MATERIALS

Introduction

It is the responsibility of the every member of staff within HE to respond to the requirements of equality legislation. The basic principle that can and should be universally responded to is that it is attitudes, barriers and other forms of discrimination within the system rather than individual characteristics or deficits that are the cause of disadvantage. Employing an inclusive approach is underpinned by the adoption of other principles of inclusive curriculum design, summarised in the adjacent text box and discussed in the introduction section of this guide available at www.heacademy.ac.uk/assets/documents/inclusion/disability/ICD_introduction.pdf

Principles of inclusive curriculum design

Anticipatory
Flexible
Accountable
Collaborative
Transparent
Equitable

May and Bridger assert, in respect of developing an inclusive culture, "making a shift of such magnitude requires cultural and systemic change at both policy and practice levels" (2010: 2). In essence this change is represented by a shift in focus from responding to the 'needs' of individuals or specific groups of students to an approach that anticipates and plans for the entitlements of the evolving student population. Thus the onus is on institutions and subject communities to change and adapt their policies and practice rather than expect this of individual or specific groups of students.

Generic considerations

— cost and financial considerations;
— embedding student and staff well-being;
— promoting student engagement;
— use of technology to enhance learning;
— responding to different approaches to learning;
— avoiding stereotypes and celebrating diversity;
— making reasonable adjustments.

There are many generic considerations of inclusive curriculum design, summarised in the adjacent text box, which are discussed in the introduction section. The focus of this section is on subject-specific considerations for those in those subjects aligned to materials. Here examples of innovation and effective practice are provided to demonstrate that effectivepractice for one group can and should be effective practice for all. The examples, resources and ideas included in this and other subject guides have come from the sector. They were obtained directly in response to a general request made to the sector during 2010, from a review of the HEA Subject Centres or from recommendations made by colleagues teaching in the specific subject.

Where there are examples in other subject guides that may be particularly relevant or worth reviewing for further adaptation these are flagged. However, notably inspiration and ideas for curriculum design can come from many sources, therefore reading strategies employed and ideas in other subject areas can be a useful source of new ideas.

Inclusive curriculum design: subject-specific considerations

Materials Science and Engineering has become a key discipline in the competitive global economy and is recognised as one of the technical disciplines with the most exciting career opportunities. (Murphy, 2009) http://www.materials.ac.uk/about/whatis.asp

An inclusive curriculum design for Materials Science students needs to consider among other things the:

— learning context and issues associated with laboratory work, including access and use of different types of equipment;
— importance of relevant content that allows application of knowledge and skills to a range of employment contexts including overseas working environments;
— potential for collaboration with potential users, employers, staff and students from other subjects to develop the employability skills and the experience of working with others whose perspective may differ from their own.

Increasing student engagement and assessment in laboratory work

See Physical Sciences section for ideas from JISC Techdis about how technology can support the delivery of practical subjects. Considering delivery issues at the design and development stage of a new module can save a lot of time and avoid the need for individual adaptation.

The guide *Teaching Materials Laboratory Classes* (Baillie and Hazel, 2003) highlights the importance of student engagement in laboratory classes, which is a necessary feature of an inclusive curriculum design. The guide explores practical examples and explains the impact of design decisions; for instance, students having practicals where all they do is watch technicians use the equipment and 'demonstrate the practical' rather than undertaking the investigation themselves.

A particular issue in laborary work relates to what Baillie and Hazel describe as 'fraudulant behaviours' associated with writing up practicals. These can be avoided by redesigning aspects of assessment that take account of students previous experiences, cultural perspectives and learning styles or impairments. The examples below relate to inclusive curriculum design considerations and principles.

Flexibility	Take action to reduce student overload. Limit the range of goals for laboratory exercises.
Ownership	Encourage a sense of ownership and identification by favouring choice of topic in investigations and projects where possible. Allow reasonable

choices about the foci of exercises to be undertaken.

Relevance — Set the laboratory work in a context where students can have some sense of identification and can see a clear vocational link or link to future coursework.

(Baillie and Hazel, 2003: 11)

The Bioscience, Built Environment, Engineering, Information and Computer Science, and Physical Sciences subject guides provide more examples of inclusive curriculum design on laboratory work.

