Research-Based Framework for Supervision of Undergraduate Research Projects

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Outline

- **Background & Motivation**
- **Models and conceptions of research & teaching**
  - Cognitive Apprenticeship
  - Conceptions of Research
  - 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 ...

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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)

Dr John Debs & Dr Nick Robins
Citation for Outstanding Contribution to Student Learning

Research School of Physics
CPMS

Portfolio
1.1MB

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

Dr Salman Durrani
Award for Teaching Excellence

Research School of Engineering
CECS

Portfolio
111KB

http://chelt.anu.edu.au/promoting-excellence/awards/vc/recipients/2015

- 2009 ALTC Grant (UQ, Griffith, USYD)

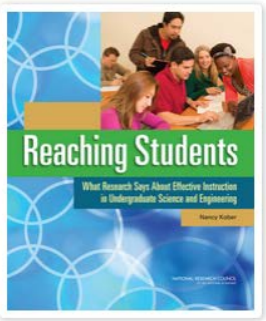
Investigating the theory (and practice) of pedagogic resonance: making disciplinary thinking visible within university classrooms

Project Information

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

Cognitive Apprenticeship

- Recent Book:



Reaching Students:
What Research Says About Effective Instruction in Undergraduate Science and Engineering (2015)

Status: Final Book
Downloads: 10,986

- Recent Talk:
  - **S. Durrani**, “Making expert thinking visible", ANU Teaching and Learning Colloquium Seminar, June 2015.

http://users.cecs.anu.edu.au/~Salman.Durrani/_papers/Slides/Durrani_STEM.pdf

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: A phenomenographic study
A Brew - Studies in higher education, 2001 - Taylor & Francis
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 ...
Cited by 232 Related articles All 3 versions Web of Science: 37 Cite Save More

Conceptions of Research

- **Domino view** suggests that research consists of a series of separate tasks.
- **Trading view** refers to the conception that what it 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.

http://researchsuper.cedam.anu.edu.au/experiences-conceptions/conceptions-research

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.

TABLE II. Relationships between conceptions of research

	External product orientation where the intention is to produce an outcome. Tends to be atomistic and synthetic	Internal process orientation where the intention is to understand. Tends to be holistic and analytical
Researcher is present in awareness	Trading	Journey
Researcher absent from awareness	Domino	Layer

To cite this article: Angela Brew (2001) Conceptions of Research: A phenomenographic study, Studies in Higher Education, 26:3, 271-285, DOI: 10.1080/03075070120076255

To link to this article: http://dx.doi.org/10.1080/03075070120076255

Implications for Teaching

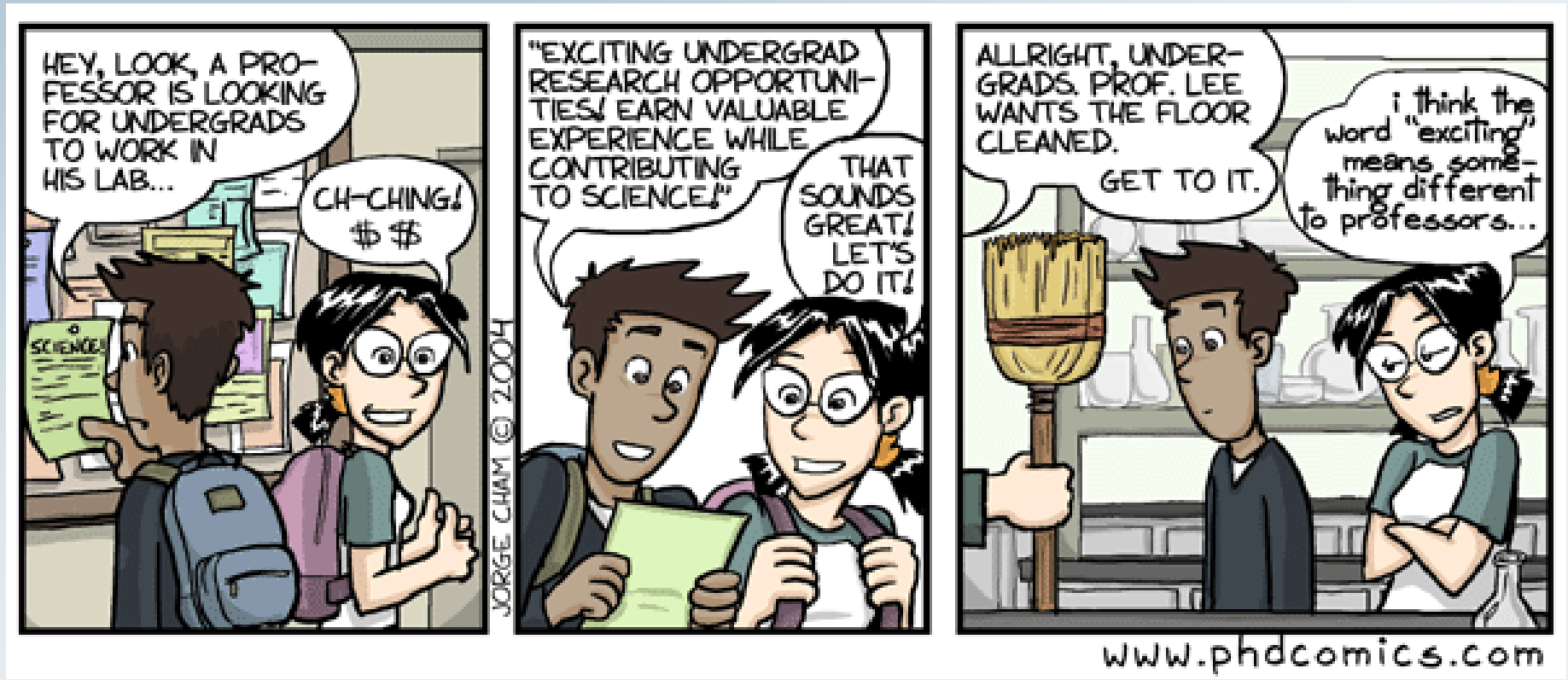
- A researcher's dominant research conception and dominant teaching conception are often linked.

