Abstract

This paper presents a university system of education and research that is specifically focussed on ergonomics. It is in contrast to many university departments throughout the world that include ergonomics as an 'add on' or complement to established programmes in medicine, physiology, anthropology, psychology, engineering or design. The Department of Ergonomics and Cybernetics, now the Department of Human Sciences at Loughborough University, in the United Kingdom, was established in 1960 and provides an example of a university department that pursues Ergonomics as its raison d'être. The undergraduate, masters and PhD programmes in ergonomics are described. They produce over fifty qualified ergonomists per year, nurtured in a fertile academic environment that teaches and researches in the component disciplines of ergonomics (including human biology and psychology) as well as in ergonomics itself. The establishment, organisation and the development of the department are presented with the present position and a discussion of future direction.

Introduction

Ergonomics in the United Kingdom developed from successful multidisciplinary industrial and military research programmes carried out in the first half of the twentieth century. It became recognised that collaboration between scientists across disciplines 'achieved results that could not have been obtained by any one discipline' (Edholm and Murrell; 1973) and that a forum was required for researchers to interact and develop this potential. The establishment of the Ergonomics Research Society in 1949 and other initiatives across the world, led to the foundation of the International Ergonomics Association in 1959. The establishment of the Department of Ergonomics and Cybernetics in 1960 (now the Department of Human Sciences, Loughborough University) provided an opportunity to pursue ergonomics research and brought together physiologists, psychologists and those from engineering and the physical sciences. It also created the environment into which those who were to research and practise the discipline of ergonomics (ergonomists) could be educated and trained.

Throughout the 1960s the research and teaching of ergonomics at Loughborough developed with research into many applied projects (industrial, consumer, military) and teaching of short courses, a masters and eventually an undergraduate programme in Ergonomics and Cybernetics. Because of a change of emphasis in both the meaning of the term and in the direction of the department, the word cybernetics was dropped and during the 1970s, the department became first the Department of Ergonomics and finally the Department of Human Sciences. In research many aspects of the subject
were explored at a fundamental and applied level. (heat and cold, vision and lighting, noise and vibration, anthropometry, energetics, biomechanics, signals and controls, consumer ergonomics and more). In 1970, two Institutes of the Department were established. The Institute for Consumer Ergonomics (ICE) and the Human Sciences and Advanced Technology Research Institute (HUSAT) operated along with the other research groups of the Department until the mid 1990s when they became independent institutes in the university.

In teaching the Ergonomics undergraduate programme spawned first the human biology and then psychology undergraduate programmes. The Masters programme has continued to educate students from around the world. This is the present position within the Department. A detailed description of these programmes is provided below. The aims and objectives of the department are provided in Annex A.

The Loughborough Undergraduate Ergonomics Programme. BSc(Hons)

An undergraduate programme must ensure that the student achieves a level associated with a degree in science as well as meeting the subject requirements to the level and breadth of ergonomist. Students are recruited directly from school (aged 18 years) and from other areas with varying levels of experience and age. The programme is for three years with fundamental knowledge of the component subjects of ergonomics in the first year, essential methods and techniques in year 2 and more advanced and specialist topics in year 3. At any time Loughborough contains around 100 undergraduate students of Ergonomics.

For the purposes of teaching and assessment, the academic year is split into two semesters. The first semester runs from the beginning of October to the end of January, the second runs from the beginning of February to the middle of June. There is a four week break for Christmas, and a three week break for Easter. Generally, weeks 1 to 12 of each semester are used for teaching and coursework, and weeks 13 to 15 for revision and examinations. In each year of the Ergonomics programme there is a total of twelve modular programme units (or 'modules') Some modules have double-weighting and count as two units. Normally, modules are chosen such that the workload is evenly distributed between the two semesters. The modules are as follows.