Enabling students to solve problems and apply theory using case studies

Within Materials Science students need to be able to apply theory in a range of practical contexts and demonstrate their ability to solve problems and work collaboratively. Case studies if integrated into the curriculum provide an ideal mechanism for ensuring that both the learning process and the content are inclusive. The benefits of case studies in Materials Science include:

— demonstrating the application of theoretical concepts, thus bridging the gap between theory and practice;
— encouraging active learning;
— providing an opportunity for the development of key skills such as communication, group working and problem solving;
— increasing students' enjoyment of the topic and hence their desire to learn (Davis and Wilcock, undated) http://www.materials.ac.uk/guides/casestudies.asp

Collaboration between Materials Science and Sports Science students at the University of Birmingham provides students with the opportunity to develop group work skills and share their respective knowledge about the use of prosthetics for athletes. Sometimes students drift towards roles for which they have a natural affinity or have had previous experience. Giving Materials Science students a chance to explore the pressures and perspective of other roles within a group in a formative and low-risk context of looking at a case study, can allow them to see their peers in a different light, increase their awareness of their own preferences and ways of working. The Prosthetic Limbs Case Study is one of a number of case studies available from the University of Birmingham's Metallurgy and Materials Department (undated: http://www.cases.bham.ac.uk/).

The content of 'real problems to be solved' can convey a greater appreciation of the alternative solutions to engineering problems. For instance, asking students to generate solutions using materials and resources only available in certain situations can encourage all students in Materials Science to recognise their

cultural and working context. UNESCO regard engineering as helping to eradicate poverty and contribute to sustainable social and economic development; in recent years UNESCO competitions or projects have provided the basis for intercultural competence for engineering students (UNESCO, undated: http://www.unesco.org/new/en/unesco/).

The Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA) Europe-wide design competition Inclusive Worlds (2006) provided design challenges ensuring students think about how design can include or exclude different people. For further details of current projects organised by RSA, see: http://www.thersa.org/projects/our-projects. and for details of the European Design for all e-Accessibility Network (EdeAN, undated): insert url http://www.education.edean.org/

Increasing curriculum relevance through multi-disciplinary collaboration

As well as supporting student engagement case studies can also increase the relevance of the curriculum especially when teaching and learning activities are supported by multi-disciplinary collaboration with industry, students in other disciplines and potential users. Curriculum relevance can also be achieved through multi-disciplinary collaboration supported by design challenges, problem-based learning opportunities and simulated tools.

The Helen Hamlyn Research Associates (2010) Programme has provided 27 case studies showing how work with industry, public and voluntary sector partners can be employed to deliver real-life benefits for older and disabled consumers that ensure products and services work better for all.

A health care innovation design brief 'Design Bugs Out' was adopted in a real-world design challenge started by the Design Council. The full design brief is available from the Design Council's website http://www.designcouncil.org.uk/our-work/challenges/health/design-bugs-out/ (2009).

Students studying BSc Product Design, BSc Product Design Engineering, BA Industrial Design and Technology, and BSc Occupational Therapy collaborated in teams to tackle problem-based, health-care-associated infections. There were five specific problem areas for students to choose from:

— hand hygiene (new product and/or service or system that improves hand hygiene of hospital staff, patients and visitors);
— bedside environment (furniture or a total system);
— commode (ease of cleaning, usability, patient experience,

comfort and dignity are priorities);
— patient transport (stretchers, wheelchairs and porters' trolleys);
— open brief (a piece of equipment, furniture or system that directly or indirectly reduces the spread of common infections in the health care environment).

(Dong and Spiliotoupoulou, undated)

An introduction to the existing impairment simulation tools and the online inclusive design simulation toolkits was used to provide students with additional insights to complement the views of users (I~Design and BT, 2010). Student feedback shows how they felt they benefited from this multi-disciplinary approach.

> Working alongside occupational therapists was extremely helpful as you are able to understand more fully the needs of the target market, thus allowing the designer to design more accordingly to the specific needs.

> Both groups of students can look at the situation from different perspectives which make the end product more usable to a wider group of people.

See also the Built Environment, and Hospitality, Leisure, Sport and Tourism subject guides for examples of using case studies.

Introducing this multi-disciplinary activity into the programme enhanced the overall curriculum design by providing a relevant focus with real-life application that required students to consider accessibility issues and how future work needs to take account of these issues.

Preparing future professionals to work ethically with end users

Multi-disciplinary collaboration can provide opportunities for engagement with professionals and end users of their designs that can assist students to develop an awareness of professional contexts and codes of conduct. For instance, Hewer and Nicolle signal the importance of adopting an ethical approach to working with end users. They recommend:

— creating a learning environment and culture where all are treated as equal and respected partners in developing inclusive design solutions;
— embedding ethical considerations for working with users in student projects in course design and not as an afterthought;
— collaborating with other disciplines regarding materials and modules;
— sharing resources rather than 'reinventing the wheel' (Hewer and Nicolle, 2006).