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Nine pedagogies of higher degree research supervision

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Abstract

This article describes research higher degree supervisors' experiences of supervision as a teaching and learning practice. While research education is considered central to the HDR experience, comparatively little is known to date of the pedagogical lenses adopted by supervisors as they go about their supervision. We worked with 35 supervisors engaged in discipline-specific and interdisciplinary research across architectural design, science, engineering, computer science, information systems and librarianship. Several of these supervisors conducted projects which interfaced with the social sciences and humanities. The pedagogies, constructed through the discussions and phenomenographic analysis, offer a picture of supervisors' collective awareness of supervision as a teaching and learning practice. Supervision as a teaching and learning practice was experienced as: Promoting the supervisor's development, Imparting academic expertise, Upholding academic standards, Promoting learning to research, Drawing upon student expertise, Enabling student development, Venturing into unexplored territory, Forming productive communities, and Contributing to society.

Nine pedagogies of research higher degree supervision

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Introduction

This paper introduces nine different ways in which research supervisors experience their supervision, from a teaching and learning perspective[2]. We have called these the 9 Pedagogies of Higher Degree Supervision. The pedagogies were developed as part of a framework for thinking about supervision through a teaching lens (Bruce and Stoodley 2010). While the framework draws together a wide range of aspects of teaching practice, this paper only reports the research underpinning the development of the 9 Pedagogies. The 9 Pedagogies represent supervisors' awareness of their engagement with higher degree supervision as teaching.

The nine pedagogies described in this paper elaborate the different stances adopted by supervisors when discussing what it means to teach and to bring about learning in supervision. They provide supervisors with a range of options from which to select as they engage with students. The pedagogies may be used by individuals and groups to:

- support less experienced supervisors looking for options in their approach to supervision as teaching;

- support experienced supervisors in mentoring junior colleagues;

- support experienced supervisors in refreshing their own supervision; and

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[2] As we share the view that the purpose of teaching is to bring about learning, in what follows we abbreviate 'learning and teaching practice' to 'teaching practice'.

- support facilitators of workshops and other development opportunities focused on supervisory pedagogy.

Literature Review

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

- researching their teaching;

- teaching their research;

- thinking about teaching (mostly at the undergraduate and honours levels) as a site of research practice, that is a space where students engage in research; and

- thinking about teaching as a pathway to research, where students might become involved in the research process.

Here we focus on a dimension of the teaching-research nexus different from those listed above - research supervision as a site of teaching. The concept of research supervision as being about teaching, or 'research education', is being constructed internationally (Boud and Lee 2008; Brew 2001; Bruce, Stoodley and Pham 2009; Green and Lee 1999; Kiley and Wisker 2009; Manathunga, Lant and Mellick 2006). '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, p. 134). Considering supervision as being about teaching, for example, acknowledges the role of the research student, or candidate, as a learner in the research sphere as well as being a contributing member of the research community.

Presently, complementary approaches to supervision are emerging, with their attendant implications for pedagogy. A *completions* focus, exemplified by the work of Sinclair (2004), reflects a higher degree research climate with pedagogies attending to project structuring and planning. A *skills* focus, recently deconstructed by Craswell (2007) reflects strong interest in research training

and often culminates in the development of frameworks such as those proposed by Willison and O'Regan (2007). A *social practice* focus is embodied in the views of Boud and Lee (2008) who suggest that the scope of supervision research needs to be extended 'to encompass a wide range of actors within the field' (p. 5). The *role of a supervisor* focus (Deuchar 2008) has been given extensive attention and pedagogically attends to the development of models, such as master-apprentice, facilitator or critical-friend. An *expanding awareness* focus suggests that bringing about learning involves widening the experience of students as they learn to become researchers; with work conducted across disciplines (Brew 2001; Bills 2004; Åkerlind 2005, 2008; Wright, Murray and Geale 2007; Kiley and Mullins, 2005) including in specific discipline contexts (for example Bruce, Pham and Stoodley 2004; Pham, Bruce and Stoodley 2005; Wood, 2006). Adopting a *learning outcomes* focus, Kiley and Wisker (2009) explore the idea of threshold concepts in the context of research supervision. Threshold concepts transform learners, enabling them to achieve more advanced research as they attain qualitatively different views of the content being learned, learning experiences or themselves as learners (p. 432).

