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BEGINNING THE RESEARCH PROCESS

LEARNING OUTCOMES

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

- Describe the integrated model
- Describe STEP 1
- Describe STEP 2

GUIDING QUESTIONS

What is the interdisciplinary research process?

How do you perform the first two STEPS of this process?

(*Note:* This material is best learned while being applied.)

CHAPTER OBJECTIVES

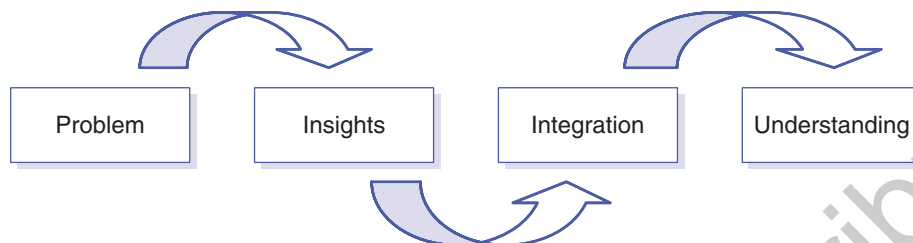
Today, there are many types of interdisciplinarity being practiced in the United States, Canada, Europe, Australia, and elsewhere. We might thus ask whether it makes sense to speak of one interdisciplinary research process. The answer is yes. Different types of interdisciplinarity essentially make different decisions *within an overarching research process*.

The chapter presents the integrated model of the interdisciplinary research process (IRP) and explains its defining characteristics. We shall see that interdisciplinary research can be performed by individuals or teams. The chapter also introduces the first two “STEPS” or decision points that the model calls for: Define the problem or state the research questions (STEP 1), and justify using an interdisciplinary approach (STEP 2).

THE INTEGRATED MODEL OF THE INTERDISCIPLINARY RESEARCH PROCESS

When driving to an unfamiliar place away from home, travelers rely on Global Positioning System (GPS) to avoid unproductive, time-consuming detours. Similarly, when proceeding from a problem to an understanding of the problem, interdisciplinarians need a map

FIGURE 3.1 ● From Problem to Understanding



to guide them through the interdisciplinary research process or IRP. The IRP in its most simplified form is shown in Figure 3.1.

Although helpful, Figure 3.1 lacks the detail necessary to proceed from the problem to the understanding. This book presents a detailed model of the IRP (shown in Table 3.1) to serve as a GPS. The model presented here integrates the prominent models of the IRP.¹ Using 10 STEPS, it provides a proven approach to conducting interdisciplinary research, finding new meaning, and creating new knowledge. Unlike a GPS that tells you when to turn and which way, the IRP can only tell you when to make a decision.

The 10 STEPS clarify the “points of decision” or “operations” that are taken in almost any interdisciplinary research project. While those working in the “softer” social sciences and in the humanities may stress the elements of intuition, creativity, and art in the research process over STEPS, the IRP, especially the integrative part of it, involves intuition *and* method, creativity *and* process, art *and* strategic decision making.

Each STEP will be carefully explained in subsequent chapters. The first couple of STEPS focus on developing a good research question. The next four STEPS involve identifying and evaluating disciplinary insights. STEPS 7 through 9 focus on integrating across disciplinary insights. The final STEP urges reflection, testing, and communication of findings. (*Note:* Descriptions of creative processes often speak of four steps—preparation, incubation, illumination, and verification—which bear a strong similarity to these four groups of steps. The IRP is thus a creative process [Szostak 2017a].)

Dividing what is essentially a fluid process into distinct STEPS may give the misleading impression that these STEPS do not overlap. They often do. For example, the cursory literature search begins during STEP 1 and continues over the next STEPS until the full-scale search is completed in STEP 4 (see Chapter 5). Some researchers begin conducting the full-scale literature search (shown as STEP 4) as soon as STEP 1, and some continue

TABLE 3.1 The Integrated Model of the Interdisciplinary Research Process**A. Drawing on disciplinary insights^a**

1. Define the problem or state the research question.
2. Justify using an interdisciplinary approach.
3. Identify relevant disciplines.
4. Conduct the literature search.
5. Develop adequacy in each relevant discipline.
6. Analyze the problem and evaluate each insight or theory.

