expectations.

2. Determining the expectations of the instructor in terms of not only the standards by which the instructor will grade the students, but also of student behavior in class and with the community partners.

3. Identifying what the community partners should expect to contribute and expect to gain by agreeing to become involved with the course.

The product design course has experience involving industry for over a decade. More recently, KTP schemes have been found suitable to provide the framework for a successful project with UG students. The discussed design case study is the forth KTP within product design at Northampton, referred to as 'knowledge base'.

LIFE PROJECTS FOR FRESHMAN DESIGNERS

The course the authors are involved in provides live projects to freshmen (Year 1 undergraduate students). The studies lead to a Bachelor of Science, which aims to develop from early-on professionalism, such as adhering to deadlines and identifying deliverables, team work, problem solving through investigation, experimentation and making, see Figure 6.

Students thus develop problem-solving skills early on, used in future assignments, they benefit from a portfolio piece with a brand name, potentially seeing the winning design being further developed for manufacturing and marketable products. Students therefore gain early insights into the workings and constraints within in-house design.

FIGURE 6
STUDENT MODELMAKING

ART DECO DOLLHOUSE STUDENT PROJECT

Aims: to develop a range of 2D concept ideas, 3D sketch models and CAD skills

Objectives: as set out in the project brief, working in pairs, to design a doll's house and a range of furniture for one room that is themed in the Art Deco period - that the Sue Ryder Care Charity might sell through their chain of shops.

Group and time frame: year one product design students, this study/project reaps benefits to a range of modules: Design Project, Engineering – 3D Modeling and Manufacture, Contextual Studies and 3D Experimental Design. The project has been facilitated by a core team of design provision with three members of staff and supplemented through staff input contextual studies, i.e. a lecture on art deco architecture and decorative arts.

The KTP associate acts as company contact and is instrumental in devising the project's objectives, communicated in a brief; he had class contact on four occasions throughout the duration of the project.

The learning was organised in studio tutorial sessions, with focus shifting to workshop (making facilities) input in the second half of project. A photo session introduced photographic documentation of models in a controlled light facility. Further, students received a lecture on the Art Deco movement, had the opportunity to join two supporting field trips

Visits to China undertaken by the associate developed a better understanding by the students to the manufacturing facilities and techniques available, see Figure 7.

FIGURE 7
MANUFACTURING OF DOLLHOUSE PARTS IN FUJIAN PROVINCE CHINA

THE ECONOMIC CONTEXT: UK MARKET AND MANUFACTURE IN CHINA

The brief, as devised by the KTP associate and summarised below, illustrates the economic context in which the industrial partner company operates; serving the UK market through a chain of giftware retail outlets and manufacture in overseas, such as labour intensive model-making in China, providing sound profit margins:

User profile: the customer base tends to be age 40+, female and mothers.

Art Deco: the design must be based on domestic British housing, if possible, this will help to provoke nostalgia and encourage the customer base to make a purchase.

Materials: most doll's houses are made from MDF or Plywood. The smaller components tend to be made from pine and basswood.

Manufacturing: all the components are made from timber, so most traditional wood working methods are used, some parts are made by automated process. Most panels are either screwed or glued together. A sample doll's house and furniture was be provided.

Distribution: students would need to consider packaging. This is an increasingly important issue for Sue Ryder Care. Increasing packaging density helps to reduce the final cost, saves time and resources.

IDEA GENERATION

Marker on layout paper was used to generate a range of images describing features of the fantasy castle design, these are communicated to the project manager in a presentation of proposals prior to developing 3D models or CAD files.

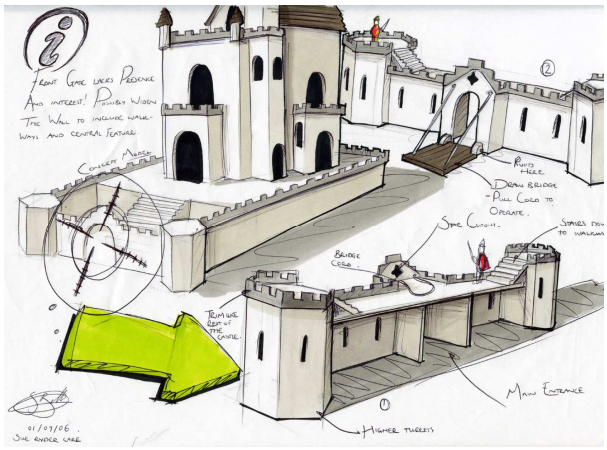

FIGURE 8
2D DEVELOPMENT SKETCHES

MODELMAKING

For a interim review a mockup model was required, made to the scale of 1:12, a standard size for doll houses, with measurements taken off a sample provided by the company. The build execution was in foam board (polystyrene sandwiched in between paper) and corrugated card. Allowing discussions of overall dimensions, with proportions suitable for display purposes, issues of assembly, flat pack and design features such as bays and staircases were also considered.

The model is the strongest tool a designer can use to present three dimensional ideas to a client. Here, materials, including resins, foams, plastics, solvents and adhesives, as well as state-of-the-art techniques, professional tips and tricks were learnt. Scale models also allowed the careful consideration of flat pack/packaging

The year one students had a live introduction to soft modelling, interior scale models of medium complexity in card and foam board, fostering an understanding of measured drawings, familiarisation with 3D workshop facilities and equipment, professional practice, see Figure 9.

FIGURE 9
CASTLE 3D DEVELOPMENT

CAD AND PROTOTYPING

Based upon the CAD files supplied by the associate plus the associated renderings, the Chinese manufacturer were able to interpret and accurately generate a prototype model.

This prototype allowed the examination of features such as flat pack assembly, in this design the sections of turret nest in order to compact the packaging, see Figure 10.

FIGURE 10
CASTLE PROTOTYPE

UK MARKET LAUNCH

The UK launch of the fantasy castle was made in conjunction with a UK newspaper, The Daily Mail. The decision to take this approach as opposed to retailing it through the Sue Ryder shop chain was made in order to obtain high volume sales, but with a reduced margin, see Figure 11.

FIGURE 11
CASTLE PROMOTION – DAILY MAIL

The outcomes to date are:

- 5,000 initial orders, high profit envisaged.
- Fantasy figures – promotion following in the Daily Mail as an up sell to the Castle.
- Fantasy castle revisited – currently under negotiation with a UK based firm to manufacture a larger derivative, with added value components and potentially a lower carbon footprint.

CONCLUSIONS

The use of the KTP scheme illustrates some clear advantages to all parties involved:

Undergraduates experience curriculum enrichment through live projects, exposure to business situation and a real understanding of lead times and deliverables.

The production of models enhance manual skills, and a deepened understanding of 3D CAD and template generation, and possible undergraduate placement opportunities.

The applied research undertaken by academic staff in the context of the KTP provides up to date understanding of current market trends, marketing strategies and manufacturing processes in a globalised market, which can be fed back into teaching.

The industrial partner having had a new design capability embedded within the organisation, is presented with a wider set of strategic opportunities and increased Company profitability.

The relationship between business and academic institution is likely to be more than a short term gain, and provides networking opportunities to benefit both parties.

The associate benefits in terms of experience, furthered academic and management competences leading to fast track career progression. The UK economy thus gains through increased business turnover.

ACKNOWLEDGMENT

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