Journal of Research Practice
Volume 3, Issue 2, Article M17, 2007

ISSN: 1712-851X

Main Article:

How and Why to Teach Interdisciplinary Research Practice

Rick Szostak
Department of Economics, University of Alberta, Edmonton, Alberta, T6G 2H4, CANADA
Rick.szostak@ualberta.ca

Abstract

This article addresses the interrelated questions of why it is important to teach students about the nature of interdisciplinarity and how this material might be best communicated to students. It is important to define for students what is meant by disciplines and interdisciplinarity. Having distinguished interdisciplinarity from the disciplinary approach, the advantages and disadvantages of each can be discussed. It is useful to discuss the history of both disciplines and interdisciplinarity. It is also useful to discuss the complex relationship between interdisciplinarity and other intellectual currents: postmodernism, unity of science, complexity analysis, feminism, and others. Critically, students should be guided as to how interdisciplinary research might be best performed. Some potential objections to teaching interdisciplinary research practice are addressed.

Keywords: interdisciplinarity; teaching; disciplines; research process

Suggested Citation: Szostak, R. (2007). How and why to teach interdisciplinary research practice. *Journal of Research Practice, 3*(2), Article M17. Retrieved [date of access], from http://jrp.icaap.org/index.php/jrp/article/view/92/89

1. Introduction

This article will first address the question of why it is thought that it is important and valuable to teach interdisciplinary research practice--ideally in one or more courses devoted to this topic. This article addresses some potential objections to doing so before turning to the question of how to do so. The How and Why questions are obviously interconnected: scholars will not convince themselves of the desirability of doing something without having some idea of how to do it. This introductory section thus closes with brief remarks that tie the Why and How

questions together by addressing also questions of What and Why Now.

What does it mean to teach explicitly about interdisciplinary research practice? While different programs (and texts) emphasize different topics, some key elements can be found across most of these endeavors. Foremost, it is important to define what is meant by *disciplines* and *interdisciplinarity*. While competing definitions exist in both cases, the literature has advanced to a degree where an interdisciplinary scholar can readily discuss the key elements of such definitions. In particular, the scholarship on interdisciplinarity generally, though not always, stresses the importance of *integration*: the need to critique the insights of different disciplines and to seek common ground when these insights disagree. The insights of a discipline are the specific arguments it makes about the nature of a particular phenomenon (a society's income distribution, or attitude toward punctuality, or fertility rate, or a particular work of art), or how one phenomenon influences another. Such insights, as we shall see, need to be evaluated in the context of the discipline's favored theories, methods, and overall disciplinary perspective. Having distinguished interdisciplinarity from disciplinary research, the advantages and disadvantages of each can be discussed. I will stress a *symbiotic* relationship.

Here it is possible to discuss certain values inherent in the interdisciplinary approach but not always stressed within disciplines: open-mindedness, tolerance of different points of view, and pursuit of a conversation aimed at enhanced understanding rather than victory for one point of view. It is useful, though less common, to discuss the history of both disciplines and interdisciplinarity. It is also useful to discuss the complex relationship between interdisciplinarity and other intellectual currents: postmodernism, unity of science, complexity analysis, feminism, and others. Finally, one should address the question of whether there is an *interdisciplinary method* or perhaps a set of interdisciplinary best practices or an ideal *interdisciplinary process*, and what the elements of such an interdisciplinary approach to research might be. While the notion of interdisciplinary research practice in its broadest sense encompasses all of the above elements, much of our attention in this article will focus on outlining an interdisciplinary research process and how this can be communicated to students.

Why now? The literature on interdisciplinary research practice has matured in the last 2 decades. While consensus may be rare, it is much easier today to identify and understand competing points of view on a range of issues relevant to interdisciplinary teaching and research. There is at least consensus on some of the key questions to ask, which is, in itself, an important step forward. Over the last decade I have regularly attended the annual conferences of the Association for Integrative Studies (AIS), a scholarly association devoted to the study and support of interdisciplinarity in both teaching and research. Over that decade, a noticeable change has occurred. While most curricular space in interdisciplinary programs is still devoted to *modeling* interdisciplinary research--that is, to discussing the process and results of particular pieces of interdisciplinary analysis--such programs increasingly include some component that explicitly addresses how and why interdisciplinary research should be performed. This material

places in context the many examples of interdisciplinary research provided in other courses. I created such a course at the University of Alberta, Canada, and taught this for the first time during the 2005-2006 academic year. This change in approach is best reflected in the publication of the first two textbooks in the field, Augsburg (2006) and Repko (2008). Augsburg and Repko speak of their intellectual debt to previous authors, notably Julie Thompson Klein and William H. Newell--and perhaps especially to the anthology edited by Newell (1998). Repko also draws upon some of my earlier work (particularly Szostak, 2004).

