

Towards a pedagogy of supervision in the technology disciplines

SUMMARY AND RECOMMENDATIONS

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FOREWORD

This is the 4th of a series of papers around the pedagogy of supervision in the technology disciplines. The papers form part of an Australian Learning and Teaching Council Fellowship program conducted by ALTC Associate Fellow, Professor Christine Bruce, Queensland University of Technology.

This paper is written to provide:

- an overview of the pedagogical framework for higher degree research supervision developed for the technology disciplines as part of an ALTC fellowship program; and
- recommendations around the development of supervisory pedagogy in the technology disciplines.

For the purposes of this program, the technology disciplines are defined as including information technology and engineering as proposed by the ALTC. We are conscious, however, that like many of our fellow disciplines Information technology and Engineering are boundary-crossing fields.

Our intended audience for this paper is:

- administrators and leaders in the technology disciplines with a focus on higher degree research supervision; and
- the Australian Learning and Teaching Council.

PREVIOUS PAPERS

The purpose of Paper One: *Program plan and conceptual framework* (<http://eprints.qut.edu.au/>) was to:

- provide a brief summary of the intended directions of the ALTC program 'A Pedagogy of Supervision in the Technology disciplines'; and
- provide an overview of existing research outcomes which are likely to be of interest to the technology disciplines, including some cross disciplinary research and some focussed specifically on some part of the technology field.

The purpose of Paper Two: *A review of the conversations and their content* (<http://eprints.qut.edu.au/>) was to:

- document the processes through which data about technology supervisor's views of supervision as a teaching and learning practice were collected; and
- report key findings from workshops and interviews conducted with supervisors from the technology disciplines (Engineering and Technology).

The purpose of Paper Three: *A pedagogical framework* (<http://eprints.qut.edu.au/>) was to:

- present the pedagogical framework that has been derived from conversations with supervisors in the technology disciplines;
- present each part of the framework in a detailed way; and
- suggest ways in which parts of the framework might interrelate to influence practice.

FELLOWSHIP INFORMATION SHEET

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TALKING ABOUT SUPERVISION IN THE TECHNOLOGY DISCIPLINES

This program aims to develop a framework for the pedagogy of supervision in the technology disciplines. The framework will be developed by investigating technology discipline supervisors' thinking and by searching the relevant literature. The viewpoints of technology supervisors will be collected using a qualitative methodology.

The outcomes will support strategic change in higher education institutions for the enhancement of learning and teaching at the HDR level. HDR supervision and its diversity has been a significant national issue for some time. There is a considerable literature attending to both what should be learned and how it should be learned or taught. As yet, however, we have little understanding of the value of these concepts to supervisors in the technology disciplines.

Significance: The process will raise awareness of HDR supervision as a teaching and learning practice, encourage sharing of practices amongst supervisors, and enable reflection and learning from research and scholarship.

Goals:

- To investigate and document technology educators' ways of thinking about supervision as a teaching and learning practice.
- To develop a framework, representing key aspects of a pedagogy of supervision, for use by supervisors and leaders in the HDR context for enhancing HDR supervision in the technology disciplines.
- To design recommendations for taking this agenda forward in consultation with key stakeholders across Australia.

Key Fellowship Activities: All strategies are designed to raise awareness of HDR supervision as a teaching and learning practice in different ways.

STRATEGY 1: BRINGING THE PEDAGOGY OF SUPERVISION INTO FOCUS I. This will involve using interviews and focus groups to investigate and document technology educators' ways of thinking about supervision as a teaching and learning practice.

STRATEGY 2: BRINGING THE PEDAGOGY OF SUPERVISION INTO FOCUS II. This will involve drawing together existing research and scholarship with the outcomes from Strategy 1 to develop a framework for use by supervisors and leaders in the HDR context for enhancing HDR supervision in the technology disciplines.

STRATEGY 3: RAISING AWARENESS OF COMMON AND COMPLEMENTARY WAYS OF SEEING THE PEDAGOGY OF SUPERVISION IN THE TECHNOLOGY DISCIPLINES. This will involve designing recommendations for taking this agenda forward in consultation with key stakeholders.