Year 1
Introduction to ergonomics
Ergonomics and design 1
Anatomy and Physiology 1
Psychology practicals
Communication and study skills(tutorials)
Experimental design and analysis 1
Ergonomics and design 2
Introduction to environmental ergonomics
Anatomy and Physiology 2
Psychology practicals
Basic cognitive psychology

Year 2
Vision
Ergonomics and design 3
Physiology of physical activity
Issues in occupational psychology
Experimental design and analysis B1
Thermal environment
Professional practice in ergonomics
Functional anatomy
Organisational behaviour
Experimental design and analysis B2
Qualitative methods for human scientists

Year 3 - Core modules
Project
Systems ergonomics and Psychology

Year 3 - Optional modules
Climatic ergonomics—theory
Climatic ergonomics—practical
Organisational issues in IT systems
Ergonomics and product design
Ergonomics of disability and ageing
Applied vision
Human factors in transport safety
Ergonomics and manufacturing systems
Psychology of human computer interaction
Human factors of advanced technology systems.

Diploma in Professional Studies (DPS)

Between years 2 and 3 of the undergraduate programme the students can opt to gain professional experience over one year in industry. The opportunities are wide and students carry out projects under professional working conditions within organisations in the United Kingdom and abroad. The students are supervised from the department but also on a day to day basis by experienced ergonomists many of whom are alumni and long standing supporters of the Department. The students return in the final year to complete their degree often to a much improved level as they draw upon their experiences from their 'year out'.

Loughborough Masters Programme in Ergonomics. (MSc)

The masters programme in Ergonomics is full time for one year, October to September, and is designed to provide knowledge and expertise to science and other graduates such that they can gain fundamental knowledge and understanding of ergonomics and qualify as ergonomists. Students would not normally have a degree in ergonomics and the programme can be considered as both conversion and advanced. The programme allows options to accommodate students in meeting their specific requirements. Graduates from psychology may concentrate more on physiology, for example and vice versa. The programme involves two semesters of taught modules plus a long project conducted after semester 2 and throughout the summer. The project can be carried out within the on-going programmes of the research groups and institutes. The outline of the programme is provided below. There are around 25
masters students in Ergonomics in the Department at any one time and many come from abroad.

Semester 1 - compulsory modules
Methods (acquisition of data)
Design of equipment and workplace
Systems ergonomics
Introduction to Psychology
Anatomy and Physiology
Socio-technical systems
Semester 1 - optional modules
Ergonomics of product design
Ergonomics of disability and ageing
Human Factors and Information Technology

Semester 2 - compulsory modules
Methods 2 (preparation and analysis of data)
Physical environment
Ergonomics in practice
Ergonomics projects, definition including project proposal
Semester 2 - Optional modules
Applied vision
Issues in safety and health
User centred product design
Socio-technical systems 2
Psychology and human computer interaction
Ergonomics in production systems
Human Factors in transport safety

Summer Period - compulsory module
MSc Ergonomics project and thesis

PhD Programmes

The Department maintains a rolling programme of about 30 to 50 research (PhD) students who are required to produce a thesis by research over a period of three years. The students are based in the research laboratories of the Department performing research within the research groups and often interacting with postgraduate and undergraduate students. Because of delays in the past in submission of theses, there is a carefully monitored system to ensure that progress is satisfactory and the thesis is submitted on time. Students who conduct PhDs can be from the undergraduate and Masters programmes in Ergonomics in the Department as well as from other disciplines from the United Kingdom and abroad.

Students and Staff

There are over 400 students in the Department of Human Sciences comprising undergraduates (Ergonomics (100), Psychology (135), Human Biology (115)), Masters in Ergonomics (25) and PhD (40). Around 60% are female and 20% are mature students (over 21 years of age). The academic staff are selected because of their
orientation to the multi-disciplinary nature of the department, ergonomics and its component disciplines. There are 7 full professors, 3 readers, 6 senior lecturers and 11 lecturers. All could be regarded as active in ergonomics and around half are involved in professional ergonomics activity. The supporting staff include nine full time technicians and 6 administrative officers. Staff and students are supported by extensive university resources on a campus based university.

Professional activity

The Ergonomics programmes of the Department qualify students to become members of the Ergonomics Society and a significant number of members of that society and its officers, qualified at Loughborough. This supports the national profile of ergonomics and ensures that informed ergonomists meet regularly and attend the annual conference of the society allowing the subject to move forward. The Ergonomics programmes also qualify students for the first part of the Centre for Registration of European Ergonomists (CREE) which is a register of qualified, experienced and professional ergonomists with a code of conduct and a system of control.

