

Research-teaching linkages: what are they and why are they important

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Teaching and the student experience

Paul Ramsden report to John Denham (2008)

There is a keenness to innovate in all aspects of the student experience among many UK academics, and there is an inquisitiveness about better teaching that is most likely related to the long-established idea that university teaching should be associated with research in the disciplines.

*Government and funding bodies should incentivise and support the radical realignment of undergraduate curricula: we require curricula that are transdisciplinary, that extend students to their limits, that develop skills of **inquiry** and **research**, and that are imbued with international perspectives.*

There are several models that we might explore. They should all:

- Encourage interdisciplinary study*
- Develop stronger learning communities to counter the potential fragmentation effects of increased modular and part-time study*
- Provide flexible transfer between part-time and full-time modes of study*
- Develop global perspectives*
- **Incorporate research-based study for undergraduates (to cultivate awareness of research careers, to train students in research skills for employment, and to sustain the advantages of a research-teaching connection in a mass or universal system)***
- Enable closer connections between undergraduate and postgraduate study*

The research-based approaches realised at the Warwick-Oxford Brookes Reinvention CETL, Imperial College and the National Science Foundation in the USA also merit consideration

There is a real sense among many academics that formal recognition is given to teaching in name only and that promotion can be obtained on research achievement alone. It is hard to see how further progress in enhancing the student experience can occur if attention is not given to amending the factors underlying these perceptions.

Can we define research-teaching linkages?

Research-led teaching

Griffiths (2004)

- Curriculum content directly based on specialist research interests of teaching staff
- Teaching often traditional 'information transmission'
- Emphasis on understanding research findings rather than research processes

Research-oriented teaching

- Emphasis on understanding the research processes as well as on learning the knowledge
- Teaching of inquiry skills and on acquiring 'research ethos'

