Integrating Research and Teaching in Construction Management Education: A Practical Approach

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Integrating new knowledge with teaching is important in student centred learning activities. The link between research and teaching needs to be formally created in higher education departments in order to achieve integration. This leads to a new relationship between research and teaching faculty. The aim of this paper is to simplify the application principles and approaches to ensure sustainable integration. It can only be accomplished through collaboration between practitioners, students and faculty. The PSF (practitioner/student/faculty) model and framework is proposed in pursuit of this objective.

Keywords: Built environment, Research, Teaching, Learning and Knowledge

Introduction

This paper presents the findings of a research study aimed at exploring the knowledge transfer process from research into teaching in built environment education. The study is ongoing and is primarily based on the findings of Amaratunga and Senaratne (2009), as presented at the ASC Conference, and previously contained in their final report (2006) named "ReKnowiT" where the seven principles of integrating research into teaching were introduced. The research methodology of this study is similar to theirs with an added active research element in order to develop a model. Conclusions on the application of their transfer principles of research into teaching with regard to construction management are offered. According to Baldwin (2005) the University of Melbourne's research activity and research culture should permeate into teaching and learning through a list of approaches. Both theories are summarised in table 1 in an attempted broad correlation between principles and approaches.

Table 1

Generic principles and approaches to integrating research into teaching

	Senaratne and Amaratunga's *principles*	University of Melbourne's *approaches*
1	"Effective research-active" academics are "natural research-informed" teachers	Drawing on personal research in designing and teaching courses
2	Critical thinking is stimulated through research training as well as knowledge and application of effective teaching methods	Placing the latest research in the field within its historical context in classroom teaching
3	Appropriate balance of research and teaching workloads lead to experienced research-active staff engaged in teaching across all levels	Conducting and drawing on research into student learning to make evidence-based decisions about teaching
4	Research-informed teaching is stimulated through formal processes to transfer research into teaching	Teaching research methods, techniques and skills explicitly within subjects
5	The maintenance and evaluation of formal transfer process' success through assessment of the student-learning that followed such a transfer	Building small-scale research activities into undergraduate assignments
6	An appropriate balance between formal and informal processes will result in research into teaching becoming departmental culture	Involving students in departmental research projects Encouraging students to feel part of the research culture of departments
7	Academic Communities of Practice to be created by the university to disseminate research knowledge to a wider community	Infusing teaching with the values of researchers Designing learning activities around contemporary research issues

Contextual Issues

It is appropriate to reflect on the built environment disciplines as a point of departure. According to Griffith (2004) the built environment consists of characteristics that make exploring the research–teaching nexus fruitful. He proposed a greater emphasis on multi-or interdisciplinary ways of thinking, and on embedding knowledge in the context of problem solving, policy and professional practice.

Brew & Boud (1995) found the correlation between research activities and teaching performance to be low. They suggest that the debate should concentrate on the link between the two, namely: the act of learning (with the emphasis on ways in which knowledge is generated and communicated). According to Healy (2005) the relationship ultimately depends on how the terms 'research' and 'teaching and learning' are conceptualized. Robertson (2007) looked at their inter-relation. Spronken-Smith et. al. (2007) researched the effectiveness of the learning method as contributing factor. Rowe and Okell (2009) focused on the nexus as a goal relating to employability. Trowler and Wareham (2008) pointed to the importance of defining the terms and placing them in context. Lucas et. al. (2008) drew attention to the diversity in discipline and institution. Jenkins and Zetter (2003) and Jenkins (2004) pleaded for focus on discipline and department and concluded on a number of aspects contained in the following two tables.

Table 2

Jenkins and other authors' conclusions on the contribution of individual academic's research to the research-teaching nexus, and its impact on students.

