

DEVELOPING AN UNDERSTANDING OF RESEARCH PRINCIPLES TO SUPPORT POST-GRADUATE EDUCATION IN THE BUILT ENVIRONMENT

Lloyd Scott¹ and Mark Shaurette²

¹ *Dublin Institute of Technology*

² *Purdue University*

Most research universities require some combination of standardized classroom teaching and independent research as part of a post-graduate level plan of study. Increasingly construction management, construction technology, architecture, and related programmes that award degrees related to the built environment (BE) are awarding post-graduate degrees. Frequently these degrees, unlike traditional engineering degrees which test theory from a quantitative or positivist position, relate to issues that are more difficult to measure using strictly quantifiable metrics. Because the managerial issues faced by these graduates deal with human interaction and behaviour, research in the BE often resembles social science research to a greater degree than traditional scientific research. As post-graduate programmes in the BE expand, there is an increasing need for student support in the research fundamentals that are required to complete valid research on construction and design issues. Small programmes can rely on the individual mentorship of students, but as student populations grow a more formalized approach is needed to support varying research methodologies employed by post-graduate students as they complete their thesis or dissertation obligations. This paper is an examination of the research fundamentals approach to post-graduate education being used by construction related research programmes in a sample of universities in the US and the UK/Ireland. Emphasis was placed on understanding the current educational support for the understanding of research fundamentals critical to research in the built environment. The paper utilizes both a literature review and a survey instrument. Specific areas of examination include information detailing the educational unit(s) within the university with responsibility for teaching research fundamentals, research fundamentals courses available, the research philosophy or approach emphasized, and the text or other literature support utilized to advance valid research design by post-graduate students. As academic processes develop at post-graduate level there appears to be a consensus that the need for research principles courses is accepted. Where the position differs is at what level this course should be offered.

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¹ Lloyd.scott@dit.ie

INTRODUCTION

College level educational programmes covering material appropriate for the built environment (BE) have experienced a long evolutionary process. In the early 20th century professional education in engineering or architecture was the typical path taken by students preparing for work in the BE. By mid-century some universities began to recognize that over and above teaching engineering and design, there was a need to add management knowledge and skill as educational objectives for future construction professionals. To meet this emerging need, engineering and architecture programs created areas of specialization for students interested in management of construction.

In 1974 an industry group and a group of university faculty (lecturers) teaching construction management (CM) worked to form the American Council for Construction Education (ACCE) in the United States to promote and accredit construction education programs. In the years since the ACCE was organized by the American Institute of Constructors (AIC) and the Associated Schools of Construction (ASC), it has accredited undergraduate programs that provide CM education primarily for entry level construction management professionals that have been in high demand (ACCE, 2009). Since the advent of accreditation specific to the BE, well over 60 universities in the US have worked through the ACCE to accredit their programme while another dozen are candidates for accreditation. This growth in accredited baccalaureate degree programmes is a testament to the recent demand for college educated construction management personnel. In the UK and Ireland the development in post-graduate education has been driven by individual universities in an attempt to address the needs of both academia and industry. It should be noted that in the context of the US, graduate program refers to Masters and PhD level study while in the UK and Ireland it is referred to as post-graduate.

Historically construction industry hiring practices have not placed as high a priority on post-graduate level education in both the US and Europe. Some CM educators have advocated the need for post-graduate education programmes that are fully aligned with the construction industry. Rounds noted in 1997 that post-graduate level CM programs would advance the body of knowledge of the industry, provide professional construction educators with industry specific knowledge, and develop graduates with advanced skills appropriate for executive level careers in construction. In addition, the need for professional construction educators was addressed in a 2005 task force report to the Board of Directors of the ASC which examined the need for and the appropriate format of a PhD degree in Construction Management. Growing demand for construction educators in the US has encouraged the growth of post-graduate education specific to the BE. In 2007 the Associated General Contractors (AGC) of America, a US trade association comprised of more than 33,000 firms, expressed the organization's support for advancement of post-graduate CM programs. They stated "The need for senior executives to secure a masters (in construction management) is apparent from two perspectives. First, they will benefit from learning newly evolved construction techniques and management methods. Second, their experience is needed on campus as instructors" (Behling, Orczyk & Jenkins, 2007).