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CONTENTS

Foreword	iii
Previous papers	iii
Fellowship Information Sheet	iv
Contents	v
Tables.....	vi
Introduction	1
Research supervision as a component of the teaching-research nexus.....	1
Thinking about supervision as a teaching and learning practice in the technology disciplines	1
Overview of the program, and how the framework was developed	2
Development context	2
Development process.....	2
Using the framework for quality supervision	3
Fellowship findings	4
The framework	4
Influence of the environment on supervisory pedagogy	4
insights from the fellowship program	7
Key research findings.....	7
Recommendations arising	8
Recommendations for the technology disciplines	8
Recommendations for ALTC and other Stakeholders.....	8
Recommendations for student research and graduate training centres	8
Responses to framework	10
a) Responses from individuals – experienced supervisors	10
B) Responses from individuals – early career supervisors.....	10
C) Responses from supervisors in workshops	10
D) Responses from students.....	11
How framework draws from existing scholarship	12
How framework adds to existing scholarship	12
Resources developed from program and availability	14
References	15
Bibliography	16
Government and related documents	16
Engineering.....	17
Information Technology	18
Interdisciplinary and cross disciplinary.....	18
Views of research, supervision	20
Other disciplines	20

Supervisory roles and styles 21

Other useful materials..... 21

TABLES

Table 1 The 9 pedagogies and related curriculum orientations 4

Table 2 Framework for thinking about the pedagogy of supervision..... 5

Table 3 Resources developed from the program 14

INTRODUCTION

"A model is a tangible aid to imagination and learning" (Morecroft 2004, p.102).

This fellowship program has drawn together existing research outcomes with new discipline specific insights, to create a pedagogical framework (see page 4 onwards) for the technology disciplines. The framework is based on technology supervisors' collective thinking about supervision as a teaching and learning practice.

RESEARCH SUPERVISION AS A COMPONENT OF THE TEACHING-RESEARCH NEXUS

Research supervision is an integral, but largely neglected, component of the teaching-research nexus. Researchers are used to:

1. researching their teaching;
2. teaching their research;
3. thinking about teaching (mostly at the undergraduate and honours levels) as a site of research practice, i.e. a space where students engage in research; and
4. thinking about teaching as a pathway to research.

This program focused on a dimension of the teaching-research nexus different from those listed above: research supervision as a site of teaching and learning practice.

THINKING ABOUT SUPERVISION AS A TEACHING AND LEARNING PRACTICE IN THE TECHNOLOGY DISCIPLINES

What do technology supervisors want their students to learn as they progress through candidature? How do technology supervisors see *research* and *learning to research*? How do supervisor aspirations compare with the broader aspirations of the university community, as expressed for example through graduate attributes? What are the barriers that supervisors experience to helping their candidates learn? How can we encourage supervisors to think about supervision as a teaching and learning practice?

While most scholarship in postgraduate study and supervision focuses on higher degree research study as a site of researcher training, this fellowship program adopts a research education lens (Boud and Lee, 2008). Scholars of research education are beginning to recognise that 'critical to how supervisors think about what they are doing when they supervise is whether they think of supervision as a teaching or as a research practice' (Brew and Peseta, 2008). In practice, while many universities position research higher degree research supervision at least in some respect as a teaching and learning practice, typically supervisors largely consider supervision as part of their research endeavour rather than as part of their teaching endeavour.

This program explored what it means to teach and to bring about learning from the perspective of research higher degree research supervisors in the technology disciplines.

It focussed on ways of thinking about research higher degree research study and supervision as a teaching and learning practice; especially around:

1. alternative supervisory pedagogies;
2. what supervisors want their students to learn; and
3. approaches and roles adopted in supervision.

OVERVIEW OF THE PROGRAM, AND HOW THE FRAMEWORK WAS DEVELOPED

DEVELOPMENT CONTEXT

The pedagogical framework (see page 4 onwards) has been developed for the technology disciplines in the following contexts.

1. **The School of Information Technology, at Queensland University of Technology (QUT)** is an example of a context where supervision capacity has not been large, but the number of higher degree research students has increased rapidly in a short period of time. The result being relatively inexperienced supervisors working with multiple candidates. Hammond and Ryland (2009) suggest this is likely to be a similar scenario in other places, given the high percentage of supervisors without completions across Australia.
2. **The Faculty of Built Environment and Engineering, at QUT** is an example of a context where supervision capacity has historically been strong but is increasingly under pressure due to higher student numbers (especially international students) and the recruitment of less experienced supervisors in areas of expertise that are new to the Faculty. The challenge is to maintain the quality of supervision under these circumstances by ensuring new supervisors get the support and training they need to be able to spread the supervision load more evenly across the Faculty.
3. **The technology disciplines at QUT** span a wide range of sub-disciplines, hence the fellowship worked across engineering, and technology, included architects, designers, librarians, and staff who's research crossed boundaries with law, medicine, education and other disciplines. A range of 'discipline' and 'cross-disciplinary' supervisors participated. Supervisors also worked with students of different genders, international students, and student with industry based projects.

