A selected bibliography of Practical and Fieldwork education

Practical work (general)

Boud, D., Dunn, J. & Hegarty-Hazel, E., (1986). **Teaching in Laboratories.** SRHE & NFER-NELSON, Surrey.
A complete guide to the design and organisation of laboratory activities and the conduct of laboratory teaching. An exhaustive up-to-date account and appraisal of current practise, with recommendations for change supported by case studies. A wide variety of literature is examined for adequacy and practicality and an extensive bibliography supplied.

Brown, G., and Atkins, M. (1988) **Effective Laboratory Teaching.** In Effective Teaching in Higher Education, pp. 91-114. London: RoutledgeFalmer. ISBN 0415036755.
An easy to read text with content covering: lecturing, laboratory teaching, research and project supervision and student learning. The age of the book (1988) is noticeable when media for presentation are being discussed. However, it is not difficult to consciously substitute media and methods currently available whilst reading the book.

Doyle, C. and Robson, K. (2002) **Accessible Curricula: Good Practice for All.** Cardiff: UWIC Press.
A useful source of information for any academic on meeting the needs of students with disabilities and/or learning difficulties. As a whole the document provides examples of good practice and appropriate 'reasonable adjustments'. Individual sections include some useful pointers and checklists and brief case studies of individual student experiences are also given. Sections 5 and 6 focus on Laboratory Practicals and Work Placements and Field Trips.
www.techdis.ac.uk/resources/files/curricula.pdf

Franklin, S., Peat, M., & Lewis, A., (2002). **Traditional versus computer-based dissections in enhanced learning in a tertiary setting: a student perspective.** J.Biol.Educ., **36** (3), 124-129.
This paper describes a study investigating both the use and usefulness of laboratory dissections and computer-based dissections, in a tertiary, first-year human biology course. The outcomes reinforce the need to offer a variety of learning experiences that target different styles of learning.

Forster, F., Hounsell, D. and Thompson, S. (eds.) (1995). **Tutoring and Demonstrating.** Centre for Teaching, Learning and Assessment, University of Edinburgh/UCoSDA.
www.tla.ed.ac.uk/services/tutdems/handbook.htm

Gibbs, G., Gregory, R., & Moore, I., (1997). **Teaching More Students series: 7. Labs and Practicals with more students and fewer resources.** 67pp. OCSLD, Oxford.
Includes sections on: Reviewing aims and resources; Teaching and assessing the aims of lab work; Alternatives to working in the lab; Doing what you can before and after the lab; Using teamwork; Alternatives to assessing practical reports; Case studies.

Hazel, E. & Baillie C. (1998). **Gold Guide 4. Improving teaching and learning in laboratories. HERDSA publications.** 77pp [order guides from *www.herdsa.org.au/?pageid=35*]
This guide is written for both experienced and inexperienced staff who are involved with laboratory classes for science or engineering subjects. The guide can be read in its entirety or specific sections can be reviewed to try to address specific issues.

Heylings, D. (1994) **Group Practical Work.** In An Enterprising Curriculum: Teaching Innovations in Higher Education. pp. 25-52. Sneddon, I. and Kremer, J. (eds.). Belfast: HMSO.
A useful case study from human anatomy to illustrate how group work can be embedded into a course. Examples of marking sheets, course evaluation and a realistic attitude to the amount of work and effort involved are given.

Hughes, I. (2004). **Coping strategies for staff involved in assessment of laboratory write-ups.** Bioscience Education, Volume 3, available at www.bioscience.heacademy.ac.uk/journal/vol3/beej-3-4.htm

Jones, A., Reed, R. and Weyers, J. (2002) **Practical Skills in Biology**. 3rd ed. Essex: Longman.

Kirschner, P.A. and Meester, M.A.M. (1988) **The Laboratory in Higher Science Education: Problems, Premises and Objectives.** Higher Education **17**(1): 81-98.
The article arose from the Dutch Open University's (a distance learning environment) desire to get the most from the limited number of practicals they run. The paper is a good overview of the issues relating to practical work in the sciences and would be of particular use to those who are introducing or modifying practical classes.

Reed, R., Holmes, D., Weyers, J. and Jones, A. (2003) **Practical Skills in Biomolecular Sciences.** 2nd ed. Upper Saddle River, NJ: Prentice Hall.
The book is written for the student rather than the lecturer/teacher. The text covers the skills required in laboratory classes, practical advice, tips, worked examples, key points, 'how to' boxes and a checklist for a wide range of experiments/techniques. Emphasis is placed on practical application of theoretical principles. The book is a useful reference to point students to and a good guide to the sort of information students need to know with respect to practicals.