B. Integrating disciplinary insights

7. Identify conflicts between insights and their sources.
8. Create common ground between insights.
9. Construct a more comprehensive understanding.
10. Reflect on, test, and communicate the understanding.

Source: Repko, A. F. (2006). Disciplining interdisciplinarity: The case for textbooks. *Issues in Integrative Studies*, 24, 112–142.

- a. The term *disciplinary insights* includes insights from disciplines, subdisciplines, interdisciplines, and schools of thought.

the search while performing later STEPS. *It is good to consider STEP 4 as a fluid process within the overall research process, especially in its early phases.*

For each STEP, we will provide a set of strategies or guidelines that have proven useful to researchers in the past, and we will provide examples of their use by scholars, practitioners, and students across the natural sciences, the social sciences, and the humanities (see Mokari Yamchi et al. [2018] for one recent recommendation of this approach in the field of food security). There is a set of common challenges—such as grappling with differences in disciplinary perspective (Chapter 2)—that are faced by interdisciplinary researchers addressing any topic, and thus a common set of strategies for confronting these. These STEPS and strategies reflect considerable consensus within the community of scholars of interdisciplinarity, although of course additional useful strategies may be discovered in the future. Some scholars are nevertheless hesitant to embrace an entire interdisciplinary research process for fear that this will somehow constrain the freedom of interdisciplinary research (Box 3.1). Significantly, the STEPS and strategies outlined in this book are shown to be inherently flexible.

BOX 3.1

Interdisciplinary researchers generally agree on the need to specify, at least to some extent, how to draw on disciplinary expertise and, especially, how to integrate disciplinary insights and theories. Those who oppose any greater specificity in research methodology do so reasoning that it might constrain freedom of activity, stifle creativity, or prevent interdisciplinarity from functioning as the antidote to restrictive disciplinary perspectives (Szostak, 2012, p. 4). Neither freedom nor creativity is compromised by providing some structure and direction to the research process. What these critics overlook is that all research, including interdisciplinary research, uses some method or strategy to approach a problem. While disciplinary methodologies generally involve a preference for certain theories, methods, and phenomena, the IRP encourages researchers to cast their gaze across *all* relevant theories, methods, phenomena, and insights. The IRP does not constrain research in the way that disciplines do.

KEY CHARACTERISTICS OF INTERDISCIPLINARY RESEARCH

Interdisciplinary research is a decision-making process that is heuristic, iterative, and reflexive. Each of these terms—*decision making*, *process*, *heuristic*, *iterative*, and *reflexive*—requires explanation.

It Involves Decision Making

Decision making, a uniquely human activity, is the cognitive ability to choose among alternatives. Decision making is complicated by the prevalence of complex problems in our personal lives, in business, in society as a whole, and in the international realm. Interdisciplinarity focuses on complex problems or questions. A characteristic of these is that there are many variables involved, each of which may be studied by a different discipline, subdiscipline, interdiscipline, or school of thought. The **interdisciplinary research process (IRP)** is a practical and demonstrated way to make decisions about how to approach these problems, decide which ones are appropriate for interdisciplinary inquiry, and construct comprehensive understandings of them (Newell, 2007a, p. 247).

It Is a Process

Doing interdisciplinary research, whether performed individually or collaboratively, is a process (Newell, 2007a, p. 246). **Process** means following a procedure or strategy.

Interdisciplinary research has in common with all disciplinary research an overall plan or approach. Reduced to its simplest terms, all applied research has these three steps in common:

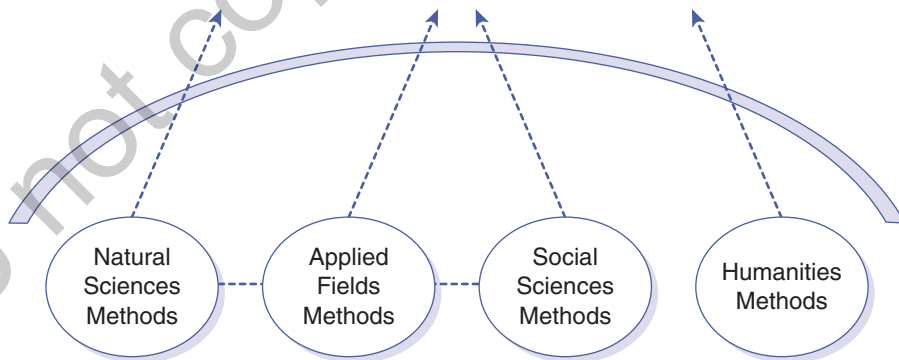
- The problem is recognized as needing research.
- The problem is approached using a research strategy.
- The problem is solved or at least a tentative solution is devised.