- 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?**



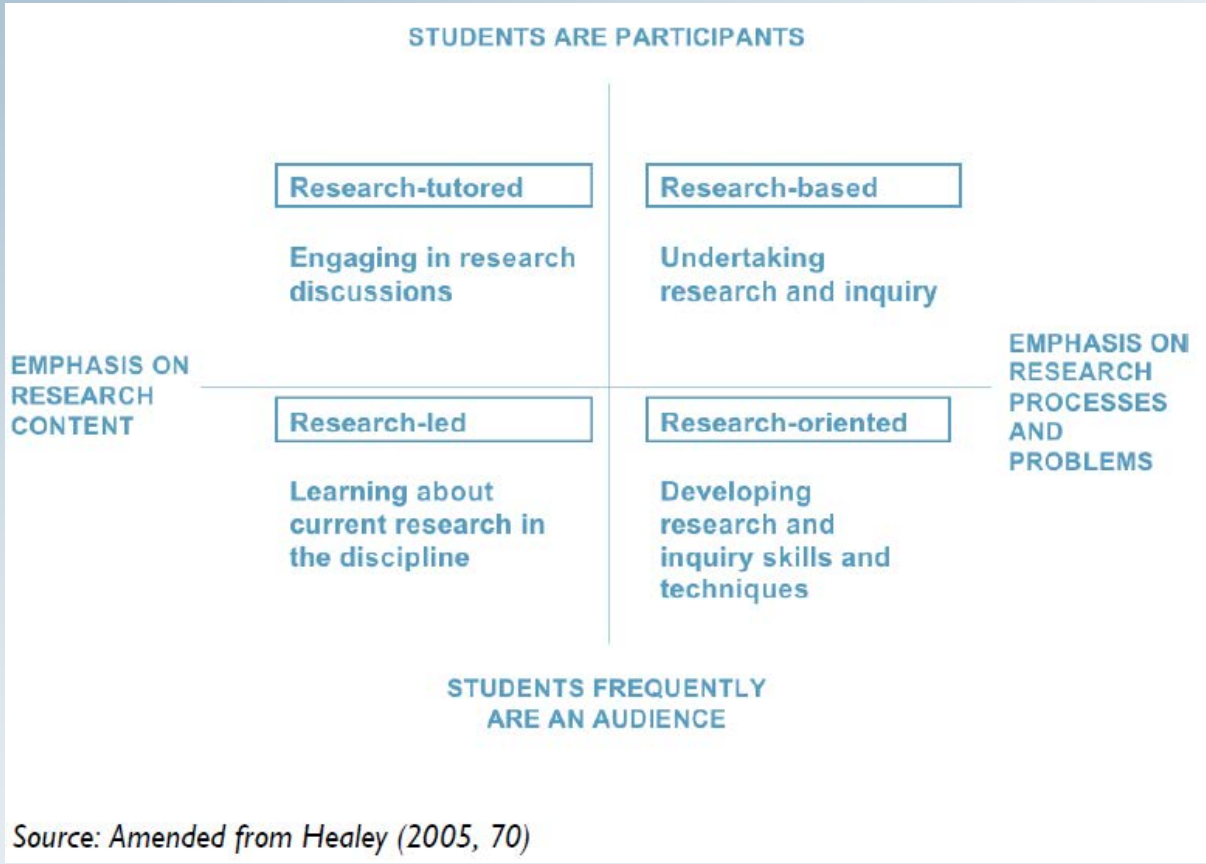
Conceptions of research

- 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?**



Source: Amended from Healey (2005, 70)