DEVELOPMENT PROCESS

The framework was developed based on

1. Conversations with supervisors, in the form of interviews and workshops.
2. Analysis of the conversations to identify variation in ways of seeing various aspects of supervisory pedagogy, especially ways of seeing supervision as a teaching and learning practice, ways of seeing research and ways of seeing learning to research.
3. Logical alignment of different aspects of supervisory pedagogy with the nine ways of seeing supervision as a teaching and learning practice.
4. Modification of the framework based on feedback from stakeholders including early career and experienced supervisors.

All the participating supervisors who contributed were from the technology disciplines and their words about supervision are adopted to communicate key ideas. It is noteworthy that the resulting ideas do not always appear technology specific. However, the framework 'belongs' to the technology supervisors, in the sense that it comes from their discussion about what they do, rather than being created from external models and presented as 'a good thing'.

USING THE FRAMEWORK FOR QUALITY SUPERVISION.

The framework provides technology supervisors with a range of options available to them with respect to supervisory pedagogy. It has been developed to highlight different aspects of thinking about supervision as a teaching and learning practice; as well as approaches and strategies and roles associated with supervision.

It is essential, that, especially new supervisors, become aware of the diverse options available to them and are provided with systematic ways of thinking about their practices. Use of this framework will encourage supervisors to make choices based on broader, rather than more limited repertoires. It will also encourage thinking about supervision as a teaching and learning practice.

The framework may be used to:

1. support less experienced supervisors looking for options in their approach to supervision as a teaching and learning practice; to help them identify possible roles, approaches, learning outcomes and ways of thinking about supervision;
2. support experienced supervisors in mentoring junior colleagues;
3. support experienced supervisors in refreshing their own supervision; and
4. support workshops and other development opportunities focused on supervisory pedagogy.

The benefits of thinking systematically about supervisory pedagogy may be simply evaluated through the use of questions such as:

1. How might your practice change?
2. How have you found this (workshops, materials, resources) useful?

FELLOWSHIP FINDINGS

THE FRAMEWORK

Technology supervisors reveal 9 pedagogies, representing different ways of thinking about teaching and learning in supervision. These 9 pedagogies align with wider curriculum orientations identifiable in the higher education sector (see Table 1 below).

Table 1 The 9 pedagogies and related curriculum orientations

9 Pedagogies (ways of thinking about teaching and learning in supervision in the technology disciplines)	Summary description	Curriculum orientations
Upholding Academic Standards	Meeting the discipline and institutional communities' expectations	Academic Discipline
Imparting Academic Expertise	Conveying expertise in research processes	Competency
Promoting Learning to Research	Meeting students' learning needs	Learning to Learn
Promoting Supervisors' Development	Pursuing the supervisor's established objectives	Personal Relevance
Enabling Students' Development	Seeking students' academic and professional maturity	
Contributing to Society	Having social impact	Social Impact
Venturing into Unexplored Territory	Discovering the research agenda together	Collaborative
Drawing upon Student Expertise	Building from existing student abilities	
Forming Productive Communities	Drawing key stakeholders together	

The 9 pedagogies may be drawn together with other elements of supervisory practice to form a framework for supervision (see Table 2 on the next page).

The different elements of supervisory practice are expanded in resources developed for supervisors as part of the fellowship program. They are also illustrated through a set of cases. These resources are listed in a later section of this paper: Resources developed from program and availability, p. 14.

INFLUENCE OF THE ENVIRONMENT ON SUPERVISORY PEDAGOGY

Technology supervisors also identify significant helps and barriers to realising their pedagogies, including facets of People and Culture, Resources, and Synergies. Interestingly, the helps and barriers mirror each other, for example deadlines and higher degree research administrative processes can be seen as helps in some circumstances and barriers in other contexts.