Each discipline has developed its own methods and preferred research strategy, as noted in Chapter 2. Likewise, interdisciplinary studies has developed a research process that differs in important respects from disciplinary methods *and subsumes them*, as shown in Figure 3.2. *The IRP is an overarching research process (noted by the arching line) that draws on disciplinary perspectives and their insights that are relevant to the problem.* The process of interdisciplinary research is necessarily distinct from the processes employed in disciplinary research because integration is at the very core of interdisciplinary activity, whereas it is not at the core of disciplinary activity.

It Is Heuristic

A **heuristic** is an aid to understanding or discovery or learning. A heuristic does not provide you with an answer but guides you to seek solutions in an effective way. The IRP is heuristic in that it places you, the student, in the role of the discoverer of knowledge. You learn how to approach the problem either by yourself or as part of a group. The IRP aids discovery by asking you to make decisions at each STEP. You as the researcher will

FIGURE 3.2 ■ Interdisciplinary Research Process



Note: The dotted lines connecting the applied fields to the natural sciences and the social sciences show that the applied fields (such as education, criminal justice, communication, law, and business) use research methods drawn from these other disciplinary categories.

still have much scope for reason, experimentation, trial and error, and creativity in the exercise of each STEP. If some find interdisciplinary research “a tall order,” it is probably because so much academic learning is “rote learning.” This is learning that occurs when the learner memorizes new information without relating it to prior knowledge, or understanding the theory underlying it. Rote learning involves no attempt to integrate new knowledge with existing concepts, experience, or objects (Novak, 1998, pp. 19–20). The standard Western approach to education lacks guides to integration and holism, a deficiency that interdisciplinarity addresses.

The IRP is student friendly. Practitioners in several nations are successfully teaching the material in this book. Students who apply themselves will master this important and new way of approaching complex problems and framing new and creative solutions to them that otherwise would be impossible using a disciplinary or multidisciplinary approach.

It Is Iterative

The IRP is **iterative** or procedurally repetitive. Although the research process features decision making and STEP taking, the process is by no means linear. That is, the process is not a simple matter of moving from point *A* to point *B* to point *C* and on to the end. Rather, when you get to point *B*, you may discover that you need to revisit and revise the decision you made at point *A*. In fact, revising work performed at earlier STEPS is likely to happen at any given point in the process. For example, the process of selecting the most relevant disciplines (STEP 3; see Chapter 4) may lead to restating the problem identified in STEP 1. And you may revisit the literature search as you perform later STEPS. *Throughout the research process, you should expect to revisit earlier work.*

Interdisciplinary researchers rely on “systems thinking” to approach a problem creatively, thinking about it “outside the box” without being influenced by solutions attempted in the past, and viewing it from different perspectives. **Systems thinking** is a method of visualizing interrelationships within a complex problem or system by (1) breaking it down into its constituent parts, (2) identifying which parts different disciplines address, (3) evaluating the relative importance of different causal linkages, and (4) recognizing that a system of linkages is much more than the sum of its parts. (We discuss this approach further in Chapter 4.) **Feedback loops**, depicted in Figure 4.1, are central elements of systems thinking. They describe the process that requires the researcher to periodically revisit earlier activity. **Feedback** is corrective information about a decision, an operation, an event, or a problem that compels the researcher to revisit an earlier STEP. This corrective information typically comes from previously overlooked scholarship. As you proceed, periodically ask questions such as

- Have I defined the problem or the question too broadly or too narrowly?
- Have I correctly identified the parts of the problem?
- Have I identified the disciplines most relevant to the problem?
- Have I gathered the most important insights concerning the problem?
- Am I privileging one discipline's literature or terminology over another's simply because I am more comfortable working in the discipline?
- Have I allowed my personal bias to shape the direction of the study?

