ENHANCING LIFE SCIENCES GRADUATE ATTRIBUTES USING RESEARCH-TEACHING LINKAGES

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PROJECT BACKGROUND

- QAA Scotland Enhancement Themes funded 12 mth duration
- 1 of 9 Discipline-based Projects - BSc & MSc Levels
- Glasgow Caledonian University & Bioscience Subject Centre HEA

- ***'How best can institutional & programme level links between research strategies and activities support the student learning experience in ways that can enhance learner achievement of research-type attributes?***

- Involves Workshops, Seminars, Literature Review, Surveys and Structured Interviews

ACTIVITIES

- QAAS Enhancement Theme Workshops
- Developing Enquiring Minds: Linking Teaching & Research
  Bioscience Subject Centre Event -Napier Univ., March 07
- Research-Teaching Linkages: Enhancing Graduate Attributes
  SECC, Life Sciences 07
- Surveys UK, International Students & Staff Perceptions
- Staff Interviews- Best Practice & Innovations
- Life Sciences R-T Linkages Event
  Glasgow Caledonian Univ., February 08
- Reports for QAAS Enhancement Themes Conference 08
  & disseminated via BEE-J Bioscience Subject Centre Journal

Why are R-T Linkages Important?

- Research-Teaching Nexus Tensions
- Enhancing Student Learning Experience
- Improved Graduate Attributes by learning from Common Practice, Best Practice and Innovations
- Including International, Employers & Development Sector perspectives
- Improving Value for Tax Payers given 50-60% Bioscience Students will not practice

Research-Led vs. Research-Informed

- Ageing euphemism for ‘Old vs. New’?
- Reality increasingly Mixed Mode
- Differences between Disciplines as much as Universities
- Reflected in Funding Council Resourcing Models?

Interpretation Needed

- Little, if any relationship between research productivity & teaching quality (Marsh & Hattie, 2002)

- Higher RAE Scores associated with:
- More positive student comments on way research affected learning

  BUT
- More negative student comments too….

(Lindsay et al., 2002)

- Better RAE Scores associated with:

  -Increased Student Awareness of Research & Impact on Teaching

  -Reduced access and availability Research Active Academics

(Sears & Wood, 2005)

Life Sciences are Experimental Disciplines

- All knowledge related to observation or experiment
- Families of methods grouped around investigation life processes and organisms inter-relationships
- Current hypothesis rather than certainty based
- Include rapidly changing disciplines
- Essentially practical, experimental, hypothesis testing subjects (Modified from Sears & Wood, 2005)

- Development of Fundamental & Higher Order Skills and Understanding (Hounsell & McCune, 2002)

Life Sciences Viewpoints

- ‘Integrating teaching & research is an essential component of undergraduate honours degrees.’ (Bioscience SC Advisory Board, 2003)
- All Bioscience degree programmes will include

  - ‘methods of acquiring, interpreting and analysing biological information with a critical understanding of the appropriate contexts for their use through the study of texts, original papers, reports and data sets’ (Biosciences Benchmark, 2001,2007)

  - ‘integration of theory, experiment, investigation and fieldwork and the development of principles into practice’

  (Agriculture, Forestry, Food & Consumer Sciences Benchmark, 2001)
- 2007 Revisions emphasise value of lab, project and field-work
- Discipline & Generic Skills can reinforce one another

STUDENT-FOCUSED
Students as Participants

Research-tutored
Curriculum emphasises learning focused on Students writing and discussing papers or essays

Research-based
Curriculum emphasises Students undertaking inquiry-based learning

RESEARCH CONTENT Emphasis

RESEARCH PROCESS & PROBLEMS Emphasis

Research-led
Curriculum is structured around teaching subject content

Research-oriented
Curriculum emphasises teaching processes of knowledge construction in subject

TEACHER-FOCUSED
Students as Audience

(Healey,2005)

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TEACHER-FOCUSED
Students as Audience

Life Sciences Graduate Attributes

- Enquiring, gathering & analysing information
- Hypothesis design, testing & experimental skills
- Understanding risk, health & safety
- Managing resources
- Developing lifelong learning skills
- Numeracy, accuracy & precision skills
- Integrity & open-mindedness
- Developing self-confident achievers
- Understanding science controversies and provisionality of knowledge
- Evaluation, critical appraisal and synthesis of novel concepts
- Understanding science structures
- Understanding ethics & professional behaviours
- Communication & presentation skills
- Employability skills
- Flexible, independent & team working skills
- Project management skills

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Desirable Undergraduate Attributes

- Critical understanding
- Informed by current developments
- Awareness of knowledge properties
- Ability to identify and analyse problems, evaluate and apply evidence based solutions
- Ability to systematically & critically assess complex issues
- Ability to deploy techniques of analysis & enquiry
- Familiarity with advanced techniques and skills
- Originality & creativity
- Understanding of need for high level of ethical, social, cultural, environmental & wider professional conduct

Desirable Master's Level Attributes

- Conceptual understanding enabling critical evaluation of current research and advanced scholarship
- Originality in application of knowledge
- Ability to deal with complex issues and make sound judgements in absence of complete data

“Learning skills are for life,
- not just for Christmas!”

