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The Changing Nature and Definitions of Industrial Design and Implications for Prospective Undergraduate Students

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Abstract

There are currently a wide range of Higher Education Industrial Design courses available in the UK. In the present era, a wider breadth of narrative has developed within the subject, and as a result the content of industrial design educational offerings varies considerably. The paper assesses the industry view of Industrial Design as a discipline from the perspective of those employing university graduates. These views illustrate a change in the discipline, and this is considered in respect to current education practice. The choice of entry courses for the student wishing to embark on a career in the subject has also widened. It is argued that at present, the access to courses offers a haphazard informational stream to the potential applicant. An approach to developing an online facility to enable potential students to apply for the right course is discussed. It is suggested that a consistent and comparable platform of guidance is needed by which potential students can identify and match the course offering against their aptitudes and aspirations. A framework for such a system is proposed. Given that course choice will ultimately define the nature of their career opportunities it is argued that this would be a useful and productive asset.

Key words

industrial design, design thinking, learning style categorization, university applicant

Introduction

Industrial design as a profession emerged when competition in the market place gave consumer choice, and is generally dated to the beginning of the 20th century (Heskett 1980). The idea of Industrial Design as a mingling of form and function and the need to meet business expediencies is well established and quoted in its history (Ulrich and Eppinger 2000). Traditionally, Industrial Design has been seen as an applied art, and applied science, aimed at improving the aesthetics, ergonomics, functionality, and/or usability of a product (de Noblet, 1993). Industrial designers' have required knowledge and skill in aesthetic design practice informed by ergonomics and engineering. An understanding of technical processes and requirements for manufacture; marketing opportunities and economic constraints; and distribution sales and servicing processes have also been important (IDSA 2013). At undergraduate level, the subject has therefore incorporated material from different discipline areas, and different teaching and learning approaches

have been adopted. This paper argues that prospective students of industrial design are not well equipped to make course choices for a subject that is varied and evolving.

The National Curriculum Design and Technology program as taught in secondary schools and regarded as the educational pathway at secondary school level for Industrial Design focuses on the skills/manufacturing aspect of the discipline, and three core areas of developing, planning and communicating ideas; evaluating processes and products; and knowledge and understanding of materials and components. This paper is interested in exploring how well this maps to modern definitions of industrial design as a discipline, and how well students are able to identify a suitable degree course in the area to which they are well suited.

Product design at undergraduate degree level

There are different ways of teaching design; Wang (2010) identifies and compares the 'positivist' science based teaching of design, sometimes referred to as the 'road-map' approach; and the 'atelier' system based on free creativity. The atelier approach has been the usual system of design teaching for over a hundred years. Degree-level design education is largely studio based and experiential (Lawson 2006). Generally, designers' learning tends to be exploratory and flexible and is well matched to the adaptable, project-based methods of teaching typically employed within design education that involves a large amount of personal tuition.

However Wang suggests that this method of teaching can be criticized for its potential lack of parity, and influence of individual teachers, such that one experience may not be the same as another. It also differs from the approach adopted in schools. Wang (2010 p173) notes 'there is a feeling among many design educators, that today the discipline has reached a crisis in its development, and that change is needed immediately in the way that design educators articulate their epistemology and their methodology'. Here it is recognized that in recent times, there has been significant change in the Industrial/Product Design sector with the application of design becoming broader (Keinonen, 2008). This has inevitably been reflected in the subject content and pedagogies employed at different institutions, making the application to degree level course an increasingly difficult decision.

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Applying for a design course

The current UK system for university entrants is managed through, the Universities and Colleges Admissions Service (UCAS). Prior to application to University, students will have undergone a substantial program of examined education through which their interests, abilities and aptitudes will potentially have been identified. It is assumed therefore that they have had an educational experience across the science and artistic spectrum, and that their results will be an accurate representation of their aspirations and abilities. However, it is argued that within the context of design there are a number of limitations to this process including: the individual influence of the schools and teachers, the match between the examination contents and the abilities and aptitudes required by the profession, and the match between the secondary school subject of Design and Technology, and degree level design.