Table 2 Framework for thinking about the pedagogy of supervision

Pedagogies		Supervisors' approaches	Sample learning outcomes	Supervisors primarily see research as	Supervisors primarily see students learning to research as	Supervisors' suggested roles	Curriculum orientations
Supervisors see teaching research students as	Supervisors direct attention towards						
Upholding academic standards <i>Meeting the discipline and institutional communities' expectations</i>	Established academic standards	<ul style="list-style-type: none"> • Scaffolding • Direction-setting 	<ul style="list-style-type: none"> • quality publications • topic expertise 	Substantial <i>Working rigorously on difficult problems, resulting in important breakthroughs</i>	Accepting constraints <i>Disciplined application of basic skills to new areas</i>	Manager	Academic discipline
Imparting academic expertise <i>Conveying expertise in research processes</i>	Supervisor's knowledge and skills	<ul style="list-style-type: none"> • Scaffolding • Relationship 	<ul style="list-style-type: none"> • academic writing • literature review • technical skills 	Investigative <i>Strategic, evidence-based problem solving</i>	Being apprenticed <i>Imitating a master</i>	Manager	Competency
Promoting learning to research <i>Meeting students' learning needs</i>	Students' learning needs	<ul style="list-style-type: none"> • Scaffolding • Relationship 	<ul style="list-style-type: none"> • to become an expert • reflection • study habits 	Meaning-making <i>Seeking meaning through the synthesis of complex data or knowledge</i>	Journeying <i>Self-discovery by trial and error, towards independence</i>	Coach	Learning to learn
Promoting the supervisor's development <i>Pursuing the supervisor's established objectives</i>	Supervisor's research agenda	<ul style="list-style-type: none"> • Direction-setting 	<ul style="list-style-type: none"> • join established team • enter supervisor's projects 	Deepening <i>Increasing self awareness through an iterative process</i>	Focussing <i>Pursuing mature, world-class expertise</i>	Director	Personal relevance
Enabling student development <i>Seeking students' academic and professional maturity</i>	Student maturity	<ul style="list-style-type: none"> • Relationship 	<ul style="list-style-type: none"> • mature researcher • question status quo 			Nurturer	

Pedagogies		Supervisors' approaches	Sample learning outcomes	Supervisors primarily see research as	Supervisors primarily see students learning to research as	Supervisors' suggested roles	Curriculum orientations
Supervisors see teaching research students as	Supervisors direct attention towards						
Contributing to society <i>Having social impact</i>	Society's needs	<ul style="list-style-type: none"> • Direction-setting • Relationship 	<ul style="list-style-type: none"> • develop innovative solutions 	Productive <i>Usefully satisfying a range of stakeholders</i>	Contributing <i>Exploring positive impact on others</i>	Partner	Social impact
Venturing into unexplored territory <i>Discovering the research agenda together</i>	New frontiers	<ul style="list-style-type: none"> • Direction-setting • Relationship 	<ul style="list-style-type: none"> • employ out-of-the-box thinking 	Explorative <i>Following speculative leads which challenge norms</i>	Stretching <i>Being stretched into new areas</i>	Colleague	
Drawing upon student expertise <i>Building from existing student abilities</i>	Student's contribution	<ul style="list-style-type: none"> • Relationship 	<ul style="list-style-type: none"> • become world expert • teach the supervisor 			Guide	
Forming productive communities <i>Drawing key stakeholders together</i>	Community's contribution	<ul style="list-style-type: none"> • Direction-setting • Relationship 	<ul style="list-style-type: none"> • develop networks • span disciplines 	Colleague			

Note: As supervisors... a) We may 'locate' our supervision in different parts of the framework in different contexts; b) We are unlikely to ever adopt only one frame, but we are more likely to blend more than one frame in response to variables like the student's need, the topic, the stage of candidature; c) We may emphasise, or prefer to identify with, particular parts of the framework; d) We could deliberately choose to adopt aspects most appropriate to our circumstances.

