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Developing the Parameters of Scholarship in Postgraduate Coursework Studies

Allan F. McLay
RMIT University, allan.mclay@rmit.edu.au

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Abstract
Scholarship parameters, in relation to postgraduate coursework studies, are developed against the expectations of the Boyer classifications of scholarship (Boyer, 1990) with particular emphasis on the role of minor thesis development. An example is presented in which postgraduate coursework students are required to undertake a three semester minor thesis sequence in which students engage in self directed, individual analysis and thesis preparation based on the findings of an investigative project, under the guidance of an academic supervisor. It is argued that the approach is a viable example of combined pedagogical and research oriented scholarship that addresses Boyer's tetradic framework of scholarship and provides an effective environment for developing both discipline focussed scholarship and practical experience in research activity.

Keywords
Research, scholarship, minor-thesis, pedagogy, supervision

Introduction

This paper discusses the development and application of "scholarship" parameters in relation to postgraduate coursework studies, particularly those involving a mix of coursework components, case-study analyses, project work and minor-thesis activities. The Master of Engineering Management program at RMIT University is used as an example; in this program, students are required to undertake a three-semester, minor-thesis sequence intended to extend on and reflect the core tenets of the program. The activities of the sequence strongly focus on the management of engineering and technology-based organisations. Many engineering and natural-sciences students are deeply instilled with positivist leanings and classically inductive thinking approaches to problem solving (Blaikie 1993). They are trained to ask: What is it? How does it work? How can I fix it or make it work better? They also tend to assume that whatever solutions they identify to a given problem will apply wherever and whenever the problem occurs. Rarely, it seems, are the Who and Why parameters applied. Yet, it may well be that it is in these grey areas of developing understanding about who, what, when, where and why – not necessarily how – that the minor thesis may prove its real value.

This paper develops the experiential role of the minor thesis in conducting preliminary investigations into significant issues as part of more in-depth formal research activities; for example, in the context of a subsequent doctoral research program or an external industry-based research and development activity. Typically, implementation methodologies in such coursework programs use supervision of industry-based case-studies and minor-thesis development as a formal teaching strategy for developing both discipline-focused scholarship and practical research experience. This paper reviews this approach against the expectations of the Boyer classifications of scholarship (Boyer 1990), and argues that whilst the approach is a viable example of combined pedagogical and research-oriented scholarship, further extension and integration of Boyer's scholarship parameters may further enhance overall student experience.

Perceptions of Scholarship in Postgraduate Studies

Professor Ernest L. Boyer, in his seminal work on scholarship (Boyer 1990), stresses the importance of students and academic staff to collaborate in the process of thesis development: "The work of higher learning, at the core, is and must remain disciplined inquiry and critical thought" (Boyer 1990, p69). In this integrative context, the academic supervisor and the student are responsible for ensuring that "disciplined inquiry and critical thought" are demonstrably at the root of their research processes, findings, writings and arguments.

Boyer's four-part theoretical model for thinking of scholarship incorporates four core components: the Scholarship of Discovery, the Scholarship of Integration, the Scholarship of Application and the Scholarship of Teaching (which he considers the most critical component in his model).

Boyer's own words give a sense of the Scholarship of Discovery's power to bring students and the academe into active engagement in research-based activity to enhance scholarship:

> *The scholarship of discovery, at its best, contributes not only to the stock of human knowledge but also to the intellectual climate of a college or university. Not just the outcomes, but the process, and especially the passion, give meaning to the effort. The advancement of knowledge can generate an almost palpable excitement in the life of an educational institution* (Boyer 1990, p17).

Typically, the exercise of engaging in postgraduate study involves a range of learning experiences, very often including a research project and the preparation of a minor thesis. For many engineering students in particular, this can be a daunting task; for others it can provide an exciting insight into the world of research and become the first step towards a higher degree by research or a future career path in research and development. Clark (2002), in his position paper "Evaluating the Minor Thesis", provides a telling yet succinct outline of this process as shaping the expectations of students relative to their experiences of research activity, and argues that the minor-thesis development process can be a significant factor in determining subsequent postgraduate research experience.

Within Boyer's theoretical construct of scholarship, it is readily possible to see how effective research and investigative activity and thesis preparation can help students achieve the rigour expected of scholarship in contemporary academic thought. Designing and initiating the transition from a body of disparate data, extracting coherent information and applying critical thinking and synthesis in its interpretation and application is both challenging and rewarding, as well as a significant influence on intellectual growth. It involves directed observation, data collection and analysis and a capacity to think through both the obvious and the hidden, and the application of a disciplined yet creative imagination in a search for a sustainable argument and coherent explanation. It places extensive demands on intellectual engagement in the exploration and application of knowledge and experience in resolving the unknown.

