WHAT'S IN A NAME? (STAKEHOLDER PERCEPTIONS OF ENGINEERING PROGRAMMES)

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Abstract— *As with many Higher Education Institutions in the UK, the University of Paisley has experienced a significant drop in the number of applications for engineering degrees in the last five years. As part of a Faculty strategy, it was decided to replace the two existing Honours degree programmes in Mechanical Engineering and Manufacturing Systems and Management respectively with a single Honours degree focusing primarily on design. As part of any new programme proposal at Paisley some assessment of the market must be carried out. A professional market research company was commissioned to carry out the research with leads and guidance provided by the University. A number of objectives were set and these included trying to establish the main influencing factors when making university applications, the perception of 'design', the perceived link between mechanical engineering and design and the perceived importance of industrial links and university facilities. This paper details the methodology, findings and subsequent conclusions from the market research.*

Index Terms ¾ Application factors, market research, perception of engineering programme content, perception of programme titles.

INTRODUCTION

In response to declining interest in traditional engineering programmes (in this case Mechanical Engineering and Manufacturing Systems Engineering respectively) brought about by factors such as changing: demographics, global and local economic factors, inward investment patterns, Engineering Institution Regulations (SARTOR III) [1], University strategy [2], and the emergence of Incorporated Engineer programmes [3], the Division of Design and Engineering was engaged in developing a new design-based degree programme. Indeed, whilst there appeared to be evidence that indicated a national decline in applications for engineering courses as a whole, there also appeared to be a demand and growing market for design-based courses that still utilise and expand on the existing provision offered by engineering departments/divisions.

As part of the programme validation process within the University, the Division of Design and Engineering had both a requirement and obligation to obtain feedback on the relative strengths and weaknesses as well as to establish potential demand and attractiveness of such a proposed programme in the marketplace. Once completed, the results of the study could then be fed to senior management to assist in the programme validation process. However, and possibly more importantly, the results could be used by the programme development team in their task of developing a new programme with maximum stakeholder appeal.

RESEARCH OBJECTIVES

The key aim of the project was to investigate attitudes towards and perceptions of the proposed new Engineering/Product Design course. The information gathered would be used in developing a new undergraduate programme of study focusing on design, for future, potential stakeholders. Specific research objectives for this market research project included [4]:

- to explore perceived importance of facilities, industrial links and facilities;
- to investigate attitude towards design and engineering as a fields of study;
- to examine perceived importance of course title;
- to gather reactions to and perceived attractiveness of proposed Titles and Option Streams;

In addition, the University took the opportunity to explore other, macro-issues that are outwith the scope of this paper.

RESEARCH METHODOLOGY

Market Research UK Ltd. were commissioned by the University of Paisley to perform research that would investigate levels of interest in Engineering and Product Design courses amongst a representative sample of stakeholders in Higher Education (HE). This research was performed with full co-operation of the University's Division of Design and Engineering.

This entailed adopting a qualitative approach to the research and encompassed both focus groups and in-depth interviews of stakeholders. The following sections briefly outline these methods.

Focus Groups

A total of four group discussions were carried out during October 2001. Respondents were drawn from a number of different schools and colleges in four geographical areas in order to cover an even spread of opinion and minimise bias. The focus groups consisted of three groups with S6 pupils in

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three areas (Ayr, Gourock and Paisley) and one group with Further Education (FE) students in Glasgow.

The University of Paisley provided a list of School and FE contacts. All contact names were sent a letter by Market Research UK Ltd. giving details on the background to the research. Market Research UK Ltd. then contacted the School and FE contacts via the telephone who assisted in bringing together pupils and students who fitted the specified criteria. Table 1 illustrates the focus group compositions.