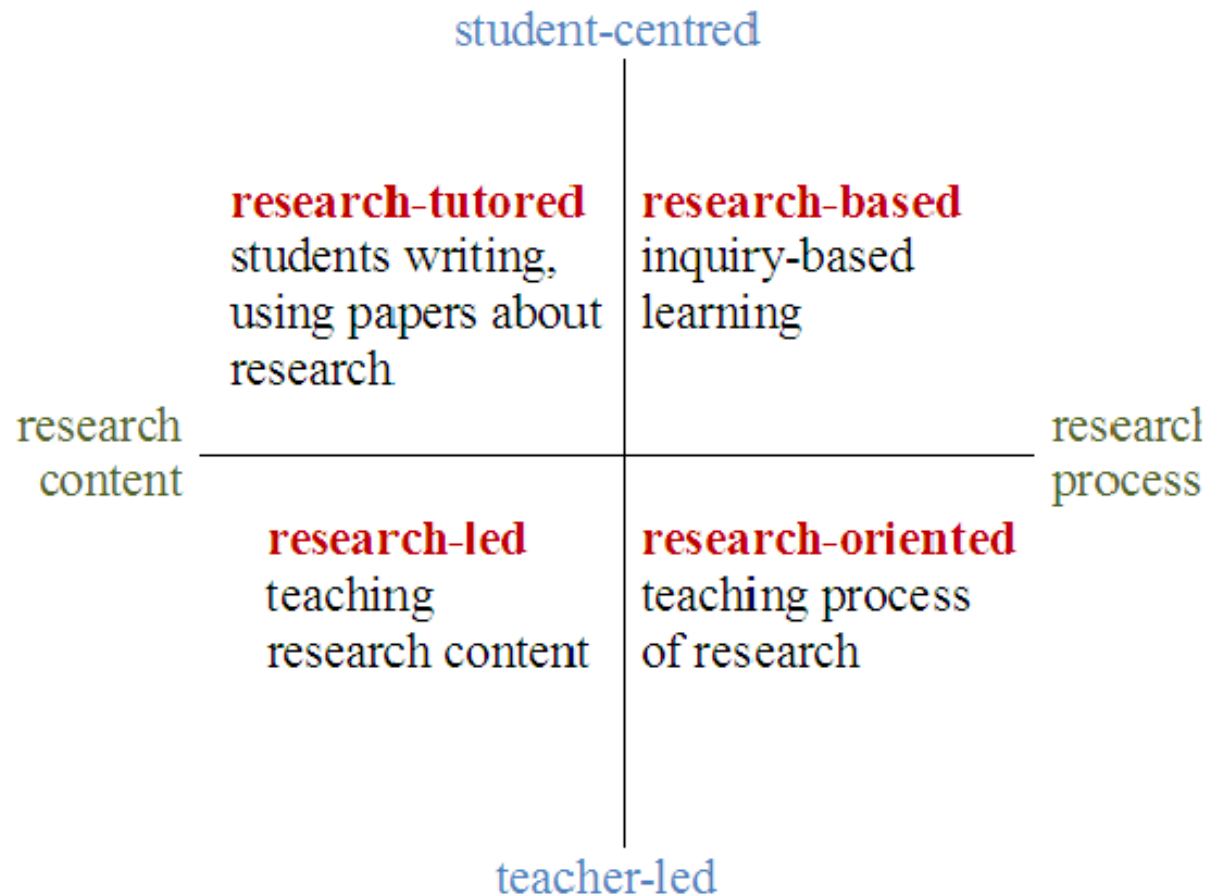
Research-based teaching

- **Curriculum** designed around inquiry-based activities, rather than on the acquisition of subject content
- Division of roles between teacher and student is minimised
- Scope for two-way interactions between research and teaching

