

Introduction to Interdisciplinary Studies

Third Edition

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INTERDISCIPLINARY STUDIES IN THE REAL WORLD

CHAPTER OBJECTIVES

This chapter explains why interdisciplinary studies is now considered basic to education, problem solving, professional practice, and innovation. Interdisciplinarity provides a time-tested practical way to address the inherent complexity of

real-world problems, including those problems arising in the workplace. The overall objective of this chapter is to spark your interest in interdisciplinary studies and help you appreciate the real-world significance of interdisciplinarity that is set out in the chapters ahead. Related objectives include understanding why interdisciplinary studies is considered basic to education and research, the factors driving the advance of interdisciplinary studies, and the relevance of interdisciplinary studies to your career development.

LEARNING OUTCOMES

By the end of this chapter, you will be able to

- Demonstrate an understanding of why interdisciplinary studies is considered basic to education, problem solving, professional practice, and innovation
- Describe the “drivers” of interdisciplinary studies today
- Identify and describe new and emerging interdisciplinary fields of study and their significance
- Explain why systems thinking and contextual thinking are increasingly viewed as important
- Explain why a knowledge society needs both disciplinary specialization and interdisciplinary breadth
- Explain the academic benefits of pursuing an interdisciplinary studies degree
- Explain the relevance of interdisciplinary studies to your career development

GUIDING QUESTIONS

- Why is interdisciplinarity increasingly recognized as important?
- What is the value of an interdisciplinary education? In particular, how might it be important to your educational goals?
- What is the relationship between disciplines and interdisciplinarity? (*Note:* This is a question we will revisit in later chapters.)
- What kinds of questions do interdisciplinary scholars engage?

Now that you are in university and enrolled in an interdisciplinary studies (IDS) course or program, you need to understand how IDS can help you achieve your long-term career goals. We begin by explaining why IDS matters and what is driving this innovative approach to learning and problem solving today. We then discuss the academic benefits of IDS and explain how IDS aids your career development.

WHY INTERDISCIPLINARY STUDIES MATTERS

We desire to have our lives count for something, to do something meaningful, to make a contribution to society. Thus, we come to the university to learn how to make a difference in the world. There are many ways to do this: educating our children, becoming responsible workers and citizens, protecting the environment, combating poverty, reducing crime and violence, creating new art forms, discovering cures for diseases, developing new technologies, starting new businesses, improving public policies, and promoting peace, justice, and security. To make such a difference, we must prepare for the realities of life in the twenty-first century with its growing complexities and new challenges. This requires developing the skills to make connections, understand others, solve complex problems, develop leadership skills, engage in strategic thinking, communicate effectively, practice analytical thinking, and work collaboratively. IDS helps you to develop these skills.

WHAT IS DRIVING INTERDISCIPLINARY STUDIES TODAY?

For over two decades, major scientific organizations, funding agencies, and prominent educators have advocated the need for interdisciplinary studies. The current interest in interdisciplinarity is widespread and increasing in intensity, motivated by the belief that it is now basic to education and research. To meet this perceived need, educators have developed a wide range of interdisciplinary courses and “studies” programs. Interdisciplinarity, it is fair to say, is becoming an integral part of higher education.

There are solid reasons for this development with which you, as an educated and responsible person, should be familiar. These reasons or “drivers” are the subject of several recent reports by leading scientific and educational organizations and are the focus of this chapter: (1) the complexity of nature, society, and ourselves; (2) the complexity of the globalized workplace; (3) the need for systems thinking and contextual thinking; (4) the changing nature of university research; (5) the public world and its pressing needs; and

(6) a knowledge society's need for *both disciplinarity and interdisciplinarity*. Combined, these drivers make a powerful case for interdisciplinary studies.

The Complexity of Nature, Society, and Ourselves

The first driver of interdisciplinary studies is the complexity of nature, society, and ourselves—all amazingly complex systems. A subject or problem is complex when its multiple parts require study by different disciplines. These parts interact in important ways, but the disciplines by their nature fail to study the interactions. For example, the subject of illegal immigration is complex because it has multiple parts, each of which is studied by a different discipline: the immigrant's home country (history, sociology, cultural anthropology); proximity of home country to country of destination (Earth science); immigration policies of country of destination (political science); and economic opportunity (economics). However, studying each part in isolation of the others and ignoring their interactions will not explain the cause or the effects of illegal immigration. What is required is an interdisciplinary approach that views the subject as a complex system with multiple interacting parts. An interdisciplinary approach critically analyzes the relevant disciplinary insights (i.e., what experts have written) and attempts to create common ground among them in order to produce a more comprehensive understanding or propose a holistic solution.

Razmak and Bélanger (2016) study the question of why electronic medical records have been adopted more slowly in North America than in Europe. They suggest that several factors, studied by different disciplines, are important: psychological resistance among some medical staff, managerial challenges, complex political decision-making processes, financial limitations, and problems in software application. They argue that only interdisciplinary research (using the research steps that are outlined in the later chapters of this book) can address such a complex problem, or indeed a host of problems in the area of business/management studies.

The Complexity of the Globalized Workplace

A second driver of interdisciplinary studies is the complexity of the globalized workplace where effective communication requires sensitivity to diverse cultures. Today, the need to understand this complexity is more urgent than ever before, especially since the human population has reached 7.7 billion, straining our planet's finite resources. In the past decade, the world economy has undergone radical change, raising the question of what knowledge college graduates need in the new globalized workplace. Pulitzer Prize-winning columnist Thomas Friedman and foreign policy expert Michael Mandelbaum (2011) describe this change in their book *That Used to Be Us*. Similarly, Buchberger reminds us that workplace changes are increasingly recognized worldwide (see Box 1.1).