TABLE 1
FOCUS GROUP COMPOSITION

Group	Gender	Type	Location
3	Mixed	S6 pupil	Ayr
2	Mixed	S6 pupil	Gourock
5	Mixed	S6 pupil	Paisley
5	Mixed	FE student	Glasgow

All respondents were interested in studying Engineering/Product-based Design subjects for the first time (S6 pupils), or in continuing their engineering studies (FE students). All S6 pupils and FE students were currently undertaking courses of study which included Scottish Qualification Award *Higher* programmes and Higher National Awards programmes in: Mathematics, Physics, English/Communication Studies, Design-based courses, and Engineering-based courses. However, questions on their personal preferences indicated a wide spread of interest in many different aspects of engineering/design, including, but not limited to: Product Design Engineering; Electrical and Electronic Engineering; Civil Engineering; Mechanical Engineering; Aeronautical Engineering; Naval Architecture; Computer/Software Engineering.

Finally, Market Research UK Ltd. designed the topic guide around which the discussion would centre with the Division's input, comment and approval prior to any group discussions. A Market Research UK Ltd. Executive, following this topic guide moderated each group discussion.

In-Depth Interviews

A total of fifteen in-depth telephone interviews were conducted as illustrated in Table 2.

TABLE 2
IN-DEPTH INTERVIEW CONSTRUCTION

No. of Depths	Type of Respondent
3	School Guidance Teacher
2	School Technical Teacher
5	Employers
5	FE Guidance Teachers

Once again, the University of Paisley provided lists for School, FE Guidance and Employer contacts, who were sent a letter explaining the background to the research. This initial communication was followed by a telephone call to recruit respondents for the interviews.

Of the five employers who were interviewed for the research, their roles ranged from Managing Director and Operating Manager to Engineering Manager. These respondents were employed in small (1-49 employees) to medium (50-249 employees) companies engaged in design (engineering-based) or manufacturing activities.

With respect to the Guidance staff recruited, all were currently teaching a diverse range of subjects within their school or college, which is typical of guidance in both schools and FE.

Once again, a Market Research UK Ltd. Research Executive following an appropriate topic guide conducted all interviews.

APPLICATION FACTORS

All respondents were asked what they considered to be important elements to consider when applying to a University. The results of this part of the market research exercise also confirmed and reinforced previous market research findings for similar exercises undertaken on behalf of the University. The factors given, in order of the number of responses received were:

- Many respondents were focused on the 'end product' of the degree. Therefore, the quality of the degree was perceived (particularly by FE and S6 pupils) to have an impact on future employability. In addition, *future employment prospects* was considered to be one of the most important factors when making an application to University by both FE and School Guidance Teachers.
- The reputation of the establishment overall was considered by many to be vitally important. Some school /FE guidance did not consider the actual reputation of the establishment to be as important as the personal effort of the student within a degree programme. S6 pupils and FE students considered the reputation of the establishment to have a major effect on the employability prospects after they had completed their degree.
- The reputation for a specific type of degree at an establishment was another factor considered by many respondents, in particular S6 pupils, was perceived to be important.
- Geographic location was considered important to all respondents but not perceived to be a main motivator of choice. This was perceived to be more important to those respondents who had budget considerations or wanted to move away from home.
- The quality of equipment at the establishment was considered to be vital to FE and S6 pupils, and it was important to ensure that the equipment was not only modern and up-to-date but also was industry compatible.
- Many of the S6 pupils and FE students commented on the fact that they consulted League Tables for more information on universities and this encompassed looking more closely at the quality of staff and the teaching at an establishment.

- There was a general consensus amongst all respondents that the 'end result' to a major extent was dependent upon the actual content of the degree and as such this was considered to be another important factor to consider.

PERCEPTIONS OF ENGINEERING AND DESIGN

Using the topic guides prepared for the focus groups all respondents were probed with regards to their perceptions on a number of issues, including:

- **Clarifying the perception of what 'design' is:** this focused on what the word 'design' meant and identifying asscociated words and exploring the issue of Enginering v Art in the context of design.
- **The perceived link between mechanical engineering and design**: this was trying to establish if the stakeholders perceived that there was a link and then asking them to state why or why not as the case may be.
- **Perceived importance of industrial links for programmes**: establishing if the stakeholders felt that industrial links within a programme provided any benefit and what these perceived benefits were.
- **Perceived importance of facilities:** trying to establish the views of the stakeholders on the type of facilities that should be available and how they should be employed within a programme.
- **Perceived importance of programme titles:** trying to establish the views of the stakeholders on the attractiveness of specific programme titles and the perceived content based on these titles.