INSIGHTS FROM THE FELLOWSHIP PROGRAM

Specific insights from the fellowship program include:

- Supervisors seek many learning outcomes from candidature which have strong alignment with institutional graduate capabilities.
- Large numbers of research students provide a natural impetus for collaboration between supervisors in the supervision process and the use of group supervision strategies.
- Technology senior administrators are committed to providing opportunities for experienced supervisors to reflect on their practice, and developmental opportunities for less experienced supervisors.
- Contexts in which there is rapid (albeit planned) growth of research student numbers place significant strain on both experienced and less experienced supervisors.
- Technology supervisors prefer oral and group oriented modes of staff development to individual text based modes.
- Technology supervisors did not draw attention to any externally available resources or development opportunities in discussing helps and barriers to supervision.
- Some supervisors appear to remain uncertain about the alignment of graduate capabilities with their directions (due to lack of alignment between the language of the capabilities and the language they use to convey their intentions).
- The framework developed through the fellowship program integrates many known aspects of supervision, providing a whole picture.
- Many parts of the framework are supported through existing development opportunities.

KEY RESEARCH FINDINGS

Technology supervisors:

- seek a broad set of learning outcomes for the higher degree research process which align with institutional graduate capabilities;
- use a wide range of supervisory strategies akin to those found in other disciplines;
- reveal 9 different way of thinking about supervision as a teaching and learning practice;
- reveal distinctive and varied ways of thinking about research and learning to research;
- do not, as a broad group, reveal any 'signature pedagogy'; and
- focus primarily on issues of process, rather than 'discipline content', when discussing teaching and learning aspects of supervision.

RECOMMENDATIONS ARISING

RECOMMENDATIONS FOR THE TECHNOLOGY DISCIPLINES

1. Promote a vision of pedagogical excellence in supervision as a critical element of quality in research training.
2. Adopt, and adapt where required, the pedagogical framework and supporting resources as development tools for supervisors.
3. Create opportunities for supervisory conversations around pedagogy to promote communication about supervision as a teaching and learning practice.
4. Create development opportunities for less experienced supervisors, such as quarterly meetings of members of this community to discuss supervisory issues and strategies.
5. Formally establish mentors for less experienced supervisors (i.e. supervisors without completions experience).
6. Increase support for supervisors and students; for example, by creating positions that will help supervisors and students achieve aspects of the higher degree research capability agenda.
7. Establish faculty level awards for excellence in higher degree research supervision.
8. Increase the cohort of post-doc researchers to provide career paths and to assist with the regeneration of supervision pedagogy.

RECOMMENDATIONS FOR ALTC AND OTHER STAKEHOLDERS

9. Seek deeper understandings of the higher degree research curriculum as seen from supervisor and student perspectives.
10. Further develop the pedagogy of supervision framework within the disciplines of IT and Engineering.
11. Adapt and develop the pedagogy of supervision framework in relation to other disciplines.
12. Develop resources associated with the framework – electronic resources, video vignettes etc, for the technology disciplines.
13. Consider supporting a large scale survey of the views and practices of individual supervisors in relation to graduate capabilities, as suggested by Borthwick and Wissler (2003, p.10).
14. Consider awards and grants particularly focused on the higher degree research and supervision arena¹.

RECOMMENDATIONS FOR STUDENT RESEARCH AND GRADUATE TRAINING CENTRES

15. Make the Pedagogy of Supervision framework available to technology supervisors as part of the Student Research Centre standard suite of resources.
16. Link existing 'graduate capability statements' with expressions of learning outcomes using the words of supervisors from the technology disciplines, to assist with supervisor buy in to the agenda.
17. Adapt and develop the framework in relation to other disciplines. For example, if technology specific identifiers were removed it may be of use in other spaces.
18. Link supervisors to resources on a needs basis e.g. link aspects of the technology framework to specific existing resources that will provide further development in the area.

¹ This recommendation is very similar to Recommendation 7 in Borthwick and Wissler (2003, p.7): Request AUTC to consider an award category for collaborative programs in the postgraduate arena.

19. Request technology (and other) faculties to work with supervisors and students to adapt university higher degree research graduate capabilities to the faculty's disciplinary context, for instance by providing examples of planned learning outcomes that relate to each capability within the faculty context.
20. Propose faculty or school level awards for excellence in higher degree research supervision and identify markers of excellence, including clarity of pedagogical intent.
21. Survey students about their higher degree research learning experiences, at the point of completion of candidature.
22. Incorporate aspects of the framework into programs for students post submission of the detailed research proposal.