Of considerable importance to the growing focus on research education are warnings that mandated change can harm organisational cultures. For research supervision this is likely to mean 'programmes that will yield better supervisory practices will be ones which incorporate reflexive, pedagogically-sound, collegial activities where supervisors draw upon and share the best of postgraduate supervision' (Edwards 2002). This line of thought reflects the focus on narrative and the availability of case studies for supervisors, for example at the University of Sydney (http://www.itl.usyd.edu.au/supervision/casestudies/search.cfm?25785443) and the Queensland University of Technology, Brisbane (Bruce and Stoodley 2010).

The study reported here complements the growing set of insights into the varying experience of research and research supervision. It also provides a lens on supervisory pedagogy which emerges

from the experience of supervisors themselves, which can be adopted to encourage supervisors to reflect individually or together on their own experience and the value of alternative pedagogies.

Research Aim

The investigation reported here focussed on variation in supervisors' awareness of supervision as a form of teaching, exploring with them what they intended students to learn and how they might bring about that learning. We aimed to reveal variation in their experience of pedagogy as they engaged in supervision.

Method – Developing the pedagogies

Phenomenography (Marton and Booth 1997; Bowden and Green 2005; Bowden and Walsh 2000) was the point of departure for our exploration of supervisory pedagogy. Phenomenography has previously been used to deepen our understanding of research and research supervision (Åkerlind 2008; Baillie, Emanuelsson, and Marton 2001; Brew 2001; Ingerman and Booth 2003; Kiley and Mullins 2005; Wood 2006). The phenomenon under exploration in this study was the experience of supervision as teaching

In the phenomenographic approach, knowledge is understood to be constituted in the varying relations between people and the world. The 'world is not constructed by the learner, nor is it imposed upon her; it is *constituted* as an internal relation between them' (Marton and Booth 1997, p. 13). The different ways of constituting aspects of the world, in this case supervision as a teaching practice, are known as *experiences*. In phenomenography, the description of experience is achieved through an interpretive process, beginning with conversations with participants and involving interpreting these conversations in the light of each other. Thus, a picture is built of the collective experience of the phenomenon at hand.

Participants

All participants were practicing supervisors, see Table 1. Their experience of supervision ranged from early career with no completions, through to very experienced with many completions. Our categorisation of experience in terms of completions is based on Hammond, et al.'s (2009) conceptualisation of levels of supervisory experience. Participants represented a breadth of architectural design, science, engineering, computer science, information systems and librarianship research interests, and included research leaders (for example, assistant deans and research coordinators).

[Insert Table 1 here]

As our purpose was to reflect pedagogical experience as broadly as possible, supervisors from all academic levels of appointment, and with a variety of experience, participated. While precise details of student backgrounds are not available, it was evident that these supervisors were working with male and female, international, as well as small and large cohorts of students.

Talking with supervisors about their experience

The data was gathered through semi-structured interviews and workshops. In order to understand their experience of supervision as a teaching practice, supervisors contributing through one to one conversations were invited to describe and provide examples of a) their approaches to HDR supervision, b) their expectations about what students would learn throughout the period of study, c) their (the supervisor's) role in the process, and d) helps and barriers to making it possible for students to learn.

Supervisors participating in workshops were invited to identify a) supervisory strategies that work for them and how they are implemented, b) what they expect students to gain and other benefits of the strategy, c) how they know students benefit, d) the most important thing they want their students to learn, and e) helps and barriers to their students' learning. All interview conversations were recorded and transcribed.

Forming descriptions of the pedagogies

We explored participants' contributions to develop an understanding of the different ways in which supervision is experienced as a teaching practice. Nine categories of description evolved from the analysis. They were formed through an iterative cycle of tentative categorisation, return to the data and re-formation of the categories. The participants' own words were central to this process. We sought to discern both the meaning and structure of these categories from the data, including for each category a theme, thematic field, margin and dimensions of variation (Marton and Booth 1997). As the structure was explored, meanings shifted, which in turn influenced the discernment of structure, reflecting the iterative nature of phenomenographic analysis. Descriptions of participants' experience eventually stabilised.

In the final descriptions, each category includes three structural elements:

(1) The theme: those things which supervisors' awareness is directed towards.

(2) The thematic field: those things which supervisors consider relevant to the experience.

(3) The margin: those things which supervisors consider less relevant.

Each also includes the following dimensions that vary across the categories:

(1) Supervisors' views of research; and

(2) Supervisors' views of learning to research.