Reactions to each of these issues are outlined in the following five sub-sections:

Perception of 'Design'

In general there was agreement from all stakeholders that 'design' applied to both engineering and the arts. However, each stakeholder group aired some individual views.

The S6/FE students appeared to have very narrow views of the term 'design' and this was highlighted further when they were asked to give examples of words associated with this term as illustrated in Table 3. This limited perception also influenced their views on course titles and option streams.

There were also strong views aired by the guidance teachers, particularly those from FE, that the Engineering v Art perception would be heavily influenced by previous personal experience and knowlegde on the subject. The guidance teachers also had a fairly limited perception of design as illustrated by their examples of associated words as illustrated in Table 3.

TABLE 3
WORDS PERCEIVED TO BE ASSOCIATED WITH 'DESIGN'

S6/FE Students		School/FE Guidance
Creation	Product design	Innovation
Production	Something new	Stylish/fashion
Buildings	Product evaluation	Aesthetics
Imagination	Bridges	Tunnels
Drawing	Shapes	Market niches
Art	Cars	

While employers firmly agreed that there was a strong link between enginering and the arts in terms of design, they expanded freely on their perceptions of design. They considered there to be two key aspects to design, namely the functionality and the cosmetic appearance of a design i.e. not only must it look good, it has to work! Design was considered to be an all-encompassing cycle from conception to completion and must be cost effective and 'fit for purpose'.

Perceived Link Between Mechanical Engineering & Design

There was general agreement that there was link between mechanical engineering and design. When pressed for a view on the nature of this link, the general perception was that mechanical engineering would help 'build the design concept' and that 'design would help package the concept'. This was interpretated as mechanical engineering providing the analysis upon which a concept was developed and the 'design packaging' being the ergonomics and aesthetics of a product.

Perceived Importance of Industrial Links

There was general agreement across all stakeholders that industrial links were important and provided benefits to both students and employers alike.

The S6 and FE students felt it particularly important that any such industrial links within programmes were explained fully at the initial stages of application to an establishment. They also perceived links with well known and established companies would increase employability upon graduation. These views were echoed by the guidance teachers.

Employers acknowledged that studying design in HE was difficult without links to industry that would allow students to gain invaluable practical experience. However, employers also perceived benefits of having strong links with HE in that students would have up-to-date knowledge of industry and could relate to the needs of industry and employers as whole.

Perceived Importance of Facilities

In general good facilities were expected of a University. Furthermore, they were considered an essential part of the delivery of a design-based programme. The facilities provided should be up-to-date and reflect industry standards.

In addition, employers felt that the use of such facilities not only gives the student a good understanding of such

equipment, but also improves the competitive position of such graduates in the employment market. However, some employers expressed the view that it is unrealistic to expect Universities to be able to provide all state-of the-art equipment. Therefore, employers placed emphasis on the fact that the understanding of general concepts is as equally imporant as the use of such equipment. Furthermore, the ability of HE to adapt to the use of new equipment was also considered important.

Perceived Importance of Titles

Despite the fact that there were a number of different views expressed across the stakeholder groups, all agreed that a programme title should accurately convey its content. Many also felt that the title should also 'sound good' to make it more noticable, although there were some who felt that content was more important that the actual title. The FE students in particular placed least imporance on programme title as they perceived a degree as a 'stepping stone into employment'. Finally, employers stated that most graduates were hired on the basis of their performance as opposed to specific degree titles and as such they did not consider it particularly important.

REACTIONS TO PROPOSED PROGRAMME TITLES

A major part of the market research was to try to establish what would be the most effective title to attract potential students on to a design-based programme. Therefore, using the topic guides only the S6 and FE students were asked to consider the programme titles. However, it was considered more appropriate to ask all stakeholder groups to consider the option streams.