Mention should also be made of the journal, *Issues in Integrative Studies*, and especially the debate regarding the nature of interdisciplinarity in the 2001 and 2002 issues of that journal. The European literature of *transdisciplinarity* is introduced on the Web site of the International Center for Transdisciplinary Research (CIRET). While the term *transdisciplinarity* at one time signified an insistence on integrating beyond the academy (an orientation also embraced by many interdisciplinarians), its meaning today is often very similar to that of the term *interdisciplinarity*.

2. Why Teach Interdisciplinarity?

Usually, a discipline-based introductory course tends to communicate the essence of the underlying discipline: its core subject matter, its main theories, and its main methods (though the latter in particular may only become obvious in more advanced courses). To be sure, disciplinary programs could be more explicit about why certain material is important and useful for students in their later lives. If interdisciplinary programs fail to communicate to their students a similar sense of the elements of interdisciplinary research practice, then they disserve their students. They may also create for both students and administrators the mistaken impression that interdisciplinarians are unable to provide a coherent overview of the interdisciplinary enterprise. Where several interdisciplinary programs exist at a particular institution, a course on the interdisciplinary enterprise per se could provide a synergistic link among them. If we do not think it worthwhile to tell our students what interdisciplinarity is all about, we can hardly be surprised if administrators (especially when faced with budget cuts) wonder if interdisciplinary programs are relevant to the institutional mission. (An overview of administrative challenges to interdisciplinary programs, and strategies for addressing these, is provided by Henry, 2005; for some comments on this article, see *Issues in Integrative Studies*, Volume 24, 2006).

This material should, of course, be taught primarily with the aim of informing students rather than impressing administrators:

(a) Such material provides students with an understanding of their program which will facilitate their drawing connections between different courses in the program. This is true both for programs in “interdisciplinary studies” itself as well as for thematically oriented programs such as environmental and gender studies. If students never discuss how and why interdisciplinary analysis is performed, they may have little appreciation of why they deal with political economy

in one course and social psychology in the next, and especially how they might tie the material from these courses together.

(b) The course should help students appreciate connections not only within their interdisciplinary major but across *all* of their courses. Gerald Graff has bemoaned in various publications the ability of students to compartmentalize knowledge: to not even recognize that their political science professor and economics professor are addressing the same subject (aided by the use of different jargon in different disciplines), and thus not feel any need to ask why they reach different conclusions. Graff's (1992) advice that we "teach the conflicts" means in practice that we must teach students to first recognize the different insights that flow from different disciplinary (or other) perspectives and then provide them with some tools for resolving these conflicts. This, of course, is the central purpose of interdisciplinarity. Notably, then, a powerful case can be made that such material should be taught to *all* students, a possibility that might readily be implemented at institutions that have core courses for all students (such as the general education requirements in the United States).

(c) The alternative to explicitly teaching this material is to simply *do* interdisciplinarity. Interdisciplinary programs with a thematic or topical focus thus take students through a variety of exercises in integration relevant to that topic or theme. More general interdisciplinary programs provide integrative courses focused upon a range of topics or themes. It is generally hoped that students will learn how and why to integrate along the way. This practice is quite different from the behavior of disciplinary programs. Disciplinary programs at the undergraduate level tend to contain one or more methods courses, and at the graduate level even more method content--though again this material is often poorly motivated. When interdisciplinary programs are criticized for lack of rigor, their critics often have these courses foremost in mind (though concerns regarding theory are also important). Since interdisciplinarians draw on multiple methods, interdisciplinary programs cannot contain the same sort of methodological material as disciplinary programs. Instead of learning one or two theories or methods in detail, students should learn the essence of several and how these might be *integrated*. Integration is of critical importance here: in its absence, learning a little bit about a lot of theories or methods might indeed be of little use to the student. The rigor in interdisciplinarity can only come from knowing how, why, and what to integrate. Almost all interdisciplinary programs tend to have an implicit goal of showing students how, why, and what to integrate. As with disciplines, they could better achieve implicit goals by making these explicit.

(d) The course should help students communicate the nature of interdisciplinary research practice to various nonacademic audiences. Students need to justify and explain their majors to parents, friends, and prospective employers. These others will often think they know what chemistry or history is all about, but will wonder about more novel interdisciplinary programs. Students in interdisciplinary programs thus are more likely to be queried regarding the nature of their education. They may struggle to answer such queries without explicit curricular content

devoted to this (see Augsburg, 2006). This learning exercise can usefully be interactive if students are asked to write brief essays on what they expect to learn from their degree during their first or second year and also later.