Survey Results

- 276 Students & Researchers
- Abertay, Napier, GCU & SAC
- Life Sciences 07 Education Symposium
- HEI & Programme based analysis
- Ongoing- Volunteers welcome!

	STATEMENT	1	2	3	4	5
1	From the lectures I have attended I understand how bioscience research is carried out.				ALL	
2	Lecturers on this programme explain how research is done.			LEC	STU	
3	In the lectures I have attended so far the lecturers frequently illustrate the topics by examples from research that has been carried out.				ALL	
4	At this stage in my programme/after carrying out my research project (delete as appropriate), I understand how bioscience research is carried out.			C	A,N	LEC
5	From the work on the programme so far I understand what is meant by the word “hypothesis”.				ALL=	ALL=

	STATEMENT	1	2	3	4	5
6	I understand that when research has been done and results obtained, the conclusions are published in scientific journals or presented at conferences.					ALL
7	My programme encourages me to read scientific papers about research (the so-called “primary literature”).				C	ALL
8	On my course I have been asked to summarise one or more scientific papers.				LEC, C	A,N
9	On my course it has been explained to me how scientific papers are written and formatted.				STU	
10	I know that scientific papers are written in a standard format with sections like “Materials and Methods”, “Results”, and “Discussion”.					ALL

	STATEMENT	1	2	3	4	5
11	I understand that the “facts” in the textbook(s) I use represent conclusions based on actual research that has been done in the past.				ALL	N
12	I am aware that the “facts” in the textbook(s) that I use may change over time as new discoveries are made.				LEC	STU
13	In my practical classes the staff help me to understand how experiments are planned and how controls and statistics are used.			LEC=	STU, LEC=	
14	After taking a year out to work in industry [or work on an ERASMUS exchange, etc] I have a much clearer idea of how research is done.			STU		LEC
15	I have a clear idea of why statistics are used in most bioscience research.				STU	

	STATEMENT	1	2	3	4	5
16	I have a clear idea of why it is necessary to use Controls in bioscience research.				ALL=	ALL=
17	I have a clear idea of what “ethical behaviour” means when applied to scientific research (e.g. honest reporting of data, no plagiarism, ethical behaviour when working with animals or human patients)					STU

GOOD PRACTICE EXAMPLES

- **‘Teach Science as a method of thinking & doing’**
  (Charles Paxton & Morven Shearer, St Andrews University)

- Students too often taught discipline specific facts but no general principles, assumed either not necessary or will be picked up incidentally
- Declining citizenship quality by limited understanding of risk, peer review, basic logic, replication & statistics
- Utilise interdisciplinary module using Philosophy, Ethics, Statistics, Computer Science, Psychology, Geoscience & Biology
- Attempting to combine scientific rigour with popularism

GOOD PRACTICE EXAMPLES

- **‘Using Data Discussion to promote Scientific Thinking in Undergraduates and MSc Students’**

  (Maria Jackson, Glasgow University)

- Data Discussions & Case Studies develop Student Skills in:
- Critical Analysis & Evaluation
- Knowledge Application to Real Problems eg Cancer Genetics
- Communicating Ideas and Building on Each Other’s Ideas
- Planning Logically
- Intrinsic Feedback for Skills in Development

GOOD PRACTICE EXAMPLES

- Experiential Learning CETL, Plymouth University

  (Kirsty Magnier & Matthew Sharples)
- ‘Bioscience Student Conceptions Experiential Learning & Implications for Skills Development’
- Fieldwork, Labwork & Work Based Learning judged as highly relevant
- Mastery of practical skills developed in field, lab or workplace increasing career opportunities
- Closing loop to Biosciences Benchmark (& current revision out to Consultation)

How best can institutional & programme level links between research strategies and activities support the student learning experience in ways that can enhance learner achievement of research-type attributes?

Institutional Level

- Consider use of formal mechanisms to ensure R-T linkages in every programme
- Develop appropriate mechanisms to monitor effectiveness of R-T linkages
- Involve Students & Employers in effectiveness checks
- Encourage discipline related P/T employment opportunities
- Encourage placements or vacation jobs relevant to disciplines

How best can institutional & programme level links between research strategies and activities support the student learning experience in ways that can enhance learner achievement of research-type attributes?

Programme Level

- Share good practice between teaching units more
- Consider earlier use of Research Skills or Mini-Project activities
- Consider placing greater emphasis on ‘developing enquiring minds’ activities in earlier years
- Reflect & refresh nature of R-T linking activities

Emerging Outcomes…

- Wide variety of ways in which R-T Linkages achieved in Biosciences
- R-T Linkages part of Biosciences culture
- R-T Linkages could be made more explicit & more fully exploited
- Wide range of good practice across Biosciences sub-disciplines and diverse institutions
- Engagement with Subject Centres, CETLs to enhance R-T Linkages and student experience

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- Enhancement Themes & Research Teaching Linkages http://www.enhancementthemes.ac.uk/themes/ResearchTeaching/RT_LS.asp

- Thanks for joining us today and for participating!