2000

Information Systems Research Education in Australia: Continuing the Past or Gearing up for the Future

Beverley G. Hope
Victoria University, beverley.hope@vuw.ac.nz

Mariam Fergusson
University of New South Wales

Information Systems Research Education in Australasia: Continuing the past or gearing up for the future

Beverley G. Hope
Victoria University of Wellington, Box 600, Wellington, New Zealand
Beverley.Hope@vuw.ac.nz

Mariam Fergusson
School of Computer Science, University College, UNSW,
Australian Defence Force Academy, Canberra, Australia

Abstract

As the information systems discipline grows, so do the number of programs offering graduate research degrees (GRD). In Australasia these include one year post-graduate (honors) programs with research components, masters by research degrees, and doctorate degree programs. Graduate students entering their first research program are faced with a quantum leap in expectations and required skills. The burden is significant: they need to find a referent discipline, select a research method and paradigm, defend the research relevance, and fulfil the requirements of adding to a body of knowledge. The purpose of this paper is to inform discussion on the issue of graduate research skills. We identify the critical research skills needed and present two pragmatic models for teaching them. This provides a basis for a shared knowledge and discourse based on lessons learnt.

THE IMPERATIVE FOR TEACHING RESEARCH

Research:

A systematic investigation to establish facts [1]

A laborious or continued search after truth; [2]

Research as a *search after truth* requires a spectrum of cognitive abilities, from the simple ability to establish facts to the more complex ability to judge and evaluate. In higher education we might reasonably expect students to be led through this spectrum to the point where they are able to criticize, to analyze, and to reach a deep understanding of knowledge. Typically, however, students are graduating their first degrees in information systems (IS) with limited research training and under-developed critical thinking skills. One reason for this may be that in competitive educational environments, undergraduate IS is seen as a professional qualification rather than an academic discipline. The need for practitioner skills and the ever-increasing knowledge base in IS, leaves little time for research skilling. We teach *what* is known, not *how* it is known. Furthermore, an increasing number of students are entering graduate programs with strong professional experience in lieu of academic prerequisites. Thus, IS students are entering research programs without understanding research issues or possessing research skills.

To be successful – to complete good research in a timely manner - students must rapidly acquire the necessary skills. Determining what skills are necessary requires us first to determine what is good research. Good research, like good food, good wine, or good music, depends on the consumer. This raises the question of audience.

The question of audience

Graduate research degree programs may vary in content and structure, but the output almost invariable includes a written document, whether a research project, published paper, thesis, or dissertation. The document is the culmination of many months or years of study and serves not only to communicate findings but also to evidence the student's ability to conduct credible research. To be credible in IS, the report must be both relevant and rigorous.

Relevance and rigor are paradigmatic issues because paradigms guide the selection of phenomena to study, the methodologies available, and values [3][4]. As such they set the scene for the selection of a *good* topic (relevance) and provide a benchmark or standards for evaluation (an aspect of rigor). IS, however, is at best multi-paradigmatic and at worst non-paradigmatic. It is a "fusion of behavioral, technical and managerial issues" [5]. The discipline borrows theories, models, and methods from the physical and social sciences, as well as from professional business disciplines. As early as 1980, Keen [5] noted the plethora of reference disciplines in practice, including computer science, experimental social psychology, cognitive psychology and political science. There are no fewer today. The 1993 "Keyword Classification Scheme for IS Research Literature" contains 16 reference disciplines [6]. With no single accepted paradigm and multiple reference discipline, IS researchers must select an "appropriate" discipline from which they can set standards, draw theories, select methodologies, and find criteria for evaluating research [7] This places the novice IS researcher on a steep learning curve.

The problem facing novice IS researchers is not always shared by research students in more mature disciplines. For

example, science and engineering students have a well-defined research paradigm that is both normative and scientific. At masters and Ph.D. level these students are likely to become part of a research team with an established area of study. The *apprentice within a team* approach provides for a rapid start, an effective mentoring system, and the benefits of collegiality. Typically, Australasian IS students entering research programs do not have these advantages. In an empirical study students reported a big leap in expectations and skill requirements upon entry to an honors (first graduate research) program, but the step up to Ph.D. study was less problematic [8]. The difference is knowledge and experience of research.