Gumport (1993) has traced the role of research in post-graduate education during the last century as part of a book titled *The Research Foundations of Graduate Education: Germany, Britain, France, United States, Japan*. Beginning in the late 1800s, research and post-graduate education became closely linked at major universities primarily

through the growth in the disciplines of science and engineering. The common practice of post-graduate student education in the US and Europe at that time consisted of a period of class-based study followed by research. Post-graduate education during this time period evolved to become a mentor based learning environment where students worked alongside professors on research projects. The benefit of this mentor-based process was that students would transition from consumers of research to producers of research. This process was accelerated in the post-World War II period where the economic expansion and cold war competition of the time period encouraged significant financial support for research. By the 1970s top tier universities had interwoven organized research and post-graduate education and lower tiered institutions strove to emulate this practice.

RESEARCH PROBLEM AND SIGNIFICANCE

Although some universities may offer non-thesis post-graduate options, research will continue to be a significant component of the post-graduate education provided by many construction management programmes. Some programmes consider research to be the most effective approach to the promotion of self-education or life-long-learning. Others see the need to maintain a research focus to support those who will become future educators of the BE. In some cases programmes may be given little choice within the university structure in which they operate. As post-graduate programmes grow many will face challenges in supporting the educational needs of their students. The potential for these challenges become more apparent as construction researchers expand the diversity of research philosophies and research methodologies considered appropriate for research in the BE. Those BE programmes that depend on the regular supervision of post-graduate students by mentors/supervisors within the programme are limited by the capacity and number of mentors available. Programmes that look to the college or university in which they operated to provide courses in research methods are limited by the range of research methodologies provided at that level. Ultimately the question must be asked “what are the most appropriate ways to prepare post-graduate students for their research activities”? This paper attempts to provide the first step in that quest by exploring what post-graduate programmes in the BE are currently providing as research methods resources for their students.

EVOLVING CONSTRUCTION RESEARCH PHILOSOPHY

Quantitative or positivist views of construction research dominated early construction research published in academic literature. Possible explanations for this include the fact that many construction educators came from backgrounds in engineering where quantitative research is utilized both because of its ability to demonstrate scientific rigor and validity as well as the relative ease of relating engineering theories to mathematical analysis. During the last few decades an evolution in thinking about research philosophy in construction research has come about. In 1997 Seymour, Crook, and Rooke called for a debate on the role of theory in construction management research. Seymour *et al.* encouraged a dialogue about the need for a broader view of alternate research paradigms. They contended that the management components of construction require a more interpretive view of research that necessitated a reconsideration of what defined theory, rigour, and objectivity in construction research. Later that year Runeson responded to the call for debate by stating that positivist research is the best insurance against bad research. Although Runeson acknowledged that interpretive research has a place in normative research, he

asserted that it should not be taken as science. His arguments placed a clear demarcation between the value of qualitative and quantitative approaches.

The following year Wing, Raftery & Walker provided a less dichotomous response to the debate contending that the research philosophy or methodology chosen for construction research should be based on the nature of the problem being examined. In arguing against a single research approach they pointed out that behavioural scientists had been expressing dissatisfaction with 'scientific' methods since the 1960s. Wing *et al.* provided numerous references from a variety of disciplines to advocate for pluralism and diversity in construction research philosophy and methodology. They suggested the complementary use of quantitative and qualitative approaches. While this debate is not as public today, the authors suspect that the diversity of research approaches taught by various post-graduate programmes is not consistent. It is interesting to note that the qualitative vs. quantitative debate has been active in recent years among researchers in engineering education (Borrego, Streveler, Miller, & Smith, 2008; Borrego, Douglas, & Amelink, 2009).

In the construction management research community in the UK and Ireland discourse around methodological approaches have also begun to receive attention (Dainty, 2009). Knight and Ruddock assembled 14 chapters by various authors which each describe a different methodological approach that is applicable to the built environment. More than half of the approaches presented are not strictly from the positivist philosophy of research design. Nevertheless, Dainty in the opening chapter describes the recent history of research enquiry in the BE while advocating for a pluralistic approach toward research methodologies. He describes the relatively narrow range of methodologies employed for research published in a 2006 volume of "Construction Management and Economics". While his evidence is limited, he goes on to suggest that there is still a need for a paradigmatic change from the apparent dominance of a positivistic approach to research in the BE.