Boyer's construct of a Scholarship of Integration addresses the need to integrate new and evolving knowledge into, throughout and across established disciplines of knowledge and practice. "The results of a scholar's integrative efforts might help shape public debate and broaden understanding of the issues at hand" (Glassick et al. 1997, p30). All too often, the spectre of resistance to change appears in the form of barriers to entry of new ideas and approaches that challenge understanding, knowledge and experience. These barriers typically appear where there are fixation on existing and proven curricula, embedded systemic teaching strategies and techniques and an established history of assessment practice and performance expectations. However, such environments are also rich grounds for the introduction of new approaches, adaptation and opportunity for growth in integrating new knowledge, skills and evolving cross-disciplinary expertise. For the student, this represents an opportunity for potentially significant added value in their learning experience through a broadening of perception and an introduction to new relationships beyond their expectations.

Boyer's Scholarship of Application extends these integration issues to the building of new expertise and practice in addressing complex problems in a scholarly manner, and then in the real world: this application to a broader context is what Boyer terms the Scholarship of Engagement (Boyer 1996, p11). In large measure, this shift in conceptual positioning reflects the necessary transition from intellectual engagement in academic pursuits (as is typically the case in higher-education teaching and learning environments) to a refocusing on using that same intellectual engagement with new knowledge and skills in resolving real problems in the real world in real time (Braxton & Luckey 2010). Whilst "application" and "engagement" are typically seen within academia as the mechanisms through which faculty members demonstrate their scholarship abilities through publication, applied research and industry and civic relationship building (O'Meara 2010), for the student it has often taken the form of "work-integrated learning" and internship placements. However, the greater challenge that is laid down by the scholarship constructs of application and engagement is for both faculty and graduates alike to use theory and practice to change the world (Fitzgerald et al. 2010).

The fourth component of Boyer's model, the Scholarship of Teaching, not only focuses on the classroom, but has strong relevance to the role of the project/thesis supervisor. Boyer clearly considers this to be a critical and potentially integrative component in his classification system: "It is the scholarship of teaching that keeps the flame of scholarship alive" (Boyer 1995, cited in Glassick et al. 1997, p2). The progressive shift from a focus on the structure and practice of teaching to a focus on the form and function of learning has been a growing characteristic of the education field over the past 20 years. In turn, this has required a rethinking of the role and purpose of teaching, to where it is increasingly seen as a means to the far more complex and powerful construct of learning. Yet, teaching itself remains not simply a means to an end, but is in itself a growing and complex set of evolving knowledge and practice. As a form of scholarship, it requires active research and enquiry, continuing integration of new knowledge and practice and a level of dedicated engagement and participation in the processes of learning and its application to the real world.

Subsequent research and critique of Boyer's classification scheme has seen both support for its central theme, and arguments to extend and broaden the interpretation and application of his scholarship constructs. In particular there have been calls for mechanisms to evaluate what is meant, implied or interpreted, and the results of actions from the use of "scholarship" as expressed in Boyer's framework (Glassick et al. 1997). Researchers have also pointed out the need to extend the experience and meanings of scholarship in its various forms across the educational community at large (Huber & Hutchings 2005; Hutchings et al. 2011).

Boyer's concerns are reflected in the works of other writers and theorists, although at times difficult to extract and focused on different aspects of the overall theme of teaching and learning in higher education. Indeed, many writers (including Boyer) have largely placed their attention on developing and enhancing pedagogy-oriented teaching and learning in undergraduate programs; however, many aspects (though not all) of adult education are generic across program boundaries, whether undergraduate, postgraduate, coursework-based or research based, and across disciplines.

As a particular example, Ramsden's study of teaching and learning in higher education provides particularly relevant insights into the array of strategies available, their location within particular theoretical frameworks and their relation to the constructs of "surface" or "deep" approaches to learning. His "Theory 3: Teaching as making learning possible" (Ramsden 2003, p110) confronts lecturer and thesis supervisor alike with the challenge of developing active student-teacher-supervisor engagement with the subject matter. This in turn reflects Ramsden's core determinate of developing pertinent curricula, implementing relevant teaching strategies, designing appropriate student-teacher-supervisor interaction and encouraging learning processes that collectively create a learning environment conducive to "deep" approaches to learning:

> *Deep approaches generate high quality, well-structured, complex outcomes; they produce a sense of enjoyment in learning and commitment to the subject. Surface approaches lead at best to the ability to retain unrelated details, often for a short period of time. As they are artificial, so are their outcomes ephemeral* (Ramsden 2003, p80).