Practicals for the Biosciences
www.bioscience.heacademy.ac.uk/resources/compendium/

This resources aims to provide useful information and resources for new staff and inspiration for all staff developing this area of the bioscience curriculum. The compendium includes: A searchable collection of bioscience laboratory and field practicals, investigations and activities and good practice drawn from UK Bioscience Departments; Access to downloadable 'practicals' including student handouts and supporting information. Please note the compendium is currently being updated.

BES Ecological Project Compendium
"The British Ecological Society's Ecological Project Compendium (EPC) is a collection of successful ecological practical exercises taught to undergraduate students. The philosophy of the Compendium is to share good practice that will stimulate further innovation and debate in the teaching of ecology. Each project describes a successful ecological exercise, includes specimen data, and provides suggestions for further modifications that extend the usefulness of the author's approach. The projects are presented as brief, peer-reviewed articles which can be browsed on the website or printed out." **www.britishecologicalsociety.org/epc/index.php**

Canolfan Edward Llwyd: Plant Identification
"This website is intended as an aid to those learning the skills of plant identification, and offers a variety of resources, some interactive, to help you navigate your way through the process of learning and practising." Available in English and Welsh: **www.aber.ac.uk/plant-id/**

Fieldwork

Gravestock, P. and Healey, M. (eds.) (2002) **Six Web-based Guides on Learning Support for Disabled Students Undertaking Fieldwork and Related Activities.** Gloucestershire: Geography Discipline Network.
The first guide examines the issues involved in providing learning support for disabled students undertaking fieldwork and related activities. The other 5 guides cover specific impairments or difficulties. Although drawn from the geography and earth science disciplines the majority of situations and scenarios are directly applicable to the biosciences. **www.glos.ac.uk/gdn/disabil/**

Jenkins, A. (1997). **Teaching More Students series: 9. Fieldwork with more students.** 69pp. OCSLD Oxford.
Includes: Staff and students' experience of fieldwork; Problems caused by fieldwork with more students; Fieldwork review questionnaire; Strategies for delivering fieldwork with more students overview; Addressing problems of cost; Addressing the problems of staff time; Reducing the burden on fieldwork locations; Assessing fieldwork more economically; Attending to safety and discipline; Defending fieldwork.

Jenkins, A. (1994) **Thirteen ways of doing fieldwork with large classes/more students.** Journal of Geography in Higher Education **18**: 143-154.
The paper starts from the basis that many departments spend a large proportion of their budget on fieldwork. As student numbers increase class sizes are likely to rise as are Student:Staff Ratios (SSRs). The problems associated with larger class sizes and SSRs are discussed followed by 13 different options to manage the problem. These range from ‘don’t do it’ to considering fieldwork as quality time to be rationed. Although the article does not attempt to make a case for retaining fieldwork it provides a useful series of questions/items for consideration for those people who seek to maintain (or introduce) fieldwork in the current political climate.

Manning, M., Harris, J.A., Maher, W.A. and McQueen, K.G. (1998) **Learning in the Field: A Manual for Conducting Field Classes**, Gold Guide No. 5. Jamieson, ACT: HERDSA. [ISBN 0-908557-44-2; guides may be ordered from **www.herdsa.org.au/?pageid=35**]
The focus of this manual is outdoor field-based programs. Coverage includes the design and planning of field-based learning programs, including the rationale, structure, approaches and objectives. It explores the major planning issues relevant to field classes, such as logistical and financial aspects, health and safety, social and gender considerations, and presents strategies for maximising learning outcomes. A field class checklist is included. Examples of specific programs and an approach to evaluating field-based learning are included.

Nichols, D (ed.) (1999). **Safety in biological fieldwork - Guidance notes for codes of practice.** 4th edition. London: Institute of Biology.
An important but concise account of this vital topic for the modern fieldworker or staff supervisor.

Openshaw, P.H. & Whittle, S.J., (1993). **Ecological field teaching: how can it be made more effective?** J.Biol.Educ., **27** (1), 58-66.
Ecological field trips can be fun but sometimes frightening for both teacher and students. They can be more effective if learning problems are identified and overcome.

Promoting scientific inquiry and other skills

Clarkeburn, H., Beaumont, E., Downie, R. & Reid, N., 2000. **Teaching biology students transferable skills.** J.Biol.Educ., **34** (3), 133-137.
Biology students will require skills and abilities distinct from academic knowledge in their future working life. An educational programme based on interactive teaching units at the University of Glasgow is described to provide an opportunity for the development and practice of these skills.