RESPONSES TO FRAMEWORK

A) RESPONSES FROM INDIVIDUALS – EXPERIENCED SUPERVISORS

- It helped me reflect on the way my supervision had evolved.
- This makes you realize you've got to think of new ways of doing things.
- I am very intense in supervision. My students have complete structure. Perhaps they should have freedom to chase shadows.
- I may be too intuitive, too much emphasis on ideas. I need to adopt more of a planning approach.
- I need to think more about supervision as a group activity other than one-on-one.
- I do not use the word “pedagogical” - why not just say “teaching”?
- I like the quotes – they make it personal and give me something concrete to identify with.
- It's good to have time to reflect and consider new approaches and ideas.

B) RESPONSES FROM INDIVIDUALS – EARLY CAREER SUPERVISORS

- As a soon-to-be supervisor this gives me ideas about how I might approach and plan my 'supervision style'. I may develop a more structured yet individual framework that includes more attention to graduate capabilities.
- I have never thought about my supervision at a methodological level before, nor have I analysed the methods that I have applied in my supervision. These materials inspired me to think about supervision at a high level and in a systematic way.
- I can use supervisory roles for thinking about how different members of the supervisory team can contribute, work together.
- I can see how I could use all of the approaches to supervision in different balances for different students, but how can I transition from one approach to another?
- This is a really comprehensive work and the papers are very well structured and presented. They are definitely useful and helpful for us to improve our supervision... inspire me to think about supervision at a high level and in a systematic way.

C) RESPONSES FROM SUPERVISORS IN WORKSHOPS

- I will incorporate this framework into my supervision. Particularly, I will focus more on outcomes. It will provide an interesting opportunity to track the success of different supervisory techniques with different students.
- It gave time to reflect and consider new approaches and ideas.
- It has reinforced my respect for the wisdom and expertise of my academic colleagues.
- I didn't realise I was so passionate about Higher Ed!
- Great catalyst for reflection. I would also like more strategies that I can apply directly in my supervision.
- I will consider other pedagogies. For example, I have not previously given much thought to 'contributing to society'. Also I can see that some pedagogies may be useful for different periods of a student's candidacy.
- It is great to have these resources, as there are few materials so concise for postgrad supervision. I have learnt we (PhD supervisors) have and use a lot of common strategies for supervision.

- This pack is well put together and provides many angles that could be useful. I like the concise nature and the quotes from the interviewed supervisors.
- This has crystallized some of my thoughts on supervision and also provided some stimulus for viewpoints I had not considered.
- I now realise the contradictions within ideas/views I thought I held.
- I may now be more varied for different students, and at different stages of candidature.
- Like the pack. First time anybody has provided the comprehensive list/overview of the outcomes, desires and processes of supervision.

D) RESPONSES FROM STUDENTS

- This could be useful for students
- It gives insight into my supervisors' approach. I wonder if it could show how I can identify my supervisor's view and why this is their view.
- It could help identify different expectations, especially in the initial stages of the candidacy.
- If you know your supervisor's style, you can understand them better and think about how to manage them.
- The teaching views connect clearly with the learning views.
- Supervisors need to see how students see these things, too.
- My preferred supervisor would have a bit of everything!
- This would be a good communication tool, to open up conversations and explain why supervisors/students are doing some things.
- Maybe it would help to have a third party act as a mediator, to help supervisors and students talk about their different expectations.
- The roles help draw the ideas together under one heading.

HOW FRAMEWORK DRAWS FROM EXISTING SCHOLARSHIP

A wide range of existing cross-disciplinary scholarship associated with the pedagogy of supervision, in particular research and scholarship associated with the conceptions of research, conceptions of supervision, conceptions of learning to research has been explored as part of this fellowship program.

This material, and other papers associated with supervision in the technology disciplines, was used to:

- a) identify literature on supervision in the technology disciplines that has been previously scattered or difficult to access;
- b) develop a conceptual framework;
- c) inform 'gaps' in the pedagogical framework constructed through investigating the experience of technology supervisors; and
- d) make succinct summaries of selected scholarship in resources developed for technology supervisors.

Pre-existing scholarship associated with researching learning in higher education informed the conceptual framework and approaches to engaging supervisors in conversation through various parts of the program.

In particular, the views of learning and approaches to researching learning associated with phenomenography (Marton and Booth 1997, Bowden and Marton 1998, Bowden and Green 2005, Bowden and Walsh 2000), made it possible to identify significant variation in ways of thinking about supervision as teaching and learning. These approaches also provided the platform for focussing on supervisors' 'objects', intentions and strategies.