BOX 1.1**The Changing Workplace**

The merger of globalization and the IT revolution that coincided with the transition from the twentieth to the twenty-first century is changing everything—every job, every industry, every service, every hierarchical institution. It is creating new markets and new economic and political realities practically overnight. This merger has raised the level of skill a person needs to obtain and retain any good job, while at the same time increasing the global competition for every one of those jobs. It has made politics more transparent, the world more connected, dictators more vulnerable, and both individuals and small groups more empowered.

All of these dramatic changes in the workplace, coming in rapid-fire succession, have left a lot of people asking, “Where do I fit in? How do I stay relevant in my job? And what kind of skills

do I need to learn at school?” The short answer is that the workplace is undergoing a fundamental restructuring that every educator, parent, and worker needs to understand (Friedman & Mandelbaum, 2011, pp. 54, 72). These workplace changes are increasingly recognized worldwide. “Today’s graduates face a rapidly changing work environment. They are also entering a world with complex problems that individual disciplines are ill-equipped to address. Historically, our educational systems have been set up to produce graduates who are specialized in only one academic area. . . . By contrast, interdisciplinary studies is a cognitive process where individuals or groups seek insights from all the disciplines relevant to the question being considered and then integrate these insights to gain a more holistic understanding of a complex problem” (Buchberger, quoted by Tejaswi, 2019).

This fundamental restructuring of the economy and the workplace demands a new type of worker with a new set of skills. This is a person who can understand, use, and integrate knowledge, technology, and methods, as well as collaborate with persons from diverse cultural backgrounds with diverse disciplinary training. This person must be able to work with intangible information to produce a tangible product. Most tangible products are the result of integrating information from multiple and diverse knowledge domains and require working in teams. For example, designing an “app” for the Apple iPhone involves, at a minimum, the ability to integrate software, art, math, gaming, English grammar, marketing, law, database management, finance, and interpersonal communication—everything that goes into an application. In other words, designing an app requires a lot more training and creativity than just writing software code.

The world of business is becoming increasingly interdisciplinary because business is transacted within an increasingly fast-paced and complex environment that demands interdisciplinary skills to address this complexity. Among these skills, the ability to integrate knowledge from multiple disciplinary sources is critical. Jan Rivkin (2005), a professor in the Strategy Unit of the Harvard Business School, identifies the skills that are crucial for today’s managers (see Box 1.2).

BOX 1.2

Integrative Skills

Integrative skills are crucial. Managers who possess them can spot the core of an innovative strategy, grasp the implications for other parts of the company, and build out the idea relentlessly until it comes to pervade a company's entire

value chain. They see, for instance, how improvements in a retailer's information system have implications for store location, store manager autonomy, pricing policy, and vendor relations. (Rivkin, 2005, p. 42)

The Need for Systems Thinking and Contextual Thinking

A third driver of interdisciplinary studies is the need for systems thinking and contextual thinking. Reduced to its most basic meaning for the purposes of this book, **systems thinking** is the ability to break a problem down into its constituent parts to reveal internal and external influences, figure out how each of these parts relates to the others and to the problem as a whole, and identify which parts different disciplines address. The ability to analyze systems is thus a key component of the increased job complexity discussed earlier. Addressing pressing public policy problems such as climate change or inner-city poverty also require systems thinking.

Everything we do takes place within systems. Examples of systems in which we operate daily include the environment, the economy, and transportation. It is useful to understand how complex systems function and how their various parts interrelate so we can understand how they affect our lives. We also need to understand the operation of complex systems so we can figure out which public policies to support.

An example of a complex system is the U.S. economy. A key component of an economy is its central bank (e.g., the Federal Reserve, the “Fed,” in the United States) and its power to set interest rates. By lowering the prime interest rate, the Fed impacts the U.S. economy in multiple ways, economic as well as noneconomic. First, a lower prime rate reduces the cost of loans to consumers, such as car loans (which has a positive effect on the economy by stimulating car sales and thereby increasing the number of cars produced, which means that manufacturers should eventually have to hire more workers). But a lower prime rate also reduces the interest rate that banks can pay on savings (which has a negative impact because it reduces the interest income that retirees depend on to purchase things such as cars). There are also the unexpected political impacts of a reduction in the prime rate. For example, China (which already holds a substantial amount of U.S. national debt) may be less interested in purchasing more debt because of the lower rate of interest it would receive. So if you ask the question, “What interest rate *should*

the nation’s central bank charge?” answering it requires input from several disciplines including political science (which studies government policies and international relations), economics (which studies consumer behavior), philosophy (which studies ethics and logic), and possibly history (which studies historical patterns).

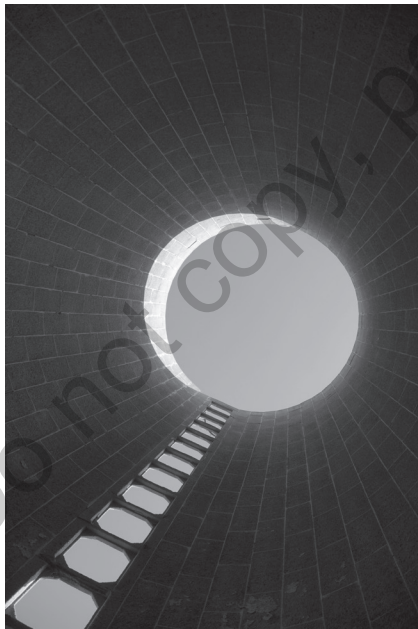
In addition to being able to apply systems thinking upon entering the globalized workplace, students need to be prepared to apply contextual thinking to complex problems. **Contextual thinking** is the ability to view a subject from a broad perspective by placing it in the fabric of time, culture, or personal experience. This kind of thinking, which is a primary focus of interdisciplinary learning, “is characterized by wholeness, by the relationship between parts, and by the assumption that knowledge changes” (King & Kitchener, 1994, p. 40).