Future Directions

The Department has successfully maintained its human centred approach to research and education and the Ergonomics programmes are as strong as ever. It has sustained its activity through a period of retirements of eminent academic staff and into the next generation, There have however been threats along the way. In particular the problems of multi-disciplinarity have had to be addressed. The United Kingdom rigorously assesses the quality of its research and education programmes. During a period where the Department’s research was not published in traditional outlets (e.g. academic journals) but in more immediate and applied areas, low research ratings were obtained with financial consequences. In addition it appears to be difficult to identify methods of assessment and assessors for multidisciplinary research. The Department has had to remain versatile to these issues and has successfully presented itself to national assessment systems. It is now rated highly in both research (international standing) and teaching (rated second to none) by the UK systems.

Future directions are to carry on providing high quality research and education in ergonomics. New methods of delivery offer opportunities and there is debate, as there is internationally, of how to best to carry this out. Discussions of universities, distance learning methods and other are compared with traditional methods that offer the opportunity to study with other students in an environment dedicated to ergonomics teaching and research. Mechanisms for exchange and hosting students and visiting researchers have not been satisfactorily solved at the level of business plans. The United Kingdom system is costed. Departments have business plans and accounts and must justify them. Accountants often see academic opportunities as a financial burden.

All challenges for the future.

References

Annex A: Aims and Objectives of the Department of Human Sciences

A. Aims

The university’s mission is education, academic enquiry and the advancement of knowledge to provide the highest quality of educational experience and the widest opportunities for students, to advance industry and the professions, and to benefit society. The Department of Human Sciences promotes this mission through its own, which is to “contribute to the advancement and application of knowledge in Ergonomics, Human Biology and Psychology.”.

This is achieved by:

**Aim 1.** - quality teaching and learning programmes, at undergraduate and postgraduate levels.

**Aim 2.** - research based teaching at advanced level.

**Aim 3.** - involvement with industry and the professions in research and teaching, manifest by courses involving professional experience and multidisciplinary education programmes.

**Aim 4.** - continued development and use of information technology in support of innovative teaching, research, communication and administration.

**Aim 5.** - a stimulating, fair, friendly and supportive environment for all of our students.

B. Department Objectives

On completing their studies, students will:

**Objective 1.** - have acquired an understanding of the relevant principles of the human sciences and their methodologies and be able to apply them to a range of situations;

**Objective 2.** - have enhanced their understanding through contact with researchers, outside experts and with industry and work experience where appropriate;

**Objective 3.** - be competent to work independently in problem definition, the use of information based resources, the design and execution of research programmes, the evaluation of research findings and their justifiable application.

**Objective 4.** - have developed skills of communication, organisation and working with others through individual and group assignments involving oral and written reports supported by appropriate Information Technology;

**Objective 5.** - have adopted an attitude to scholarship which will facilitate continued learning and professional development throughout their careers.
C. Specific Objectives by programme.

In addition to the department objectives there are objectives specific to each programme as follows:

Ergonomics Programmes

Objective 6 - to prepare undergraduates and postgraduates for professional careers as Ergonomics specialists in industry and enable them, on application, to be accepted as members of the Ergonomics Society and CREE (European Ergonomist).

Objective 7 - having undertaken the postgraduate programme, had the opportunity to further their scientific and technological knowledge and extend it to include Ergonomics principles, theories and practise, and to have successfully planned and executed an applied ergonomics project within the University or in industry.

Human Biology Programme

Objective 8 - to provide students with a firm foundation in scientific method and knowledge of the application of human biological techniques and to advance the understanding of the biology of individuals and populations in terms of variation and adaptation in health and disease.

Psychology Programme

Objective 9 - To sustain a distinctive yet representative syllabus of courses that allows students to experience the analytic perspectives of modern psychology and to provide degree programmes validated by the University under external examination and accredited by the British Psychology Society, taking full advantage of the staff expertise and scholarship.

Psychology with Ergonomics programme

Objective 10 - To provide students with a firm foundation in both Psychology and Ergonomics and in the interrelationships between the two disciplines to a standard recognised by both the Ergonomics Society and the British Psychological Society such that students can go on to pursue a successful career in areas of study and application that draw upon both disciplines.

Diploma in Professional Studies (DPS)

Objective 11 - having undertaken the four year undergraduate programme, had the opportunity to experience and practise application of their discipline of study in a professional placement through the DPS programme.