Conclusions by various authors on the individual academic's research contribution (Jenkins, 2004).
1. An enduring myth - that good teachers are good researchers.
2. Teaching and research are loosely coupled
3. No simple functional relationship.
4. Student dissatisfaction with research-orientated faculty.
5. Teaching and research orientations differ.
6. Academic identities differ.
7. Differences in conceptions of teaching and of research.
Jenkins' (2004) conclusions on the individual academic's research contribution
1. At the level of the individual member of faculty, the simple models of faculty that are heavily productive in research outputs, being the most effective teachers, or that high productivity in research results in effective teaching, are clearly suspect.
2. There is no indication of the extent to which faculty involvement in research is necessary or important for effective teaching. It does not help in the differentiation between the types and levels of knowledge necessary for effective teaching in different disciplines, types of institutions or levels of the curriculum, e.g. introductory courses. At best we can make informed judgments on these and other issues from reflections on practice.
3. Some faculty's motivations to work in higher education are shaped by strong values of the importance of a teaching-research nexus, with significant disciplinary differences.
4. How academics conceive teaching and research may be central to understanding the relationships and how they might be linked.
Jenkins' (2004) conclusions on the impact of research on students
1. There is clear evidence of students valuing learning in a research-based environment.
2. Students vary in their attitudes to staff research. As one would no doubt predict, those with a more academic orientation to their studies are more positive to staff research. This may be linked to the specific discipline or the culture of the discipline.
3. From one UK institution there is evidence that postgraduate students attach greater importance to learning in a research-based environment and these students wanted that research to be salient to their curricular concerns.
4. There is evidence that these institutions and departments may not be effectively supporting students to obtain maximum value from these opportunities, or managing the negative impacts.
5. There exists limited evidence of the impact of research-based learning on student epistemological and intellectual development.

Table 3

Jenkins and other authors' conclusions on the contribution of disciplines on the research-teaching nexus.

Other authors' conclusions on the role of disciplines on the research-teaching relationship (Jenkins, 2004)
1. Research cultures and practices. There is a strand that identifies different research cultures, practices and disciplinary types and how disciplines shape pedagogic cultures and practices.
2. Research organisation and scholarly-research connections.
3. The role of professional societies. In some of the professional disciplines, professional requirements for accreditation may support or obstruct faculty drawing connections between teaching and research
4. Student perspectives. Students vary in their attitudes to research. It is possible that students with different conceptions of knowledge, of the role of universities and of obtaining a degree will choose different disciplines and thus shape the disciplinary pedagogic culture.
5. Where are the research frontiers in relation to the curriculum? In some of the sciences, faculty research may be so far ahead of the undergraduate curriculum that making strong connections between faculty research and student learning is very difficult.
6. Hierarchical disciplinary knowledge structure.
7. The key role of practice in shaping knowledge and the curricula.
8. The role of 'Mode 2 knowledge' in professional disciplines. In a knowledge-based society, research and consultancy skills are key attributes in vocational and professional fields like the Built Environment.
Jenkins' (2004) conclusions at the disciplinary level
There is growing research indicating that there are important disciplinary variations in teaching-research relations.

Wynn (2003) pointed out that built environment departments are over-enrolled in student numbers, resource capabilities are stretched and that departments are under-staffed on faculty resources. White and Irons (2008) explores the potentially beneficial relationship to faculty, students, and stakeholders through research-led, research-informed or just plain scholarly methods. This method was echoed by Griffith (2004).

According to Griffith (2004) the production and validation of knowledge, in the built environment, appears to operate according to different principles than other disciplines, suggesting that conventional or generic ideas about the research–teaching nexus may have limited applicability in the built environment.

Research Methodology

The research was conducted within the broad guidelines and methods similar to that of Amaratunga and Senaratne (2009). According to Amaratunga and Senaratne, the case study method is considered most suitable for this type of research. This study, however, was based on a single case study, which is of exploratory and explanatory nature. The case study was conducted by identifying the unit of analysis and a sampling strategy. The unit of analysis considered was an academic department within a university, while the study expanded to individual and university levels where appropriate. The sampling strategy was limited to the department that focuses on a vocational discipline, namely construction management. The aim of this case study was not to explore the research and teaching link in academic departments beyond the construction management discipline.

Specific objectives were formulated to determine the degree of agreement / disagreement with the stated findings of Amaratunga and Senaratne (2009). These are: to identify possible issues in transferring research knowledge into teaching in the department / discipline; to identify specific enablers and barriers in creating this link in the department / discipline; to identify best practices in the department / discipline; and to discuss further suggestions to improve the link in the department / discipline. The data collection methods also included semi-structured interviews and document surveys were used to triangulate data. The interview sample mainly comprised of academic staff and graduate students and alumni.

Issues listed in the results section are the same as those contained in Amaratunga and Senaratne's (2009) paper.

