Research-Based Framework for Supervision of Undergraduate Research Projects

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Outline

• Background & Motivation

• Models and conceptions of research & teaching
  o Cognitive Apprenticeship
  o Conceptions of Research
  o Research-teaching nexus

• Analysis of undergraduate student supervision to date

• Conclusions
Background

• “Postgraduate study is too late to start; research attributes need to be integrated fully into undergraduate courses.” Ian Diamond (2010)

• “Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.” Angela Brew (2007)

Source: “ANU EFS Masterclass: Engaging Students in research-led education" workshop by Prof. Mick Healey (Emeritus Professor, University of Gloucestershire), ANU, Aug. 2015.
Background

• Undergraduate Research Projects in Engineering:
  • ENGN4200 (12 unit project).
  • BE RnD projects
    • 6 unit (one semester)
    • 12 or 18 unit (1-2 years)
    • 24 unit (1-2 years)

• Supervision summary:
  • 12 BE RnD projects supervised to date since 2009.
  • 23 BE Hons projects supervised to date since 2005.
Motivation for this talk

- Undergraduate BE RnD student supervision outcomes for past 2 years:
  - [ENGN3712], 2015. Publication: Conference paper under preparation.
  - [ENGN2706], 2015.
  - [ENGN3706], 2014. Publication: Conference paper
  - [ENGN4718], 2014. Publication: Conference paper
  - [ENGN2706], 2014. Publication: Journal Paper
  - [ENGN2706], 2014.

 67% success rate!!

- 6 BE RnD projects supervised between 2009-2013 did not result in any publications.
Motivation for this talk

- Undergraduate BE Hons student supervision outcomes for past 2 years:
  - [ENGN4200], 2015.
  - [ENGN4200], 2015.
  - [ENGN4200], 2014. Publication: Journal paper
  - [ENGN4200], 2014.

25% success rate!
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Cognitive Apprenticeship

Cognitive apprenticeship is a structured model of learning with the basic goal of “walking the students through the processes that our minds automatically go through as experts”.

[PDF] Cognitive apprenticeship: Making thinking visible
A Collins, JS Brown, A Holum - American educator, 1991 - elc.fhda.edu
IN ANCIENT times, teaching and learning were accomplished through apprenticeship: We taught our children how to speak, grow crops, craft cabinets, or tailor clothes by showing them how and by helping them do it. Apprenticeship was the vehicle for transmitting the ...
Cognitive Apprenticeship

“Teaching methods should be designed to give students the opportunity to observe, engage in, and invent or discover **expert strategies in context**.”

- **Modeling** teacher performs a task so students can observe
- **Coaching** teacher observes and facilitates while students perform a task
- **Scaffolding** teacher provides supports to help the student perform a task
- **Articulation** teacher encourages students to verbalize their knowledge and thinking
- **Reflection** teacher enables students to compare their performance with others
- **Exploration** teacher invites students to pose and solve their own problems
Cognitive Apprenticeship

• Teaching our Future Professionals to “Think like a Physicist” (2014)

• Enabling students to think like experts in the field of electronic engineering (2012)


• 2009 ALTC Grant (UQ, Griffith, USYD)

Investigating the theory (and practice) of pedagogic resonance: making disciplinary thinking visible within university classrooms

Project Information

Year Funded: 2009
Grant (ex GST): $217,000
Cognitive Apprenticeship

• Recent Book:

  ![Book Cover]

  **Reaching Students:**

  *This PDF is available from The National Academies Press at [http://www.nap.edu/catalog.php?record_id=18687](http://www.nap.edu/catalog.php?record_id=18687)*

• Recent Talk:

Conceptions of Research

• What do we mean by research?