3. Why Not?

The practical barriers to the teaching of interdisciplinary research practice are considerable. Most centrally, faculty members within interdisciplinary programs generally identify themselves primarily in terms of a particular interdisciplinary theme or question, rather than with interdisciplinarity itself. They may thus claim to lack both interest and expertise in interdisciplinary research practice. The problem of expertise can now be addressed quite easily through access to the Augsburg (2006) and Repko (2008) texts, and to the literature cited therein. As regards interest, it can be created through suitable initiatives. Seabury (1999) reports that she had invited colleagues at the University of Hartford, USA, to read the Newell anthology (Newell 1998); many were unenthused but reported afterwards that it had greatly improved their teaching. One spoke of the pre-reflective stage as “interdisciplinarity by accident”--when they taught in an interdisciplinary manner without reflecting much on what this meant. Any scholar who wishes to teach and/or do research in an interdisciplinary manner should have some interest and expertise in questions regarding the definition of interdisciplinarity and how interdisciplinary research might best be performed.

A comparison with disciplinary practice is again apt: While courses on disciplinary methods are often taught by scholars who specialize in method, this is far from always the case. Disciplinary scholars who claimed to have little interest or expertise in disciplinary method(s) would be viewed with suspicion by their colleagues. Of course, interdisciplinary subject areas are different from disciplinary fields in many ways. But just as all disciplinary fields must engage disciplinary methods, all interdisciplinary research needs to grapple with questions of how and why to integrate the insights of different disciplines.

A second practical problem is simply that most program curricula are already filled with requirements. Adding a new requirement must mean giving something up (and/or discouraging student enrollment). This should not be a problem if it is accepted that the material recommended in this article should lie at the core of an interdisciplinary (indeed any) education. In practice, though, practical concerns regarding what must be given up (and the institutional politics that often lies behind such concerns) will often be expressed as pedagogical concerns regarding what is to be added.

It is sometimes argued (and I have witnessed these arguments myself) that the suggested material is too meta-theoretical, too far removed from the real-world problems that interdisciplinary research usually addresses. I must confess here to being well disposed to meta-theory. I think students in an undergraduate program need to develop some philosophical appreciation of the limits to the validity of all the “stuff” they would have learnt at the end of 4

years. Likewise, they also need to appreciate the nature and limits of ethical/moral reasoning as they are continuously exposed to ethical/moral judgments from teachers and peers. But the case here for meta-theory is even stronger: if the central premise of an interdisciplinary program is integration then we cannot escape the responsibility of teaching students how and why to do so.

This section suggests that concerns that it is not desirable to teach this material can often be deconstructed into concerns that it is not possible to do so. In other words, the question of why to teach this material cannot be separated from the question of how to do so.

4. What and How to Teach

This section introduces several topics that should be addressed in a course about interdisciplinary research practice and discusses how the literature with respect to each might be addressed in practice. I will try to model here how instructors might introduce students to various debates while not being shy about confessing to their own (hopefully internally consistent) preferences with respect to each. That is, while I have my own preferences regarding whether interdisciplinarians should seek to destroy disciplines or build upon their insights, and pursue grand theory or more localized integration, I think it important that students be exposed to both sides of such debates in an open-minded manner.

4.1. Defining Disciplines and Interdisciplinarity

One of the key characteristics of a discipline is the worldview or perspective that shapes research and teaching in the discipline. This embraces the four elements below, but also elements of ethics, aesthetics, and ideology (Klein, 1990; Salter & Hearn, 1996; Szostak, 2003):

(a) A set of phenomena that are the focus of study
(b) One or a few key theories
(c) One or a few key methods
(d) The “rules of the game” governing hiring, promotion, and publication decisions

Students should appreciate that disciplines evolve through time and also that there is diversity within each one. Nevertheless, the above features are important to the interdisciplinarian in understanding the insights generated by a discipline at a point in time. In particular, interdisciplinarians should appreciate the interdependence among these: disciplines choose methods that are well suited to the investigation of their favored theories, phenomena that can readily be studied with these theories and methods, and rules of the game that reward the application of the favored theories and methods to the favored phenomena.