There are a large number of institutions offering product design related undergraduate degree level courses. A search of the UCAS website under 'Product Design' reveals 94 providers, and for 'Product Industrial Design' reveals 48 providers (UCAS 2013). On closer examination the results of both searches are ambiguous, leading to identification of courses covering media, music and engineering. Whilst UCAS links to individual course descriptions and websites, it can be difficult to make comparisons between courses and truly understand the nature of the course and therefore its suitability to an individual applicant.

The aim of this research therefore is to explore the changing nature of Industrial Design and how it is experienced by different groups. The decision making tools used to inform the course choice of undergraduate students is considered as well as the design related subjects they have been exposed to before University. The paper then goes onto to consider the industry view of Industrial Design as a discipline from the perspective of those employing university graduates. These will be used to comment on whether there is a change in the discipline, and the nature of this change in respect to current educational practice.

Exploring the decisions and perceived skills of students

A survey was carried out to understand the drivers of current undergraduate student in applying for a specific design course and to understand the design skills they felt they had on entry to University.

Method

A brief anonymous survey was designed and administered. The survey took approximately 15 minutes to complete. It was distributed on paper to all first year product and transport design students within the Industrial Design department at Coventry University during the first two weeks of the first term. Students were asked to complete the survey at the beginning of a lecture.

The survey was completed by 92 participants. They were all aged between 18 and 26 years, the majority were male. The demographics of the participants are summarised below in Table 1. 51 participants were from transport related courses including automotive, bike and boat design) and 41 on product design related courses (e.g. consumer and sports product design).

Course	No. of participants
Transport related courses	51
Product related courses	41
Gender	
Male	75
Female	17

Table 1. Demographics of survey participants

Results

Course choice

The first part of survey sought to determine what was important to the students when choosing their course. Figure .1 shows that most students were informed by the reputation of the course rather than information about course content that may be provided through UCAS or websites.

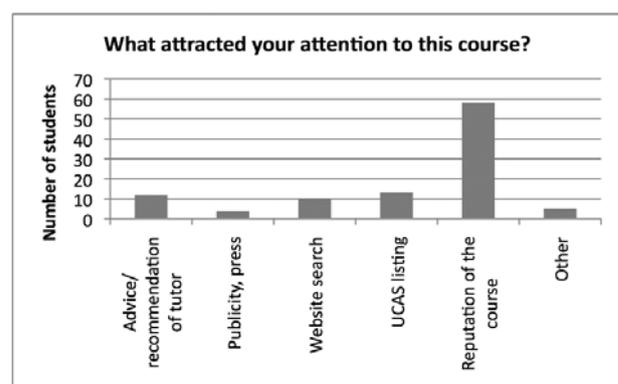


Figure 1. Factors influencing course choice

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Coventry Industrial Design Department is known for its leading and highly specialist Automotive and Transport Design course, and this may be a factor that was particularly important to this cohort.

The survey went on therefore, to consider factors influencing the decision to take up a place on their chosen course. This was an open response question. They were not limited in the number of responses they could provide. 90% (83 out of 92) of participants provided at least one factor that had influenced their decision.

The reputation of Transport and Product Design at Coventry University was the most frequently cited factor. 59 (64%) participants listed the course reputation. 50 (54%) of the students indicated the importance of the course content. For many this was linked to their enjoyment of, and passion for design. The progression from Foundation and the benefit of a MDes degree was specifically mentioned as influencing the decision. The opportunity to draw and use CAD, and interest in Industrial Design were also important.

Whilst the course content was regarded as important, the survey responses were not specific enough to indicate a clear preference by the students for the course content at Coventry University over other similar courses.