However, contextual thinking is not a primary learning outcome of traditional disciplinary majors. After completing their general requirements (which vary from university to university), many undergraduates specialize or “major” in a traditional discipline. As

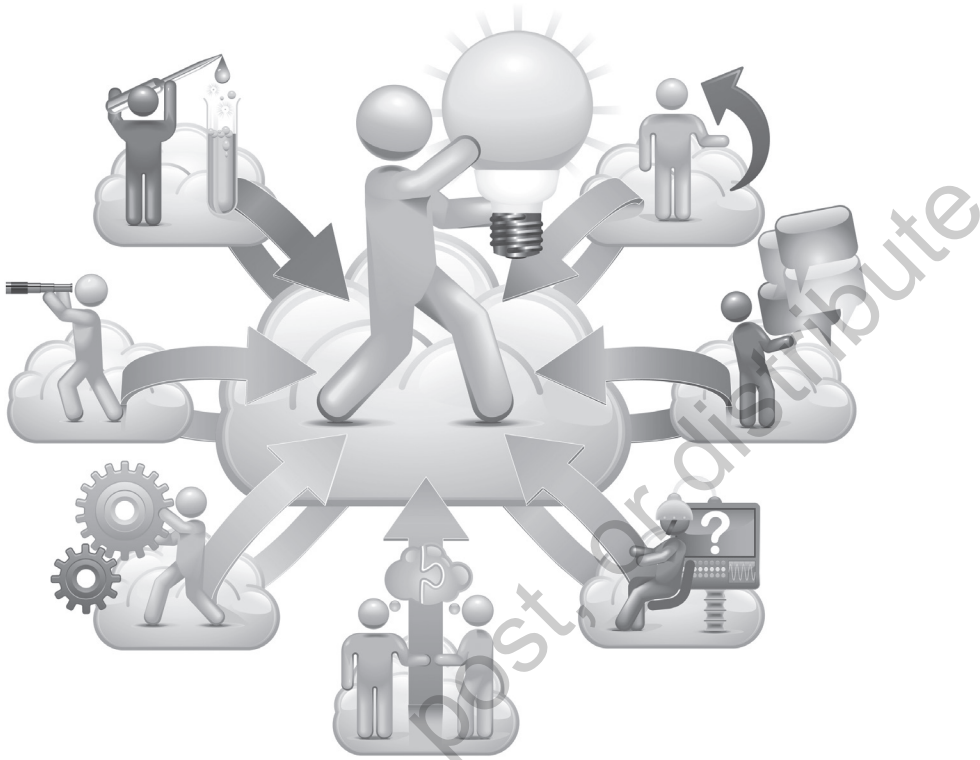
they proceed in their major, they are prone to develop a **silos perspective**, meaning the tendency to see the university and the larger world through the narrow lens of that major (see Figure 1.1). What a traditional major typically fails to provide is context—the context of the whole system—and the ability to view reality through multiple disciplinary lenses and make connections across different knowledge formations (see Figure 1.2).

In contrast, undergraduates pursuing an interdisciplinary field such as environmental studies, cultural studies, American studies, urban studies, and health management studies are taught to relate the smallest parts of the system they are studying to the whole. A hallmark of interdisciplinary studies is relating the particular to the whole by drawing on multiple disciplinary perspectives that are relevant to a specific problem or question. This feature is

FIGURE 1.1 ● View From Inside a Silo



Source: ©iStockphoto.com/Michael Westhoff.

FIGURE 1.2 ◆ Integrative Thinking

Source: ©iStockphoto.com/danleap.

one of the reasons interdisciplinary studies is becoming a key component in liberal arts programs across the United States and elsewhere.

A liberal education fosters both systems thinking and contextual thinking. It develops the “integrative arts” necessary for meeting the challenges of our globalized world (Schneider, 2003). A liberal education helps you to learn how to learn, draw on multiple sources of knowledge, apply theory to practice in various settings, critically analyze information, integrate diverse and even conflicting points of view, collaborate with others in problem solving, and understand issues and positions contextually. A liberal education that emphasizes integrative and interdisciplinary learning—the ability to make connections—is well worth pursuing (Huber, Hutchings, & Gale, 2005, pp. 4–5).

BOX 1.3

The Nature of the Academy

Students are rarely—even in general education programs—given a sense of how the academy as a whole is organized. The modern university has generally been structured around discipline-based departments. These departments usually have considerable autonomy in decisions about whom to hire and what to teach. As we shall see in Chapter 4, disciplines are each characterized by a set of research questions, theories, and methods (and other characteristics). Universities may thus encompass scholars with expertise on every phenomenon that scholars study and every type of theory and method that they employ, but the university has no master strategy for best communicating this knowledge to students. Indeed, university presidents do not even have a visual map of what theories, methods, and subjects are addressed across their various departments (though it is possible to construct such a map). Universities may use their general education programs to achieve some broad overview of the scholarly project, but general education programs themselves often defer to departments and thus simply require students to take courses from several disciplines without providing much advice on how to draw connections across these courses. The various “studies” programs noted above have emerged in recent decades to allow insights from diverse disciplines into a common theme to be gathered (but not always integrated). Universities are still experimenting with the best way of achieving interdisciplinary understandings within an organizational structure designed with disciplines in mind. Should “studies” programs be freestanding departments, or should

they employ faculty that are also appointed to a disciplinary department? How can general education programs best be structured so that students gain some sense of the academy as a whole and an idea of how to integrate insights from different disciplines? This book, and the literature on interdisciplinarity in which it is grounded, provides important input into these debates regarding the organization of the academy by showing that there is a coherent body of understanding about interdisciplinarity itself that all students should be exposed to.

