

THE IMPORTANCE OF COMMON SENSE: ERGONOMICS IN DESIGN EDUCATION

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ABSTRACT

Ergonomics is often just considered by designers and engineers as ‘common sense’. Given this perception what is the rationale for including ergonomics with Product Design curriculums?

This paper investigates the current varying provision of formal ergonomics teaching within UK’s Product Design undergraduate degree programmes and explores the perceived importance of teaching ergonomics to designers, from the perspective of both lecturers and students. In exploring the potential links between the UK’s innovation driven economy and ergonomics, the paper argues the importance of designers with an ergonomic skill set to address market changes and identify user-led innovation opportunities.

Keywords: Ergonomics, human factors, design education, design curriculums

1 INTRODUCTION

In 1996, after working with design students, Ergonomist Stephen Pheasant published five statements summarising the beliefs of students in regard to ergonomics [1]. Statement five declares ‘*Ergonomics is an excellent idea. I always design with ergonomics in mind – but I do it intuitively and rely on my common sense so I don’t need tables of data or empirical studies*’ [1]. Ergonomics (or Human Factors) is still often considered ‘just common sense’ by designers and engineers [2]. If this is the case, is there a rationale for including ergonomics in Product Design curriculums?

‘Ergonomics (or human factors) is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design in order to optimise human wellbeing and overall system performance’ [3]. It is difficult to argue with the benefits of applying ergonomic principles to the design process. Taking into account users’ capabilities and limitations helps ensure products are designed fit for purpose by the target user/market. However, the ‘common sense’ adage implies good designers would apply ergonomic principles by default, whether included in the curriculum or not. This poses the question; do design students need to be formally taught ergonomics?

Time constraints on degree courses make this question particularly important. New technology and changing industry needs suggests the range of skill / knowledge attributes expected from design students is shifting. During the 2011 Product Design + Innovation conference, Richard Seymour, Co-founder of Seymour Powell, argued that he was not sure all the skills needed in a 21st century consultancy could be found in one person [4]. As the breadth of skills / knowledge associated with design students is changing and diversifying, is there still a place for ergonomics in a design curriculum? Or should it make way for less ‘common sense’ skill / knowledge acquisitions while leaving ergonomics to the ergonomists?

This paper investigates the formal teaching provision of ergonomics within some of the UK’s Product Design undergraduate degree programmes and discusses the perceived importance of teaching ergonomics to designers, from the perspective of both lecturers and students. The paper also explores the potential links of equipping design students with an ergonomic skill set and the UK’s innovation driven economy agenda.

2 CURRENT PROVISION

According to Universities and Colleges Admissions Service (UK) (UCAS) there are 65 undergraduate Product Design courses shared between 39 UK Higher Education Institution (HEI) available to start in

2013 [5]. A sample of 8 courses, each provided by a different HEI, was taken from the list (excluding any BEng or undergraduate masters' courses). Each university was contacted to identify the current formal teaching provision of ergonomics within the selected course, as summarised in Table 1.

Table 1. Amount of formal Ergonomics teaching provision

	BA/BSc	Amount of formal Ergonomics teaching
1	BA	No specified formal ergonomics teaching within the curriculum
2	BA	Specific ergonomics module in first year and additional optional ergonomics related modules in second / third years
3	BA	Multiple lectures and activities within a first and second year module
4	BA	Couple of lectures in a first year module, second years have a User Analysis module
5	BA	Lecture within a first and second year module
6	BSc	Elements in a first year module activity and a specific second year module
7	BSc	Couple of lectures in a first year module
8	BSc	First year module and elements within another first year module

The definition of formal teaching provision is considered to be where modules / lectures / seminars etc are specifically stated in course documentation to cover ergonomic principles. However, from discussions with course staff, the majority of ergonomics teaching appears to be conducted informally, for example as part of project specific tutorials. Unfortunately, the nature of this knowledge transfer would make it unfeasible to reliably measure and is therefore not included in Table 1.

Table 1 indicates a wide variation in the formal teaching provision of ergonomics across undergraduate Product Design courses. Discussions with institutions that provide both BA and BSc Design course suggest that BA students, in general, are more exposed to formal ergonomics teaching than BSc students.

3 STUDENTS' PERSPECTIVE

3.1 Student Questionnaire

Final year Product / Industrial design students from two HEIs were asked to complete a questionnaire regarding their perspective on the importance of ergonomics within design curriculums. HEI 1 has no formal ergonomics teaching provision within the design curriculum, whereas HEI 2 has a comparatively large formal ergonomics teaching content within the curriculum. The two different institutes were selected to compare opinions between students who have had formal ergonomics teaching and those who have not. The results of this questionnaire are summarised in Table 2.