Other influencing factors included, the location of Coventry University (29%), the living accommodation and general environment as important factors, 22 students stated that the facilities and equipment available were priorities when choosing the course(24%), the Industrial Design staff at open day (17%); the potential job opportunities and employability post-course (14%); high teaching and learning standards, and the perceived quality of the educational experience (13%); course connections with Industry (8%); work of previous students (8%) students indicated the importance of work undertaken by previous students; and financial reasons (4%). Other factors influencing the decision to join the course included the atmosphere / vibe, the open day and friends.

Previous learning

The survey went on to explore the learning experiences of students prior to the course. Participants were asked to indicate which subjects they had studied prior to joining the course. The results are summarized in Figure 2.

The responses indicated that many of the participants had studied traditional subjects such as art and design, design and technology, and mathematics. They were less likely to have studied (or to have recognised that they had

studied) more specific areas of design such as transport technology, research methods and rendering which were identified as being relevant components to the Coventry degree programs.

Discussion

The results of the survey are based on a small sample from one specific institution. However, it might be argued that the students are typical in terms of their decision making processes and knowledge base. Course reputation has attracted students to a course. The final choice has been led by reputation and to a marginally less extent by course content as well as a range of other contributing factors. Exploring prior learning experience however, has suggested students may have had limited exposure to relevant subject areas. These factors may not provide a good match between the student and course, potentially leading to student dissatisfaction and drop out.

Having explored the experiences of students at degree entry level, a further study explores the views of current design professionals who represent the employment sector for graduates from Industrial Design courses.

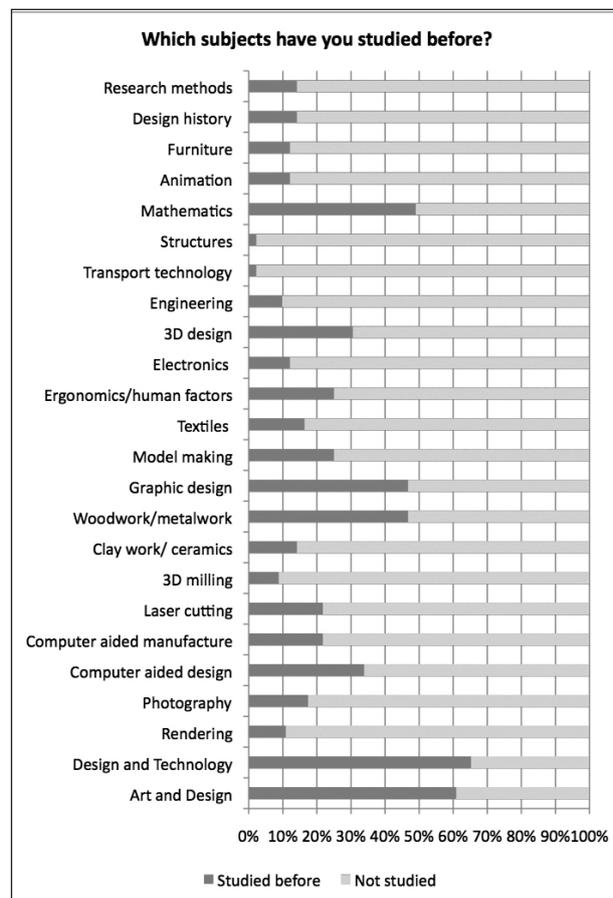


Figure 2. Design-related subjects studied

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Participant	Years experience	Job role	Size and type of organization
1	18	Director	1-5 employees, contemporary
2	34	Director	1-5 employees, established
3	38	Senior Partner	15-20 employees
4	30	Principal, Product Design	35-50 employees
5	32	Design Manager	200+ designers

Table 2. Summary of participants

Exploring the views of design professionals

A written narrative analysis approach was used to collect and compare the views of established designers on the current focus of Industrial Design as a discipline. This was undertaken to identify whether there has been a change in focus over time in the subject and if so, to try and define this.

Method

Five experienced designers were selected, who are leaders of successful industrial design businesses across a range of company sizes defined by number of employees to represent a range of different organizational sizes and areas of industrial design. As potential employers the participants could provide a reference to the desired future career destination of graduates; their characteristics are summarized in Table 2.