Marshall (2009) specifically addresses the potential for developing higher levels of cognition and intellectual engagement through incorporating thesis or dissertation requirements into curricula:

> *Projects and dissertations have always been seen as an effective means of research training and of encouraging a discovery approach to learning…. Such an approach is*

> *aimed at the development of higher level cognitive skills such as analysis, synthesis and evaluation* (Marshall 2009, p151).

It is a postulate of this paper that it is possible to build a theoretical viewpoint on Boyer's scholarship classifications, and in particular his "scholarship of research", that can bring together a viable teaching and learning strategy for the role of minor-thesis engagement, and specifically its inclusion within curricula at postgraduate coursework level. The approach of incorporating research skills as a core component in university business- and management-related curricula is exemplified by the works of the late Professor Bill Zikmund (vale 2010), Professor Uma Sekaran and many others, who have consistently asserted that business research is an important managerial tool that can significantly influence the quality of management decision-making (Zikmund 2003; Zikmund et al. 2010; Sekaran & Bougie 2011; Cavana et al. 2001). There is significant argument made for the development of business-related research skills that use systematic and objective processes for collecting, collating and analysing business- and management-related data. Zikmund et al. (2010) also clearly place research activity within the purview of epistemology and the search for knowledge, asserting a definition of the practice of research: "The term [research] connotes patient study and scientific investigation wherein the researcher takes another, more careful look at data to discover all that can be known about the subject" (Zikmund et al. 2010, p5).

However, the implication that a student may, through careful and patient study, "discover all that can be known" reflects a number of anomalies and misconceptions about the very nature of research as perceived by the academe and students alike. In essence, research is the means by which we explore, observe, apply the tools and instruments of analysis and formulate conjecture. The likelihood of this ever achieving "all that can be known about" a given topic or subject of investigation is exceedingly unlikely (Magee 1973; Papineau 2004; Popper 1972). Instead, it is important that students are aware that they face a challenging world of uncertainty with continually moving boundaries when entering into research-related activity, whether in the context of coursework programs or fully research-based programs.

Whilst it is possible to identify the characteristics or generic focus of thesis preparation as identified in university course guides and assessment outlines for particular programs, these vary widely in both detail and complexity. However, for all the variations, it is clear that the learning experience of "thesis", whether minor or major, is premised on a supervised academic activity undertaken within locally defined guidelines and subject to rigorous assessment, with clear implications for and expectations of demonstrated "scholarship" capabilities. The student needs to demonstrate clarity of purpose and the application of critical thinking within the parameters of discipline defined theory and practice. The academic supervisor needs to ensure that there is clearly demonstrated compliance with the expectations for scholarly engagement with the subject matter, and that relevant issues identified in the research have been raised and discussed adequately within the constraints and requirements of the program area.

The relevance of the above viewpoints on scholarship, teaching and learning to thesis work is clear. The role of supervisor/teacher is critical to encouraging the student to engage with the subject matter and to providing an enabling, scholarship-oriented environment that actively engenders a pleasure and enjoyment in learning and in the challenge of the unpredictable. This is the realm of the "palpable excitement" of Boyer's "life in an educational institution" (Boyer 1990, p17) and the "enjoyment" that Ramsden (2003, p95, p98) speaks of. Yet there are other, more pragmatic or prosaic ways of thinking about the various theoretical constructs and associated processes involved in research. These include, but are not be limited to: relevant research design, clarity and definition of stated purpose and intent, perceived need and potential benefits, definite

and achievable research objectives, relevant and answerable research questions, definable research methodology, reliable data-collection strategies, appropriate measurement regimes and rigourous approaches to analysis and argument development.

However, even these traditional, essentially positivist foci for research practice are being challenged in the light of more contemporary approaches to business- and management-related curricula and the educational use of research as a viable teaching and learning strategy (Cassell & Lee 2011). The central issue is that of expanding the space of learning. This invokes shifting students out of the established textbook/lecture orthodoxy of a directed and positivist tradition of thinking (Cassell & Lee 2011 p2), to the far greater challenge of encouraging students to determine for themselves their own approach to a problem or issue and selecting and applying – and perhaps even developing – their own choice of appropriate research strategies.

What value, then, does the formal inclusion of research activity provide or add to a curriculum? How does it contribute to, enable or enhance student experience and quality of learning? Cassell and Lee (2011) explore these issues and questions as well, addressing them as components in key issues in the growing area of business- and management-oriented research. In effect, these new areas of argument and challenge produce a shift in the underlying purpose for the presence of research in academic curricula: away from the traditional construct of academic ownership of research as a particular strategy to set in concrete previously taught concepts, to one of pro-actively producing a new category of research-skilled graduates, capable of both critical reflection and rigorous analysis and willing to challenge the historical bastions of business and management education and practice. Given the demonstrable failure of so many historically informed and structured management decisions in recent years, and the resultant global economic crises, this has the potential to significantly shift the ground on which a wide range of academic curricula in management-related programs have been constructed.