The early stage in the research life of a student has been identified as being critical [9]. This is particularly important for honors students who have a short time to complete their program of coursework and research and for masters and Ph.D. students seeking a timely completion date. Particular problems arise for the novice IS researcher because of the lack of an IS paradigm and research tradition, and the need to make IS research both rigorous and relevant. We argue that they need to begin their GRD programs with research training.

In this paper we propose a minimal set of skills and understandings (thought processes and concepts) as part of the researcher's repertoire, and propose some teaching strategies that can foster their development. The important assumptions underlying the framework are:

- research is situated, that is, what constitutes knowledge and good research are defined by the audience or discipline; and,
- research skills are not innate, they can be learned (and, conversely, can be taught).

TEACHING RESEARCH SKILLS

Research skills, like any other skill, can be taught. Just as students were once taught to analyze an information system and draw a DFD, so they can be taught to analyze literature and write academic articles. But what skills are needed and how are research skills best taught? While there is a plethora of books to assist students in completing theses (see, for example, [10] [11]) these usually address the research process rather than the component skills. It has even been argued that textbooks can be a barrier to creative thinking as they "instill judicial thinking" [12, p.47]. The term judicial thinking implies a correct way of critiquing, judging, or solving problems. Thus books, while useful, do not replace the valuable contribution of the research instructor, mentor, or class.

The notion of teaching research skills represents a paradigm shift from focussing on the research topic to focussing on learning outcomes. Student learning outcomes "encompass a wide range of student attributes and abilities, both cognitive and affective" [13, p.4]. According to Ehrmann & Chickering seven principles of good practice guide the student based paradigm approach to higher education [cited in 13]. These are:

1. encouraging contacts between students and staff,
2. developing reciprocity and cooperation among students,
3. using active learning techniques,
4. giving prompt feedback,
5. learning to use time spent on a task effectively,
6. articulating high expectations from students, and
7. respecting diversity in talents and ways of learning.

The new pedagogical approaches to higher education are typically aimed at traditional coursework teaching. It behooves the teachers of research to examine these principles also, and to incorporate them into an appropriate learning experience for research students.

Current teaching practices

A cursory review of current postgraduate research practices suggests that GRD students acquire research skills in a variety of ways that can be represented as being somewhere along the continuum defined by two extremes: the lone scholar and coursework.

The lone scholar approach is the traditional form of research training in Australasia as it is in the United Kingdom. Here, students work with supervisors in a one-to-one relationship. In theory, this provides students with a way of internalizing the work habits and expertise of a seasoned researcher: in reality, the student will rarely observe their supervisor in action. The approach emphasizes depth at the expense of breadth and individualism at the expense of collegiality and debate [14][15].

There are many possible learning outcomes at this end of the training continuum. Learning can be serendipitous, and dependent upon both the problems that the student encounters and the skill and attitude of the supervisor. If the supervisor is a subject but not a research specialist, acquisition of research skills can be minimal. The success of the relationship can be affected by the chemistry of the personality mix and the workload or availability of the supervisor. At one end there are students who are left to "muddle along" and teach themselves research skills. They learn from books or from emulating a method from published research. Learning is most often just-in-time, exposing the student to the risk of learning too late that an essential step was omitted, perhaps invalidating results. While they may become adept in the chosen method, they are unlikely to be knowledgeable in a variety of methods or to even know of their existence. These researchers acquire a narrow view and are likely to be method rather than problem driven. The self-taught student is the poor cousin in the research arena.