Results

With regard to key issues on research to teaching transfers, our respondents agreed that:

- *Academics need to be practitioners as well as teachers.*
- *Informal practices are in place but formal strategies are equally important.*
- *It is important to identify what aspect of research needs to be transferred to students.*
- *Research expertise of staff should increase with the level of studies.*
- *Part-time students expect practical knowledge more than research knowledge.*
- *Students do not link their objective of getting a marketable degree to research.*
- *Faculty is motivated when their teaching modules are closely related to their research activities.*

but some of our respondents were unsure whether:

- *Curriculum limitations allow for linking teaching modules and research activities.*
- *It is difficult to match the actual real world research and the teaching module objectives.*
- *The research that faculty are doing is not directly relevant to teaching programmes.*
- *It is problematic to mainly focus on research output, i.e. publications.*

and our respondents disagreed on whether:

- *The ideal situation is to transfer research indirectly to teaching.*
- *People who do research are better at teaching.*
- *The difficulty of research in subjects is due to the diversification of subjects.*
- *Workload limitations make it difficult for academics to be active in research.*
- *It is important to gain skills like critical thinking. Research skills facilitate thinking processes.*
- *It is necessary for faculty to master research skills in order to teach students.*
- *Research into teaching transfer at different levels is different.*
- *Part-time students are more motivated as they know the benefit in terms of work prospects.*
- *Pressure to do research facilitates the teaching process.*
- *Organising teaching around research is easier.*

With regard to enablers of research to teaching transfers, our respondents agreed that:

- *Research strength in research-biased departments is another enabler.*
- *Recognised faculty and positive attitudes are seen as enablers within departments.*
- *Individual faculty motivation and the existence of research-active faculty are enablers to transfers.*
- *The existence of research institutes, funding opportunities and resources are key enablers.*

but some of our respondents are unsure whether the following can be seen as enablers:

- *The significance of including research in the mission statement of departments.*
- *University level drivers and management structure.*
- *External links with professional bodies, such as other universities.*
- *An inter-disciplinary working culture within the built environment.*
- *Applied disciplines research is more relevant with more opportunity to use research in teaching.*

and our respondents disagreed on:

- *Availability of modern and expensive equipment for research.*
- *The opportunity to use students in their labour-intensive research activities.*
- *In the built environment faculty's work is seen as research. .*

With regard to barriers on research to teaching transfers, our respondents agreed that the following are barriers:

- *In teaching-biased departments the common barrier is the absence of a research culture.*
- *In research-biased departments, barriers are high workload, time restrictions, etc.*
- *Less motivation and financial incentives for research faculty to do teaching.*

- *Barriers arising from students' lack of motivation and participation.*
- *Students expecting delivery of handouts rather than gaining knowledge through self-learning.*
- *The fear and risk factor, such as: student's ability, wrongly designed programmes; etc.*

but some of our respondents were unsure of:

- *The effect of inadequate funding and support given to individually motivated faculty to undertake research.*
- *Less interaction between academics, researchers and students to disseminate their research.*
- *A mismatch between faculty's research and teaching programmes.*

and our respondents disagreed on:

- *There exists a division between research-active staff and teaching-only staff in departments.*
- *Learning outcomes in module specifications limit the inclusion of research knowledge into teaching.*
- *Insufficient teaching is undertaken by research-active faculty.*
- *Experienced faculty should be teaching undergraduate courses, especially in the 1st year.*
- *The built environment focuses on industry requirements rather than faculty's research expertise.*
- *The aim of most students, nowadays, is to get a paper certificate.*

On good practices of research to teaching transfers our respondents agreed that the following are good practices:

- *Project-based working, problem-based learning and active learning.*
- *Programmes enriched with additional workshops, seminars and guest lectures.*
- *Faculty recruitments from research faculty and PhD students and initiation of new schemes.*

but some of our respondents were unsure of:

- *Engaging in research through academic enterprises.*
- *A student placement-based scheme in vocational disciplines facilitates the transfer process.*

and our respondents were in disagreement on:

- *Special modules that aim at delivering research knowledge within programmes.*

On suggestions to improve research to teaching transfers, our respondents agreed that:

- *Academics need to create a balance between teaching and research.*
- *Present barriers within departments should be overcome.*

but some of our respondents were unsure of the benefits of:

- *Formal mechanisms to boost informal research-based teaching.*
- *Innovative teaching through student-centred, problem-based learning mechanisms.*
- *Increasing interaction among all members to create this cultural change.*
- *Including research to teaching in the learning outcomes of module specifications.*
- *Introducing an equipment pooling mechanism so that resources can be effectively shared.*

and our respondents disagreed with the following statements:

- *Informal mechanisms rather than formal mechanisms.*
- *Students' awareness of staff research and access to other research activities is important.*
- *Using research staff effectively by encouraging them to a research profile with teaching duties.*
- *To overcome research funding problems create business based on cutting-edge research.*
- *Increase financial gains through academic enterprises and short programmes.*

Discussion

It appears that Senaratne and Amaratunga (2009) assumed consensus among their interviewees on all aspects listed above and therefore deducted their principles from the complete list. However, in comparison, our respondents indicated uncertainty and disagreement pertaining to a majority of these statements. This suggests that the seven principles are not necessarily generally applicable to all disciplines. Our results support a similar opinion expressed by Griffith (2004). In an attempt to address this possible discrepancy, action research was employed to develop a

model specifically for construction management. It is generally agreed that construction management differs from general higher education in many aspects and it might have been expected that Amaratunga and Senaratne (2009) and Amaratunga et. al. (2006) would have indicated whether they agree by highlighting this difference when they alternated between the built environment and other general education on the topic of research and teaching.

