GRADUATE INSTRUCTION IN THE RESEARCH PROCESS

Molly Stock
Department of Forest Resources
University of Idaho
Moscow, Idaho 83843

Abstract: Most new graduate students arrive ill-prepared for initiating and carrying out their first research project. The old rules that guided them to success and high grades in undergraduate courses are no longer of paramount importance, but rules for performing the new task -- research -- are poorly defined. In addition, ideas about research and researchers derived from the published literature may lead to unrealistic expectations, wasted time, conflicts with advisors, and needless discouragement. By formalizing activities related to initiating research, and by giving students a clearer and more realistic view of the research process, a research orientation course or seminar can facilitate the successful transition from undergraduate to graduate school. Fundamental goals for an introductory research course should include making research a less intimidating prospect, providing a sequence of tasks that minimizes procrastination and provides direction, giving encouragement for the student's initial efforts, providing criteria for making informed decisions and judging performance at critical stages in the research, and helping students develop realistic expectations of themselves and their advisors.

INTRODUCTION

New graduate students, especially new master's degree candidates initiating their first research projects, have unique problems and needs as they strive to meet the challenges presented by graduate school. Serious consideration of these problems and needs is an essential step toward developing improved methods of teaching the research process.

As we are all well aware, the quantity and quality of information about the research process available to graduate students from their departments, colleges, and individual research advisors lacks uniformity. In fact, the research training environment to which graduate students are exposed is so variable that their ability to do independent research would probably differ greatly even if all of them started with equal ability and motivation. Some time ago I discovered that one basic principle explains most events in life. This principle is embodied in Stock's Second Law: All things are random. More than we care to admit, this law applies to graduate education and research, especially the first research project undertaken by a new graduate student. The luck of the draw too often pertains in, for example, choice of graduate schools, advisors, and thesis topics.

In addition, many unwarranted assumptions are made about the advisor/advisee relationship and the research training environment. A few of the more universal and illogical of these assumptions lead to poor quality research training, and hinder development of a truly effective, formalized, systematic approach to research instruction. In spite of these obstacles, however, many departments have research courses or seminars; but their content, format, and emphasis varies widely -- more widely than does, for example, the content of a basic silviculture or forest entomology course. Guidelines or even textbooks appropriate for research methods courses are not widely available. While professors might agree on, say, the content of an introductory statistics course, there seems to be little agreement on the content of a course on the even more important and fundamental subject of research. To understand why research training is so variable and especially why some research training is so poor, I'd like to explore some of the fundamental and erroneous assumptions that hinder open communication and exchange of ideas on research methods instruction.

ASSUMPTIONS

Assumption (Myth) #1
Knowing that they have been screened for appropriate undergraduate coursework and a minimum GPA, we assume that *graduate students are well-prepared for graduate school*, including initiating a research project, given a bit of guidance by an advisor.

Most educators are aware that to best teach new behavior, students must be provided with clearcut criteria or standards for judging their performance at the new task at various stages in the learning process, not just at the time of the exam or thesis defense. The best teachers provide these criteria, thus permitting more of their students to do well. Learning becomes a less random, better directed process.

But graduate students arrive at graduate school not knowing what the appropriate performance criteria for research are. The performance criteria that they learned to excel at as undergraduates -- studying for grades in a structured setting -- no longer pertain in any really important way in graduate school, but the criteria for the new task -- research -- are ill defined. In research, for example, there is usually no clearly prescribed sequence of tasks, and there is little formal or regular evaluation of progress. These differences between undergraduate courses and research are not minor. New graduate students think that the game simply gets harder when in truth they are playing a whole new game with lots of new rules. All the skills learned to get A's are not particularly useful, *but the students don't know that*. Therefore, early graduate training in the research process should focus, at least in part, on the way the new game is played. Without

some orientation in this regard, students can become discouraged, frustrated with their advisors, and waste time. (In some cases they quit, and the university may lose considerable time, money, and other resources invested in those students.) They will not have a realistic perspective of this new adventure and will not be able to efficiently and effectively get at what it's like to do research.

Assumption (Myth) #2

We also tend to believe that *all professors are good* (or at least adequate) *research advisors*. Clearly this is not true, but the way students select advisors, and the way professors select advisees, often seem to be based upon this assumption. The guidance received by the student, based on the one-to-one relationship between advisor and advisee, varies from excellent to abysmal. The relationship between having earned a PhD. and being a skilled advisor is as tenuous, perhaps, as the relationship between being able to produce a child and being an effective parent. An additional set of skills must be learned. A minority of individual professors are, through talent or, more often, hard-earned ability, excellent research counselors and instructors. Most of the rest are wise advisors to at least some of their students some of the time. I'd like to briefly itemize a few obstacles that arise at one time or another in the advisor/advisee relationship. The obstacles contribute to the "randomness" of research training and can serve to emphasize the problems inherent in a system that too often relies almost entirely on research instruction by individual advisors.