In forming the categories, we adjusted our language over time, moving away from formal phenomenographic terminology as we strove to communicate clearly with supervisors. The changes in language, for example, from 'thematise', to 'direct attention towards', are presented in Table 2. This shift in vocabulary is mirrored in the category descriptions in this account.

[Insert Table 2 here]

The 9 Pedagogies

Nine pedagogies, or ways of experiencing supervision as teaching, were identified:

(1) Promoting the supervisor's development - Pursuing the supervisor's established objectives

(2) Imparting academic expertise - Conveying expertise in research processes

(3) Upholding academic standards - Meeting the discipline and institutional communities' expectations

(4) Promoting learning to research - Meeting students' learning needs

(5) Drawing upon student expertise - Building from existing student abilities

(6) Enabling student development - Seeking students' academic and professional maturity

(7) Venturing into unexplored territory - Discovering the research agenda together

(8) Forming productive communities - Drawing key stakeholders together

(9) Contributing to society - Having social impact

The outcome space: representing interrelationships between the categories

Central to phenomenography is the representation in an outcome space of the relationships between the different experiences. The relationships are typically expressed in terms of expanding awareness (Marton and Booth 1997). Such expansion can be perceived in Table 3 – progression down the rows moves in groups of three categories, from supervisors adopting an orientation towards themselves, through supervisors adopting an orientation towards students, to supervisors adopting an orientation towards the wider community. The vocabulary used to describe the theme of each experience reflects this progression. Such changes of perspective are understood to indicate a broadening of awareness on the part of the supervisor, from their immediate environment to the wider community.

The first three categories, representing a supervisor orientation, identify elements of the supervisors' expertise as central to pedagogy. Supervisors may seek to promote their own interests,

they may see themselves as the key source of knowledge relevant to the candidature or they may be seen as the guardian of standards pertaining to their own (academic) environment.

The second three categories, representing a student orientation, identify aspects of the candidate's journey as central to pedagogy. The student's learning determines the activities engaged in, they are valued as a key source of knowledge or their maturity is the goal of the candidacy.

The final three categories representing a community orientation identify aspects of the wider community as central to the pedagogy. The community significantly influences the direction of the research endeavour, an extensive network of collaborators is seen as a key source of knowledge or meeting the community's needs is the goal.

The outcome space is a succinct means of representing such changes in awareness.

[Insert Table 3 here]

The relationships between categories may also be represented in terms of the content, intentions and strategies of supervision (Table 4). Aspects of supervision as teaching are indicated in the columns and a widening orientation is shown in the rows. In the columns, 'Content' refers to what supervisors see as the substance of the material to be imparted to the student, 'Intention' refers to supervisors' motivations behind imparting that content and 'Strategy' refers to how supervisors engage students with the content.

[Insert Table 4 here]

Category 1: Promoting the supervisor's development

Supervisory pedagogy may be experienced as promoting the supervisor's development. Table 5 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards their established research objectives, determined by their personal and their team agendas. They are likely to consider relevant to supervision

established agendas, the existing network, leveraging past work, personal survival and the hierarchy's expectations of supervisory load. They are less likely to consider students or society.

The way I work with students is, during the first year they are working as a research assistant, learning the ropes. 'This is what you have to do, you have to do the literature review and this is the kind of program you will have to write and this is how we are going to test it', etc. (I1)[3]

I do like them to do some safe, well defined work early. It's a lot of money and if they are not performing in a project it is quite stressful... you also wonder if it's going to ruin your career because you have to get the publications out or you won't get more funding. (SI3)

Category 2: Imparting academic expertise

Supervisory pedagogy may be experienced as imparting academic expertise. Table 5 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards their expertise in the knowledge and skills needed for research. They are likely to consider relevant to supervision their area of interest and expertise, the institution's facilities, and control over the candidacy. They are less likely to consider student and community goals.

What I expect them to learn... is how to conduct research... using my approach… because I consider myself quite a successful researcher; I believe that the way I do it works. (I1)

...my approach is to lead the student to a path that they find successful by using, as much as possible, my experience on one side and their desire to succeed on the other side. I mean, I always give to the students a certain basis of what I know. (I4)

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[3] Quote sources are indicated, 'I' for interview and 'W' for workshop, for example 'I1' indicates Interview 1.