Klein and Newell have provided a definition of interdisciplinarity which has received widespread support:

> A process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession . . . Interdisciplinary studies draws on disciplinary perspectives and integrates their insights through construction of a more comprehensive perspective. (Klein and Newell, 1996, p. 395)

While I quite like their definition, I have attempted a complementary definition which lays equal stress on each of the five characteristics of disciplines noted above (though I should have used the word *integration* rather than *application*):

> Interdisciplinarity involves *openness* to the application of *all* theories and *all* methods to *any* set of phenomena. . . . Interdisciplinarians are open to applications of each of the five types of ethical perspective. . . . Interdisciplinarians believe that research should be evaluated solely in terms of whether it contributes to our collective understanding. (Szostak, 2003, pp. 30-34)

There are of course other definitions of interdisciplinarity. Students should be introduced to some of the key issues that underlie differences in these definitions:

(a) Is integration essential? Klein and Newell would argue that simply adding together disciplinary insights is just multidisciplinarity, while integrating these is necessary for interdisciplinarity. The term *transdisciplinarity* used to mean integration not only within the academy but with community groups as well, but its meaning has evolved to approximate interdisciplinarity. Klein and Newell (1996) have suggested that integrating within and outside the academy involve similar processes.

While Lattuca (2001, p. 23) concurs that "[m]ost scholars define the locus of interdisciplinarity as the integration of disciplinary perspectives," she worries that such a conceptualization "conceals the disciplinary critiques that drive much interdisciplinary scholarship today" (2001, p. 4). Moran (2001) likewise downplays the role of integration. Students can and should be introduced to forms of "critical interdisciplinarity" that do not stress integration, while recognizing that most interdisciplinary analysis is problem-based and integrative (Salter & Hearn, 1996, p. 30).

(b) What is integration? The closest synonym is *synthesis*. Integration involves first an important element of critical reflection: what are the strengths and weaknesses of different disciplinary insights, and how might they reflect biases inherent either in disciplinary practice or more general academic practice (or indeed limitations to human perception and reasoning). Integration then involves finding common ground among different disciplinary insights.

(c) What is the most important focus of integration? As Repko (2008) argues, it is the insights generated by different disciplines that the interdisciplinarian seeks to integrate. In order to evaluate these and find common ground, one needs to understand the theories, methods, and phenomena in which these insights are grounded, and the overall perspective of the discipline. One can identify, for example, the main strengths and weaknesses of different methods and

theories (Szostak, 2004). Moreover, a discipline's preferences with respect to phenomena, theories, and methods are important components of its disciplinary perspective. Attempting to draw on disciplinary perspectives in interdisciplinary research will be unnecessarily challenging if perspectives are not defined carefully in terms of such elements.

4.2. Comparing Disciplines and Interdisciplinarity

What role should disciplines play in interdisciplinary research and teaching? The Klein and Newell definition grounds interdisciplinary analysis in the disciplines, highlighting the task of building upon disciplinary insights. Others take a less positive view of disciplines and see interdisciplinarity as a revolutionary process whose goal should be the subversion of disciplines (Carp, 2001). Naturally, they emphasize the value of interacting with nonacademics. However, interacting with nonacademics appears to be welcomed by all interdisciplinarians. Klein and Newell seek a compromise attitude toward disciplines that stresses that interdisciplinarity can change disciplines.

One obvious element of common ground here is that both points of view recognize important limitations to disciplinary analysis. They differ only in the degree to which they find value in disciplines. There can be an empirical resolution to this difference: one can apply agreed-upon procedures of interdisciplinary analysis in order to critique disciplinary insights, and evaluate how useful these insights might be in specific cases.

I suggest a *symbiotic* view of the relationship between disciplines and interdisciplinarity. Disciplinary specialization has an advantage: by sharing theoretical and methodological preferences, and focusing on a small set of phenomena, a community of scholars can readily understand what each other is saying. Thus they can pursue a narrowly defined set of questions without each having to frequently explain to others what they are doing. This implies obvious weaknesses: ease of understanding is bought at the price of excluding other theories, methods, and phenomena from consideration. There is thus an essential role for a second sort of scholar who looks beyond any one discipline and investigates the implications of considering a wider set of phenomena, theories, or methods. This second sort of scholar might also ask what biases are inherent in a disciplinary perspective and how these might be overcome through recourse to different disciplines with different perspectives. Disciplines often evolve precisely because they have learned to borrow some key element from another. Historians of science appreciate that major breakthroughs generally result from some sort of interdisciplinarity (Root-Bernstein 1989). Nevertheless, the scholarship of integration remains rather underappreciated in the academy (Glassick, Huber, & Maeroff, 1997).