Table 2. Q1 & 2 Students' questionnaire results

	Number of students	Q1: Is Ergonomics an important consideration in the design process?			Q2: Should design students be taught Ergonomics as part of their design curriculum?		
		Yes	No	Don't Know	Yes	No	Don't Know
HEI 1	28	27	0	1	24	0	4
HEI 2	24	24	0	0	23	0	1

The results show that, bar one, all students regarded ergonomics as an important consideration in the design process and, bar four, should be taught as part of the design curriculum.

Results showed no significant difference between opinions of students from the two HEIs except, probably unsurprisingly, students from HEI 2 in the open questions, seemed to demonstrate in general a wider and clearer understanding of the role of ergonomics, in the opinion of the authors.

Students were asked to elaborate on why students should or should not be taught ergonomics as part of the design curriculum. The majority of students made reference to ergonomics being taught due to its importance in creating usable / functional products for users. However, most of the answers might be considered more of a reflection on the perceived importance of the subject area within the design process rather than the need for students to be taught ergonomics. Nevertheless, some comments (mainly from HEI 2 students) did clearly relate to the perceived need to be taught the subject:

- *'Peoples designs will become more functional as they will be more aware'*
- *'A better knowledge & practice of ergonomics...would be beneficial'*
- *'Gives the student an understanding of the relation between user and the product'*
- *'Important design skill for design students to be taught ...having background knowledge can avoid minor mistakes'*
- *'It improves your understanding of human interaction with products'*
- *'I studied this module in year two and I believe it helped me design my products more efficiently'*
- *'Students probably wouldn't be able to cater for all ergonomic considerations in a design without being taught how'*
- *'Anyone can claim to use ergonomic data to influence their design but only if it is used well will it actually be beneficial to the design of the project'*
- *'Having been taught ergonomics, I find it an automatic consideration during my design process'*
- *'Also understanding proper ergonomics can lead to many design innovations'*

One student, who stated they did not know if it should be taught, reasoned that *'it's unique on each product and in different situations, and in some cases not applicable'*.

3.2 Ranking Exercise

While the results from the students' questionnaire indicated that the majority of design students recognised the importance of ergonomics as part of their education, the data did not reflect on the relative perceived importance against other subject areas. Therefore, a ranking exercise was conducted with a convenience sample group of 28 design students from HEI 1 to supplement the questionnaire. The students were asked to rank eight topics, common in undergraduate design courses, in order of importance within a design curriculum.

Table 3 shows the overall ranking, created from the mean average scores for each subject.

Table 3. Ranking results

Overall Relative Ranking	Subject	Mean Ranking	Standard Deviation
1	Visualisation (Sketching / Rendering)	2	1.62
2	CAD – 3D Modelling	3.4	1.89
3	Prototyping / Model Making Skills	3.8	1.94
4	Materials and Production Processes	4	1.59
5	Ergonomics / Human Factors	4.4	1.85
6	Visual Language / Identity	4.9	1.77
7	Engineering Principles	5.6	1.78
8	Design History	7.9	0.36

While the sample size is small, the results suggest that, even between a student cohort from the same institution, there is little agreement about the ranking order of subject areas, as demonstrated by the mean rankings and the large standard deviations (excluding Design History).

4 LECTURERS' PERSPECTIVE

All lecturers acknowledged the importance of ergonomics within the design process, often evidenced by its inclusion in marking criteria, but opinions as to whether it should be taught formally within courses were divided. Generally, opinions supported the current provision within their respective institutions. For example, where no formal teaching occurred one lecturer stated that it should not need to be taught separately as it is just '*good design*'. While at the other end of the spectrum, one lecturer argued that if ergonomics was just common sense '*why would there be so many things that are badly designed and difficult to use*'. However, a couple of academics lamented their ability to include more ergonomic content, stating time constraints as a barrier; with other subject areas given priority within the curriculum.

Student's ability to assimilate information was also raised as an issue. Changes in course structure in some of the institutions over the last few years had led to the amalgamation of modules (including ergonomic specific modules) into fewer, larger modules per year. The rationale behind these changes was that students struggled to manage multiple modules and to transfer knowledge between separate projects. While these changes related to design teaching as a whole, lecturers from the institutions related that the same rationale applied to specific ergonomic modules. This view was also shared by lecturers from an institution with no recent history of formal provision, who argued that separate ergonomic modules would not work, as students would view the module in isolation, limiting transference to other projects. In contrast, one lecturer from a different university described, what they termed, their holistic approach to design pedagogy, where students are exposed to an entire range of fundamental subjects from the outset of their studies, including a dedicated ergonomics module. As students progress through each level of their programme, each subject is delivered in more comprehensive depth, building on the previous knowledge base and promoting students to practice and develop their integrative design skills.