Case Study: Master of Engineering Management

The Master of Engineering Management is a typical coursework-based postgraduate program. It specifically aims to challenge students to demonstrate that they can meet increasing industry and government demand for knowledgeable, creative and responsible leadership in managing technology-based organisations and systems. Since its inception in 1996 the program has graduated more than 300 students, with approximately 10% continuing on to doctoral studies both in Australia and internationally. An average of more than 50 students is active in the program at any one time, 90% of whom come with academic backgrounds in the engineering disciplines. Whilst the program is primarily targeted at engineering professionals, it also attracts participants from various technology-related backgrounds. The essential focus of the program is to develop students' skills and capabilities in thinking strategically; challenging established practices and norms of industrial behaviour; developing innovative approaches to managing an ever-changing technology base; developing a systems approach to problem-solving; and addressing opportunities for developing competitive advantage. Students are exposed to and encouraged to address and engage with real-world issues, and to assume responsibility for their own learning and key directions for their investigative/research activities. Currently, the program is structured as one-third core coursework, one-third elective coursework and one-third mandatory investigative case-study and research activity.

The pedagogical design of the program has progressively evolved from an original focus on classroom-based teaching with limited opportunity for divergence from a fixed set of curricula and

assessment requirements, to a more flexible structure that gives students choice and control over 66% of their program, as well as choice in delivery mode. Pedagogical adaptation has seen a significant shift from the lecturer as a central and controlling authority figure to a more collegiate form of engagement. The design and introduction of independent-learning guides and the subsequent development of more-flexible online delivery have offered students a wider range of teaching and learning modes.

The inclusion of the investigative and research component in an otherwise coursework-based program was a response to widespread discussion of the "Review of Engineering Education" undertaken by a joint Task Force of the Institution of Engineers Australia, the Academy of Technological Sciences and Engineering and the Australian Council of Engineering Deans. This review identified the need for a culture change in engineering education focused on producing graduates capable of leading the engineering profession in active engagement with the continuing reality of increasingly frequent social, economic, environmental, and cultural challenges and technological transitions (Institution of Engineers Australia 1996).

Given this background, the engineering management minor thesis sequence was initiated in 2000 with a one-semester research-methods course, during which students develop an initial research proposal identifying a problem or opportunity, developing a research methodology and approach and identifying appropriate investigative strategies. The research activity is carried out throughout the following semester through a formal literature review and data collection, collation and analysis. The third semester involves the formal writing and submission of the final minor thesis, expected to be on the order of 15,000 to 20,000 words. This full sequence is individually supervised by an academic supervisor. Students are encouraged to determine their own choice of topic, albeit in consultation with the Program Director and potential research supervisor. This individual selection of research topic results in a very wide array of topics being addressed. It should be noted that local students working in industry invariably negotiate topics of direct relevance to their workplace and with the support and encouragement of their employer. This provides a unique opportunity for the program and its academic staff to actively engage with industry through student participation in addressing real-world, industry-based issues. Typically, 20 to 25 students take the minor-thesis sequence each semester, with the program's academic staff supervising three to four students each, based on their own research interests and expertise.

The following recent successfully completed research topics typify the range and complexity of issues addressed:

- Application of New Technologies and Systems in Bushfire Management;
- Quality Management Issues in a Global Supply Chain;
- Predicting the Impact of Planned Outages on a Electricity Power Grid;
- Measuring Employee Performance in an Automotive Company;
- Improving Clinical Engineering Services in the Healthcare Industry;
- Developing an Integrated Management System: Environment, Safety and Quality;
- Impact of Government Legislation on Project Management Methods;
- Identifying Constraints in Technology Leadership;
- Effectiveness of Knowledge Transfer and Knowledge Management Systems in a Large Organisation.

The curriculum structure and supporting materials for this investigative research component are largely drawn from the body of published works on applied research, business research, technological innovation and change management, plus elements from social research, given that

beyond the more obvious technology issues, engineering firms are made up of people, with all the attendant concerns and issues that social structures and interrelationships bring with them. This overall approach is based on the view that research is essentially a complex process, inevitably reflecting the interests, values and expectations of its proponents (Cavana et al. 2001, p8).

The relationship between student and supervisor is primarily focused on helping the student develop a rigorous and independent approach to analysis, particularly through encouraging the student to apply strategic and innovative thinking and critical reflection to key issues, and to integrate discipline-based theory and practice in both the research process and findings. The student's specific responsibilities lie in demonstrating a capability for conducting rigorous and independent investigation and analysis of project findings and the exploration and understanding of key issues, and for identifying potential future applications and broader engagement.