The words *disciplinary* and *interdisciplinary* can give rise to the mistaken idea that interdisciplinarity is an optional add-on to the core operation of disciplinary scholarship. I think the symbiotic view will be better served by using different words, *specialized* and *integrative*, to

refer to the two types of scholarship, hinting at the potential contribution from each.

4.3. The History of Disciplines and Interdisciplinarity

There are two important historical facts that students of interdisciplinarity should note. The first of these is that disciplines themselves are relatively new. To be sure, different fields of research and teaching have long existed. The ancient Greek academies already distinguished among several subjects: music, grammar, arithmetic, and so forth. But disciplines as defined above, with consensus on theory, method, subject matter, general outlook, and publication and hiring practices, simply did not exist until the eighteenth or nineteenth centuries. The German research universities were important in establishing departments which tended to hire only professors with degrees in that discipline. Still, late in the nineteenth century, Max Weber, one of the leading figures in modern sociology, would spend much of his career occupying a chair in economics. Specialized academic journals came gradually to supplant more general publications. Disciplines began perpetuating themselves through their institutionalization in departments and journals. Turner (2000) argues that most characteristics of disciplines flow from the reality of departments hiring only scholars with PhDs in those disciplines.

It is sometimes said that writers such as Aristotle, Hume, or Adam Smith were interdisciplinary. These writers can be more correctly thought of as pre-disciplinary. They roamed across a landscape where disciplinary boundaries had not yet hardened. The appeal of “great books programs” (i.e., educational programs based on a curriculum of selected material from a list of “great books”--such a list is maintained by The Great Books Foundation) reflects in large part the wide-ranging contemplations of such writers. But they did not face the challenges faced by today’s interdisciplinarians, who must confront a set of disciplinary discourses.

The second useful historical fact involves interdisciplinarity itself. Necessarily, this must be newer than disciplines. One can identify concerns with the narrowness of disciplines as soon as disciplines emerge. Interdisciplinarity has ebbed and flowed in popularity over the last century or so. This ebb and flow might lead pessimists to predict that the present interest in interdisciplinarity will inevitably dissipate. The symbiotic perspective outlined above leads us to understand these ebbs and flows in terms of a conflict between the desirability of interdisciplinarity and the difficulty of pursuing interdisciplinary research or teaching successfully. Previous incarnations of interdisciplinarity, including the interwar blossoming of the “unity of science” movement, tended to stress a search for unifying grand theories. Today’s interdisciplinarity usually stresses instead integration across different theories: the goal for most scholars is no longer one big theory but a large number of theories each casting light on different (and overlapping) facets of the world in which we live. This arguably is a much more achievable goal.

The issue of achievability deserves emphasis. Interdisciplinary research projects and

interdisciplinary programs are often held to a false standard. While the greatest breakthroughs in scientific understanding can be attributed to interdisciplinarity, it cannot be expected that every exercise in interdisciplinarity will result in a startling new breakthrough. In the terminology used by Thomas Kuhn, interdisciplinarity need not be (though it can be) *revolutionary science*, but can proceed as *normal science*: identifying weaknesses in existing insights, searching for compensating insights from other communities of scholars (or nonscholars), and striving to overcome disagreements between disciplinary insights. Notably, normal science within disciplines proceeds because of the shared understandings that revolutionary science transcends; normal science in interdisciplinary research will also be aided by shared understandings of how to proceed, but these must not constrain interdisciplinarians from revolutionary thought. Many interdisciplinarians would worry that we cannot have both shared process and revolutionary imagination. An important task of subsection 4.5 is to argue otherwise. In other words, I will suggest that we can best think outside the box if we know what the interdisciplinary box looks like.

4.4. Relationship to Other Discourses

When I have taught interdisciplinary research practice myself, I have devoted much class time to postmodernism in particular, since interdisciplinarity, especially in the humanities, is often compared with or even confused with postmodernism. Postmodernism comprises a set of critiques of the contemporary academy and its discipline-based organization. Thus it is hardly surprising that many postmodern critiques resonate with interdisciplinarians; particularly concerns about scholarly biases, suspicion of overarching *meta-narratives*, and the celebration of diverse points of view. But interdisciplinarity must in the end hinge on a belief that we can, through integration, achieve understandings that are in important ways more comprehensive and less biased than disciplinary insights--and some versions of postmodernism would doubt such a possibility. The very possibility of adding to the body of human understanding needs to be defended against the more extreme version of postmodern thought (Szostak, 2006).

