Students’ expectations to research based teaching

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Humboldt on the nature of the university

It is particular for higher scientific education, that scientific problems are always treated as a not yet solved and therefore we continuously keep on doing research, whereas the schools only deal with and teach “solved” and limited knowledge. The relationship between student and teacher thereby becomes fundamentally different than before. The first is not there for the latter, they are both there for science. The teacher’s work depends upon the presence of the students and would not be successful without it.

(Humboldt 1809:89)
What is research based teaching?

Open the socrative app –
or go to http://b.socrative.com/login/student/
or go to http://socrative.com/ - choose ‘student login’

Room number: 642618

Please answer the question:

What is ‘research based teaching’ – in your opinion?
Types of research based teaching (Healey)

STUDENTS ARE PARTICIPANTS

EMPHASIS ON RESEARCH CONTENT

B: Research-tutored
- Engaging in research discussions

C: Research-led
- Learning about current research in the discipline

EMPHASIS ON RESEARCH PROCESSES AND PROBLEMS

A: Research-based
- Undertaking research and inquiry

D: Research-oriented
- Developing research and inquiry skills and techniques

STUDENTS FREQUENTLY ARE AN AUDIENCE

Healey, 2005
Linking research and teaching

“In contrast to the apparent academic myth that research productivity and teaching effectiveness are complementary constructs, results of the present investigation—coupled with the findings of the Hattie and Marsh (1996) meta-analysis—provide strong support for the typical finding that the teaching-research relation is close to zero.”

Marsh & Hattie, 1998
How can we teach in ways in which we experience a positive relation between teaching and research?
Research based teaching in large classes at the Faculty of SCIENCE

• Mathematics: ~ 160 students
  • From doing calculations to proving theorems
• Biochemistry: ~ 100 students
  • From closed to more open-ended lab-exercises
• Landscape Architecture: ~ 60 students
  • Teaching based research: Students make color charts throughout the year for selected Danish tree species
Types of research based teaching (Healey)

STUDENTS ARE PARTICIPANTS

**Research-tutored**
- Engaging in research discussions

**Research-based**
- Undertaking research and inquiry

**Research-led**
- Learning about current research in the discipline

**Research-oriented**
- Developing research and inquiry skills and techniques

**A**
- Landscape architecture

**B**
- Biochemistry

**C**
- Math

**D**
- Students frequently are an audience

Emphasis on research content

EMPHASIS ON RESEARCH PROCESSES AND PROBLEMS
Biochemistry – design your own cook-book
~ 100 students

• Purifying an enzyme from a pig kidney.
• Design their own ‘cook-book recipe’ in small groups
• Given a scientific article, methods are presented.
• Keep a lab log
• Assessment: Present and discuss their results in the format of a scientific article
Biochemistry – how open or how closed exercises?

<table>
<thead>
<tr>
<th>Level</th>
<th>Problem</th>
<th>Method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>Closed</td>
<td>Closed</td>
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</tr>
<tr>
<td>Level 1</td>
<td>Closed</td>
<td>Closed</td>
<td>Open</td>
</tr>
<tr>
<td>Level 2</td>
<td>Closed</td>
<td>Somewhat Open</td>
<td>Somewhat Open</td>
</tr>
<tr>
<td>Level 3</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
</tr>
</tbody>
</table>

Tamir (1989)
Brew - biochemistry

Brew, 2013
5E’s - biochemistry

Engage

Elaborate

Evaluate

Explore

Explain

Frisdahl 2014
Landscape architecture ~ 60 students
Color charts to describe urban trees

Aimed at practitioners in landscape architecture
• Nuanced information of colors of urban trees for plant selection and composition

Educational aim:
• Involve first year bachelor students in research,
• Form a basis for courses on use of color in landscape architecture.

• Students identify color of trees in different seasons
• 3-4 sessions during the first year
Brew – landscape architecture

Brew, 2013
5E’s – landscape architecture

Scientific inquiry/learning cycle

Modified from Frisdahl 2014
How important is it for you, that the following elements are present in your program?