Dimensions

When supervisors experience supervision as *Promoting the supervisor's development* or as *Imparting academic expertise*, they primarily see research as investigative. Research is about strategic, evidence-based problem solving. Key ideas associated with this view include: problem-solving techniques, persistence, being systematic, strategies for understanding, obtaining relevant resources and being evidence-based.

> *Because we work in science… they have to learn a scientific method of research. So, trial and error, to try a certain experiment, see if the experiment Is successful, if it is not successful try to find answers. (I4)*

When supervisors experience supervision in this way, they primarily see learning to research as being apprenticed. Learning to research is about imitating a master. Key ideas associated with this view include: imitation, apprenticeship, following a model, walking alongside a researcher (initially), following expert advice, and understanding process and standards.

> *I guess it is the master-apprentice approach, where you basically teach them how you do it. (I1)*

[Insert Table 5 here]

Category 3: Upholding academic standards

Supervisory pedagogy may be experienced as upholding academic standards. Table 6 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards the expectations of the academic community (both discipline and institutional), concerning the standard of work produced and the time within which it is produced. They are likely to consider relevant to supervision graduate capabilities, external examiners, timelines, the thesis as a deliverable, journals and conferences. They are less likely to consider the needs of students and others.

Something I've said to students for many years now is that they should be the world's foremost authority in the narrow area of their research by the time they complete… If they are going to be rigorous enough and deep enough, then they have to be relatively narrow and it's not a stretch to assume that they will be the world's foremost authority in that narrow area. (I12-1)

The first six months I spend quite a lot of time… doing all the usual boring things, the Confirmation, etc. (I22)

Dimensions

When supervisors experience supervision as *Upholding academic standards*, they primarily see research as substantial. Research is working rigorously on difficult problems, resulting in important breakthroughs. Key ideas associated with this view include: tackling difficult problems, finding solutions, arriving at an informed view, sound methodology, rigor, hard work and disciplining the mind.

...they've got to learn the rigours, that badly done research is pointless; and so if they are working with an engineer and it frustrates them that they have to spend so much time designing an experiment or a technique, that they understand this is valuable at the end of the day. If you're going to do it, you've got to do it properly. (I5)

When supervisors experience supervision in this way, they primarily see students learning to research as accepting constraints. Learning to research is about disciplined application of basic skills to new areas. Key ideas associated with this view include: developing habits, applying basic skills, disciplining the mind, grasping fundamentals, constructing an argument, interrogating existing research and seeking out resources.

Science is 99% perspiration and 1% inspiration, it's so repetitive. However, there is the possibility of branching out to pursue their vision as well. They have to be able to accept the mundane tasks to begin with so they can then move on further. (SI4)

[Insert Table 6 here]

Category 4: Promoting learning to research

Supervisory pedagogy may be experienced as promoting learning to research. Table 7 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards the needs of the student, in order to enable the student to reach the end goal of their candidacy. They are likely to consider relevant to supervision ideas such as student's mental, physical and emotional well-being, and institutional support structures. They are less likely to consider people other than the student.

> As they say, 'Every child is different', so every student is different. So, each one is a new learning in how to do it… I try to work in detail with the students. (I16)

> There's a big difference between the beginning and the end of the PhD. They should be independent... at the end... By the time they get to the end it is really being done mainly by themselves. (I20)

Category 5: Drawing upon student expertise

Supervisory pedagogy may be experienced as drawing upon student expertise. Table 7 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards existing student abilities and interests in order to pursue a mutually defined question. They are likely to consider relevant to supervision student interests and expertise, student insights, the student as a source of knowledge, and student control. They are less likely to consider community goals.

> ...the most important thing I think is to actually get the student to work their way into the topic and to identify what they think are the key issues that they need to resolve. (I3)

It's a research partnership… I've learned an awful lot from PhD students and from Masters students. Some of the suggestions you hear… are excellent. So, I learn a lot from the students themselves. (I8)

Dimensions

When supervisors experience supervision as *Promoting learning to research* or *Drawing upon student expertise*, they primarily see research as meaning-making. Research is seeking meaning through the synthesis of complex data or knowledge. Key ideas associated with this view include: gaining insight and finding solutions.

I expect them to learn how to think, to critically analyse the problem, to come up with a variety of solutions and to narrow that down. (I13)

When supervisors experience supervision in this way, they primarily see learning to research as focussing. Learning to research is about pursuing mature, world-class expertise. Key ideas associated with this view include: pursuing a passion, aiming to be the world's expert, embodying research, shouldering responsibility for the research and 'hitting a gear'.