Other important intellectual currents, such as feminism, complexity research, and the unity of science movement, share many of the postmodern concerns. However, some versions of these pursue some grand theory that will explain much or all of human existence, instead of reflecting the postmodern suspicion of meta-narratives. As noted above, most interdisciplinarians no longer pursue grand theory. This important distinction should also be brought out in courses on interdisciplinarity.

4.5. How to Do Interdisciplinarity

Since interdisciplinarity involves integration across disciplinary theories and methods, guidance as to how to do interdisciplinarity must differ in important respects from guidance on how to do disciplinary research. Instead of detailed discussion of one or a small number of theories or

methods, interdisciplinary education must grapple with how to deal with many. That is, interdisciplinary research must involve a *process* of integrating across the insights generated from disciplinary theories and methods. Youngblood (2007) makes a similar argument in this special issue: interdisciplinarity must be defined in terms of a process rather than a domain (or "academic turf").

The textbook by Repko (2008) builds on works such as Newell (2007) and Szostak (2002) to develop guidelines for how students should perform interdisciplinary research. Students should in general follow the same research guidelines as scholars, though they will most often not be able to devote as much time to each step in the research process. These guidelines should be flexible because the interdisciplinary research process cannot be "disciplined" but must embrace multiple perspectives (Newell, 2007, p. 247). Moreover, the guidelines must be iterative: researchers will almost certainly want to revisit earlier steps while performing later steps.

The process of interdisciplinary research must start by asking an interdisciplinary question. This may seem a simple step, yet one cannot know if a question can be answered well within one discipline unless one has an understanding of the strengths and weaknesses of different disciplines. Individual researchers may well start with a seemingly simple question that appears to demand the insights of one discipline, only to discover the complexities as they proceed with their research. Economists for the last 5 decades have generally treated the causes of economic growth as a disciplinary question, but are now coming to appreciate that political scientists, sociologists, and anthropologists may each have useful insights (as borne out in many of the articles in Aghion and Durlauf [2005]). One important danger is that the question might itself be phrased in a manner that biases the research in a disciplinary direction. Until recently, most economists concerned with growth had effectively asked this question: How can economic growth be understood with reference to a handful of economic variables? They had also implicitly assumed that only the theories and methods of economics were necessary to answer this question. How can a researcher judge if a question is interdisciplinary? The best guide is to ask if answering the question well is likely to involve the phenomena, theories, or methods of more than one discipline.

The next step(s) must involve the gathering of relevant disciplinary insights. How does the researcher know where to look? There are two complementary strategies. One is to reflect on the nature of different disciplines and identify those that are likely to have something to say about the issue of concern. The second is to ask what phenomena, theories, or methods are implicated, and then ask which disciplines study each phenomenon identified and/or apply each theory or method. Szostak (2004) develops exhaustive classifications of phenomena, theory types, and methods to facilitate the latter approach: in the absence of these it is all too easy to be seduced by disciplinary emphasis on a subset of relevant theories, methods, or phenomena. Repko (2008) identifies the key elements of disciplines in terms of these and other classifications. One challenge the interdisciplinary researcher will face is that library catalogues are organized by

disciplines, and different terms are used in different disciplines to refer to the same phenomenon, theory, or method. I have argued elsewhere that library classifications both could and should be interdisciplinary in orientation, classifying works in terms of universal classifications of phenomena, theories, and methods (Szostak, 2004, chap. 7, 2007, in press). An issue of *Library Trends* in 1996 (Volume 45, Number 2, themed issue on "Navigating among the disciplines: The library and interdisciplinary inquiry"), contains several ideas on how libraries can adapt the existing knowledge taxonomies and classification schemes to facilitate interdisciplinary scholarship. Claudio Gnoli and colleagues have begun to develop a classification scheme for this purpose: Integrative Level Classification (ILC).

It is often noted that we live in an age of information explosion. Even disciplines cannot hope to acquaint students with the full range of disciplinary research. In such an environment, education should not focus on the transmission of a set of facts. Rather, education should stress skills such as asking the right question, knowing where to find information, and knowing how to utilize it. The interdisciplinary process involves such skills, and is thus particularly well suited to the needs of contemporary students.