It deserves emphasis that general education programs that expose students to different disciplinary perspectives but provide no encouragement toward integrating these can inadvertently encourage a narrow disciplinary focus. Students can become understandably frustrated when experts reach different conclusions about the same issue. They are then guided—likely subconsciously—to cling to the consensus within their disciplinary major. An exposure to interdisciplinary thinking—that there are reasons that experts disagree, that undergraduate students can understand these reasons and learn to evaluate and integrate differences in insights across disciplines—can transform frustration into excitement. Students should see coping with complexity as a challenge: It is not always easy, but there are techniques for proceeding toward a more comprehensive understanding. This book can only explore some of these techniques, but we hope nevertheless to fire students’ excitement toward addressing complex questions.

The Changing Nature of University Research

A fourth driver of interdisciplinary studies is the changing nature of university research. Leaders of major U.S. scientific organizations are emphasizing the importance of increased interdisciplinarity. The reason, explains Rita Colwell (1998), former director of the National Science Foundation (NSF), is that “interdisciplinary connections are absolutely

fundamental” because “it is at the interfaces of the sciences where the excitement will be most intense.” Emphasizing more interdisciplinary research is both financially and scientifically sensible, says Columbia University Professor Mark C. Taylor, because graduates are becoming too specialized to find employment due to the unsustainable nature of department-based hierarchies (Baskin, 2012). In 2011, the NSF dispatched one of its top officials and University of Michigan Professor Myron P. Gutmann to college campuses to promote the need for greater interdisciplinary research if they wish to win NSF grants. Gutmann notes that such research has yielded rapid advances in various fields, such as health care applications of atomic-scale science and the study of extreme weather events through analysis of both natural and social variables (see Box 1.4).

BOX 1.4

Interdisciplinary Social Research

The social, behavioral, and economic sciences—famously known as the “SBE sciences”—increase fundamental understanding of human social development and interaction and of human behavior, as individuals and as members of groups and more formal organizations. Our sciences contribute knowledge that has societal relevance and can inform critical national areas such as job creation, health care, education, public safety, law enforcement, and national security, among others. NSF’s SBE directorate is unique in that it houses a mosaic of related programs

enabling fundamental research in crosscutting topics by combinations of economists, political scientists, sociologists, psychologists, linguists, neuroscientists, anthropologists, and other social and behavioral scientists. This focus on fundamental research allows us to collaborate effectively with our colleagues in other directorates and federal agencies to address problems that range from coastal flood response to the needs of an aging population to preparing our military with the insights they need to understand behavior in a changing world (Gutmann, 2011).

Similarly, the U.S. National Institutes of Health (2012) describes how interdisciplinary connection making is essential to the advancement of health research (see Box 1.5).

BOX 1.5

Interdisciplinary Health Research

Health research traditionally has been organized much like a series of cottage industries, lumping researchers into specialty areas, where their

efforts remain disconnected from the greater whole by artificial barriers constructed by technical and language differences between different

(Continued)

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disciplines and departmentally based specialties. But, as science has advanced over the past decade, two fundamental themes are apparent: The study of human biology and behavior is a wonderfully dynamic process, and the traditional divisions within health research may in some instances impede the pace of scientific discovery.

The broad goal for the [Interdisciplinary Research] Program, therefore, is to change academic research culture, both in the extramural research community and in the intramural program at the NIH, such that interdisciplinary approaches are facilitated. The . . . Program includes initiatives

to dissolve academic department boundaries within academic institutions and increase cooperation between institutions, train scientists to cultivate interdisciplinary efforts, and build bridges between the biological sciences and the behavioral and social sciences. Collectively, these efforts are intended to change academic research culture so that interdisciplinary approaches and team science are a normal mode of conducting research and scientists who pursue these approaches are adequately recognized and rewarded. (U.S. National Institutes of Health, 2012, Overview section, para. 2)

Increasingly, the significant advances in knowledge production are occurring at the interdisciplinary borderlands between established disciplines and fields. (On team research, see Cooke & Hilton, 2015.)

Interdisciplinary Borderlands

This perceived need to cross disciplinary boundaries in order to advance scientific progress is reflected in the results of the national survey of interdisciplinary programs at 222 colleges and universities conducted in 2006 by the Social Science Research Council (SSRC; see Table 1.1). Clearly, a wide variety of interdisciplinary programs have become common in recent years.

TABLE 1.1 ● Top 10 Interdisciplinary Majors and Percentage of Institutions Offering Major

Top 10 Interdisciplinary Majors	Percentage of Institutions Offering Major
Intercultural studies*	13.08
Latin American studies*	16.82
African American and Africana studies***	21.50
International relations*	28.04
Asian and East Asian studies*	31.78
Biochemistry and molecular biology**	33.64
American studies*	36.45

Top 10 Interdisciplinary Majors	Percentage of Institutions Offering Major
Neuroscience and psychobiology**	36.45
Women's and gender studies***	44.86
Environmental studies and science** (could also be ***)	63.55

Source: Rhoten, D., Boix-Mansilla, V., Chun, M., & Klein, J. T. (2006). *Interdisciplinary education at liberal arts institutions*. Brooklyn, NY: Social Science Research Council.

Note: Of the top 10 interdisciplinary majors, more than half are in global or area studies (*), three follow a biology-plus model (**), and the most popular are in areas often considered advocacy/activism fields (***). Also striking is that two thirds of respondents expected to increase interdisciplinary offerings over the next 5 years. "The most commonly cited motivation was research, based on the belief that the kinds of questions students and faculty are investigating today often require the expertise of scholars from more than one discipline" (Klein, 2010, p. 43).