Conceptions of Research: a phenomenographic study

ANGELA BREW
University of Sydney, Australia

ABSTRACT  This article reports on an investigation into the variation in how research is experienced by established senior researchers. It provides a new, discipline-neutral, non-technical framework for interpreting how academics are responding to the challenges of the changing context of higher education. The study identified four qualitatively different ways in which research is understood. These are differentiated according to whether they have an external product orientation or an internal process orientation; and whether the researchers themselves are in the forefront of their awareness or whether they appear to be incidental to their awareness. In the context of concern about the nature and role of research in the economy and about how it should be funded, and at a time when knowledge is said to be in crisis, the article suggests that the framework can contribute to rational analysis and decision-making.
Conceptions of Research

- **Domino view** suggests that research consists of a series of separate tasks.

- **Trading view** refers to the conception that what is driving the research is its products, for example, publications and grants which are then traded for kudos and promotion.

- **Layer view** suggests that research is about uncovering or unearthing that which is hidden and bringing to the fore.

- **Journey view** is that research informs life and the individual and collective journey.

Conceptions of Research

• **Summary of Findings**: While individual researchers may principally be associated with one particular view, others span two or three. No researchers demonstrated evidence of all four categories.
Implications for Teaching

• A researcher’s dominant research conception and dominant teaching conception are often linked.

• Trading view is least conducive to teaching (often leads to information transmission view of teaching).

Source: “ANU EFS Masterclass: Engaging Students in research-led education" workshop by Prof. Mick Healey (Emeritus Professor, University of Gloucestershire), ANU, Aug. 2015.
Conceptions of research

• How to engage undergraduate students with research?
Conceptions of research

• There are four main ways of engaging undergraduates with research and inquiry:
  • research-led: learning about current research in the discipline;
  • research-oriented: developing research skills and techniques;
  • research-based: undertaking research and inquiry;
  • research-tutored: engaging in research discussions.

https://www.heacademy.ac.uk/resource/developing-undergraduate-research-and-inquiry
Conceptions of research

- What is the nature of undergraduate research?

![Diagram showing conceptions of research]

Source: Amended from Healey (2005, 70)

https://www.heacademy.ac.uk/resource/developing-undergraduate-research-and-inquiry
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Results

- 6 BE RnD research projects (2013-2009)
Results

- 6 BE RnD research projects over last 2 years (2015-2014)
Results

- 4 BE Hons research projects over last 2 years (2015-2014)
Conclusions

- In this talk, we have looked at some models and conceptions of research, relevant to undergraduate research supervision.

- The four quadrant model is an effective way of engaging undergraduate students with research and inquiry.
Thank you for your attention!

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Back Up Slide
## PhD Supervisory Styles

- **4 main styles of supervision:**

<table>
<thead>
<tr>
<th>High Support</th>
<th>Pastoral Style</th>
<th>Contractual Style</th>
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<tbody>
<tr>
<td>Low Support</td>
<td>• Low structure and high support</td>
<td>• High structure and high support</td>
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<tr>
<td></td>
<td>• Candidate has personal low management skill but takes advantage of all the</td>
<td>• Candidate highly motivated and able to take direction and to act on own</td>
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<td></td>
<td>support facilities that are on offer</td>
<td>initiative</td>
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<td></td>
<td>• Supervisor provides considerable personal care and support but not</td>
<td>• Supervisor able to administer direction and exercises good management skills</td>
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<td>necessarily in a task-driven, directive capacity</td>
<td>and interpersonal relationships</td>
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<tr>
<td></td>
<td>• Low structure low support</td>
<td></td>
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<tr>
<td></td>
<td>• Candidate has limited levels of motivation and management skills</td>
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<td>• Supervisor in non-directive and not</td>
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<td>committed to high levels of personal</td>
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<td>• Supervisor may appear uncaring and</td>
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<td></td>
<td>uninvolved</td>
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- **Laissez-faire Style**
  - Low structure low support
  - Candidate has limited levels of motivation and management skills
  - Supervisor in non-directive and not committed to high levels of personal interaction
  - Supervisor may appear uncaring and uninvolved

- **Directorial Style**
  - High structure and low support
  - Candidate highly motivated and sees the necessity to take advantage of engaging in high structural activities such as setting objectives, completing and submitting work on time on own initiative without taking advantage of institutional support
  - Supervisor has a close and regular interactive relationship with the candidate, but avoids non-task issues

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