Most felt that the majority of students did not either appreciate the importance of ergonomics, were not aware of its scope or required repeated prompting to apply ergonomic consideration within projects; one person equated it to having to teaching the students '*common sense*'. It was also argued that the label 'Ergonomics' itself was not helpful, as it has become synonymous in students eyes with a narrow view of the field e.g. just anthropometrics.

5 INNOVATION DRIVEN ECONOMY AGENDA

The appropriate application of ergonomic principles within the design process of a product can help ensure products are 'fit for purpose' [6], therefore yielding benefits from the user/s' perspective. However, the following section discusses how equipping designers with an ergonomic skill-set could support the UK's innovation driven economy agenda.

In the current economic climate companies are facing significant challenges, including increased competition [7]. Company's future prosperity will depend on their ability to compete in a global economy that is increasingly driven by innovation; the UK's Innovation and Research Strategy for Growth views innovation as the main pathway to sustainable economic growth and Design as a vital component in leading or supporting product and process innovation [8].

In 2004 the UK government Department of Trade and Industry (DTI) published the Global Watch Mission Report 'Innovation through people-centred design – lessons from the USA' [9]. In observing the technology-led culture within UK companies and the limitations to innovation this presents, the report recommends UK companies to adopt user-centred techniques at an early stage to drive innovation and design. If design is a vital component in leading innovation then design professionals need to take a leading drive for user-led innovation. This can only be possible if the design professionals of the future are equipped with the skills and knowledge to identify user-led innovation opportunities.

There are also some significant demographic trends occurring in the UK population that could provide future innovation opportunities. This increasing diversity and mobility of the population [10] means innovative product solutions to these emerging societal needs will be required [8]. Added to an increasingly global market, products are likely to have to accommodate a larger variety of physical, psychological and cultural specific needs to achieve desired market size. Without the skill-set to understand and address changing markets needs students are unlikely to produce designs which will satisfy the global market, never mind capitalise on the potential user-led innovation opportunities.

6 DISCUSSION

This paper takes the position that the benefits of applying ergonomic principles within the design process are widely recognised (supported by the responses by both design students and lecturers). There also appears to be general agreement, among students and lecturers, that students should be taught some degree of ergonomics within the curriculum. However, the amount and form this teaching takes varies significantly across design courses. Unsurprisingly, the students who had been exposed to formal ergonomics teaching demonstrated a much clearer understanding of the scope of the subject area (i.e. more than just size) and how that knowledge could be applied to the benefit of their designs. The translation of this awareness into their design processes is unknown but students from HEI 2 did perceive benefits from having been taught ergonomics; *'Having been taught ergonomics, I find it an automatic consideration during my design process'*.

This study has primarily focused on the measurement of formal teaching provision but this raises the question; should ergonomics be taught in the form of specific formal lectures / modules? From the lecturers' point of view the key barriers to formal ergonomics teaching appear to be time constraints and students ability to assimilate information. Some lecturers suggested that due to the compartmentalising nature of a modular course structures, students would struggle to transfer knowledge from a specific ergonomics module into applied practice in other projects.

Therefore, future research is needed, not on whether ergonomics should be taught but what is the best teaching approach in the context of these constraints / concerns? The identification of best practice is not within the scope of this study. However, some points were highlighted which warrant further consideration:

- The impact of the perceived scope of ergonomics
- Ability of students to transfer knowledge into project specific applications
- The need for repeated reinforcement

This paper also briefly considered how ergonomic skills may facilitate designer's ability to capitalise on user-led innovation, in line with the UK Government's Innovation Driven Economy Agenda. As market populations diversify, competition increases and consumers become more informed, only taking a 'common sense' approach to the application of ergonomics may not be enough for products to be successful in the global market. This paper argues that the target markets' needs / desires are likely to become more complex to distil cohesively, requiring a higher degree of skill to understand and apply in a Product Design context. While many larger companies will have the resources to employ the services of ergonomic specialists, smaller companies (at the start of 2012, 59.1 per cent of the manufacturing industries private sector business employment was in SMEs [11]) may have to rely on the knowledge / skill-set of their designers. If awareness of ergonomic principles is not embedded in their skill-set, designers may not have the awareness to address market changes in new products, never mind identify potential user-lead innovation.

Even if you prescribe to the notion that ergonomics principles are just 'common sense', it's worth noting 'common sense sometimes seems remarkably rare' [1].

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