It has been stated that the lone scholar in the Ph.D. setting "produces an excessive narrowness which is of little relevance to even the most academic of careers, and which is likely to be actively unhelpful in any occupation which goes beyond the academic sphere. Most subsequent occupations are likely to involve interacting with other people, writing in such a way as to interest and influence them, and meeting

reasonably short deadlines. The Ph.D. student is given neither training nor experience in any of these." [14, p.130]

The problems of the lone scholar may be overcome by the collegiality, support, and structure at the coursework end of the training continuum.

Coursework

Students who are required to complete coursework in research methods and issues learn about a variety of research methods through a combination of attending lectures, analyzing published research, completing practical assignments, and writing papers. Course content may be dependent upon the prevalent paradigm of the particular IS department or the bias of the instructor. Some address only positivist paradigms and are heavily quantitative, but increasingly the interpretivist paradigm and qualitative methods are being taught. The coursework mode fails to realize its potential when the curriculum favors a particular paradigm or methodology, or fails to include experiential learning.

Constructivist theory of knowledge suggests that actual knowledge is not transferred from one person (the teacher) to another (the student), rather it is constructed in the mind of the student. A way of achieving this is through the cooperative learning approach. Educational theorists consistently claim that the most successful learning outcomes are attained when the concepts taught are grounded in experiential learning. Practicing the research skills on a real or hypothetical research problem gives context and meaning to the teaching, thereby enhancing learning. This has the advantage of allowing students to articulate and clarify the concepts they have learnt, and to encourage critical thinking [16]. The co-operative learning approach, however, requires students to have a set of skills that need to be taught purposefully and precisely [17]. The grounded coursework mode of instruction grounds coursework in the student's research activity. Students enroll in a research methods course while doing research in a supervised setting.

So, where along this continuum is the best mode of instruction? While all modes can lead to success, we believe that benefits are obtained at the coursework end of the continuum. Coursework provides a more focussed and structured learning environment, ensuring better coverage of a broad range of research paradigms and methods. In addition it is more economical both of staff and student time. In the long term, the structured teaching of research methods and skills must benefit the IS discipline as graduating students go on to conduct research and disseminate their findings. Research Methods classes are becoming increasingly common in Australasia where IS departments are offering honors and masters degrees, many of which emulate the course component of the United States style doctoral programs.

Successful courses include research practice because students learn best through involvement in research [18]. By providing the right kinds of experiences, we can enhance our student's ability to search the literature, think critically, and write concisely in an academic style. We can teach them how to challenge assumptions, critique methodologies, and improve article organization [19]. A particular strength of the research classroom is that students are able to learn from each other's experiences as well as their own. This enriches their view of the approaches to research, and allows them to work together on essential skills, but independently on their own research projects. They also learn through debate to articulate and defend their argument, an important skill.

We contend that the research class is the appropriate environment for optimizing learning, and that it is important to provide novice researchers with learning experiences that address both cognitive skills and research techniques. To construct a research training program we need to be able to identify both cognitive skills and research techniques that the experienced researcher employs. These are proposed as the critical skills that are needed as a part of a GRD program. The skills identified are intended as a framework around which GRD research courses can be organized. They are intended as an indicative list, not an exhaustive one.

CRITICAL RESEARCH SKILLS

For the purpose of identifying critical skills it is convenient to conceptualize research as a linear series of steps grouped according to the common milestone outputs. In reality, the process is likely to involve several iterations and include feedback loops [20]. From the literature (see for example, [21]) and from our experience, we posit the following set of skills:

Phase I Topic Analysis

1. Choose a topic area
2. Survey the literature (and practice)
3. Identify a relevant research problem/opportunity
4. Identify the audience for the intended research output
5. Identify the research approach suited to the problem and the audience

Phase II Research Proposal

6. Thoroughly search the literature and synthesize the findings
7. Define the research questions, with hypotheses where required by the paradigm
8. Develop a research design and method, including a time plan for the research
9. Identify key assumptions and limitations

Phase III Research Report

10. Collect and analyze "data"
11. Interpret results in light of existing knowledge and theory
12. Communicate the findings (thesis, paper, article)

These skills can be grounded in the student's own research. Outputs at the end of each phase are practical applications of the lessons learnt to the students' actual research: topic analysis, research proposal, and research report, thesis, conference paper, or journal article. The

outputs provide the formal framework within which the student's understanding can be expressed and subsequently discussed as a cooperative group learning experience.