To advance this paradigm shift in BE research, Boyd (2011) gives several examples of ways to prepare post-graduate students for a less restrictive view of BE inquiry. In one instance he describes the use of systems education to help students become oriented to complex construction practice as well as the inherent complexity of research or problem solving in what has been described as construction's "loosely coupled systems" (Dubois & Gadde, 2002). Through the use of systems theory, and rich picture diagrams as a support tool to model multiple case examples (Sutrisna & Barrett, 2007), a deeper understanding of the problem complexity can be developed by the student (Boyd 2011). In a second presentation to BE educators Boyd describes a module where he encourages students to develop a personal construct theory by engaging in participant observation, ethnography and cooperative inquiry to develop their ability as critical thinking, learning practitioners (Boyd, 2012).

RESEARCH METHODOLOGIES APPROPRIATE FOR CONSTRUCTION RESEARCH

When a theory or hypothesis fits available data or realities of data acquisition, experimental approaches to construction research is preferable because of its ability to produce generalizable results. Frequently these experimental approaches require the researcher to separate naturally occurring phenomena into small components that facilitate data collection. Bernold and Lee (2010) describe five methods of experimental or quasi-experimental design commonly used for construction research. These five methods; pilot testing of devices and methods, passive observation,

controlled experiments, randomized experiments, and four group experiments may be favoured when measurement of well defined variables can be obtained. Unfortunately, conditions that allow such measurable evidence to be collected are often confounded by conditions beyond the researcher’s control.

To overcome the challenges of experimental design, alternative philosophies and methodologies have been adapted from research more common to social science. A complete description of the range of research methods at the construction researcher’s disposal is beyond the scope of this paper. However, a recent issue of the *Journal of Construction Engineering and Management* contains several articles describing both experimental and alternative approaches to construction research that can serve as useful reference material. Table 1 lists the range of methodologies and approaches described. While this list is by no means exhaustive it does show the breadth of research tools with which post-graduate students should be exposed in their education.

In addition to an introduction to multiple methodologies, students need to understand the limitations inherent in each particular case. Because validation of research results is necessary in order to obtain true meaning or application of the research, learning differing methods of validation is also important in preparation for the execution of scholarly work (Lucko & Rojas, 2010). For example multiple cycles of testing may be utilized to validate action research results (Shaurette, 2009). This approach is not necessarily appropriate or possible with other methods. Without implementation of sound and appropriate research procedures at every research step from conceptualization through data analysis and conclusions, theories and hypotheses cannot be reliably confirmed or denied (Abowitz & Toole, 2010).

Table 1: Research Methods in Journal of Construction Engineering and Management, January 2010

Method	Authors
Experimental Research	Bernold & Lee
Mixed Method Research	Abowitz & Toole
Observational Research	Leicht, Hunter, Saluja & Messner
Delphi Method	Hallowell & Gambatese
Ethnographic Theory-Building Research	Phelps & Horman
Action Research	Azhar, Ahmad & Sein
Charrettes as a Research Method	Gibson Jr. & Whittington

METHODOLOGY

The exploratory study described in this paper sought to identify what post-graduate programmes in the BE are currently providing as formal research methods educational resources. The scope of the inquiry was to examine course-based education in research methods based on the concept that students require a formal introduction to a diversity of research philosophies and methodologies appropriate for use in construction research. Although possible through one-on-one interaction with a research supervisor/mentor, growth in graduate enrolments make sole reliance on supervisory guidance for research fundamentals education increasingly difficult. The primary components of the inquiry were intended to disclose if programmes require

completion of a research methods course, if the research course is construction based or generic in nature, if a variety of philosophies and methodologies are included, and some indication of the assessment of student success in mastering research fundamentals. In addition, an opportunity was provided for respondents to describe other forms of support available to students.