The framework itself does not refer directly to previous scholarship, because the views represented in the framework were derived from conversations with technology supervisors. Related scholarship is, however, represented in the conceptual framework informing this program and also is referred to in resources developed for supervisors to provide them with the broader scholarly context.

HOW FRAMEWORK ADDS TO EXISTING SCHOLARSHIP

The fellowship advances knowledge by:

- a) identifying details of aspects of supervision associated with teaching and learning from the perspective of members of the technology community. Aspects included 3 approaches to supervisory pedagogy, 8 strategies used, 6 views of research, 6 views of learning to research, a wide range of learning outcomes articulated in the language of supervisors and 3 key roles adopted;
- b) identifying 9 'pedagogies' of supervision in the technology disciplines. The pedagogies represent ways of thinking about supervision as teaching and learning. They are artificial constructs intended to inform supervisors and provide a vehicle for self reflection and the identification of options; it is not expected that individuals would be readily identifiable with single pedagogies, but rather that they would locate themselves across the 9 pedagogies; and
- c) drawing those aspects of supervision attended to in the technology disciplines into a pedagogical framework. Each pedagogy may be logically or analytically aligned with the various aspects of supervision identified.

The program extends and contributes to existing research and scholarship being conducted internationally. In particular it contributes to scholarship around researchers' and research students' ways of seeing and

thinking about research and learning to research, an area where Australian higher educators (for example, Angela Brew, Margot Pearson, Margaret Kiley and Gerlese Åkerlind) play a lead role.

The concepts of research education and supervision as a teaching and learning practice been promoted widely by Australian educational leaders, especially Mark Tennant, David Boud, Alison Lee, amongst others. In the US, the Carnegie Foundation has completed a project supporting universities in scrutinising and making public their supervisory practice. (More detail is available in Paper 1 from this Fellowship.). This project focuses these directions on the technology disciplines.

RESOURCES DEVELOPED FROM PROGRAM AND AVAILABILITY

A range of resources have been made available from this program to support supervisors in the technology disciplines. These are accessible to individuals and groups via the ALTC exchange (<http://www.altcexchange.edu.au/>) and some material also through QUT e-prints (<http://eprints.qut.edu.au/>).

The materials are freely available for use and adaptation in workshops and other development programs.

Table 3 Resources developed from the program

Resource type	Title
Papers	1. Bruce, C. & Stoodley, I. (2009) <i>Fellowship plan and conceptual framework</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
	2. Bruce, C., Stoodley, I. & Gasson, S. (2009) <i>A review of the conversations and their content</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
	3. Bruce, C. & Stoodley, I. (2009) <i>A pedagogical framework for the technology disciplines</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
	4. Bruce, C., Bell, J., Gasson, S., Geva, S., Kruger, K., Oloyede, K., O'Shea, P., Stoodley, I., Raymond, K. & Wissler, R. (2009) <i>Summary and recommendations</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
Resources	5. Bruce, C. & Stoodley, I. (2009) <i>Resource for supervisors</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
	6. Bruce, C. & Stoodley, I. (2009) <i>Student resources for the use of supervisors</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
Workshops	7. Bruce, C. & Stoodley, I. (2009) <i>Workshop for supervisors</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.
Cases	8. Bruce, C. & Stoodley, I. (2009) <i>Cases from the technology disciplines</i> . (Towards a pedagogy of supervision in the technology disciplines series.) Brisbane: QUT.

Our intended audience for Papers 1-3 is:

- supervisors, administrators and academic developers in the technology disciplines who are interested in the views of their colleagues about supervision as a teaching and learning practice; and
- colleagues and academic developers in other disciplines who are interested in views from the technology disciplines about supervision as a teaching and learning practice.

Our intended audience for Paper 4 is:

- administrators and policy-makers who require a succinct overview of the program outcomes.

Our intended audience for the Resource, Cases and Workshops is:

- supervisors at all levels of experience.

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² We were surprised to find that there was so little scholarship on this topic around information technology supervision, compared with Engineering. We searched Ebsco, Proquest, Springer Link : ("information systems" OR "comput*" OR "security") AND ("higher education" AND supervision/doctoral supervision), as well as various other permutations, and even got the faculty librarian in to help, to little advantage.

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