Something I've said to students for many years now is that they should be the world's foremost authority in the narrow area of their research by the time they complete. (I12-1)

[Insert Table 7 here]

Category 6: Enabling student development

Supervisory pedagogy may be experienced as enabling student development. Table 8 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards student growth into academic and professional maturity. They are likely to consider relevant to supervision student weaknesses and strengths, student ambitions and interests, and student potential. They are less likely to consider societal needs.

Basically, an independent researcher so they can do all the things that they need to do. They can

do their lit review, come up with a variety of solutions and then work on it. So, they will develop

a level of independence. (I13)

...one day they'll be known as 'Doctor Somebody' and… I still think that society tends to look at it

in some certain way. They need to think about what this means socially and ethically to them.

(I22)

Dimensions

When supervisors experience supervision as *Enabling student development*, they primarily see

research as deepening. Research is about increasing self awareness through an iterative process.

Key ideas associated with this view include: narrowing focus, deepening self and understanding your

own contribution.

To work their way into the topic and to identify what they think are the key issues that they need

to resolve (I3)

When supervisors experience supervision in this way, they primarily see learning to research as

journeying. Learning to research is about self-discovery by trial and error, towards independence.

Key ideas associated with this view include: learning about self, learning to choose focus, climbing by

yourself, being self-starting and self-monitoring, linking broad and deep knowledge, tolerating

rejection and learning from it, and learning to choose which advice to listen to.

There's a big difference between the beginning and the end of the PhD... I expect them to take

more and more responsibility as they go along… by the end the student should be functioning like

we do as colleagues. (I20)

[Insert Table 8 here]

Category 7: Venturing into unexplored territory

Supervisory pedagogy may be experienced as venturing into unexplored territory. Table 9 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards forming a research team whose members work together to discover the research agenda. They are likely to consider relevant to supervision inter-relations, team's strengths and weaknesses, new insights, and non-standard approaches. They are less likely to consider needs in the wider society.

I expect them to learn about how to ask questions and think in a creative and expansive way that is not limited by what other people have said or done. (I9)

It's the esoteric thoughts that you really need in research. You need the wacky thoughts, 'Why don't we try looking at it this way?'... If you are going to bother doing research, you may as well not make it incremental. (I13)

Category 8: Forming productive communities

Supervisory pedagogy may be experienced as forming productive communities. Table 9 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards drawing key stakeholders together into an active network of contributors to the research endeavour. They are likely to consider relevant to supervision networks (of students, supervisors and industry partners) in order to introduce alternative points of view, multiple interactions, communication, exploration of possibilities, and relinquishment of central control. They are less likely to consider their own goals.

...you create a bidirectional flow whereby you have a team or this organization has a very dense network in itself. You have all these dots, but all these dots are very well connected. I want that there is a maximum density in this network. (I12-2)

Invite students to meet with industry partners (W1)

Dimensions

When supervisors experience supervision as *Venturing into unexplored territory* or *Forming productive communities*, they primarily see research as explorative. Research is about following speculative leads which challenge norms. Key ideas associated with this view include: newness, following leads, thinking outside the square, big risks leading to big steps, exploring esoteric thoughts, asking big questions and questioning norms.

To have the courage to approach things from unorthodox ways… So, a kind of independence of thought and not being afraid to go out on a limb, but to do that responsibly. Of course… you become part of a field and that field has its own norms but still to be aware that you are not to be trapped by that. (I16)

When supervisors experience supervision in this way, they primarily see learning to research as stretching. Learning to research is about being extended into new areas. Key ideas associated with this view include: expanding into new areas, big changes and cutting edge.

It's the esoteric thoughts that you really need in research. You need the wacky thoughts, 'Why don't we try looking at it this way?' If you're not comfortable, you're only going to say things that are safe. If you are going to bother doing research, you may as well not make it incremental. (I13)

[Insert Table 9 here]

Category 9: Contributing to society

Supervisory pedagogy may be experienced as contributing to society. Table 10 depicts the key elements of this category. When supervisors experience teaching research students this way, they direct their attention towards society's needs and work towards having positive social impact. They are likely to consider relevant to supervision meeting others' needs, responsible scholarship,

relevance to industry and the potential to commercialise. They are less likely to consider personal and student goals.