The Public World and Its Pressing Needs

The public world and its pressing needs is a fifth driver of interdisciplinary studies. The need to resolve problems of a general public interest is noted by the National Academy of Sciences (2005; see Box 1.6).

BOX 1.6

Interdisciplinarity and Technology

Human society depends more than ever on sound science for sound decision making. The fabric of modern life—its food, water, security, jobs, energy, transportation—is held together largely by techniques and tools of science and technology. But the application of technologies to enhance the quality of life can itself create problems that

require technological solutions. Examples include the build up of greenhouse gases (hence global warming), the use of artificial fertilizers (water pollution), nuclear power generation (radioactive waste), and automotive transportation (highway deaths, urban sprawl, and air pollution). (National Academy of Sciences, 2005, p. 34)

These public interest problems cannot be adequately addressed by individual disciplines because they require drawing on expertise from multiple disciplines: Should we genetically modify plants and animals? Is an affordable university education a civic right? What is the meaning of the rise of populist movements? What causes income inequality?

It is worth noting here that an interdisciplinary approach to public policy issues seeks to dispassionately evaluate differing policy suggestions and aspires to combining the best

elements of competing policy analyses. An interdisciplinary approach steers us away from vilifying those we might disagree with toward seeking to understand why they disagree and what we might learn from them.

When addressing problems of general public interest, it is often necessary (and even preferable) to draw on expertise from public stakeholders. Such a **stakeholder** is a person or an entity outside the academy who is interested in and may have a material stake in the outcome of a particular societal issue. For example, community development projects in urban areas typically recruit expertise from relevant disciplines as well as from community institutions and interest groups. They join forces around complex societal issues of mutual concern such as homelessness, gang violence, affordable housing for low-income families, green spaces for recreation, public transportation, small business development, and venues for local artists and musicians.

The word *transdisciplinarity* is often employed to describe research efforts that involve stakeholders from outside the academy. Scholars of transdisciplinarity often note that many of the same challenges are faced when involving such stakeholders as when performing interdisciplinary team research within the academy. In particular, researchers need to address the fact that different team members have different perspectives and employ terminology in different ways. Although this book will focus on interdisciplinarity rather than transdisciplinarity, it is important for students to appreciate that many of the strategies for interdisciplinary analysis they will encounter in this book are also useful beyond the academy. They can apply interdisciplinary skills and attitudes in their careers, as members of local and national and global communities, and in their personal lives anytime they must address complex challenges or interact with people with differing perspectives or understandings. (*Note:* Much more information on transdisciplinarity is available at www.transdisciplinarity.ch/en/td-net/Ueber-td-net.html.)

Community Development

Interdisciplinarity has implications not just for global challenges such as climate change, but also for a host of more local concerns. Butterfield and Korazim-Korosy (2007) discuss both how and why to pursue community development in an explicitly interdisciplinary fashion. They argue that experts trained in many fields need to work collaboratively with community members. There are thus two types of collaboration and integration involved: among disciplines and between academy and community. Butterfield and Korazim-Korosy note that these disciplinary experts generally lack training or encouragement to support interdisciplinary interactions. Social work in particular is, like all professions, inherently interdisciplinary, but interdisciplinary techniques are not always taught to social work students.

Interdisciplinary courses often have a community–service–learning component, where students can apply their interdisciplinary skills (see Box 1.7). Students can then engage with the community and draw upon information from multiple disciplines to help develop community initiatives. Many students in interdisciplinary programs have an interest in addressing community challenges, and they enter careers or volunteer roles later in life where they can apply interdisciplinary understandings in the pursuit of novel community programs.

BOX 1.7

Integrative Studies

Many colleges and universities these days have “Integrative Studies” initiatives that look beyond integrating academic material. They hope to connect students’ course work with their residence life, volunteer activities, and more. These programs provide further evidence that integrative skills have value far beyond one’s course work.

And these programs find indeed that the integrative challenges students face outside the classroom are similar to and can be addressed in similar ways to the integrative challenges addressed within interdisciplinary courses. See Hughes, Munoz, and Tanner (2015).

Successful Intelligence and Integrative Thinking

It is tempting to suppose that revolutionary insights and generative technologies come only from a gifted few such as a Jeff Bezos, a Mark Zuckerberg, or an Elon Musk. Not so. Revolutionary insights and generative technologies require what Robert J. Sternberg (1996) calls “**successful intelligence**.” Sternberg, one of the world’s leading researchers and authorities on intelligence, says that successfully intelligent people think well in three different ways: creatively, analytically, and practically.

Sternberg describes the three types of intelligence that together make for successful intelligence:

- **Creative intelligence** formulates ideas and makes connections.
- **Analytical intelligence** breaks a problem down into its component parts, solves problems, and evaluates the quality of ideas.
- **Practical intelligence** applies an idea in an effective way, whether in business or in everyday life.

What makes for successful intelligence, says Sternberg, is keeping these three ways of thinking in balance and knowing how and when to use each way of thinking.

Interdisciplinary learning fosters the development of all three components of successful intelligence. First, it helps to build the creative thinking tools of observing, imaging, abstracting, recognizing patterns, forming patterns, analogizing, empathizing, modeling, transforming, and integrating. Second, it stresses the importance of breaking a problem down into its component parts and connecting each part (if applicable) to a discipline. Third, it values applying the result of the interdisciplinary project in a way that is practical and critical.

Producing revolutionary insights and generative technologies requires the ability to think integratively as illustrated in Figure 1.2. **Integrative thinking**, a defining characteristic of interdisciplinary learning, is the ability to knit together information from different sources to produce a more comprehensive understanding or create new meaning. Integrative thinking is a subject of Howard Gardner's *Five Minds for the Future* (2008).