Table 1: Comparison of Minor and Major Theses

	Minor Thesis	Major Thesis	Convergence or Differentiation
Problem or Opportunity Definition	Invariably pragmatic in orientation and primarily focused on developing understanding about what is known about a potentially esoteric issue.	May be more esoteric in nature, although invariably focused on investigating in-depth some specific real-world problem or issue with a future orientation.	Clarity of purpose and intent critical to success in both.
Context Development and Scope	Often a broad context but with limited scope, which is essential for realisation within time and resource constraints.	May be more detailed in development of context, with more intensely defined and focused scope.	Potential for minor-thesis approach to explore initial area of understanding prior to more intensive activity in a major thesis.
Currency and Future Orientation	Primarily focused on "currency": what has been evidenced and is now known to be.	Primarily focused on growth of knowledge with a strong future orientation.	Potential to view minor thesis as documenting known facts, on which a major thesis may build new findings.
Methodology and Theoretical Positioning	Limited but rigorous, with demonstrated competence in research methodology and practice.	Extensive and rigorous, with demonstrated advanced competence in the field of interest.	Potential to use minor thesis as a tool to establish appropriate methodological approach for major thesis activity.
Strategy Development and Orientation	Often focused on meeting short-term requirements.	Primarily focused on meeting stringent longer-term demands.	Potential for minor thesis to provide initial testing of ideas from which larger-scale research may be developed.
Knowledge Base	Largely focused on developing understanding of what is known and practiced in current contexts.	Largely focused on expanding barriers of knowledge through adding new knowledge and potentially leading to new practice.	Need to understand what is known before attempting to address what is not known.
Commercial Opportunity	Limited but possible, typically speculative in nature.	A critical expectation of significant contribution to potential commercialisation.	From short-term opportunistic advances to longer-term strategic alliances.
Publication Potential	Clarity of discussion and critical exposition, with excerpts suitable as conference papers.	Compelling/defensible argument suitable for major publication.	Both provide opportunity for formal publication.

Table 1 gives an analysis of the curriculum documents for this coursework program and other more research-based programs, and compares the minor and major theses against a limited set of

typical thesis characteristics, particularly with regard to a future role for the minor thesis as precursor to more formal research activity. Note that these reflect key characteristics referenced earlier in the discussion on perceptions of scholarship in thesis development.

Pedagogy and Related Teaching and Learning Issues

In general, the processes of supervision that apply in minor thesis work do not differ greatly from that of supervising formal research theses, in that outcomes are expected to demonstrate a clear understanding of a stated problem or opportunity and develop, implement and test solutions in defined contexts. Where differentiation does exist, it appears to be largely in relation to the extent or scope of the research undertaken and the expected depth of detail and extended rigour of analyses being applied. The pedagogical attributes of the minor thesis are strongly oriented towards the development of both theoretical and practical understanding and competencies in research methodology (as discussed above); the application of program tenets to develop understanding and, potentially, the resolution of an identified issue; and a value-added experience of effective and enlightening supervision.

The current graduate attributes and associated course and assessment requirements listed for a minor thesis in Table 2 also identify students' expected characteristics, thus provide insights into the potential needs and direction for minor-thesis pedagogy and successful, value-adding supervision. Whilst reflecting a commonly used approach to identifying how a particular program or course will contribute to student growth in skills, knowledge and expertise, it also identifies the generic core areas on which supervision must necessarily focus, and in which all of Boyer's scholarship ideals may be applied.

Table 2: Graduate Attributes for Master of Engineering Management Thesis (derived from McLay 2012a)