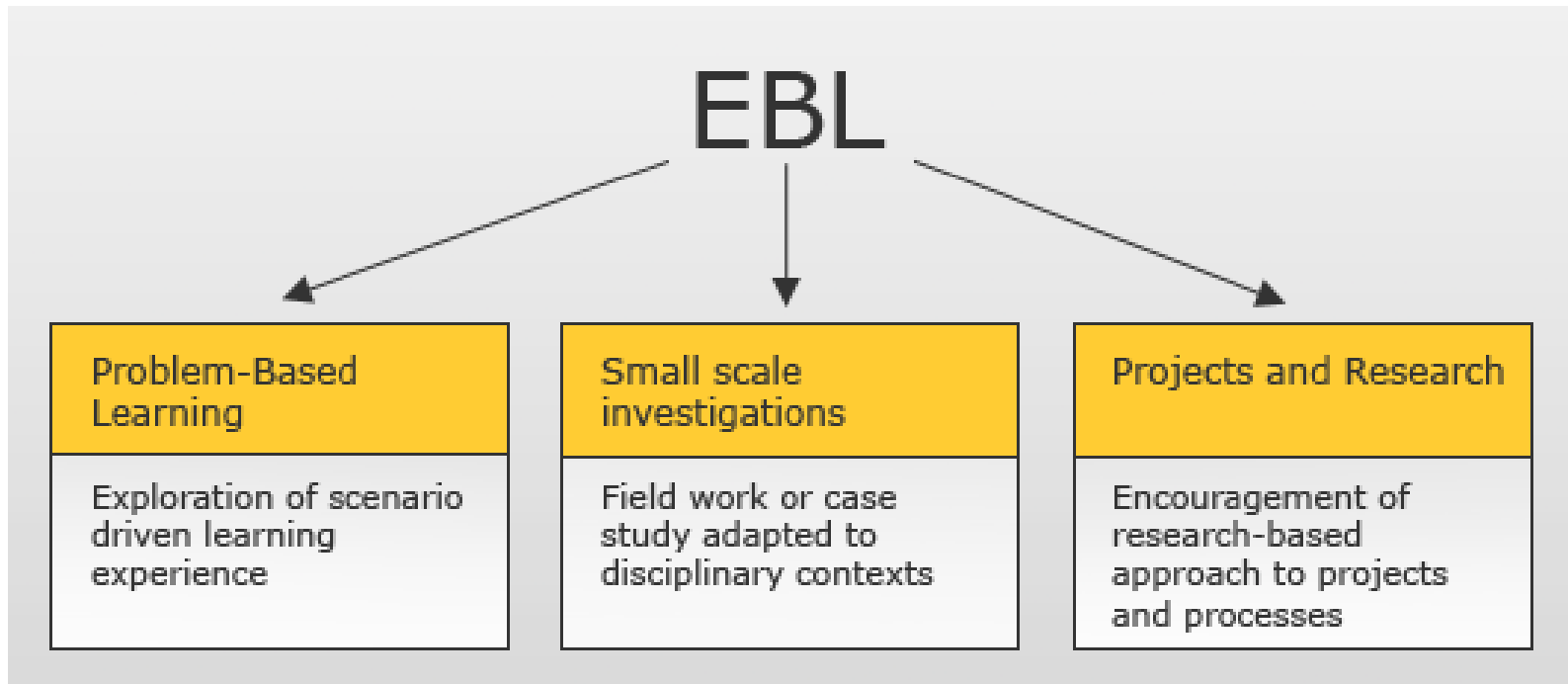
Research-informed teaching

- Draws on research into the teaching and learning process itself.

Healey (2005)



Centre for Excellence in Enquiry-based Learning (CEEBL)



Enquiry-based learning

- Curriculum and pedagogy driven by students working together to solve problems rather than receiving direct instruction
- Student-centred, with an emphasis on group work and use of resources.
- Lecturers become facilitators, providing support and guidance
- Students develop higher order thinking skills and transferable skills.
- Students gain a deeper understanding of the subject-matter and ability to tackle complex problems that occur in the real world.

Advantages of EBL

- Students are more motivated and engaged.
- EBL allows a more flexible approach to study. Students have freedom and responsibility to organize their own pattern of work within time constraints of the task.
- Students develop transferable skills e.g. group work, communication, critical thinking etc
- Students become self-directed learners, ultimately better PhD students.
- Gives students the big picture i.e. how chemistry works, contributes to science and society.

What is PBL?

- Start with real life applications
- Macro to micro
- Problem scenarios serve as the context for new learning
- Problems are encountered before all relevant knowledge has been acquired
- Solving problems results in the acquisition of knowledge and problem-solving skills
- Long history in medical and professional education

The Titan Project

(long problem from University of Hull)

Titan Industries have just purchased a titanium dioxide plant.

Consider:

- The advantages / disadvantages of SP and CP

- What the various options for the site are

- Propose a strategy for the next 5 years

- Present your recommendations to the board

- Plan new environmental monitoring lab

- Compare methods of analysis

- Make recommendations

Evening Herald

Volume 17 Issue 25

Serving the County of Midshire.

Local Elections Loom

Local MP for Beauport East, Simon Ford officially opened his election campaign on Tuesday to a packed hall. As he put it 'the two biggest issues facing the town today' are unemployment and the environment. A representative of the nearby nature reserve said later that he was encouraged but remained yet to be convinced.

'Industry must clean up act'

After a lengthy investigation, the Midshire Water Authority has condemned local industry for its poor pollution record.

A report issued this week highlights the need to clean up the Coley River and Estuary. Local environmental groups (supported by MP Simon Ford) have called for a dramatic reduction in

Local Success Stories

This week our weekly feature highlights two different stories of recovery in the local area.

Workers Save Mill

Two months ago, the Paperpak Ltd. paper mill, west of Beauport faced almost certain closure. Today, however, managers are discussing expansion plans after securing a new contract with the government. Paperpak Ltd. will supply high quality paper for use in official documents in a 10 year deal of undisclosed value.

A spokesman on behalf of owner John Tate said 'The credit must go to our workers who have put in a great deal of extra work over the last year.' Paperpak is hoping to employ 100 more staff on the completion of the expansion work which is necessary to equip the mill to supply the

Next week

"I was given 3 months to live....in 1957", a local farmer's battle to prove the doctors wrong.

Political Row over Water Treatment Plant

At a recent dinner, MP Simon Ford claimed the soon to be opened water treatment plant as part of his 'Environment and Employment' campaign. However the opposition claim that the Beauport East MP has had little to do with the development until recently.