The principles on integration of research and teaching, suggested by Senaratne and Amaratunga (2009) and Amaratunga et. al. (2006), are discussed from a construction management viewpoint. It also serves the purpose of feedback on the practical application of the principles established on the topic. (Refer to table 1 on the first page.)

Principle One: It is preferable that academics are research-active, it is also logic as they are best equipped for the task. It should be a free and spontaneous activity that regards specific specialities, background, successes, opportunities, interests, etc. to produce research of exceptional quality. This might not relate to current teaching responsibilities of the particular academic. It should never be a forced and formal process. Research-activeness, as defined, is not a pre-requisite, or principle, to being research-informed and research success does not automatically lead to teaching success, and vice versa.
Principle Two: The attributes of critical thinking are attained by more than mere effective teaching methods that relate to learning methods. It should not be left to the academics only. Active student participation produces student-focused teaching.
Principle Three: The involvement of all members of faculty in all aspects of departmental research, teaching, practice and assessment thereof appears to be a vital practical arrangement due to a multitude of reasons of personnel related nature. The involvement could be by invitation and restricted to specific activities and need not be a permanent arrangement.
Principle Four: Research-informed teaching is stimulated through formal and informal processes to transfer research into teaching.
Principle Five: The maintenance and evaluation of formal transfer process' success through assessment and thorough feedback of the student-learning that followed such a transfer.
Principle Six: An appropriate balance between formal and informal processes will result in research into teaching becoming departmental culture. It is probably and unfortunately impossible to define "appropriate balance" and is in practice the origin of many faculty debates. A proposed framework should benefit even those departments with over-extended faculty members.
Principle Seven: Communities of Practice are by definition a very closed and private affair for the crux is that they assert influence on their members. It is debatable whether an "advisory panel" can assume the role of a Community of Practice. Universities should refrain from creating academic Communities of Practice but rather assist faculty to establish their own Community of Practice. Universities, on the one hand, should not force academics into Communities of Practice as it might defy the objective. It is after all only a 'very nice to have' capability. Faculty, on the other hand, should consider (and reconsider) the fostering of such a relationship.

Conclusions and recommendations

Construction Management students, graduates and registered professionals keep sending us, academics, messages that they need more than what we are delivering. We work harder to increase information and neglect research, we do not put out publications to keep industry informed, and we do not make innovative changes to the curriculum or teaching methods to align to an ever increasing variety of learning methods. Our department decided to approach it differently. We tried to implement new principles, guidelines and teaching models but could not get the process working. We then decided on a different model, one where we are the managers of the educational process and not the workers. We will, and did, fail as active workers in the process. The PSF model (Practitioner / student / faculty) on the next page is still in progress and is probably not the final product. We borrowed and adapted the model proposed by Amaratunga and Senaratne (unknown) and Amaratunga et.al. [2006, 2005, 2004(a) and 2004(b)].

In designing the model we concluded that practitioners are the key to our solution. We approach our alumni with a research suggestion or request them to produce one of their own from experience. Once the topic of research is identified, defined and discussed, the first of the logistics needs solving, namely, the number and experience of participating students. We then assign a member of faculty to the project and start working. The practitioner assumes the duty of research leader. Faculty features in an advisory capacity. Depending on the research topic we will assign dedicated workspace, internet connections and admin support through university resources. We decided to implement pilot programs, such as: building information modelling, value management, lean construction, etc. It is

limited to determining the extent of existing research knowledge and its interest and applicability to local conditions and practice. The intended outcomes are: (a) study manuals, for teaching purposes, and (b) research reports, for publication purposes, that result from practitioner generated, managed and / or directed research.