The first phase of the study was conducted utilizing a short survey administered through an internet based survey tool and this was followed with by phone interviews utilising a standard set of 10 questions. The interviews were a convenience sample of four respondents from the online survey who answered a follow-up email with their availability and willingness to provide greater detail. University BE post-graduate programmes in the US, Ireland and the UK that require completion of a research thesis was the population of interest. A list of post-graduate coordinators or chairs and their email contact information was assembled by the authors based on previous knowledge and a search of descriptions available through programme websites. The membership of the Associated Schools of Construction (ASC) was used as a guide to avoid exclusion of US based programs. A review of the membership of ARCOM was used in the case of the UK and Ireland based research degrees. A total of 22 programmes were identified and all were sent a survey.

The survey was administered using Bristol Online Surveys. This allowed anonymous responses to be made by respondents, a major requirement for receiving exemption from full human subjects review by university Institutional Review Boards. The survey was completed over a two-week period with a reminder sent after one week to encourage those who had not yet responded to do so. A total of 16 responses were received for a 73% response rate.

SURVEY RESULTS

Data collected via an anonymous on-line survey of academics involved in post-graduate research were mainly numerical with opportunities for respondents to include narrative data in response to a very limited number of open questions. The numerical data were analyzed mathematically by exporting the assembled data from the BOS survey software and are presented as tables of results. It was only necessary to do one cross tabulation.

The results of the survey indicate that in 81% of cases respondents require research students to take a research fundamentals/methods course as part of their research programme. There were 3 cases where there is no requirement on the part of the student to take any type of research fundamentals/methods course. Table 2 below sets out the breakdown of what level within the institution the research courses are taken.

Table 2: Level within the Institution the Research courses are taken

Level Where Research Course is Taught	Number of responses	% of Responses
University	4	31%
College	2	15%
School / Department	1	8%
Programme	6	46%
Supervisory and Other	0	0%

It is interesting to note that 54% of cases offer research fundamentals/methods courses at school, department or programme level. This would indicate that a focus on discipline-based courses prevails in those cases. This would appear to be a positive approach in that students are potentially exposed to research methodology principles that are discipline focused. However, this cannot be assumed as the research fundamentals experiences offered may be of a nature that might be narrowly focused based on the experience of those involved. One respondent made the following comment in regard to this area: “University wide Graduate School for the Social Sciences provides programme for CM doctorals. Research Engineers have their own credit-bearing courses in EngD programme”.

Table 3 Titles Used for Research Fundamentals/Methods Courses

Course Title	Number of responses	% of Responses
Analysis of Research in Industry and Technology	1	8%
Research Methods in Construction	2	17%
Models of Disciplined Inquiry	1	8%
Research Approaches	1	8%
Research Methods	5	43%
Theory of Research in Construction Management	1	8%
Dissertation	1	8%

In 11 (73%) of the cases the research fundamentals/methods course is taken for credit. This would indicate that in the majority of cases ‘learning’ the rudiments of research are integrated into the research approach. This possibly offers the motivation for students, as judged by their supervisory team, to engage at a deep level to a course of study that may be viewed by them as unnecessary. The proportion of respondents with research fundamentals/methods classes at department or programme level indicates that the preferred option is for candidates to be prepared for this aspect of the research journey at a more local level. The titles of the research fundamentals/methods course offered in the institutions are shown in Table 3. The title Research Methods appears to be the preferred one. In only one case did a respondent name the title with the university coding.

Other forms of research support are provided by 100% of the respondents. The following list shows the forms of structured research supports available to research candidates:

- Online training programmes
- Data bases, online journals
- SPSS training programmes
- Library support, List of library references
- Generic Research Skills programme also available to all students
- PhD Conferences
- Online resources/references library databases online journals module/course texts
- Research Seminars - Presentations of active research within the department
- Students can also take additional other research methods courses from other departments
- PhD Forum

In terms of research course text, respondents specified different core texts. In three cases they specified social science research texts. The most common reply was “various texts specified”. Two respondents indicated that BE specific research texts were used. A cross tabulation between Q2 (level where research course was offered) and Q5 (title/author of text) indicated that the social research science texts referred to were the recommend texts of those taking university level research fundamentals courses.

It is interesting to note that only 70% of respondents indicated that candidates are required to submit thesis or research project minimum research requirement as part of the programme requirement. In 77% of cases no written/oral qualifying exam is necessary. In addition, 57% indicated that there is no formal approach to the assessment of students' research abilities. Further exploration is needed of specifically what is required of candidates as evidence of their ability to conduct sound research.