The mind that is able to integrate and communicate complex ideas is one of the five minds that the fast-paced future will demand as described by Gardner in Box 1.8.

BOX 1.8

The Interdisciplinary Mind

Against all odds, individuals seek synthesis, . . . the most ambitious form of synthesis occurs in *interdisciplinary work* [emphasis added]. Biochemists combine biological and chemical knowledge; historians of science apply the tools of history to one or more fields of science. In professional life, interdisciplinarity is typically applied to a team composed of workers who have different professional training. In a medical setting, an interdisciplinary team might consist of one or more

surgeons, anesthesiologists, radiologists, nurses, therapists, and social workers. In a business setting, an interdisciplinary or cross-functional team might feature inventors, designers, marketers, the sales force, and representatives drawn from different levels of management. The cutting-edge interdisciplinary team members are granted considerable latitude on the assumption that they will exit their habitual silos and engage in the boldest forms of connection making. (Gardner, 2008, p. 54)

The rapidly changing workplace that Gardner describes highlights the need for interdisciplinary studies. Increasingly, workplaces need people who are educated in multiple disciplines, who know how to gather and integrate knowledge from those disciplines, and who know how to apply that knowledge to complex problems. Because the pace of job destruction and job creation is increasing, students entering today's workforce will not only need to change jobs several times in the course of their working life but also

need to change careers. According to Andrew Ross (2012), “no one, not even in the traditional professions, can any longer expect a fixed pattern of employment in the course of their lifetime.” This means that you must learn to be flexible and develop a broad range of cognitive and technical skills that you can apply as your jobs and careers change. Interdisciplinary learning provides you with the cognitive tools that will enable you to integrate information and synthesize new solutions.

Ethical Analysis. We will focus most of our attention in this book on interdisciplinary analysis of how the (natural and social and individual) world works. That is, we will discuss how different disciplines analyze the world we live in, and how interdisciplinary analysis can lead to more comprehensive understandings of how the world works. It is important to appreciate, though, that interdisciplinary analysis can also be applied to ethical questions. Just as we can strive to understand and eventually integrate differing insights into how the world works, we can strive to understand and perhaps integrate different beliefs about how the world *should* work and how individuals *should* behave within it. Note that our ability to address pressing public policy issues often requires us to achieve some consensus both about what our goals should be (how we want the world to work) and how best to achieve these (the practical challenges of making the world work the way we want it to). It may often be harder to achieve consensus on goals than on the means to achieve these. We shall discuss in Chapter 4, though, how interdisciplinary analysis can be applied to ethical issues.

One characteristic of the world of the twenty-first century is cultural diversity. Most countries, including the United States, have become much more culturally diverse in recent decades. And there is much greater contact between countries than there used to be. Yet diversity can make it harder to achieve consensus on the goals of public policy. More dangerously, people may come to doubt that consensus is possible. They may even doubt that we can understand why others disagree with us about the goals of public policy. An interdisciplinary understanding of how the world works will be of limited value unless we can also strive for some societal consensus about how the world ought to work.

A Knowledge Society Needs Both Disciplinary and Interdisciplinarity

A sixth driver of interdisciplinary studies is the awareness that a knowledge society needs *both* disciplinary and interdisciplinarity. Science and society now recognize that disciplinary and interdisciplinarity are not mutually exclusive but are complementary within a knowledge society (Frodeman & Mitcham, 2007, p. 1). As we shall see in later chapters, there are advantages of disciplines: Scholars who share understandings of theories, methods, and terminology can communicate easily about shared research interests.

Yet these very advantages mean that alternative theories, methods, and subject matter will be largely ignored within a discipline. Interdisciplinarity can combine the best that disciplines have to offer to produce a more comprehensive understanding.

A **knowledge society** is one in which the development and creative application of knowledge is the primary engine of economic growth, prosperity, and empowerment of all developing sectors of society. According to Robert Frodeman and Carl Mitcham (2007),

Knowledge *production* today has a tendency to swamp knowledge *use systems* [emphasis added] at both the individual and institutional levels. Overwhelmed by knowledge, we find it increasingly difficult to make good decisions—or, Hamlet-like, any decision at all. . . . [P]oliticians, [for example], when faced with difficult problems, often call for more research as a way to stall for time. (p. 2)

In addition to data overload, Frodeman and Mitcham assert that our knowledge society is increasingly characterized by a disconnect between knowledge production and knowledge utilization (see Box 1.9).

BOX 1.9

Knowledge Production Versus Utilization

This disconnect is in part the result of the sheer volume of information being produced. Disciplines pursue more and more specialization and detail, crowding out awareness of ends or purposes. Interdisciplinary efforts are often characterized as shallow, but this is true only in comparison with the [silo] narrowness of depth in disciplinary detail and specialization. It's equally the case that the disciplines are unable to offer any width and

breadth of contextualization. Moreover, no epistemological justification is offered for why we should prioritize the vertical as compared to the horizontal dimensions of knowledge. In what sense does a PhD know something more valuable than a person with three masters? As important as disciplinary depth is [equally important is] knowledge of the overall topographic landscape of human affairs. (Frodeman & Mitcham, 2007, pp. 2–3)

THE ACADEMIC BENEFITS OF PURSUING AN INTERDISCIPLINARY STUDIES DEGREE

Fortunately, once closed-minded disciplines and applied fields are beginning to recognize that interdisciplinarity is necessary for four practical reasons. (1) Interdisciplinarians—that is, scholars familiar with strategies for integrating insights from diverse disciplines—are uniquely equipped to ask and answer questions about complex issues that transcend the

confines of single disciplines. (2) By placing complex issues in a broad context, interdisciplinarians raise additional questions that often challenge societal values. For example, addressing environmental sustainability raises questions about human freedom and responsibility and the proper roles of the public and private sectors. (3) Interdisciplinarity offers a process that enables you to effectively integrate knowledge drawn from relevant disciplines. *This process enables you to go as deep into as many disciplines as is necessary or appropriate to grasp the essentials of the problem, to see the problem in the broadest possible context, to integrate expert insights into it, and to construct a more comprehensive understanding of it.* (This process is the subject of Part III of this book.) (4) Pursuing interdisciplinary studies empowers you in five ways:

- a. To deal with complex societal problems. Interdisciplinary courses and programs typically focus on complex subjects such as the environment, sustainability, rights, politics, justice, and public health. These are *civic issues* in that they impact society as a whole. Interdisciplinary pedagogies (i.e., methods of teaching) prepare you for civic engagement by creating a classroom experience that encourages openness, dialogue, and mutual respect. Civic engagement flows from a sense of empathy and ethical consciousness.
- b. To effectively translate your education to new contexts, new problems, and new responsibilities. Civic engagement means using political as well as nonpolitical means to affect the quality of life in a community. Civic engagement is advanced as you appreciate diversity, tolerate ambiguity, and develop a sense of responsibility for the community *as a whole*.
- c. To think and act *effectively* on complex problems without getting overwhelmed or cowed by disciplinary experts or resorting to digging in your heels. It is OK to acknowledge that people with whom you disagree make valid points because you know how to proceed toward integration in the face of disagreement.
- d. To know how to find and evaluate information relevant to the complex problems you will face in life. In an age of information overload, you need to know how to look for information and then to assess its reliability.
- e. To develop a more holistic understanding of your personal identity (see Box 1.10).

An extensive assessment of student learning outcomes at the University of North Dakota found that interdisciplinary learning (and participation in interdisciplinary learning communities) significantly enhanced both academic achievement and degree completion. The assessment exercise also found that interdisciplinary students were more engaged and showed higher skill achievement. These results are likely connected

to improved academic achievement (see Carmichael & LaPierre, 2014). We return to the question of skills in Chapter 4. Van der Lecq (2016) found that interdisciplinary students become self-directed learners, see multiple perspectives, and pursue breadth of understanding.

BOX 1.10

Integrating Personal Identity

Our colleagues at Norfolk State University have an intriguing assignment in their Introduction to Interdisciplinarity course. They have students create videos in which they take an interdisciplinary approach to the question of personal identity (drawing on Crenshaw's [2014] research on intersectionality). Personal identities are complex, with multiple meanings, and intersect across race, class, gender, and sexuality, while reflecting experiences of family, government, economy, education, and religion. Increasingly, technology serves as a highly relevant vehicle or tool for crafting a cohesive identity. Note that these

various aspects of who we are need not always align: We may, for example, have aspirations that are quite different from what our parents want(ed) us to do. Interdisciplinarity can help us, then, to achieve a more holistic understanding of who we are. Moreover, this project provides a space for students to reflexively engage interdisciplinarity and subsequently illustrates that interdisciplinary understandings are useful for far more than just integrating across disciplines. We are happy to report that through utilizing technology, students often incorporate interdisciplinarity as part of their identity.

INTERDISCIPLINARY STUDIES AND YOUR CAREER DEVELOPMENT

In 2011, an article compared three surveys (completed from 2008 to 2010) that rated the skills valued most highly by employers. The article included a table, shown in Figure 1.3, in which the top-rated skills identified by each of the three surveys are listed. (*Note:* The NACE is the National Association of Colleges and Employers, and the AMA is the American Management Association.)

We could hardly ask for better evidence that interdisciplinarity education aids employability: These skills listed in the table are independently identified as outcomes in studies of interdisciplinary programs. By encouraging students to see issues from multiple perspectives, interdisciplinarity prepares students for teamwork and social responsibility. We will devote much attention in this book (Chapter 8 especially) to providing advice on how to carefully read documents from diverse sources. We discuss three other highly desired skills in more detail here.

FIGURE 1.3 ● Comparison of Top-Rated Skills*Comparison of the Three Surveys' Top-Rated Skills*

21st Century Survey (2008)	NACE (2009)	AMA (2010)
Oral Communications	Communications	Communications
Teamwork	Teamwork	Collaboration/Teamwork
Ethics/Social Responsibility	Analytical	Critical Thinking/Problem Solving
Professionalism	Technical	Creativity/Innovation
Reading Comprehension	Strong Work Ethic	

Source: Hodge, K. A., & Lear, J. L. (2011, Winter). Employment skills for 21st century workplace: The gap between faculty and student perceptions. *Journal of Career and Technical Education*, 26(2), 31.

Communication. IDS programs typically emphasize the skills of effective communication and productive collaboration. The communication in view here is of two kinds. The first is the ability to communicate across interdisciplinary boundaries. This communication is possible because, despite the differences in jargon, there is overlap among the assumptions, concepts, theories, and methods used by the disciplines as well as underlying recurring patterns in both natural phenomena and human behavior that are perceived across disciplines. In many cases, each of the disciplines is saying something similar about the nature of the world, only in a different language. The second is the ability to engage in productive communication with students and coworkers who hold a variety of interests, beliefs, and mind-sets, even if some of these sharply conflict with and differ from yours. IDS programs typically promote this skill by involving students in teamwork, which fosters the skill of working collaboratively.

Creative problem solving. Interdisciplinarity advances creative approaches to solving complex intellectual and practical problems. In interdisciplinary work, **creative problem solving** involves bringing together different perspectives and previously unrelated ideas, discovering commonalities among them, and combining them into a more comprehensive understanding. This new understanding should be both novel and useful, the defining characteristics of a creative solution. As we shall see, the interdisciplinary research process as outlined in Section 3 of this book overlaps considerably with the creative process as understood by scholars of creativity (Szostak, 2017a).