The designers were contacted and invited to take part and upon agreement they were asked to provide a considered written narrative to the title *'What is Industrial Design?'* They were not given a specified number of words to provide. Thematic analysis of the resulting data was undertaken. 5 key themes were identified through the analysis and the importance of these 5 themes was identified based on the frequency with which they were referred to during each narrative.

Results and Discussion

The text lengths varied between 439 and 1042 words. The analysis revealed 5 key themes that were used to describe Industrial Design within the collective narratives, these were defined as follows:

- **Business:** Words referring to the business aspects of an Industrial Design company, e.g. commercial, dialogue with clients, managing client expectations.
- **People:** Words referring directly to human investigations e.g. ergonomic tests, customer insight investigations, ethnographic research, market analysis.
- **Operation:** Words referring to the design process as carried out by the design company itself, application of techniques and tools such as CAD, presentation techniques, consultancy offer frameworks.
- **Function:** Words relating directly to designing as an iterative activity of exploration and experimentation to find solutions to a brief that has been constructed to create artefacts to perform a purpose.
- **Cognitive:** Words referring to intangible thought and emotion based activities e.g. dream, innovate, inspire, engender.

For each narrative the words linked to each key theme were identified and frequency counts made. Table 3 summarizes the number of word references in each of the 5 design themes across the participants.

Design Company	Business	People	Operation	Function	Cognitive
Contemporary 1-5	3	3	13	6	8
Established 1-5	11	1	6	2	10
15-20	9	12	2	4	23
35-50	8	1	8	1	19
200 plus	3	1	7	1	30
TOTALS	34	18	36	14	90

Table 3. Keyword segmentation taken from texts of 5 design company leaders

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The results indicate that the most words used to describe Industrial Design fell in the cognitive theme (n=90) that is 'words referring to the intangible, thought-based activities'. The proportion of 'cognitive' keywords used appears to increase with the size of the business (this is not consistent since text length varied). Some of the statements given include:

'The Industrial Designer can visualize his dream he can define it and share it and inspire' (P3)

Industrial Design is not what it was 20 years ago! It is far more intellectually rigorous' (P5)

Cognitive attributes referring to thought and emotion based activities took a prominent part in all of the narratives. 'Innovation', 'design thinking', 'vision', and 'culture' are referred to as explicit aspects of the industrial design offering to clients;

'We create dreams, we develop themes, we provide direction, we provoke discussion and we engage in discourse. And we like to disrupt.'(P4).

Industrial Design as described in the narratives, varied considerably from a traditional skills/task analysis base to a cognitive emotional activity base. The focus of the narratives was found to differ based on the type of organization that the participant represented. The small businesses had a less clear focus on cognitive activities and were found to refer more to the operation of their business, and the meeting of outcomes for their clients businesses.

Thematic analysis indicated a move towards 'the globalisation of design' and the increasing importance of human and therefore intangible skills on the part of the graduate Industrial Designer. The role of the designer to 'create dreams' and 'disrupt' and balance this against practical delivery of a design solution was clear.

The results suggest that the current view of professional practice does not just lie in a traditional Industrial Design domain. The leading statements by four of the five designers were not concerned with the Industrial Design framework of form, material, production, market place, aesthetics, and costs that have traditionally formed the primary content of industrial design practice. Instead the drive at senior level is for cognitive capabilities such as visualization and communication.

Industrial Design has always straddled the two camps of rationality and free creativity, and the observations of the

five texts of the professional designers suggest that both ways of thinking are applied in the professional discipline and should therefore be reflected in the education. In observing the dominance of these cognitive qualities it would be wrong to suggest that the categories of business, people (ergonomics), operation and function were not still significant, and teaching in these areas equates more with Wang's 'positivist' methodologies. However, the most striking observation from the texts is the dominance of references to cognitive words describing intangible qualities. The term 'Design Thinking', which has strongly engaged the interest of practitioners and educators in the design sector in recent years embeds methodologies that relate to a non-regulated approach to Industrial Design. Its methodologies are already being explored in various centres of design education, and its explicit inclusion into the declared curricula of undergraduate Industrial Design degrees.