It Is Reflexive

The IRP is also **reflexive**, meaning that we become self-conscious or self-aware of our disciplinary or personal biases that may influence our inquiry and possibly skew our evaluation of insights and thus bias the end product. As you make decisions about which insights to use and which to discard, avoid the temptation to eliminate insights or theoretical approaches that are unfamiliar to you or that challenge your beliefs. In fact, you should expect that your biases will be challenged throughout the research process.

Two Cautions Concerning the STEPS

First, it is tempting to avoid difficult STEPS and leap ahead to later STEPS. By keeping in mind the STEPS of the model, researchers are more likely to realize that they have skipped over an important STEP and need to return to complete it. Since each STEP typically requires at least preliminary completion of previous STEPS, it is important to regularly reexamine the work done in earlier STEPS. For example, you might be tempted not to spend much time developing adequacy in the disciplines relevant to the problem (STEP 5; see Chapter 6) and proceed with analyzing the problem and evaluating disciplinary insights into it (STEP 6; see Chapter 7). This impatience to “get on with the project” can prove costly, however. Unless you know what specific information to look for when developing adequacy—the discipline's relevant concepts, assumptions, theories, and methods—the time and effort invested may fail to yield the quality information that you need to perform later STEPS. Ultimately, you have to develop adequacy in each relevant discipline before reading and comprehending the discipline's insights profitably. Avoiding difficult STEPS and decisions will make the task of modifying insights and then integrating them problematic.

Second, describing the IRP in terms of STEPS may give the impression that each relevant discipline is “mined separately for nuggets of insights before any integration takes place,

and that when integration occurs, it happens all at once” (Newell, 2007a, pp. 248–249). Nothing could be further from actual practice. You should partially integrate as you go, meaning that you should incorporate disciplinary insights or theories into a broader understanding of the problem as you proceed (p. 249).

In the end, each interdisciplinary research project presents a unique combination of challenges and opportunities. The many examples of professional work and exemplary student projects threaded throughout this book clearly show the variety of ways to creatively do interdisciplinary research. The critical differences between interdisciplinary and disciplinary approaches to research are noted along the way.

NOTE ON TEAM RESEARCH

A guiding premise of this book is that individual students and scholars can perform interdisciplinary research. They need not have the same level of expertise in a discipline as a researcher who specializes in that discipline to draw intelligently on that discipline for the purposes of interdisciplinary analysis. It is nevertheless true that large-scale interdisciplinary research is often performed in teams. Team members may each bring expertise with respect to different disciplines or theories or methods or phenomena.

Although teams have the potential advantage of bringing diverse perspectives and expertise to bear on a single problem, they inevitably face all of the challenges inherent in interdisciplinary communication. Team members may attach different meanings to words. These differences may not always be obvious and may lead them to think that they agree when they do not, or that they disagree when they do not. Team members will also bring different perspectives. This is another important source of miscommunication, for one team member may make assumptions that are not made by others from a different discipline.

The Toolbox project (long centered at the University of Idaho) has tackled the second challenge. The project managers give questionnaires—regarding epistemological and methodological issues—to members of interdisciplinary research teams. They then discuss with the research team how and why their answers differ. When the questionnaire is given again, there is usually some convergence in answers: Team members come to respect the views of others and move away from extreme attitudes. Most importantly, team members report that the exercise enhanced team communication: Each member had a better sense of where other team members were coming from (see Looney et al., 2014; it is in a volume by O’Rourke et al. that addresses communication challenges more generally). The lesson for interdisciplinary communication is that it is very useful to be explicit about the nature of disciplinary (and other) perspectives. Much of this book seeks to do precisely that. Students will thus be better prepared for teamwork later in life.

In addition to these cognitive challenges—dealing with differences in definitions and perspectives—there are also psychological challenges. Team members must get along

and respect each other, and individual team members must do their share of the work. These challenges may be exacerbated in interdisciplinary research if some team members feel—perhaps subconsciously—that their discipline (or favorite theory or method) is somehow superior.

Team members must respect other perspectives and be curious to learn about them. They must more generally have considerable intellectual curiosity. They must have the courage to reflect on their own hidden assumptions as they interact with others. They must be willing to cope with complexities and uncertainties (see Misra, Hall, Feng, Stipelman, & Stokols, 2011). Team members should also be collaborative, responsible, and have good time-management and information-management skills.