To create ground-breaking systems that help other people. (W2)

Dimensions

When supervisors experience supervision as *Contributing to society*, they primarily see research as productive. Research is about usefully satisfying a range of stakeholders. Key ideas associated with this view include: usefulness to industry, satisfying stakeholders and commercial value.

Some of them have industry sponsors... and I say, 'It is your responsibility to ensure that this sponsor organization gets value for what you are doing.' (I12-1)

When supervisors experience supervision in this way, they primarily see learning to research as contributing. Learning to research is about exploring positive impact on others. Key ideas associated with this view include: coming to understand the impact of research on society.

...the ability to reflect very effectively, on their processes to improve them, to be able to contribute better to society. (I2)

[Insert Table 10 here]

Discussion

The 9 pedagogies represent supervisors' collective awareness of their supervision as a teaching practice. The categories are constructs intended to inform supervisors, and provide a vehicle for self reflection and the identification of pedagogical options for supervision. The outcome space represents collective awareness through revealing the interrelationships between the pedagogies.

While the study reported here explores conceptions of supervision as a teaching practice, it contributes to a line of research and scholarship associated with variation in the experience of supervision, research and learning to research which has been introduced earlier in this paper. It

also extends our understanding of variation in the academic experience of teaching into the supervision arena. Here, there are expanding orientations towards the teacher, towards students, and towards the broader context of learning which at least partially reflect the experience of teaching in academic coursework contexts.

Other aspects of the pedagogies are also supported by previous work. Recent attention to threshold concepts in higher degree research (Kiley and Wisker, 2009), identifies questioning and research design as conceptual thresholds which indicate that an appropriate level of work is being done for postgraduate study. Such thresholds particularly support the *Promoting learning to research* and *Enabling student development pedagogies,* as they relate to the increasing independence and maturity of research students.

Brew (2001, p. 440) identifes in her 'Domino conception' that research may be experienced as separate linked elements, which need to be mastered and synthesised, this is an idea which appears in our *Imparting academic expertise* category, where research is seen in terms of individual skills to be learned and implemented. Brew's 'Journey conception' involves an awareness of the influence of research on society, as does the pedagogy here described as *Contributing to society*.

Supervisors' conceptions of research have also been found to reflect a university/non-university dichotomy where university research is assigned legitimacy (Bills, 2004). Legitimate research is thus understood as involving rigour (excluding, in the eyes of some, qualitative research), order, ability to advance knowledge and conformity to a research tradition. These views influence industry collaboration and the perceived legitimacy of researchers in the industry context. What Bills (2004) found to define legitimate research reflects only a small part of supervisors' collective pedagogical awareness, aligning mostly with one category, *Upholding academic standards*.

Wright, Murray and Geale (2007) studied doctoral supervisors' experience of supervision and how this influenced their role. They report five conceptions of supervision, in which supervisors saw

themselves as quality assurers, supportive guides, research trainers, mentors and knowledge enthusiasts. Whilst they did not specifically explore views of pedagogy, their 'Quality assurer' category shares elements of meaning with our *Upholding academic standards*; their 'Supportive guide' with our *Promoting learning to research*; their 'Research trainer' with our *Enabling student development*; their 'Mentor' with our *Drawing upon student expertise*; and their 'Knowledge enthusiast' with our *Venturing in to unexplored territory*. The four remaining pedagogies reported here are not reflected in their descriptions of supervisory experience.

The broadening awareness of supervisors from their own concerns, to the needs of students, to community also reflects an emerging pattern in the literature focussed on the collective awareness of research, study and supervision. Brew's (2001) conceptions of research, for example, represent expanding awareness from the components of the research process to impact on society. Similarly, Åkerlind (2005, 2008), reporting the experience of research and being a researcher, describes an expanding awareness from the application to specific skills to meet academic, disciplinary or institutional requirements, to benefitting their immediate or wider communities. Bruce, Pham and Stoodley (2004), focussing on researchers' experience of significance in research, report expanding awareness from the individual, through their immediate context, to the wider world (Bruce, Stoodley and Pham, 2009), which reveals expansion from a technical focus to a focus on benefitting people.

What do the pedagogies mean for the HDR community?

Research is the highest form of learning (Marton and Bowden, 1998). From this point of departure we can propose that the purpose of HDR supervision must therefore be to bring about learning of the highest form. In this context, the categories and the associated outcome space become tools for illuminating different experiences and promoting conversations about supervision as a teaching practice. They may be used to reveal to supervisors their current pedagogical lenses and possible alternatives. They form both a stimulus for reflection and an aid to active adjustment of supervision.