Having gathered the relevant disciplinary insights, the interdisciplinary researcher must then critically examine the same, exercising critical thinking skills such as distinguishing assumptions from arguments and evidence from assertions. In this respect, interdisciplinarity differs from those elements of postmodernism which mistrust critical thinking on the ground that all opinions are equally valid (Halperin, 1997, p. 6). Interdisciplinary research can draw upon several unique strategies for critique:

(a) Asking how an insight might have been shaped by a particular disciplinary perspective

(b) Asking how an insight might have been shaped by the theories and methods used by the discipline

(c) Asking how the insight might have been different had the discipline in question examined a wider set of phenomena

(d) Asking whether the insights from one discipline would point to possible weaknesses in the insights from another discipline

(e) Asking whether some understanding from outside the academy would point to possible weaknesses in a disciplinary insight

This process of critical inquiry responds to a complaint made by Katzer and Crouch: "rarely are students taught how to evaluate what they need to read" (Katzer & Crouch, 1998, p. 3). It is also worth stressing here that evaluation can generally proceed without requiring that the researcher be expert in the discipline in question (Newell, 2007).

Finally, some *common ground* needs to be achieved that would integrate the insights of various disciplines. This calls for creativity, intuition, and inspiration. As the history of science suggests, scientific breakthroughs usually reflect creative integration within a well-prepared mind (see, for example, Root-Bernstein, 1989). However, it would be extremely dangerous to identify interdisciplinary research with such sorts of "revolutionary" insights. As should be clear by now, interdisciplinary research can proceed as "normal science." While it can and should set the stage for creative insight, we should not hold every research project, and certainly not every interdisciplinary term paper, to the standard of revolutionary insight. To carefully identify appropriate disciplinary insights and to critique these carefully is valuable interdisciplinary work, and can be built upon in a cumulative fashion by later researchers. The process of finding common ground can utilize the following strategies:

(a) One can first ask to what extent seeming differences in disciplinary perspective are apparent rather than real: differences in terminology may mean that different disciplines are not actually talking about the same causal process even when they appear to be. The interdisciplinarian can often redefine concepts, or extend a concept from one discipline to the subject matter of another.

(b) When concepts from different disciplines disagree, these can often be placed on a *continuum* or within a *classification*: the tendency of economists to stress rationality and of sociologists to stress irrationality can be handled by referring to the *degree* of rationality that individuals might display in specific situations (Newell, 2007).

(c) An attempt can be made to overcome some of the remaining differences by making possible alterations to the disciplinary assumptions.

(d) Finally, different disciplines might shed light on different aspects of the question at hand. An interdisciplinary understanding will generally contain a combination of understandings of the relationships between pairs of phenomena as well as of any emergent properties in the system of phenomena under study.

The interdisciplinarian should then reflect on the results of their research, contemplating the biases that might have crept into their own work. They should seek to identify ways in which their integrative understanding might be *tested*. And finally they should communicate their results in a format that is accessible to multiple audiences. This involves appreciating both the knowledge bases of different audiences and their interests: the results should be connected to issues that different audiences (including those working within disciplines) already care about.

Of course, the above discussion is highly abbreviated. Much more advice on how to perform interdisciplinary research can be given--without disciplining the interdisciplinarian. Yet it must equally be stressed that this advice can be given within a limited amount of curricular time. One (or maybe two) course(s) in a program can cover all of the material suggested in this article. Ideally this material will then be reinforced in other courses as instructors refer to it, and as

papers and capstone projects are both shaped by and evaluated with respect to it. But for the most part interdisciplinary programs should find that this material is easily integrated into existing curricula.

4.6. A Note on Assessment

As noted just above, the material referred to in this article should be reinforced throughout the student's education and used in the creation and evaluation of student papers and projects. Interdisciplinary programs can then be evaluated in large part in terms of how well students have mastered interdisciplinary research practice and how well they apply this to questions relevant to the program. Wolfe and Haynes (2003 and elsewhere) outline how various interdisciplinary skills can be identified in student papers. Since life itself is an interdisciplinary adventure, student mastery of interdisciplinary research practice will prepare students well for life. Programs that can illustrate success in interdisciplinary skill acquisition not only serve their students but the broader mission of universities to prepare students for life in a complex world.

5. Concluding Remarks

It is both possible and desirable to teach students about interdisciplinarity: what it is, how it should be done, and how it relates to disciplines and other intellectual currents. The questions of How and Why (and of What and Why Now) are interconnected: those who doubt the feasibility will also often doubt the value of teaching such material. This article has thus treated them together, and also pointed to a body of literature that can be drawn upon in the teaching and learning of interdisciplinary research practice.

Acknowledgments

I thank Anne Dalke, Liz McCormack, and four anonymous referees for careful and constructive commentary on an earlier draft of this paper. This paper would not have been possible without my decade-long association with the Association for Integrative Studies, and especially Bill Newell and Allen Repko. The paper was written while I was Visiting Fellow in the Department of History and Civilization at European University Institute (EUI) in Florence, Italy. I thank the EUI and especially Professor Giovanni Federico for providing an excellent locale for the pursuit of research.