There are various strategies for encouraging positive team outcomes. There must be many collaborative conversations, but also clear tasks, for each team member to perform between conversations. There should be opportunities for the exploration of differences in definition and perspective. Individual team members should feel that they will be rewarded for their effort and collaboration. If a team leader is chosen, this should be a person who is respectful of all team members and good at providing constructive encouragement (and constructive criticism if necessary).² It is best if the team is formed at the start of the

interdisciplinary research process: If the team does not agree upon—and fully understand—the research question(s) then collaboration in later steps is unlikely.

Instructors in interdisciplinary courses may encourage students to work in teams. They may require a group project or group presentation in class. They might employ group exercises in class. For example, students in a group might each be asked to sketch an interdisciplinary research question on a piece of paper. As the papers are passed around, each subsequent student seeks to clarify the question. This exercise could be performed either before or after guidelines for a good interdisciplinary research question are addressed in class. Similar exercises can be pursued at each step in the interdisciplinary research process. Students will experience the advantages of having different minds work together on a single project. They will likely also experience some of the communication challenges inherent in interdisciplinary research. Even if explicit teamwork is not encouraged, class discussions regarding the challenges students are facing at each step in the interdisciplinary research process are an invaluable strategy for learning both about interdisciplinary research and about the value of bringing multiple perspectives to bear on a particular challenge. (More details on this sort of group exercise can be found at <https://i2insights.org/2019/03/12/idea-tree-brainstorming-tool/>.)

STEP 1: DEFINE THE PROBLEM OR STATE THE RESEARCH QUESTION

This graphic shows the STEPS of the research process. We highlight STEP 1 and bullet point the decisions that it involves.



A. DRAWING ON DISCIPLINARY INSIGHTS

1. **Define the problem or state the research question.**
 - **Select a problem or pose a question that is complex and requires drawing on insights from more than one discipline.**
 - **Define the scope of the problem or question.**
 - **Avoid three tendencies that run counter to the IRP.**
 - **Follow three guidelines for stating the problem or posing the question.**
2. Justify using an interdisciplinary approach.
3. Identify relevant disciplines.
4. Conduct the literature search.
5. Develop adequacy in each relevant discipline.
6. Analyze the problem and evaluate each insight or theory.

B. INTEGRATING DISCIPLINARY INSIGHTS

7. Identify conflicts between insights and their sources.
8. Create common ground between insights.
9. Construct a more comprehensive understanding.
10. Reflect on, test, and communicate the understanding.

Defining the problem or stating the research question is the first and most basic activity that one undertakes in conducting research or engaging in problem solving of any kind. It is also the STEP that often takes considerable time and effort because you do not yet know much about the problem or even if it is researchable in an interdisciplinary sense. For this reason, you should expect to revisit your definition of the problem or statement of the research question as you take additional steps.

Select a Problem or Pose a Question That Is Complex and Requires Drawing on Insights From More Than One Discipline

A problem is ripe for interdisciplinary study when

- it is complex (i.e., requires insights from more than one discipline), and
- it is **researchable in an interdisciplinary sense** (i.e., authors from at least two disciplines have written on the topic or at least on some aspect of it).

If you have trouble telling *in advance* whether a problem is complex, a useful *initial test* is to ask whether there is more than one legitimate way to look at the problem and, if

so, which disciplines would likely be interested in it. Referring to Tables 2.2 and 2.3 in Chapter 2 will aid you in making this tentative determination. (*Note:* A more detailed discussion of complexity as a criterion for interdisciplinary inquiry follows below.)

To decide with confidence whether a problem is researchable requires conducting the literature search (the subject of Chapter 5). A problem may be complex but for some reason has failed to generate scholarly interest outside a particular discipline. Such is the case with the problem concerning the effects of physician shortages on society. The problem appears to be complex and is certainly important to society. But for whatever reason, it has failed to attract much scholarly attention outside the field of medicine (although it is a subject of discussion in multiple arenas that draw on economic, sociological, political, and demographic perspectives). (*Note:* The discovery of such gaps in research opens the door to potentially fruitful interdisciplinary inquiry, although undergraduates may want to avoid such questions, while graduate students and scholars may see an opportunity.)