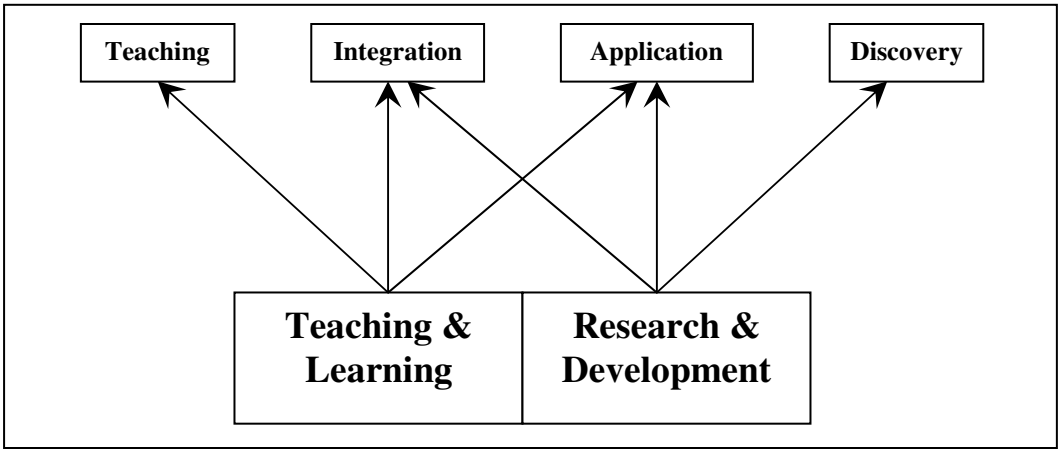
Graduate Attributes	How Course Addresses Attributes	How Assessment Addresses Attributes
Knowledgeable	Develops knowledge and understanding of key concepts.	Requires demonstrated understanding of key issues.
Creative	Encourages creative approaches to resolving real-world problems.	Provides opportunity for creative problem-solving.
Critical	Provides opportunity for critical reflection on key issues and development of critical thinking.	Requires in-depth critical argument.
Responsible	Develops theme of industry taking responsibility for its actions	Requires development of strategies reflecting responsible thinking and actions.
Employable	Develops strategic management skills.	Requires demonstrated capacity for strategic thinking.
Life-long Learners	Encourages students to continue to explore and develop themes and issues of specific interest.	Provides framework for extending learning activities beyond direct scope of current course/program.
Potential Leaders	Strongly emphasises leadership potential and identifies key areas requiring current and future leadership.	Requires student to take an active leadership role either in group activities or in development of assessment materials.

Clearly, though, it does not provide either the specifics or the metrics for an interpretation of exactly how individual theses may meet the required attributes. For example, how is the graduate attribute "knowledgeable" to be interpreted in the context of the minor thesis and in relation to the

role of the supervisor? Is it to be directed only at developing understanding in the key discipline-based areas of knowledge? Or could it be interpreted as incorporating the methodological approaches, strategies, rationale, intent and purpose in a particular area of research activity? For the supervisor, this may in turn provide challenging variations in demand for an interest, and for skills in strategic thinking about issues, purpose and intent, versus a detailed and technically specialised background.

It is not uncommon for minor-thesis students to say, "I am interested in … but I have no real working knowledge about it." For the supervisor this raises immediate concerns about the perceived necessary conditions or level of entry knowledge and skills required to undertake meaningful research activity. On the other hand, it also indicates an opportunity for the student to experience real growth in understanding! It is also typical of the election to investigate an emerging area of research interests where little or no background data or information is readily available. Developing skills to help students address these challenging new areas is clearly relevant to both major- and minor-thesis supervisors. The supervisor must make sure students have the opportunity to identify and engage in creative problem-solving strategies, reflect on key issues and engage in critical thinking as a "deep learning" strategy (Ramsden 2003; Biggs & Tang 2007) that applies cognitive processes to resolving challenges and enhancing engagement in developing in-depth arguments. All this is in the context of also ensuring opportunity for students to develop leadership skills and a disciplined and imaginative creativity that builds and extends intellectual endeavour.

Figure 1: Boyer Scholarship Model (as referenced in RMIT Teaching and Learning Strategy 2000-2002)



It would seem then that some thought is needed on what constitutes core purpose and intent for the introduction of a minor thesis and its actual role in the implementation of the Boyer model of scholarship in postgraduate programs. What is it meant to do? What purpose does it serve in the overall scheme of developing demonstrable knowledge, skills and expertise through identified processes subjected to the demands of academic rigour, requirements for expression of independent thought and action and compliance with specific assessment criteria? Further, how is this core purpose to be translated into Boyer's classifications of scholarship in a concrete way?

In the particular minor-thesis example outlined above, the thesis activity is structured as a three-semester sequence. In the first semester the student is largely engaged in class-work/coursework-based learning that directly and intensely involves the processes associated with Boyer's Scholarship of Teaching. Students are introduced to the theoretical underpinning of research methodologies. What are they? Who developed them? When were they developed? Why do we have them? How do we use them? What does it all mean in the broader sense of individual and related discipline areas? What are the connections between theory and practice and how are they formulated in relation to the student's own selected research topic (McLay 2012b)?