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

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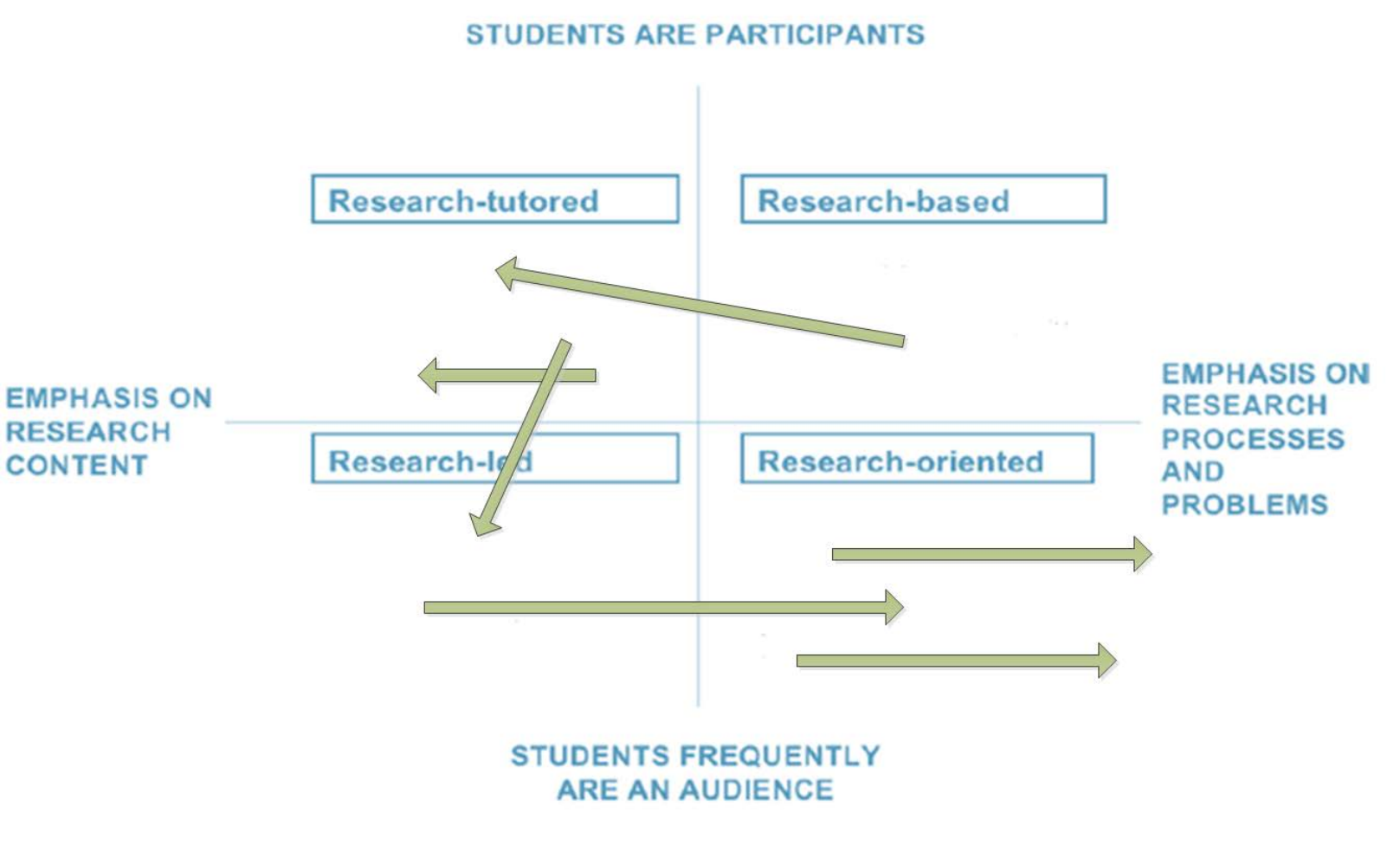
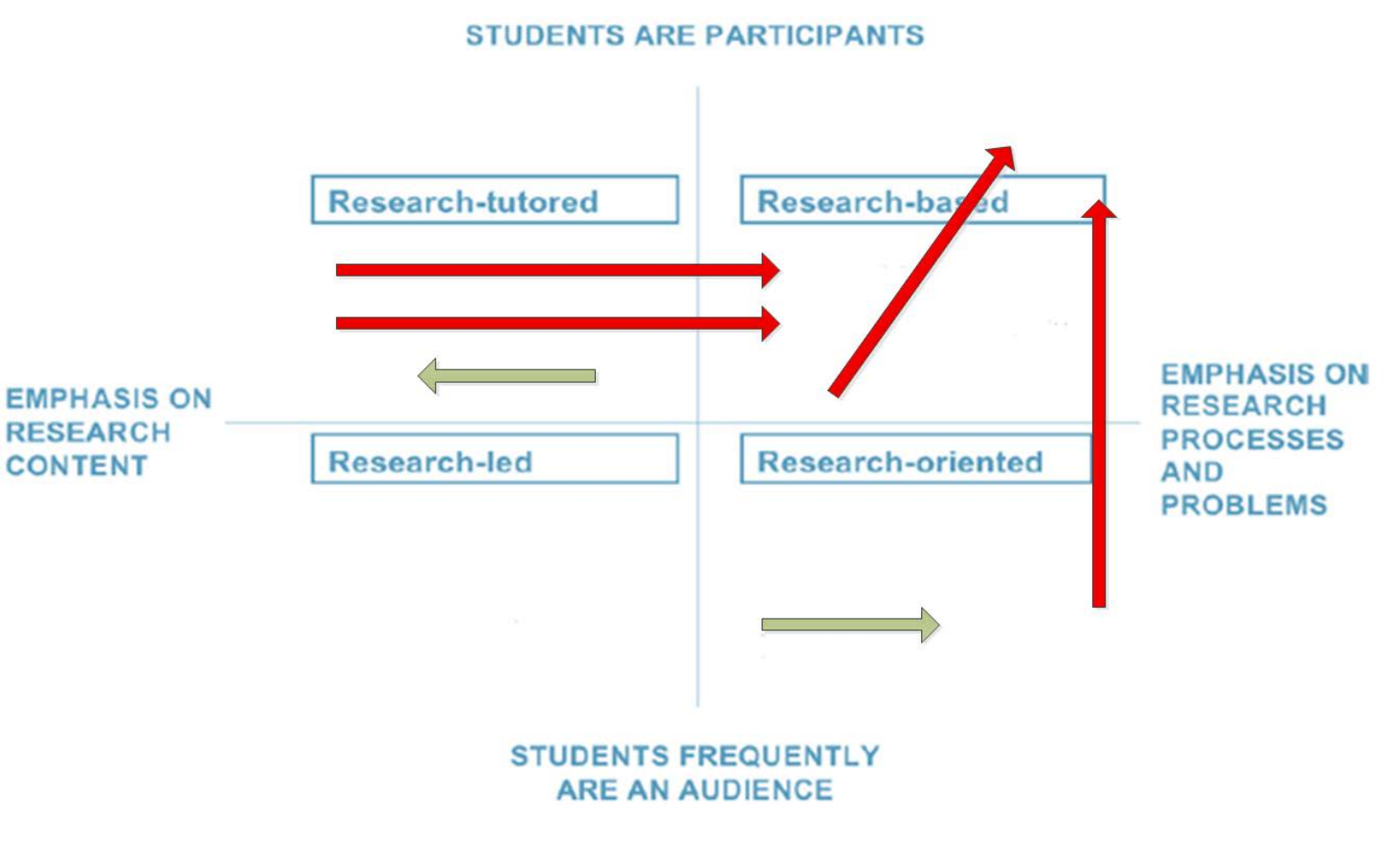
Results