It is argued here that the relevance and role that these skills now play in degree courses is not made sufficiently explicit or understandable, to potential students who have been exposed only to school level design education. Evidence from the employer's side supports the expansion of the Industrial Design narrative and indicates the need for communication and clarification to the teenage applicant whose experience is only within the secondary school system.

Developing a system to match students to degree courses

It is proposed that in order to address the changes in the practice of Industrial Design and to cater for future development and diversity in degree course offering, that a system should be developed that better advises student on their course options. The following sections therefore scope out a potential tool for matching students to available courses, taking into account both thinking and learning styles.

Design Thinking

Design thinking has been identified above as an important part of contemporary design practice. Owen identifies that 'design thinking is in many ways the obverse of scientific thinking. Where the scientist sifts facts to discover patterns and insights, the designer invents new patterns and concepts to address facts and possibilities' (2007 p 17). Owen identifies two ways creative people work. He recognises 'finders' and 'makers'. Finders exercise their creativity through discovery and are driven to understand and find explanations. Professionally they typically become scientists or scholars. Makers are creative in a different way and demonstrate this through invention, construction,

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composition and developing new concepts. They typically become designers, engineers and artists.

Expanding on these views, Owen identifies other factors that differentiate professional fields and further defines design thinking. Figure 3 illustrates a framework to distinguish the activities based on mental activity and culture of operation:

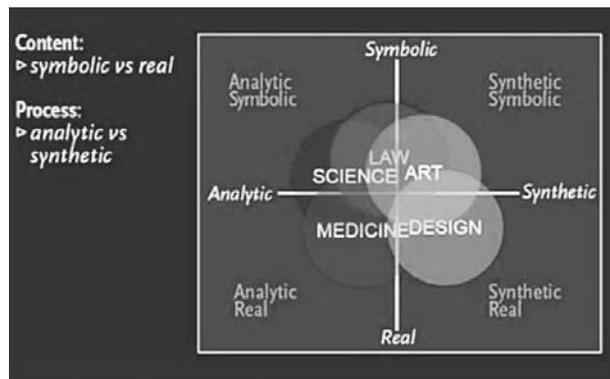


Figure 3. Map of creativity (taken from Owen 2007 p18)

Owen's map positions design in the lower right quadrant associated with making and inventing, and focused on the real world and the synthesis of artefacts and systems necessary for managing the physical environment (Owen 2007). This is in contrast to the position of science. Owen argues therefore that a combination of science and design thinking, rather than just one, is the strongest approach.

This spread of mental (and possibly emotional) activity required through the breadth of different Industrial Design activities, demonstrates the need for a guide for potential applicants to identify the right degree course among a range of offers, that focus on different areas of this map. Owen goes on to propose a progression of need/goal to values to measures, and gives word descriptors associated

with each area. The following table lists descriptions of the focus of different disciplines:

It can be seen from Owen's methods of comparison that contrasting qualities can be identified regarding the different aspects of Industrial Design in which all these categories are represented.

It is proposed that these measures can be used to illustrate the balance of course content and focus of an Industrial Design course. This can be utilized in a reflective exercise or questionnaire by a student seeking a degree course to map their skills.

Learning Preferences & Design

To further enhance student understanding of their own aptitudes, psychometric tests may be appropriate. Carl Jung's theory of psychological types illustrates preferred ways of adapting and learning. Based on Jung's theory, the Myers-Briggs Type Indicator (MBTI) is a psychometric tool for assessing 16 'types' and their associated learning styles (Myers and McCaulley 1985). It operates by categorization under 4 comparisons as summarized in Table 4 below. These comparisons gives rise to 16 constructs, e.g. ESFP, each of which has an associated personality description.