Focus on the teaching aspects of research supervision could enhance supervision practice by making supervisors aware that

(1) supervisors experience supervision as a teaching practice in multiple ways, which result in different supervisory relationships, practices and learning outcomes being emphasised;

(2) different pedagogies may be more or less appropriate at any one time, influenced by the student, the stage of the candidacy, external factors and the supervisor; and

(3) the more pedagogical lenses a supervisor is aware of, the more options they have to choose from, and the more they are likely to be able to adapt their pedagogies to the needs of their students.

Supervisory communities may also be invited to explore the influence of their environments, research cultures, and the history of their institutions, on the pedagogies they choose to adopt; or to explore the extent to which their personal research paradigms might influence their chosen pedagogies and other supervisory processes.

Such conversations and opportunities are vital in communities where teaching and learning are not commonly associated with research and supervision processes. In our project, while supervisors willingly engaged in conversations around the pedagogical aspects of supervision, they frequently expressed the opinion that words like 'learning' and 'pedagogy' did not belong within the sphere of higher degree research supervision. It is possible that this reflects their views of teaching and learning in other aspects of their academic life. Establishing development processes to widen academic views of teaching generally, and as they pertain to supervision, becomes increasingly important as doctoral education falls under more intense scrutiny.

Conclusions

The 9 Pedagogies are the outcome of a phenomenographic investigation of supervisors conducting research across a range of disciplines. In describing the pedagogies, supervisors' language has been

adopted in order to communicate the key ideas as faithfully to their way of thinking as possible. It is noteworthy that the resulting ideas are not overtly discipline-specific, and that the outcomes are conceivably applicable across disciplines. This may be because the supervisors largely worked in cross-disciplinary projects representing social science and humanities, as well as science and technology domains.

Supervision as a pedagogic practice continues to be an under-researched aspect of the higher degree research community. The 9 Pedagogies provide a platform through which it may be possible to a) promote pedagogical excellence in supervision as a vital component of research education, b) promote conversation and communication about supervision as a teaching practice, c) create development opportunities for supervisors with various levels of experience, and d) continue research into the pedagogy of supervision.

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Tables

Table 1 Participant profile

	Gender		Appointment level					Principal completions			Associate completions			Students		
	M	F	A	B	C	D	E	0	1-5	>5	0	1-5	>5	1-5	6-10	>10
Eng.	X	X	X	X	X	X	X	X	X	-	X	X	-	X	X	X
IT	X	X	-	X	X	X	X	X	X	X	X	X	X	X	X	X
Sci.	X	X	X	-	X	X	X	X	X	X	X	X	X	X	X	X

Organisational areas: Eng. = Engineering (including Architecture), IT = Information Technology (including Information Systems, Computer Science and Librarianship), Sci. = Science; X = represented, - = not represented; Principal/Associate = as principal/associate supervisor

Table 2 Terminology used to communicate to supervisors

Formal phenomenographic terminology	More communicative terminology for supervisors
When supervisors experience teaching research students as upholding academic standards, they *thematise* the expectations of the academic community…	When supervisors experience teaching research students as upholding academic standards, they *direct their attention towards* the expectations of the academic community…
The *thematic field* of this experience includes…	They are *likely to consider relevant* to supervision…
Considerations which lie in the *margin* of their experience are …	They are *less likely to consider*…

Table 3 Outcome space for the 9 Pedagogies of Supervision

	Pedagogy Supervisors see teaching research students as	Theme Supervisors direct attention towards	Margin Supervisors are less likely to consider	Research Dimension Supervisors primarily see research as	Learning to Research Dimension Supervisors primarily see students learning to research as
Orientation					
Supervisors	**Promoting the supervisor's development** Pursuing the supervisor's established objectives	Supervisor's research agenda	Students and society	**Investigative** Strategic, evidence-based problem solving	**Being apprenticed** Imitating a master
	Imparting academic expertise Conveying expertise in research processes	Supervisor's knowledge and skills	Student and community goals		
	Upholding academic standards Meeting the discipline and institutional communities' expectations	Supervisor's discipline's standards	Students and others	**Substantial** Working rigorously on difficult problems, resulting in important breakthroughs	**Accepting constraints** Disciplined application of basic skills to new areas
Students	**Promoting learning to research** Meeting students' learning needs	Students' learning needs	Others beyond the student	**Meaning-making** Seeking meaning through the synthesis of complex data or knowledge	**Focussing** Pursuing mature, world-class expertise
	Drawing upon student expertise Building from existing student abilities	Student's contribution	Community goals		