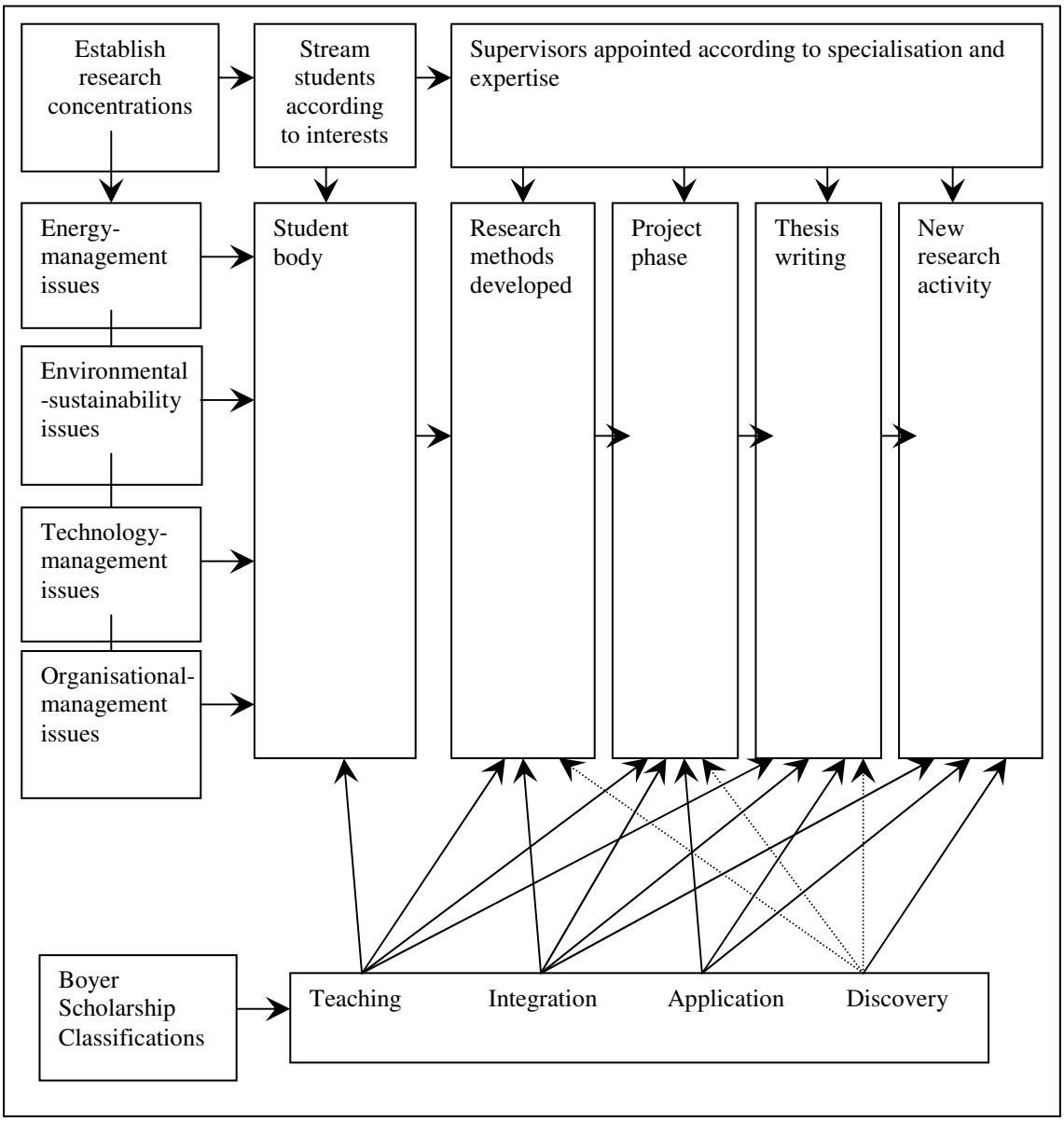
Within a lecturer-directed environment, open discourse with peers and staff develops the self-directed and disciplined learning process so essential for the successful researcher. Thus, the minor thesis clearly commences within the ambit of the Scholarship of Teaching, the quality of which will largely influence the direction, structure and potential success of the subsequent research activity. The supervisor's role here is clearly pivotal as the student prepares to identify and go through the processes of formal problem or opportunity definition and the matching of these against the options for developing a formal research methodology and approach.

The minor-thesis process further progresses through the Scholarship of Integration as students grapple with how to design and construct a meaningful and effective research strategy. At this stage, students and supervisors typically find themselves having to operate across discipline boundaries. Engineering students, for example, suddenly find themselves faced with having to explore issues related to social science, health, or business. This broadening of perceptions and valuing of other discipline bases can play a significant role in the development and maturing of a successful researcher and, by extension, a quality graduate.

As the student then proceeds to implement the selected research strategies and faces the all-too-often confusing task of resolving the many pragmatic and conceptual issues that face and challenge all researchers, the supervisor must again take on a challenging and pivotal role if Boyer's Scholarship of Application and Scholarship of Engagement are genuinely to bring theory and practice together in scholarly service to address real-world concerns.

More difficult to perceive is the application of the minor thesis to the Scholarship of Discovery. Experience has shown that occasionally minor-thesis students do make that unique breakthrough that produces something new, or at least a new insight into an old problem or issue. It is perhaps here that a new role for the astute supervisor can be argued for: to be able to identify when a piece of minor-thesis work begins to approach boundary conditions and to raise conceptual or practical challenges that demand further empirical attention in a more formal or major research environment. In terms of the Boyer scholarship model, there would appear to be a prima facie case that the minor thesis has a serious role to play, at least in connecting, and potentially operating across the scope of, the four scholarship areas, particularly when it leads to major research.