A number of different programme titles were presented to S6 and FE students and asked for their perceptions on the content of such titles. The four titles to be considered were: Product Design; Product Design Engineering; Engineering Design and Design. Reactions to each of these proposed titles are outlined in the following four sub-sections:

Product Design

The general perception of a programme with the title Product Design was that the content would be a mixture of science and art-based subjects, graphical communication and design. The S6 students in particular expected that this might be art-based in nature. It was thought that this type of programme would appeal to those students interested in art, maths, physics and/or technical drawing. However, a number of students thought it sounded too art-based and on the basis of this it would not be of interest. Subsequently there was a medium level of appeal for this title.

Product Design Engineering

There was an increase in the level of appeal for the Product Design Engineering title, particularly from students interested in engineering related programmes. The perception was that the content of this programme would be more difficult than that of Product Design as it would be a mixture of design and engineering subjects. It was perceived that this would cover a wider and more diverse content base and include drawing, design applications, marketing and computer-aided design (CAD). Due to this, it was thought that this would appeal to students in art and design, engineering or both. It was fair to say that this title was preferred to that of Product Design on that basis that the use of the word 'engineering' implied that design would be covered from a functional and an aesthetic/ergonomic perspective.

Engineering Design

The third title to be considered was that of Engineering Design. This was perceived to be more engineering-based as the word 'engineering' came first and thus was emphasised. In terms of content this would involve more practical work, CAD and probably be biased towards structural and civil engineering. Consequently, it was thought that it may be of interest to those wanting to pursue careers in civil engineering. Finally, for those students already interested in engineering, there was a high level of appeal for this title.

Design

The fourth and final title to be considered was that of Design. The general opinion was that this title was too vague in comparison with the others. As such it was perceived not to convey enough about the content of such a programme. However, a number of art-based students though the title to be 'quite appealing'. They suggested that a course such as this might allow for choice and specialisation at the later stages of the programme, with a broad base of subjects being covered in the early stages but were not quite sure what! On the whole very few students suggested possible content due to the vagueness of the title. Consequently, in general this title had a low level of appeal due to this vagueness.

Summary

In summary, the most popular title was perceived to be that of 'Product Design Engineering'. This was due to the fact it was considered to provide a clear indication of the programme and it's content. It was thought that this would appeal to those interested in both art and engineering. There was equal appeal in the titles 'Product Design' and 'Engineering Design' depending on personal preference for engineering or design. Finally, the least popular of the titles was that of 'Design' as it was considered to be too vague.

REACTIONS TO PROPOSED PROGRAMME OPTIONS

The options to be considered were grouped into four cognate groups or streams and all stakeholder groups were asked to consider them. The option streams under consideration were:

- Sport Technology/Medical Device Technology/Bio-engineering/Sustainable Technology;
- Mechatronics/Product Development/Manufacture;
- Virtual Modelling/Advance Simulation/Graphical Communications/Digital Prototyping;
- Entrepreneurship/Marketing/Business Studies/Quality Management.

Reactions to each of these proposed option streams are outlined in the following four sub-sections:

Sport Technology/Medical Device Technology/Bio-engineering/Sustainable Technology

In general it was considered that these option streams would appeal to those interested in medical engineering, electronic equipment or biology. In fact, many felt that although the option stream seemed to focus more on biology rather than mechanical design, it still offered a wide and diverse range of subjects. Thus it would allow many career options to be pursued and these would typically be in designing sports equipment, prosthetics or hospital equipment.

There was a low level of appeal from the S6 and FE students for these options. This was on the basis that it was perceived to be less engineering driven as a result of the option streams. As such it was perceived as more of a medical- or science-based course.

School and FE Guidance Teachers found this option stream 'quite appealing' as they perceived this as an area of interest for students. They also felt that it would be necessary for students to have a good grounding in maths, physics, chemistry and computing to be successful in this option stream. Some FE Guidance Teachers though it might be more appealing if it had more of a focus on engineering applications in the medical field.

There was a high level of appeal for these option streams amongst employers. They considered this to be extremely valid in society as it was covering an area of expertise perceived not to be widely available to students. They also considered it was more likely that in such option streams that the 'total design approach' was more likely to be considered and both functionality and aesthetics would be covered.