Klappa P. **Assessment of practical skills, TDF (Teaching Development Fund) project funded by the Centre for Bioscience.**
A research project that investigated how practical classes could be designed such that an assessment of practical skills and manual competency of bioscience students was achieved. Further information about the project and resources to accompany the practical are available from: **www.bioscience.heacademy.ac.uk/resources/projects/klappa.aspx**

Stefani, L (2003). **Developing problem-solving skills through practical work.** Bioscience Bulletin **9**: 4-5. www.bioscience.heacademy.ac.uk/ftp/newsletters/ltsn9.pdf
Promoting inquiry in the curriculum; this article contains useful advice on strategy.

Thomas, M., Hughes, S.G., Hart, P.M., Schollar, J., Keirle, K. & Griffith, G.W., (2001). **Group project work in biotechnology and its impact on key skills.** J.Biol.Educ., **35** (3), 133-140.
A group work approach to the teaching of ethical issues in biotechnology is described and its impact on the acquisition of the key skills of working together, communication, and problem solving, is evaluated. An attempt is made to identify the skill items that are influenced most by the group project work. Gender differences are also highlighted.

Turner,M.E., Paradise,N.F. & Johnson,M.L., 1998. **Simulating a research environment in an undergraduate genetics laboratory.** J.Biol.Educ., **32** (2), 92-96.
Creating the excitement of scientific discovery in an undergraduate genetics laboratory.

Experimental design & data analysis

Fielding A., **Distant access to an ecological field experiment. TDF project funded by the Centre for Bioscience.**
Full, on-line access to the experimental details and extensive results of an on-going project to identify the effects of grazing and woodland management on the biodiversity of regenerating and mature broadleaf woodland. This is a useful source of primary data for data analysis exercises, further information and links to the website are available from:
www.bioscience.heacademy.ac.uk/resources/projects/fielding.aspx

Povey, D. & Bennett, J., 2000. **A software tool for simulating practical chemistry.** Alt-J, **8** (2), 40-50.
Although describing a practical chemistry simulation, this paper contains many relevant aspects of the simulation versus practical debate and should be read. It is particularly relevant to the development of experimental design.

Open-ended investigations and student projects

Stefani, L.A.J. & Tariq, V.N., 1996. **Running group practical projects for first-year undergraduate students.** J.Biol.Educ., **30** (1), 36-40.
Reporting on the introduction of three open-ended, problem-based laboratory projects, this article describes some of the problems and the many rewards associated with introducing group project work to a large class of first-year undergraduate students.

Ryder, J. and Leach, J. (1997) **Research Projects in the Undergraduate Science Course: Students Learning about Science through Enculturation**, Proceedings of the 4th International Student Learning Symposium, G. Gibbs (ed.). Oxford: OCSLD.

Undergraduate Research Journals

There are a range of undergraduate journals that are produced by bioscience departments to publish their students work.

Bioscience Horizons is a free online journal publishing the best undergraduate bioscience research from the UK and Republic of Ireland. The journal provides a forum for students, their supervisors and institutions, to showcase high quality undergraduate research work, strengthening the link between teaching and research in higher education. All papers are written by students and based on final year research projects.
www.oxfordjournals.org/our_journals/biohorizons/

Origin an in-house undergraduate journal developed through a Centre for Bioscience Teaching Development Grant. Origin was created to publish representative examples of the research undertaken by Biological Science students at the University of Chester.
www.chester.ac.uk/origin/

Biolog-e an graduate e-journal based upon assessed final year research projects at the University of Leeds. Each issue includes articles based on a sample of first class research projects from students on the Biology programmes, covering Biology, Animal Science, Zoology and Genetics. A longer term aim is to develop the resource with interested undergraduates taking responsibility for peer review and editing of the journal, thus allowing them to develop work-based skills and a deeper understanding of skills required for successful research careers.
www.fbs.leeds.ac.uk/students/ejournal/current/

BURN (Biosciences Undergraduate Research at Nottingham) is a showcase for undergraduates presenting articles and scientific reports of student research from across the Bioscience divisions. All the research reported in BURN has been carried out by undergraduate students in the University of Nottingham, School of Biosciences. **www.nottingham.ac.uk/~sbzml/**

Journal of Young Investigators (consortium of several universities) JYI's web journal (which is also ca is dedicated to the presentation of undergraduate research in science, mathematics, and engineering. It publishes the best submissions from undergraduates, with an emphasis on both the quality of research and the manner in which it is communicated. JYI also allows students to experience the other side of the scientific publication process: the review process. Students working with their faculty advisors review the work of their peers and determine whether that work is acceptable for publication in the Journal.
http://jyi.org/