References

Aghion, P., & Durlauf, S. (Eds). (2005). *Handbook of economic growth*. Amsterdam: Elsevier North-Holland.

Augsburg, T. (2006) *Becoming interdisciplinary: An introduction to interdisciplinary studies*. Dubuque, IA: Kendall/Hunt.

Carp, R. M. (2001) Integrative praxes: Learning from multiple knowledge formations. *Issues in Integrative Studies, 19,* 71-121.

Glassick, C. E., Huber, M. T., & Maeroff, G. I. (1997). *Scholarship assessed: Evaluation of the professoriate*. San Francisco: Jossey-Bass.

Graff, G. (1992). *Beyond the culture wars: How teaching the conflicts can revitalize American education*. New York: Norton.

Halperin, D. F. (1997). *Critical thinking across the curriculum*. Mahwah, NJ: Lawrence Erlbaum Associates.

Henry, S. (2005). Disciplinary hegemony meets interdisciplinary ascendancy: Can interdisciplinary/integrative studies survive, and, if so, how? *Issues in Integrative Studies, 23,* 1-37.

Katzer, J., & Crouch, K. H. (1998). *Evaluating information: A guide for users of social science research*. Boston: McGraw-Hill.

Klein, J. T. (1990). *Interdisciplinarity*. Detroit, MI: Wayne State University Press.

Klein, J. T., & Newell, W. H. (1996). Advancing interdisciplinary studies. In J. G. Gaff & J. Ratcliff (and associates) (Eds), *Handbook of the undergraduate curriculum* (pp. 393-395). San Francisco: Jossey-Bass.

Lattuca, L. (2001). *Creating interdisciplinarity: Interdisciplinary research and teaching among college and university faculty*. Nashville, TN: Vanderbilt University Press.

Moran, J. (2001). *Interdisciplinarity: The new critical idiom*. London: Routledge.

Newell, W. H. (Ed.). (1998). *Interdisciplinarity: Essays from the literature*. New York: College Board.

Newell, W. H. (2007). Decision-making in interdisciplinary studies. In G. Morcol (Ed.), *Handbook of decision-making* (pp. 245-265). New York: Marcel Dekker.

Repko, A. (2008). *Interdisciplinary research: Theory and methods*. Thousand Oaks, CA: Sage.

Root-Bernstein, R. (1989). *Discovery*. Cambridge, MA: Harvard University Press.

Salter, L., & Hearn, A. (1996). *Outside the lines: Issues in interdisciplinary research.* Montreal, Canada: McGill-Queen's University Press.

Seabury, M. B. (1999). *Interdisciplinary general education: Questioning outside the lines*. New York: College Board.

Szostak, R. (2002). How to do interdisciplinarity: Integrating the debate. *Issues in Integrative Studies, 20,* 103-122.

Szostak, R. (2003). "Comprehensive" curricular reform: Providing students with an overview of the scholarly enterprise. *Journal of General Education, 52*(1), 27-49.

Szostak, R. (2004). *Classifying science: Phenomena, data, theory, method, practice*. Dordrecht, Netherlands: Springer.

Szostak, R. (2006). *Modernism, postmodernism, and interdisciplinarity*. Manuscript submitted for publication.

Szostak, R. (2007). Interdisciplinarity and the classification of scholarly documents by phenomena, theories, and methods. In B. Rodríguez Bravo & Ma. Luisa Alvite Díez (Eds), *Interdisciplinarity and transdisciplinarity in the organization of scientific knowledge* (Proceedings of the 8th ISKO-Spain Congress, León, Spain, April 18-20, 2007) (pp. 469-477). León, Spain: University of León.

Szostak, R. (in press). Classification, interdisciplinarity, and the study of science. *Journal of Documentation*.

Turner, S. (2000). What are disciplines? And how is interdisciplinarity different? In P. Weingart & N. Stehr (Eds), *Practicing interdisciplinarity* (pp. 46-65). Toronto, Canada: University of Toronto Press.

Youngblood, D. (2007). Multidisciplinarity, interdisciplinarity, and bridging disciplines: A matter of process. *Journal of Research Practice, 3*(2), Article M18. Retrieved October 30, 2007, from http://jrp.icaap.org/index.php/jrp/issue/view/6

Wolfe, C. R., & Haynes, C. (2003). Interdisciplinary writing assessment profiles. *Issues in Integrative Studies, 21,* 126-169.

Received 24 April 2007

Accepted 21 September 2007