Mechatronics/Product Development/Manufacture

All stakeholder groups considered these option streams to be more engineering-based than the others. Consequently, it was generally perceived that students with a strong interest in engineering and were strong in subjects such as physics and/or maths would be interested in these option streams. Typical career paths might include working in the electronics industry, in production control, servcing, manufacture of mobile phones, computing, CAD or as a design or development engineer.

This had a high level of appeal for S6 and FE students as it was perceived that these option streams would be more practical and engineering-based. They thought that this might include subjects such as industrial manufacturing and/or electronics. They also felt that there was not enough specialisation in these streams and that something needed to be added. They also perceived these option streams as being relevant in industry.

The guidance teachers perceptions more or less fitted with the general perceptions. However, in addition they thought this may include design with manufacture, electronics, mechanics and computing.

The majority of employers thought the option stream titles were too vague and general. Therefore, they were unsure as to what the content of the option streams would be.

Virtual Modeling/Advanced Simulation/Graphical Communications/Digital Prototyping

In general it was felt that this option stream was Information Technology (IT) based and may even involve software engineering. Consequently, it was felt that those students interested in IT would be most attracted to this. It was perceived that a good grounding in computing/IT, art, maths and physics would be required for this stream. It was thought that career options would be wide ranging and may even include computing careers.

The S6 and FE students felt that only those interested in computing would take up this option while others would reject it. They also perceived that industrial links for this option would make it very attractive to those already interested.

Employers thought this option to be very appealing as they perceived it as useful in the workplace. They felt that these options provided the students with skills that would not be covered elsewhere. Furthermore, they considered the content of this option stream to be a very important area related to the design process.

Entrepreneurship/Marketing/Business Studies/Quality Management

The initial reaction to this stream from the students and guidance teachers was that it would not be of interest to those interested in engineering and would actually be of interest only to business students. However, upon reflection a minority of S6 students and FE Guidance Teachers thought that this could be a useful option for engineers. This was based on the fact that it could give engineering students an insight into the overall economic viability and marketability of a design project.

In contrast, employers thought the options in this stream to be essential for students to be comfortable in a business environment. They believed that students need to be able to relate their technical skills to the business environment. They also felt that this should have a financial and project management element included. Consequently, this option had the greatest appeal to employers.

CONCLUSIONS

The market research exercise undertaken on behalf of the University of Paisley yielded a number of conclusions which are outlined below:

- The majority of respondents felt the most important factors when applying to University were the quality of the degree, the employment prospects after the degree and the overall reputation of the establishment.
- The majority of both S6 and FE students held no clear understanding of 'design' despite showing an interest in pursuing a career in this field.
- In general, with the exception of employers, there appeared no clear understanding of the relationship between design and engineering.
- All respondents considered industrial links to be very important and to offer benefits to both the student and the employer.
- There was mixed reaction to the importance of the degree title. For S6 pupils and FE students in particular, the most important factor for a title was that it accurately identified what was being studied within the degree. Whereas FE/School Guidance and Employers recognised that the degree title would have to initially attract pupils and students to the degree.
- With regard to attractiveness of the proposed programme titles, Product Design Engineering held the widest appeal to the majority of respondents. The Engineering Design and Product Design titles had more limited appeal.
- There appeared to be a polarisation of opinion between S6/FE students/Guidance Teachers and employers with respect to the attractiveness and importance of the proposed option streams. This was evidenced most strongly when considering the 'Entrepreneurship, Marketing, Business Studies and Quality Management' options. The majority of students and teachers perceived this to be aimed at people with a Business interest rather than Engineering. However, employers considered this option stream to be essential in the current industry climate. This in line with current national economic strategies that define 'talent' as comprising three major components, namely technical skills, business skills and entrepreneurial skills [5].

One factor that may have influenced the findings of the market research was the fact that all students involved were already interested in studying engineering or design. A larger population with more varied interests may have changed the findings accordingly. However, the cost of carrying out such extensive market research was prohibitive.

ACKNOWLEDGEMENT

We would like to thank Professor Roger McLean, Head of School of Engineering and Science for permission to use material from the original market research report.

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