Not all students take part in the research project as enrolment is voluntary and based on merit. A subject will be registered for the purpose of research and practitioners will be invited to sponsor a particular student(s) involved in the research project(s) that interest them or that they are involved in. The sponsorships will be based on the performance of the student(s). When students are assessed as unsuccessful, they are removed from the project, held responsible for payment of any subject registering fees and receive a fail outcome. The failure of this subject should, however, not influence their graduation. It is of utmost importance to ensure that a project is completed within the academic year it is initiated, for reasons of, logistics, admin, student availability, etc.

The most important outcomes from this research projects are:

- Increased student / practitioner research participation, involvement, exposure and liaison.
- Direct student exposure and involvement to research-informed results.
- Exposure of research projects to research interested students.
- Limited time involvement of practitioners.
- Results will be published in accredited journals and conferences.
- The practitioners and community will be exposed to the research results through Continued Professional Development, Continued Education Programmes and student seminars.
- Students from the department will be exposed to the research results by the participating students and/or faculty at under- and/or graduate level.
- Students from the broader Built Environment will benefit through exposure during the 'capstone' project school presented on a yearly basis by the University of Pretoria's School for the Built Environment.
- Improvement in the assessment of construction management students' evaluation of themselves and by their peers from other departments due to increased knowledge, skills and competencies.

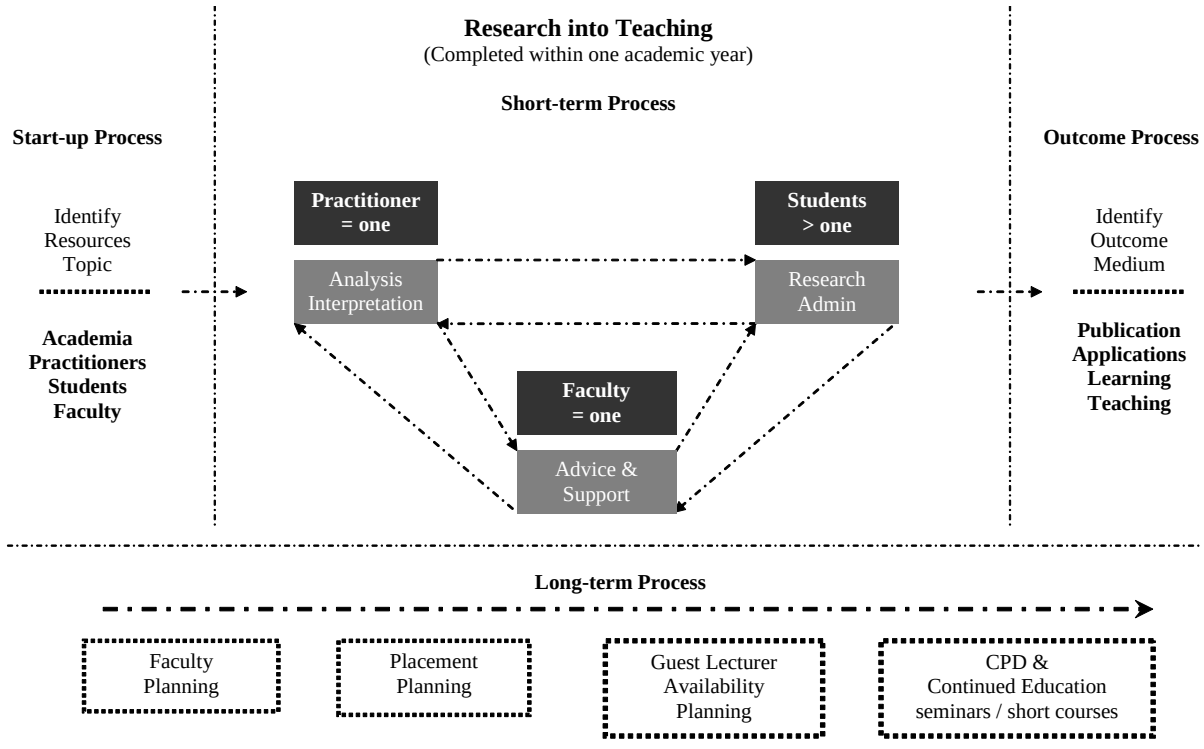

Figure 1 The PSF(practitioner/student/faculty) model for integrating research into teaching

On reflection, the above recommendations are not complete without reference to *the seven principles of good*

practice in undergraduate education by Chickering and Gamson (1987), namely: good practice encourages student-faculty contact, cooperation among students and active learning, gives prompt feedback, emphasizes time on task, communicates high expectations and respects diverse talents and ways of learning. The constant and *un-relentless* applications of *the seven principles of good practice* are as important to graduate education as it was proven to be for undergraduate education, and that includes construction management education.

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