Interview Results

The data collected from the follow-up qualitative interviews offered a deeper understanding. More challenges than solutions were identified by the interviews and these included:

- Student attitude and motivation a key to success - not clear at application stage
- Candidates ability to write a limitation - differs by background
- Limited support for those with weak writing skills

In all but one case some weakness in the research course or dissatisfaction with research preparation were identified. All those interviewed acknowledged a need to offer students a full range of research methods and that there are limitations to this at most institutions. Where university or college level modules are utilized, students may have difficulty applying the methodology to BE applications. Another key aspect recognised is that students have difficulty defining and limiting their research question. It was also noted that data analysis (statistics) is sometimes emphasized over methodology. The supervisor background was posed as problematic at times. For example, the assigned supervisor may not be active in research calling for training and a greater need for uniform research assessment procedures. Several of those interviewed acknowledgement they were "learning as we go" indicating the need for a community of practice among the construction management research active members.

DISCUSSION

As academic processes develop at the post-graduate level more institutions appear to be requiring research students to take a research fundamentals/methods course. The survey responses would support this. Responses also indicate that differing practices and configurations are in place by those institutions who are offering post-graduate research opportunities. A formalized approach to these courses is slowly developing and it will be interesting to observe how this emerges in the short term. There seems to be some inconsistency and diversity of opinion as to whether this is a positive direction and if research fundamental/methods courses should be held at programme, school/department or university level.

A goal of this paper is to increase the awareness of the role that research courses play in scholarly work by providing readers with alternate means to validate research based on sound research principles. The design of any research fundamentals curriculum should address learning, teaching and assessment approaches in line with best practice and validation. Validation of the research methodology and its results is a fundamental

element of the process of scholarly endeavour. Novice researchers need to be exposed to this discourse. Approaches used for BE research have included a variety of approaches. Some studies use more than one approach with emerging opportunities for research validation through collaborative efforts that utilize multiple research methodologies. Consequently, research courses should address multiple methods and related matters. The authors suspect that many faculty (lecturers) of research methods are not including adequate consideration of the pedagogical approach best suited to research courses. What is more, the scholarly literature contains few systematic discussions of curriculum design or teaching methods in research methods; nor is there a substantial research base to inform such discussions (Garner, Wagner, and Kawulich, 2009).

The specific issues raised by this study relate to similar positions across academic communities in both the US and Ireland/UK. The way that different BE communities deal with and manage the research of post-graduates requires a framework of best practice which can be built upon and improved over time. Included in that framework should be a contextual approach which has validity, reliability and direction as key underpinning principles.

CONCLUSIONS

As the post-graduate research community in the BE expands, the need for a focused research fundamentals/methods course will become more apparent. Whether or not it is at University, college, school/department or programme level is a matter for the programme of study committee to decide. It is the view of the authors that it is important for research candidates to have a sound understanding of a diversity of research methodologies and their underlying principles. Based on the output from this research study, it would appear that supervisory teams should advocate that research students be exposed to research fundamentals advancing from the generic to the specific. The student should experience and learn about the general overarching fundamentals of research and advance to the contextual and best practice approaches within the BE discipline.

As Wing (1998) *et al.* suggested, the way forward for the BE community should be “through methodological pluralism and paradigm diversity” for researchers to discover the rudiments of construction research through research fundamentals/methods. Post-graduate researchers need to understand fully the underpinning theory behind the methodologies that they choose to employ. The delivery of a discipline focused research fundamentals/methods course should take a comprehensive view and present diverse methodologies. This approach has the potential to provide a framework of structured thinking and activities to achieve discipline aligned research that does not limit the post-graduate researcher to a single paradigm.

Given the wide variety of issues still to be explored in the area of the education of researchers in research fundamentals/methods, discourse with respect to the best practice approach will be essential to future frameworks of post-graduate education. The authors have identified a clear need to investigate alternate research methods, this might be done by accessing some of the seminal literature sources and by collaborating across BE boundaries. The challenge is not to be “assumption free” but rather to be reflective and self-conscious of the assumptions upon which the underpinning principles operate. The BE research community, including those new to the discipline, needs to engage in the validation, justification and discourse around a

variety of research methods. While this research has evoked discourse among a small community of research active academics, there is a need to follow up with additional research and discussion.

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