This process suggests a "minimum" set of critical skills that the novice researcher must acquire to complete good research. These are shown in TABLE 1 under headings cognitive skills and research techniques. Although the distinction between cognitive skills and research techniques is not clear cut, the separation is intended to provide a useful classification against which to target particular areas for development and to compare the offerings of existing courses.

TABLE 1
ESSENTIAL RESEARCH SKILLS

Cognitive skills	Research techniques
Selecting a topic and defining a research problem	Conducting a comprehensive search of the literature
Evaluating and synthesizing existing research	Designing the research and "data" collection
Selecting and justifying a research paradigm.	Writing an academic paper

Reading Table 1 across and then down provides a loose matching with the research process steps set out earlier. The six essential skills can be used to benchmark existing or proposed courses for novice researchers. The skills can be taught to a group while allowing sufficient diversity for individual development. In addition, the list of skills can be used as a reference for criterion based assessment.

RESEARCH PROGRAMS

Programs of study for research students tend to vary considerably. The honors year varies both in terms of the relative proportions of coursework to research project(s) and the amount of prescribed "research methods coursework." At the University of Tasmania, honors study begins with an intensive one week program [22]. The objective is to focus the student on finding a research topic. This has been acknowledged as the most difficult task [14]. Several Australasian universities have made significant in roads to change the focus from the research "body of knowledge" to the student learning outcomes. Two such programs are described to illustrate approaches that have been found to work.

Case 1: Honors at University College, ADFA

Students are required to do four subjects and a thesis over one year, with Research Methods prescribed in the first semester. A subject is the equivalent of 36 contact hours. Each student is allocated a research supervisor.

The assignments for the Research Methods subject are: a topic analysis, a literature review, a presentation to the School, and finally a research proposal. Assignments are criterion referenced and marked independently by the course lecturer and the student's supervisor. The role of the supervisor is to provide topic specific expertise and advice, including help with finding the relevant literature, and choosing a suitable research paradigm.

Students are encouraged to find a topic themselves. Students who "ask" their supervisors for a research question tend to be more organized with their work and able to focus early on the body of knowledge surrounding their topic. Their enthusiasm for the topic is typically high to start with, and reduces gradually over the year. Students who elect to find their own topic are much slower to "settle" though they tend to maintain momentum until the end of the year. There is no difference in the performance of students who choose their own topic and those who pick one from the list.

The cognitive skills are all covered in the subject material, and practiced in the assignment. Workshops and mini-tasks are used to assist the students with selecting a topic and defining a problem, as well as evaluating and synthesizing existing research. Generic research paradigms used in IS are covered mostly by lectures. Justification of the research paradigm is a required part of the research proposal. Physical skills tend to be limited to writing skills, and these mostly by practice. Students have an on-line resource center which "guides" them through the semester. The greatest weakness of the students by the end of the semester is in providing alternative research designs.

Formative evaluations from supervisors consistently reported significant improvement in student performance, greater levels of motivation and better understanding of the topic area after the introduction of the research methods course. Feedback was obtained from about 25 students over a three-year period using subject evaluations. The course received positive evaluations from the perspective of students own research work. They were all able to see the direct benefits of having done the research methods course. About 20% of students reported that "learning about all the other stuff [research paradigms that they did not use] was useless". It would seem that grappling with the breadth of the IS discipline, on top of learning how to do research may be a little too much to ask of an Honors student, though the vexatious question of how to expose them to the range of paradigms and methods remains.

Case 2: Honors at Victoria University of Wellington

The honors year in the Faculty of Commerce and Administration at Victoria University of Wellington also serves as the first year of a two-year masters-by-research degree. An important objective of the IS honors program is to provide the foundation skills needed for students to progress to the masters thesis and eventually, we hope, to a doctoral degree.