Figure 2: Relationships Between Minor-Thesis Students, Supervisors, Activities and the Boyer Scholarship Classifications



Proposed Future Models for Minor Theses and Relationship to Major Thesis Work

The generic theme discussed throughout this paper of using the minor thesis as an introduction to, or providing background development for, subsequent formal research has developed from the reality of many past coursework students returning to discuss taking their minor thesis into formal PhD research or industry-based project activities. This has included projects focused on opportunities to enhance technology management and related governance issues, and both government- and industry-supported research and development projects (one particularly successful example can be seen at http://amcrc.com.au/rmit-student-prize-winner).

This approach, then, provides a possible basic framework for thinking about the future role of the postgraduate minor thesis as an effective research medium and the developing role of the postgraduate minor-thesis research supervisor. In the case of the Master of Engineering Management program, there would seem to be a strong case for defining specific areas of research concentration within the minor-thesis program itself, supplementary to and supporting the research and development concentrations already defined within the existing department and school structure.

Figure 2 provides a possible framework for thinking about the relationships between minor thesis students, supervisors, activities and the Boyer scholarship model (exemplar research concentrations are derived from the Engineering Management discipline area).

Perspectives on Minor-Thesis Supervision

In effect, this reflects a significant paradigm shift in teaching and learning within an otherwise coursework-based program. The requirement is for a move from the coursework world of clearly defined and stated learning objectives with required outcomes stated in tightly defined, and very often discipline-specific, language. Instead, students and supervisors should move to a differently defined and yet rigorous world of exploration, explanation and potential discovery, albeit still within the common bounds of the home discipline. This reflects the Boyer Scholarship idiom of moving from teaching, through integration and application, to the potential for discovery and active engagement in bringing theory and practice to bear in resolving real-world problems and issues.

For the coursework academic turned supervisor, this may well prove to be quite daunting, at least initially. Yet, the initial processes of preparing for supervision would appear to call for a no-less-structured approach than effectively preparing for a successful classroom-based lecture series. For example, the following short list of supervision tasks clearly requires preparatory thought and a goodly proportion of duty of care:

- Ensuring that both student and supervisor are alert, aware and committed from the outset to the application of rigorous and systematic methods throughout the research activity (whatever the methodological regime may be).
- Clearly articulating the processes of problem or opportunity definition that may apply to the specific field of enquiry, and ensuring there is agreement on the actual purpose and intent of the activity, the research questions to be addressed and the locus of the research focus.

- Guiding the novice researcher through the maze of research-methodology selection to ensure coherence between stated purpose, formalised research approach and subsequent research activity.
- Advising on effective research design, given the specific field of enquiry.
- Facilitating access to appropriate tools for data collection, collation and analysis, whether software, hardware or conceptual frameworks.
- Ensuring currency with relevant contemporary theory and practice.
- Determining an appropriate level of complexity and completeness for the work as a whole.
- Ensuring that the rights and obligations of researcher and researched are met in an ethical manner in keeping with university, societal and legal obligations.
- Being alert to the possibilities of uniqueness, innovation and change, whether embedded in approach or in formalised findings.

Conclusions

Clearly, the role of the minor-thesis supervisor reflects many of the characteristics of major-research supervision. The outcomes of major or minor research may differ in terms of their extent and focus on adding to a given discipline's body of knowledge and practice. However, their core purpose and intent as effective mechanisms for initiating and promulgating research skills and related discipline-specific scholarship lie along similar, if not effectively parallel, paths, whilst the array of supervision skills and expertise required to achieve satisfactory scholarship appears to differ very little.

Research supervisors, whether involved with major postgraduate research programs or postgraduate coursework-based minor theses, have considerable intellectual challenges to address in the processes of supervision to ensure the development and execution of rigorous scholarship. The above discussion highlights areas in which supervising postgraduate minor theses as significant research-focused components of otherwise coursework-based programs can be directly linked to both developing new major research and conforming to the Boyer Scholarship Model.

In particular, this may involve extending the role and purpose of the minor thesis to more directly engage in and address all of the Boyer scholarship classifications, with a particular emphasis on the Scholarship of Discovery and Boyer's later perception of a Scholarship of Engagement. Directing a student's potential entry into the world of research toward addressing real and present needs, at least in a preparation stage for subsequent formal research, clearly requires that expectations for rigor in research method and approach are genuinely reflected in the scope and quality of scholarship in the minor thesis and its effective supervision.

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