BIOSCIENCE

Introduction

Principles of inclusive curriculum design

Anticipatory
Flexible
Accountable
Collaborative
Transparent
Equitable

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.

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

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.

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 bioscience. Here examples of innovation and effective practice are provided to demonstrate that effective practice 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

Enhancing practical work in the laboratory and fieldwork sites

Laboratory and fieldwork are important and integral elements of many bioscience programmes. Much practical work has been done to make laboratories and fieldwork sites accessible to disabled students.

Simulations or other forms of blended learning can enhance the experience of all students as well as provide an alternative to some laboratory work. They can offer students the opportunity to acquire knowledge and learn the skills stipulated by benchmarking statements and other requirements. This can benefit students who:

— lack confidence or require additional practice;
— require greater flexibility in where and when they study;
— have cultural, religious or ethical reasons for not wishing to undertake certain types of experiment;
— have physical or sensory impairments that require an alternative approach.

Consideration should be given to where simulations can offer a comparable learning experience to laboratory or fieldwork:

— University College London has an online virtual laboratory where students can work flexibly through practical biochemistry classes (Bender, 2006);
— Cardiff University has devised an Aquatic Ecosystem Simulator, which can be downloaded for use in the classroom or independent study (Randerson, 2008);
— Manchester Metropolitan University have made the data from a long-term study available online to enable distant access to an ecological field experiment (Fielding, 2004).

The Virtual Analytical Laboratory (VAL) at De Montfort University supports students to gain essential laboratory skills and build their confidence in the laboratory. Using VAL enables students to gain or refresh skills before entering the laboratory. It can be accessed online, via iTunes or it can be downloaded

for use on home computers or mobile devices. Short tests undertaken after working through VAL demonstrated that those students with no laboratory experience gained similar scores to those students with previous experience (School of Allied Health Sciences, De Montfort University, undated).

The Physical Sciences, Materials, and Medicine, Dentistry and Veterinary Medicine subject guides provide examples that could be adapted for enhancing students' experience of laboratory and practical work.

Redesigning spaces rather than refurbishing can increase students' access to laboratory spaces. As Lindsey (2009) notes, relatively little attention has been paid to the redesign of laboratory spaces. The tendency to refurbish and configure curriculum design around existing facilities threatens to limit or constrain thinking. Module validation processes often provide an opportunity to promote space and other logistical requirements that can contribute to longer-term institutional discussions about developing the institution's estate. Laboratories are required to be increasingly flexible to meet the needs of different subjects and can be reconfigured to better enable communication particularly between staff and students.

The JISC Flickr site collates images of laboratories and other specialist work environments (JISC, 2010), see: www.flickr.com/photos/jiscinfonet) and Centre for Bioscience (undated) Image bank see: www.bioscience.heacademy.ac.uk/imagebank/

Adapting guidance and self-assessment opportunities around health and safety issues initially devised for disabled students can also ensure that all students develop the knowledge and self-awareness necessary for safe and effective learning.

Recognising mathematical entry skills

The entry level of mathematical skills for bioscience students is an issue of concern for many in the subject area. A tension can appear to exist between adapting modules to meet the evolving student intake and maintaining academic standards. An inclusive curriculum approach involves understanding students' prior experiences and tailoring the curriculum to provide students with the opportunity to gain the required level of competence.

Understanding the UK Mathematic Curriculum Pre-Higher Education – a Guide for Academic Members of Staff (Lee *et al.,* 2010) provides guidance for those teaching in science, technology, engineering and mathematics (STEM) subjects about attributes and skills students will have acquired from a range of qualifications. Using this guide alongside admissions data can help adapt the curriculum to respond, challenge and stimulate all students regardless of their previous learning experiences and help to meet their entitlements.

The Economics, Engineering, and Mathematics subject guides provide examples that could be adapted for use on developing mathematical skills.

Improving levels of literacy

Similar concerns about the levels of literacy exist, as Jones (2008) states: "we should not have to dumb-down courses. With the right approach staff can have high expectations of students and students can meet these expectations" (Jones, 2008: 30).

The Essay Writing Guide: A Guide by Students for Students (Bioscience students, University of Exeter, undated) produced at the University of Exeter aims to improve levels of literacy. It includes sections on:

— annotated marking criteria;
— planning, structuring and presenting essays;
— referencing correctly;
— essays in exam conditions;
— ten top tips.

Embedding skill development is another approach to skill development. The University of East Anglia integrated teaching sessions and tasks on writing skills into a year-long, first-year module, *Skills for Biologists.* One task was to complete a science log. Students were provided with a workbook with instructions and 14 blank pages. They were instructed to write for ten minutes per day on a scientific topic. In the first week they could only use full stops and in the second week any form of punctuation.

Benefits to this integrated approach included improvements for many students in the fluidity of their writing, handwriting and use of grammar. An unexpected benefit was that many students drew on relevant academic publications (such as *New Scientist*) in their writing or wrote on subjects they felt passionate about. This provided an experiential example of self-directed learning. The exercise was very popular with students.

Messages from the *Skills for Biologists* initiative include:

— everyone can improve their writing and the scientific writing required at university will be new to all students;
— staff expectations must be realistic (based on admission criteria and previous experiences of students);
— staff need to understand students' positive and negative experiences of school (and other) teaching. Staff should enable students to recognise the particular writing strengths they bring as well as valuing other writing genres that employers expect and which they may need to develop.

Responding to different learning approaches and experiences

In addition to the generic reasons for responding to different learning approaches bioscience students need to understand the relevance of the content of their previous study and become aware of the skills they have acquired and those they may need to develop. The course designer needs to consider how to respond to students with different pre-entry experiences and provide them with a range of delivery and assessment methods to prepare them for future modules.

Anatomy of the Human Body is a 12-week, second-year module taught at the University of Sheffield to a large cohort. The module recognises that many students will find utilising Latin and Greek terminology challenging and that traditional methods of teaching anatomy such as dissection and the rote learning of terms favour particular learning approaches. An integral component of this module exposes students to a range of learning and teaching approaches to enable them to access the curriculum content and increase self-awareness about effective learning (Linehan, 2009).