The program of study is preceded by a week of ½ day seminars designed to jump-start the students' research training. Topics include "being a successful honors student", library and database searching, citation and referencing using EndNote, critiquing an article, and leading a seminar session. The program consists of eight courses of which four are prescribed. Optional courses are content specific and include options in areas such as e-commerce, the virtual organization,

and change management. All the prescribed courses are devoted to research issues and practice. They are: Information Systems Research (A), Information Systems Research (B), Research Methods in Information Systems, and Research Project in Information Systems.

Information Systems Research (A) introduces the IS discipline and includes ontological foundations, an overview of the main streams of IS research, and the skills and techniques required to write a literature review. Assessments include bi-weekly article critiques, bi-weekly search and writing exercises, an integrative end-term test, and an academic literature review. Topics for the literature reviews are selected from a list of topics to be offered by staff as research projects in the following trimester. In this way, students get an early start on their research project.

Information Systems Research (B) builds on Information Systems Research (A) and involves a critical examination of recent literature in the domain of strategic, managerial and organizational aspects of IS research. Relevance of research is a strong theme in this course. The issue of relevance is also addressed through the incorporation of a practitioners' forum. Assessment includes bi-weekly article reviews, two mini-projects or literature reviews, and an end-term test.

Research Methods in Information Systems provides a critical examination of methodologies used in IS research. Both qualitative (case research, grounded theory, ethnography, action research) and quantitative methods (survey, experimental study) are included. Skill workshops include introductions to NU*DIST and SPSS. Assessment includes weekly assignments describing research methods and reviewing related articles, a research journal describing the student's learning process, an end-term test, and a research proposal. The research proposal is the major course output and brings together the skills and knowledge of the course. It also provides some depth in an otherwise broad coverage of research methods. Students are encouraged to write their research proposal for their project in the following trimester.

The Research Project in Information Systems provides an opportunity for students to synthesize the learning in previous courses and prepares them for entry into Part II of the masters program, the thesis. Students work with a selected supervisor on a project offered by that staff member. In our first year of offering this course, we allowed students to select and define their own research question, but we found that students were taking too long, often ½ the trimester, to define their topic. Under the revised scheme, students can refine the research question but they are helped by the provision of a general research topic. A conference-style presentation is required at the end of the course.

The VUW honors program is thus an intensive introduction to research incorporating both cognitive skills and research techniques. Students work long hours and burnout is a potential problem. The program does not meet every entrants needs. Those who come in expecting to receive consultancy training are disappointed, but those who come in aiming for the intended research degrees are well served. We have been impressed by the quantum leap in understanding and practice evidenced by our students following on to theses from the honors program. Many have subsequently published their research projects.

CONCLUSION

As a discipline without an accepted single paradigm, IS confronts novice researchers with many challenges. The applied nature of the discipline imposes the requirement of meeting standards of both rigor and relevance. Meeting these demands simultaneously is difficult. Therefore, IS students entering GRD programs need structured research training experiences. We argue that this need is best met through the coursework mode of instruction. Decomposing a set of critical skills derived from the research process enabled us to identify the sub-skills which could or should be included in such coursework. The skill set can also be used in designing courses and performing criterion-based assessment.

To demonstrate the applicability of the skill-set, we described two quite different honors programs, both of which were considered to meet the needs of their constituents. University College, ADFA, offers a single course which combines theory with practice. Victoria University of Wellington offers a series of courses which also combines theory with practice, albeit it more loosely. Both courses include both cognitive skills and research techniques, though techniques are more frequently practiced in the longer training program at Victoria.

Further research is needed to explore the different modes by which students acquire research skills and to assess the relative effectiveness and efficiency of each. Such research could help us to identify which modes are best suited to which learning aims and objectives. From our experience and from our review of the literature, we recommend that any research training be given a strong contextual grounding. The skills taught in an honors program must be relevant to both future academics and future practitioners.