Analytical thinking. Interdisciplinarity typically emphasizes analytical thinking that is required to evaluate the quality of ideas and solve complex problems, whether

intellectual or practical. Interdisciplinary analysis requires developing a question, gathering relevant information, evaluating information from diverse sources, and moving toward a more comprehensive understanding. Importantly, interdisciplinarity requires a blend of analytical and creative thinking. Developing this skill combination begins in the classroom and is then transferable to real-world settings. For example, in a research lab, scientists do not work on problems whose solutions can be readily discovered simply and mechanistically by applying known formulas. Instead, they tackle problems whose solutions are yet unknown and must be found. Solutions to these real-world problems require analytical as well as intuitive and speculative strategies that work sometimes but not other times. Innovative companies such as Apple, Google, and Facebook value people who think analytically and creatively. As one transformative product is being introduced to the market, another is already under development. Analytical thinking is required to know the market for a product, while creative thinking is what produces products in the first place and keeps them coming out (Sternberg, 1996, pp. 136, 141).

Our colleagues at West Virginia University survey graduates in the years following their interdisciplinary and multidisciplinary studies programs. In 2014, 112 of 118 respondents (95%) reported that they were employed. They provided a wide range of occupations: 39 were in customer-related areas of business such as real estate and sales, 20 were in other areas of business such as human resources, 23 were in education, 13 in health care, 9 in government service, and 8 in other careers. Importantly, satisfaction with the degree—an impressive 84% and rising as the program is developed—varied little across careers. While we must be careful in drawing conclusions from one survey at one university, the indication is that graduates of interdisciplinary studies programs find their education useful across a wide range of occupations.

A THREADED EXAMPLE: BASIC INCOME

We provide many examples of interdisciplinary analysis in this book. It is useful to follow one example throughout the book, thus illustrating how each chapter adds to our ability to confront complex issues. The idea of a “basic income,” a minimum income that would be guaranteed to every adult in a society, is a useful example for us to pursue. Importantly, a basic income is advocated not just by many on the political left, who see it as a strategy for eliminating poverty, but by many on the political right, who see it as potentially replacing a welter of overlapping social welfare programs and restoring the incentive to work among the very poor. Yet many on both right and left worry that such a project is infeasible or undesirable. We can then discuss how to approach this issue throughout this book, leaving the student free to reach their own conclusion.

For the purpose of this chapter, we can see that the idea of a basic income is the sort of complex public policy challenge that requires interdisciplinary analysis. There are important political questions: Is it possible to replace a set of programs—and, importantly, programs offered by different levels of government—with a simple basic income guarantee? There is a critical economic question as to how much it would cost to do so, which depends both on the level of the basic income and the cost savings from eliminating other programs. There are important psychological and sociological questions about the effect that a basic income would have on the very poor: Would they still work? Would they feel less stressed? The health sciences could inform us of whether the poor are likely to be healthier or not if receiving a basic income. Useful advice can be obtained from social workers and others who regularly interact with the very poor. Though the basic income is praised as a policy for its simplicity, the task of deciding whether it is feasible and desirable is not so simple.

We noted above that interdisciplinary policy analysis must often have an ethical dimension. The idea of a basic income forces us to confront many ethical issues. How should a society treat its poorest members? Do we want all adults to work? How much should a basic income ideally be?

Critical Thinking Questions

1. How is globalization affecting your education, and how are you preparing for life after university?
2. Why is the ability to engage in systems thinking, contextualization, perspective taking, and integrative thinking important when it comes to addressing complex problems? How important is ethical analysis?
3. Why is interdisciplinary connection-making essential to the advancement of knowledge?
4. After reading Box 1.8, explain how the humanities can aid our understanding of problems traditionally considered to fall within the research domain of the sciences, such as genetically modifying animals or public funding for educating special needs children.
5. How does interdisciplinary studies foster the development of creative intelligence?
6. Identify a generative technology (other than the iPhone or iPad) and explain how it is likely the product of integrating knowledge from multiple sources.
7. Explain why major funding agencies that support faculty research and thus shape the agenda of higher education are increasingly emphasizing the importance of interdisciplinarity.
8. Can an interdisciplinary approach enhance the quality of public debate?

Applications and Exercises

1. From your reading of this chapter, comment on this statement: “Today’s graduates will be entering *not* a career that lasts a lifetime, but a lifetime of multiple careers.” How should you prepare academically for this new reality?
2. Other than the economy and the university, what other system is impacting your life, and how?
3. Of Sternberg’s three types of “successful intelligence,” which type(s) do you believe you already possess, and which do you believe you need to develop further? Explain why. How do you intend to develop it?
4. If you know what career or profession you plan to pursue, describe how it has changed in recent years. Identify the critical skills that the career/profession requires. If you are undecided about your future career or profession, select one that you think might interest you. In either case, do you feel that your present abilities and skills “fit” the job or profession? How might the abilities and skills that interdisciplinarity fosters improve the “fit”? How might you speak to the value of an interdisciplinary education in a job interview?
5. Identify an unresolved complex problem at your place of work (or the place of work of someone you know) and explain how an interdisciplinary approach could possibly aid its resolution.
6. Much has happened in our world since the list of popular majors appearing in Table 1.1 was constructed. Given the realities of the world today and the trends discussed in this chapter, what changes in this list do you anticipate 5 years from now?
7. What are the key elements of your personal identity, and are there challenges in integrating these?

Note: Any of these questions, but perhaps especially 4, 5, and 6, could also be used to motivate group discussions on the value of interdisciplinarity. Students could seek to identify and appreciate the perspectives of others in their group.