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



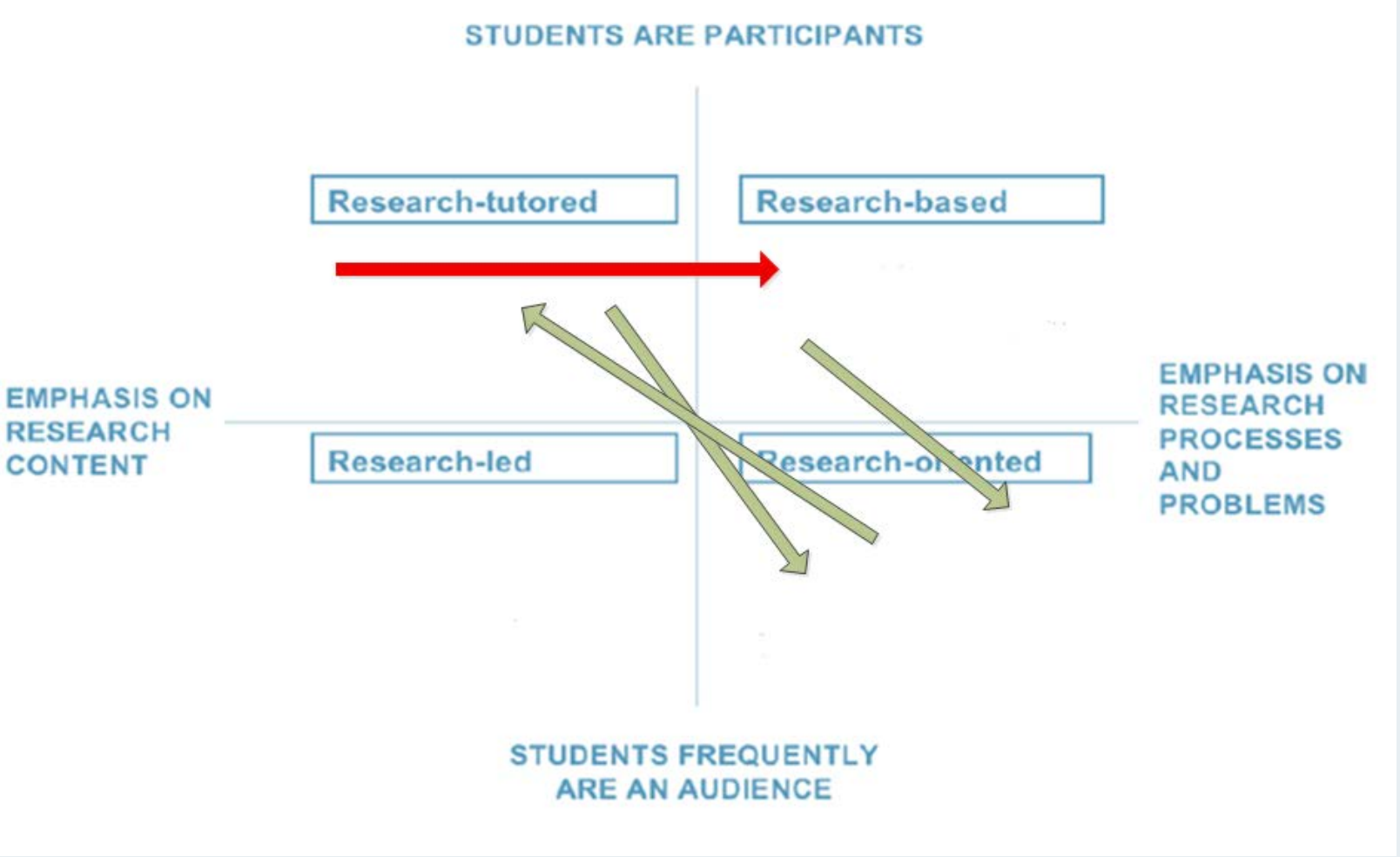
Results

- **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:

High Support	**Pastoral Style** • Low structure and high support • Candidate has personal low management skill but takes advantage of all the support facilities that are on offer • Supervisor provides considerable personal care and support but not necessarily in a task-driven, directive capacity	**Contractual Style** • High structure and high support • Candidate highly motivated and able to take direction and to act on own initiative • Supervisor able to administer direction and exercises good management skills and interpersonal relationships
Low Support	**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
	Low Structure	High Structure

Gatfield, T. (2005). An investigation into PhD supervisory management styles: Development of a dynamic conceptual model and its managerial implications. Journal of Higher Education and Policy Management 27(3): 311-325.

http://researchsuper.chelt.anu.edu.au/being-supervisor/supervisory-styles/overview