The MBTI has been used to evaluate the learning styles of various different groups. Work by Durling et al. (1996) identifies that designers as a group are quite different to the general population and to other subject disciplines in relation to their learning preferences (see Figure 4).

Broadly speaking designers prefer teaching that begins with the big picture and then explains details, focuses on future possibilities and gives alternative view-points. It has a lightweight structure, allowing for guided exploration, and predominantly shows objective data, is logical and analytical, and is based on demonstration examples (Durling et al. 1996).

Field	Need/goal	Values	Measures
Science	Understanding	Understanding Testability	True/false Correct/incorrect Provable/unprovable
Art	Expression	Insightfulness Novelty Stimulation	Thought provoking/banal
Design	Form	Cultural fit Appropriateness Effectiveness	Elegant/inelegant Better/worse Sustainable/unsustainable

Table 4. Descriptions of disciplines (constructed from Owen 2007)

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Do you prefer to focus on the outer world or on your own inner world?	Introvert (I) / Extrovert (E)
Do you prefer to focus on the basic information you take in or do you prefer to interpret and add meaning?	Sensing (S) / Intuition (N)
When making decisions, do you prefer to first look at logic and consistency or first look at the people and special circumstances?	Thinking (T) / Feeling (F)
In dealing with the outside world, do you prefer to get things decided or do you prefer to stay open to new information and options?	Judging (J) / Perceiving (P)

Table 5. MBTI personality preferences (MBTI® Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator®)

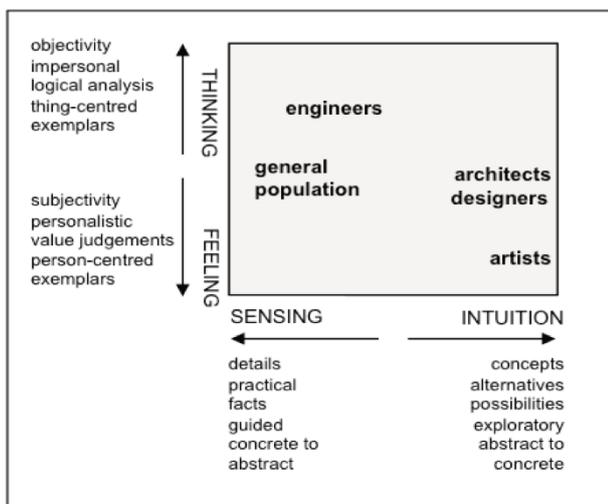


Figure 4. Learning preferences based on MBTI Types (Adapted from Durling et al. 1996)

The disparity between engineers and designers is highlighted in this research. Durling et al. (1996) point the difficulties of teaching some designers subjects such as engineering, ergonomics and computing, particularly when taught by a non-designer / subject specialist who may have a different style. Designers tend to have a natural leaning towards intuition and away from facts and a guided approach. This discord will be relevant therefore and influence success when a student enters a course that is design engineering rather than design thinking oriented. Having a means to assess students learning preferences through a test such as the MBTI, would provide another tool to equip students to match themselves to the content and style of a degree course.

A Proposed Model

Using a combination of personality testing and subject content and interest (alongside traditional metrics of capability and examination achievement), a guide to Industrial Design courses could be offered. Bringing together the work of Owen and the MBTI profile, allows

construction of a detailed model of the designer and their way of thinking and feeling. The following three stage process is suggested:

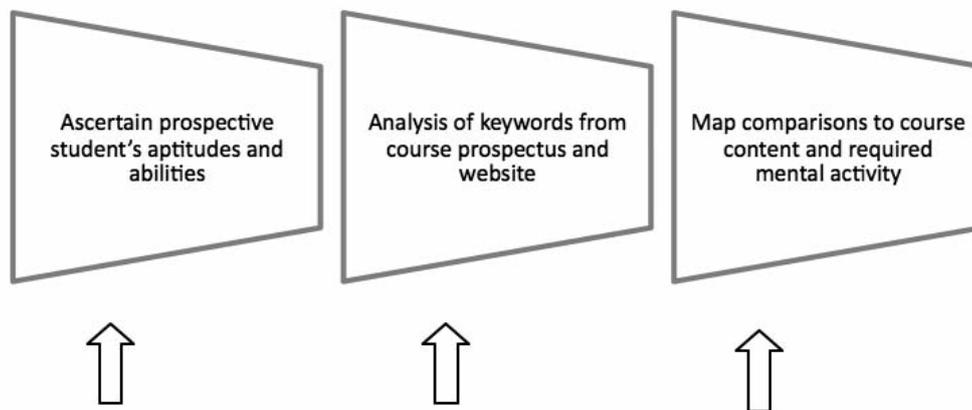
It is assumed that the system would be computer-based and accessible on a wide range of platforms including smartphones and tablets to potential students. The system would require inputs from the user of learning style and subject preferences as well as traditional indicators such as predicted grades and subject choices. The success of this model would be dependent upon an accurate picture of university courses to allow the automated comparison (for example through UCAS).

Whilst courses have their unique selling points, they are also likely to thrive on a mix of students from different backgrounds and experiences. Psychometric tests are not intended as a mean to create a homogenous group but to allow applicant reflection on their aptitudes, abilities and career options. The aim is to educate the student to the nature of the discipline of Industrial Design to enable them to make accurate and useful decisions within the subject area to which at that stage they are making a probably tentative early investigation. It would serve as a signpost for the student, and function also as an introduction to the contemporary breadth of the discipline, broadening their knowledge correcting limited or inaccurate perceptions of the discipline of Industrial Design. The output from such analysis could also be used to inform design team formation recognizing that design teams may benefit from different capabilities coming together, and certain characteristics being beneficial at different stages of the design process.

Conclusions

This paper has arisen from an awareness that the field of Industrial Design has broadened to encapsulate a variety of perceptions of the subject that are influencing the nature of courses offered at higher education level. This leaves the potential applicant with an information gap that

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STEP 1 Candidate Action	STEP 2 System Action	STEP 3 System output
Answering a brief set of online questions in an established and verified form of the Myers Briggs Preference Indicator (MBTI) and based on Owens' measures of creativity	A 'find courses' request will prompt computer analysis comparing keywords from UCAS, prospectus and website scans and relating these to the individual profile words.	The user will be presented with a quadrant map visual mapping individual characteristics to demonstrate subject and course suitability and providing hyperlinks to relevant courses

Figure 5. Model for mapping a student to a degree course

can result in enrolment on an inappropriate course of study. This is disadvantageous to both the student and the institution.

In order to attract and retain the best students, universities need to consider other selection tools for use by students beyond the personal search of marketing material, prospectuses and reputation. The research findings presented here have been used to argue a development in the nature and perception of the practice of the subject in the UK. The investigation suggested that the understood boundaries of 'Industrial Design' have developed in recent years. The emphasis towards descriptors of intangible, cognitive activity, such as behaviours and emotions that contrast with the words describing practical skills and knowledge that characterize the content of the secondary schools curriculum regarded as the preparation for a degree in Industrial Design. The findings suggest a need for cognitive skills, when school education is focusing on skills/manufacturing aspects of the discipline. In light of this, there is a need to revisit the school curriculum, and consider the alignment of school and University education in respect to contextualization of the subject areas enabled by critical awareness and reflective analysis.

It is the responsibility of the sector, to give greater clarity to prospective students on the nature of the subject they are to study. It is argued that there is a need to identify the key components of industrial design in order to inform improved matching of students to degree courses in a way that is accessible and useful to the applicant. The necessary first step is, for the sector itself to identify the categories of curriculum being practiced and to make these more explicit to potential students. An independent aptitude indicator has briefly considered and scoped out with the aim of guiding candidates to Industrial Design university courses, and ultimately a career path that would be appropriate to their personal abilities. This, like the subject of Industrial Design itself, aims to '...help users cope with the increasingly complex world they live in' (Wang 2010).

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