The plant should be operational within 12 months and should have a major effect on the state of the estuary.

Titan to Send in Top Management Team



Safe Policing

(short problem from University of Leicester)

- Grabbit and Grubbit (Solicitors to the Common Man) Ltd are proposing to take a case to the European Court claiming that the use of rubber bullets is a violation of Human Rights. Their grounds are that, for the same mass and speed, the momentum in a rubber bullet is the same as that in a lead one. Thus they do the same damage on impact and are therefore equally likely to be lethal.
- How will you prepare a case for the Government's defence?

Small scale investigations – rethinking the lab

Laboratory styles (Domin, 1999)

	Descriptor		
Style	Outcome	Approach	Procedure
Expository	Predetermined	Deductive	Given
Enquiry	Undetermined	Inductive	Student generated
Discovery	Predetermined	Inductive	Given
Problem-based	Predetermined	Deductive	Student generated

Experimenting with undergraduate practicals (McGarvey, 2004)

The influence of ionic strength on the solubility of barium iodate monohydrate

Determine the solubility product (K_s^0) for $Ba(IO_3)_2 \cdot H_2O$.

Determine mean activity coefficients (γ_{\pm}) for Ba^{2+} and IO_3^- over a range of ionic strengths.

Test the validity of the Debye-Hückel limiting law (DHLL).

Experimental

- *You will work in pairs. Prepare an experimental plan that outlines how you are going to perform the experiment and how you are going to analyse the data in order to extract the desired information.*
- *Bear in mind the availability of materials and equipment in the laboratory when planning your experimental approach.*
- *You must have your plan reviewed by a laboratory demonstrator before you start your experimental work.*

Formulate plan.

Discuss plan with demonstrator before proceeding

Complete COSHH risk assessment

Perform experiment

Analyse results (individually).

Sun Eyeware Sunglasses

(University of St Andrews)

Excessive exposure to ultraviolet radiation (radiation with a wavelength below 400 nm) can cause short-term and longterm ocular problems such as photokeratitis, cataracts and various eye cancers. Medical experts stress the importance of wearing sunglasses to protect the eyes from UV light. More recently, high energy visible light (HEV) in the range of 400 to 515 nm has been shown to cause age-related macular degeneration. Our sunglasses are the latest in technology, blocking virtually 100% of harmful UV and HEV light while transmitting a large fraction of most other, not harmful light.

We at Sun Eyeware are dedicated to innovation and function and lead the way in technological fashion. We have a huge selection of superb styles and colours available so you are sure to find something that suits you

You are a physicist working for a rival firm producing sunglasses. You are aiming to check Sun Eyeware's advert claims. Design and carry out an experiment to do this.

'students designed their own experiment and created a list of required apparatus. They then received the apparatus that they had requested and set up, carried out and analyzed their experiment. In order to account for variations in the experimental setup, we had a variety of equipment on wagons outside of the lab'

.

Issues

Challenges

- Equipment
- COSHH
- Time
- Coverage
- Demonstrators
- Assessment

Benefits

- Motivation
- Engagement
- Deep learning
- Preparation for project
- Experimental design
- Planning
- Time management
- Team work
- Mimics research

Projects

- Well established
- Professional body requirement
- Students like them
- Motivating, engaging, recruit to research
- Why wait until final year to be creative
- Engaging undergraduates in research earlier

For more ideas....

HEA Physical Sciences

www.heacademy.ac.uk/physsci

Project LEAP

www.le.ac.uk/leap/

The Reinvention Centre for Undergraduate Research

www2.warwick.ac.uk/fac/soc/sociology/research/cetl/

Π-CETL

www.open.ac.uk/picetl/

Centre for Excellence in Enquiry-based Learning

www.campus.manchester.ac.uk/ceeb/

Research-teaching linkages: enhancing graduate attributes (Physical Sciences)

www.enhancementthemes.ac.uk/documents/ResearchTeaching/Physical%20sciences%20-%20PDF.pdf