REFERENCES

[1] WordNet ® 1.6, Princeton University. 1997. URL http://www.cogsci.princeton.edu/~wn/

[2] Webster's Revised Unabridged Dictionary. MICRA, Inc., 1998.

[3] Y. Wand and R Weber, "On paradigms in the IS discipline: the problem of the problem," *Proceedings of the 1986 Decision Sciences Institute Conference*, Honolulu, Hawaii, 1986, pp. 566-568.

[4] R. Weber, *Ontological foundations of information systems*. Melbourne: Coopers & Lybrand, 1997.

[5] P. Keen, "MIS research: Reference disciplines and a cumulative tradition," in *Proceedings of the First International Conference on Information Systems,* E. McLean, Ed., Philadelphia, USA, 1980, pp. 9-18.

[6] H. Barki, S. Rivard, and J. Talbot, "A keyword classification scheme for IS research literature: An Update," *MIS Quarterly*, vol. 17, no. 2, pp. 209-226.,1993.

[7] P. Keen, "Relevance and rigor in information systems research" in *Information systems research: Contemporary approaches and emergent traditions*, H.E. Nissen, H. Klein, and R. Hirschheim, Eds., Amsterdam: North Holland, 1991, pp.27-49.

search

[8] M. Kiley and G. Mullins, Eds., *Quality in postgraduate research: Managing the new agenda*, Proceedings of the 1998 Quality in Postgraduate Research Conference, University of Adelaide, Adelaide, April 1998.

[9] M. Fergusson, "The Ferrett: A Web Tool for Postgraduate Supervision," *Proceedings of the 8th Australasian Conference on Information Systems,* Adelaide, Australia, 1997, pp. 529-539.

[10] J. Creswell, *Research design: Qualitative and quantitative approaches*. Newbury Park: Sage Publications, 1994.

[11] P. Leedy, *Practical Research: Planning and Design*. 6th ed. New Jersey: Prentice Hall., 1997.

[12] J.R. Evans, *Creative Thinking In the Decision and Management Sciences*. Cincinnati: South-Western Publishing Co., 1991.

[13] R. Frye, Assessment, Accountability, and Student Learning Outcomes. URL http://www.ac.wwu.edu/~dialogue (accessed 14 October 1999).

[14] A. Baddeley, "Is the British Ph.D. system obsolete?" *Bulletin of the British Psychological Society*, vol. 32, pp. 129-131, 1979.

[15] G. Davies, "New routes to the Ph.D.," *The Psychologist,* vol. 3, no. 6, pp. 253-255, 1990.

[16] P. Metz and K. Tobin, "Cooperative learning: An alternative to teaching at a medieval university," *Australian Science Teachers' Journal*, vol. 43, no. 1, pp.3-28, 1997.

[17] D. Johnson, R. Johnson and E. Holubec, *Circles of Learning - Co-operation in the classroom*. Edina, Minnesota: Interaction Book Co., 1992.

[18] P. Petty, *Review of Literature: Current Methods for Instructing Students in Research Methodology*, 1998. URL http://www.disturbed.com/ppetty/finalcopy.htm (accessed 1 May 1999).

[19] G. Shaw and M. Fergusson, "Literature Reviews in IT Research: A Guide for Students," *Proceedings of the 9th Australasian Conference on Information Systems*, Sydney, Australia, 1998, pp. 594-605.

[20] P.D.M. Barrow and H.E. Thomson, "Choosing research methods in information systems," *Proceedings of the 2nd UKAIS Conference,* Southampton, United Kingdom, 1997, pp. 239-251.

[21] R. Kumar, *Research Methodology A Step by Step Guide for Beginners*. Melbourne, Addison Wesley Longman, 1996.

[22] G.R. Lowry, "Postgraduate research training for information systems: Improving standards and reducing uncertainty," *Proceedings of the 8th Australasian Conference on Information Systems*, Adelaide, Australia, 1997, pp. 191-202.