**STUDENTS ARE PARTICIPANTS**

<table>
<thead>
<tr>
<th><strong>A</strong></th>
<th><strong>B</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Research-based</em></td>
<td><em>Research-tutored</em></td>
</tr>
<tr>
<td>That students work independently on research questions</td>
<td>That students critically examine an artefact, e.g. an article or a design, produced by a member of staff</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>C</strong></th>
<th><strong>D</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Research-led</em></td>
<td><em>Research-oriented</em></td>
</tr>
<tr>
<td>That the teacher reports relevant research results in class</td>
<td>That the teacher explains how knowledge is created in research</td>
</tr>
</tbody>
</table>

**STUDENTS FREQUENTLY ARE AN AUDIENCE**
# Biochemistry

<table>
<thead>
<tr>
<th>N = 15</th>
<th>Scale: 1-5</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>That students work independently on research questions</td>
<td></td>
<td>3.71</td>
<td>4.33*</td>
</tr>
<tr>
<td>That you as a students take part in developing research techniques (e.g. field work, design practice, etc.)</td>
<td></td>
<td>2.90</td>
<td>4.25*</td>
</tr>
<tr>
<td>That students read articles, or the like, produced by the teacher</td>
<td></td>
<td>2.57</td>
<td>3.25*</td>
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</tbody>
</table>
Landscape architecture

<table>
<thead>
<tr>
<th>N = 29</th>
<th>Scale: 1-5</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>That the teacher explains how knowledge is created in research</td>
<td>4,48</td>
<td>4,00*</td>
<td></td>
</tr>
<tr>
<td>That students get experience in using different research methods</td>
<td>3,96</td>
<td>3,57*</td>
<td></td>
</tr>
<tr>
<td>That students and teachers together make inquiries into a problem</td>
<td>4,19</td>
<td>3,45**</td>
<td></td>
</tr>
<tr>
<td>That the teacher reports his/her research results in class</td>
<td>3,54</td>
<td>3,07*</td>
<td></td>
</tr>
<tr>
<td>That you as a student take part in developing research techniques (e.g. field work, design practice, etc.)</td>
<td>3,64</td>
<td>2,93*</td>
<td></td>
</tr>
<tr>
<td>That students work independently on research questions</td>
<td>3,39</td>
<td>2,76**</td>
<td></td>
</tr>
<tr>
<td>That you as a student take part in a research project done by one of the teachers in the program</td>
<td>3,12</td>
<td>2,59**</td>
<td></td>
</tr>
<tr>
<td>That you as a student contribute to a conference paper or poster</td>
<td>2,52</td>
<td>2,18*</td>
<td></td>
</tr>
</tbody>
</table>
### Biochemistry

<table>
<thead>
<tr>
<th>Highest score</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>That students get experience in using different research techniques</td>
<td>4.85</td>
<td>4.83</td>
</tr>
<tr>
<td>That the teacher explains how knowledge is created in research</td>
<td>4.69</td>
<td>4.67</td>
</tr>
<tr>
<td>That the teacher reports relevant research results in class</td>
<td>4.38</td>
<td>4.67</td>
</tr>
</tbody>
</table>

### Landscape architecture

<table>
<thead>
<tr>
<th>Highest score (post)</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>That the teacher reports relevant research results in class</td>
<td>4.57</td>
<td>4.21</td>
</tr>
<tr>
<td>That the teacher explains how knowledge is created in research</td>
<td>4.48</td>
<td>4.00*</td>
</tr>
<tr>
<td>That you as a student do a project as part of the program</td>
<td>3.82</td>
<td>3.58</td>
</tr>
</tbody>
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Comparison
Biochemistry and Landscape architecture

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Pre</th>
<th>Post</th>
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</thead>
<tbody>
<tr>
<td>Bio chemistry – average RBT expectations</td>
<td>3.65</td>
<td>3.89*</td>
</tr>
<tr>
<td>Landscape architecture - average RBT expectations</td>
<td>3.44</td>
<td>3.03**</td>
</tr>
<tr>
<td>Difference?</td>
<td></td>
<td>**</td>
</tr>
</tbody>
</table>
What have we learned

• Biochemistry: Students’ expectations to getting involved in research based teaching rise from pre to post. Significant for the research based activities. As expected

• Landscape architecture: Students’ expectations to getting involved in research based teaching decline from pre to post. Significant for the research based activities. Not expected

• Why?
How can we interpret the results in Landscape architecture?

- Students’ own experience and assessment of the activities

- Program aimed at profession – not research – but also relevant for profession
  
  Biochemistry: Research is clearly relevant

- Teachers’ assessment is different: Students’ level in relation to colors remarkably higher – foundation for rest of program

- Alongside of the teaching – midterm evaluation

- This years class – engage phase, more integration, trees on campus

- In retrospect: First try with class in 3rd or 4th year...

- Research: “Summer green”
Conclusion

• The questionnaire provides valuable input to the evaluation of research based teaching