Orientation	Pedagogy Supervisors see teaching research students as	Theme Supervisors direct attention towards	Margin Supervisors are less likely to consider	Research Dimension Supervisors primarily see research as	Learning to Research Dimension Supervisors primarily see students learning to research as
	Enabling student development Seeking students' academic and professional maturity	Student maturity	Societal needs	**Deepening** Increasing self awareness through an iterative process	**Journeying** Self-discovery by trial and error, towards independence
Community	**Venturing into unexplored territory** Discovering the research agenda together	New frontiers	Societal needs	**Explorative** Following speculative leads which challenge norms	**Stretching** Being stretched into new areas
	Forming productive communities Drawing key stakeholders together	Community's contribution	Supervisor's goals		
	Contributing to society Having social impact	Society's needs	Personal and student goals	**Productive** Usefully satisfying a range of stakeholders	**Contributing** Exploring positive impact on others

Table 4 Supervisors' ways of thinking about teaching in the research context

Orientation	Content	Supervisor's intention	Supervisor's strategy
	Teaching in the research context is viewed as:		
Supervisor perspective	Upholding academic standards	Promoting the supervisor's development	Imparting academic expertise
Student perspective	Promoting learning to research	Enabling student development	Drawing upon student expertise
Wider community perspective	Venturing into unexplored territory	Contributing to society	Forming productive communities

Table 5 *Promoting the supervisor's development* and *Imparting academic expertise*

Pedagogy	Supervisors direct attention towards	Supervisors are less likely to consider	Research Dimension	Learning to Research Dimension
Promoting the supervisor's development *Pursuing the supervisor's established objectives*	Supervisor's research agenda	Students and society	**Investigative** *Strategic, evidence-based problem solving*	**Being apprenticed** *Imitating a master*
Imparting academic expertise *Conveying expertise in research processes*	Supervisor's knowledge and skill	Student and community goals		

Table 6 *Upholding academic standards*

Pedagogy	Supervisors direct attention towards	Supervisors are less likely to consider	Research Dimension	Learning to Research Dimension
Upholding academic standards *Meeting the discipline and institutional communities' expectations*	Established academic standards	Students and others	**Substantial** *Working rigorously on difficult problems, resulting in important breakthroughs*	**Accepting constraints** *Disciplined application of basic skills to new areas*

Table 7 *Promoting learning to research* and *Drawing upon student expertise*

Pedagogy	Supervisors direct attention towards	Supervisors are less likely to consider	Research Dimension	Learning to Research Dimension
Promoting learning to research *Meeting students' learning needs*	Students' learning needs	Others beyond the student	**Meaning-making** *Seeking meaning through the synthesis of complex data or knowledge*	**Focussing** *Pursuing mature, world-class expertise*
Drawing upon student expertise *Building from existing student abilities*	Student's contribution	Community goals		

Table 8 *Enabling student development*

Pedagogy	Supervisors direct attention towards	Supervisors are less likely to consider	Research Dimension	Learning to Research Dimension
Enabling student development *Seeking students' academic and professional maturity*	Student maturity	Societal needs	**Deepening** *Increasing self awareness through an iterative process*	**Journeying** *Self-discovery by trial and error, towards independence*

Table 9 *Venturing into unexplored territory* and *Forming productive communities*

Pedagogy	Supervisors direct attention towards	Supervisors are less likely to consider	Research Dimension	Learning to Research Dimension
Venturing into unexplored territory *Discovering the research agenda together*	New frontiers	Societal needs	**Explorative** *Following speculative leads which challenge norms*	**Stretching** *Being stretched into new areas*
Forming productive communities *Drawing key stakeholders together*	Community's contribution	Supervisor's goals		

Table 10 *Contributing to society*

Pedagogy	Supervisors direct attention towards	Supervisors are less likely to consider	Research Dimension	Learning to Research Dimension
Contributing to society *Having social impact*	Society's needs	Personal and student goals	**Productive** *Usefully satisfying a range of stakeholders*	**Contributing** *Exploring positive impact on others*