•**Unrealistic (overly high) expectations for guidance.** Having been guided by their undergraduate teachers, many graduate students expect their advisors to take the lead, not knowing that it is they who must take the lead in the graduate program.

•**Personality differences.** Researchers range from creative and impulsive to systematic, from authoritarian to democratic. Conflicts can arise between an advisor and student with basic differences in research or leadership style.

•**Excessive faith in trial-and-error learning.** Most researchers learned a great deal of their craft through trial and error. As graduate students, they were thrown in the water and learned to swim, so they believe (to some extent perhaps correctly) that this is a good way to sort out the qualified from the unqualified researchers of the future.

•**Heavy work load/not enough time.** Unfortunately, many faculty members (perhaps especially the most competent and professionally involved ones) are genuinely too busy to take the time they would like to take to work with each of their students.

•**Increasing dependence on learning by osmosis**. New assistant professors usually spend a great deal of time working out the nuances of research with their first graduate students. However, after doing this a few times, less and less effort may be put into it. Advisors begin to assume that subsequent generations of graduate students will absorb the appropriate "street smarts" from their predecessors once they've gotten the ball rolling.

•**Fading memories.** In most researchers, memories of the anxieties, questions, and self-doubts that they felt about their own early research efforts tend to fade as they gain self-confidence. It's harder to recall the initial fears and problems once you've mastered the game.

•**Overemphasis on methods.** Finally, even when advisors make a real attempt to communicate with their advisees, it is much too easy to focus on the methods. Often a student will come to an advisor with a difficult and usually ill-defined intellectual problem and the two will end up rummaging in a drawer looking for a different kind of lens or making phone calls about some piece of equipment, the real intellectual issue set aside because neither the student or the advisor could easily deal with it. Fortunately, some activities routinely required in graduate programs, such as oral exams and seminars, provide a degree of formalized group discussion of the intellectual aspects of the research process.

Assumption (Myth) #2

The research process is logical and straightforward, and thus easy to teach. The fact of the matter is that research only appears logical and straightforward after it is tidied up for publication. The more coherently a scientist writes, the more an illusion of order can be created from disorder. Although this practice has many important benefits for the dissemination of knowledge to the scientific community as a whole, students having read about research in textbooks or journal articles enter graduate school with a stereotyped and unrealistic notion of what research is all about.

Students doing research are regularly faced with discrepancies between the model of research provided by texts and teachers and the realities of how research is actually conducted. This tends to make the students feel that much of what they are doing is wrong because it does not match the published research accounts that they accept as performance standards. The discrepancies between what they think they should be doing and what researchers actually do can be disorienting and discouraging.

The idealized concept of research and the writing style required by journals suggests that research moves in an orderly, step-by-step manner from background theory and observation to problem definition. A hypothesis is formulated and tested, the accepted, rejected, or modified. Finally, the new information is added to the body of background theory used to do further research.

Actual day-to-day research differs a great deal from this simplified model. Actual research consists of a number of closely related activities that overlap continuously, rather than follow a prescribed sequence. In most research there

is no clear end point. Because of time and reporting constraints, an end point must be imposed upon an essentially endless process. (According to Lanier's Axiom, a research project is never completed; it is merely abandoned when the ratio of cost -- in dollars or effort -- to results becomes less favorable than that of another project or enterprise.) Beginning researchers are also unaware of the amount of change and revision involved in research, since they see only the final product in the literature. They also often do not know that a research subject is often chosen for nontheoretical reasons, such as the availability of support funding, and only afterwards is it given a theory-based justification.

Finally, one of the largest differences between research as it is described in the literature and actual research is that actual research involves many additional activities that are rarely, if ever, mentioned in publications. These activities include logistics (the management of money, people, facilities, and time), intellectual activities (such as those involved in the generation of ideas or hypotheses), and communication. Writing and speaking coherently and eloquently about research are not automatically derived from doing research (not even from doing very good research), but they are an extremely important part of the process.

DISCUSSION

By formalizing activities related to initiating research, a research orientation course or seminar can give students a clearer and more realistic view of the research process and facilitate their successful transition from undergraduate to graduate school. Fundamental goals for graduate research instruction should include: making the prospect of research less intimidating; providing students with criteria for making informed decisions and judging their performance at critical stages in the research; and helping students develop realistic expectations of themselves and their advisors.

Practical aspects of research are particularly important in such instruction. In addition to the standard information on research history, philosophy, and methods, an introductory course can also include information on research management (e.g., planning, time management, budgets), the creative process (e.g., idea generation, the role of chance in discovery), and communication (both writing and talking). Development of individual research proposals during the course increases interest in the subject matter, adds motivation, and provides continuity and integration of all course elements.

SUGGESTED READING

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