Frequently, the research problem that we would *like* to investigate cannot be the problem that we *can* investigate because the cursory literature search has failed to reveal relevant insights concerning it from two or more disciplines. Consequently, we must revise the problem, question, or topic based on material that the search has revealed.

How, though, do we identify a research question in the first place? Some students may begin with some burning question that has long troubled them, and find that it is suitable for interdisciplinary inquiry. Some instructors may encourage certain research questions. But many students will find it difficult to formulate a suitable question. They can take heart from the fact that even seasoned scholars sometimes struggle to identify good research questions. Students, like scholars, can develop questions by reading the existing literature in some area that they are curious about. What questions do authors raise but not answer? Do you have doubts about the conclusions they reach? If you read works on the same topic from multiple disciplines, do there seem to be disagreements or gaps in understanding between these? Note that this exploratory reading by its nature is a bit unstructured: You cannot know in advance what sort of question you might come up with. But you should have confidence that if you do read widely, you will come up with something. You are more likely to develop a good question if you care about the topic in which you are reading. We have hinted above that interdisciplinary research is a creative process: You may find even at this earliest step that an idea will suddenly pop into your head. But this will only happen if you are relaxed and confident enough that subconscious thought processes can generate a good idea. And good ideas only come to the prepared mind: You need consciously to think and read about an area of interest before you can subconsciously develop a good research question. It can be useful to map the connections among phenomena identified by different authors: Do you see novel connections, or perhaps a novel system of connections that you might investigate? Yet you may well find that you develop a question that is tangential to your original reading: Some

side issue or related topic may catch your interest. Last but not least, you may be inspired by conversation: Talk to friends and fellow students and your instructor (or perhaps collaborators in a community service learning initiative) about your interests and you may collaboratively achieve a good research question. The sort of group exercise mentioned in our note on team research above may be useful here.³

Define the Scope of the Problem or Question

Once you have identified the topic or problem, your next decision is to define its scope. **Scope** refers to the parameters of what you intend to include and exclude from consideration. In other words, you are telling your readers how much of this problem you plan to investigate. For example, if the problem is repeat spousal battery, how will you approach it? Will you focus on the *causes* of repeat spousal battery or on the *prevention* of repeat spousal battery? Will you research the *treatment* of the perpetrator and/or the victim of spousal battery? Or will you focus on the *effects* of repeat spousal battery on a particular demographic, say the children? Though all these options are clearly related to the overall problem of repeat spousal battery, narrowing the scope of the problem at the outset, to the extent possible, will facilitate the literature search and provide focus to subsequent STEPS in the research process. The extremes to be avoided are conceiving the problem too broadly so that it is unmanageable (such as investigating both the causes and effects of repeat spousal battery), and conceiving the problem too narrowly so that it is not interdisciplinary or researchable (such as focusing just on the psychological effects of spousal battery on the children).

Subsequent STEPS in the research process may require revisiting your initial statement of the problem or focus question and modifying it in some way. Here is an example (developed in a class) of how to transition from the *very broad topic* of “ways to prevent domestic violence” to a narrower and more focused *interdisciplinary statement* of the problem:

The problem of domestic violence is broad, and developing strategies to prevent one of its most insidious manifestations—repeat spousal battery—is a pressing social need. Whereas single disciplinary approaches focus on only a single aspect of repeat spousal battery, an interdisciplinary approach that takes into account all aspects of the problem will hopefully lead to interventions that will mitigate this social scourge.

This transition from broad to narrow was possible after the class had read more widely about domestic violence and had begun to understand its complexity. This statement, which appeared in the introductory paragraph, was the product of several iterations, each of which was made after the class had taken additional STEPS in the IRP.

Avoid Three Tendencies That Run Counter to the IRP

In defining the problem or stating the research question, three tendencies should be avoided that may be acceptable in some academic settings but that run counter to the IRP: disciplinary bias, disciplinary jargon, and personal bias.

Disciplinary Bias

The first tendency is to engage in **disciplinary bias**, which means to state the problem using words and phrases that connect it to a particular discipline. For example, the problem statement “The Responsibility of Public Education for Sex Education” is biased in favor of education. Stating the problem in *discipline-neutral* terms makes it easier to justify using an interdisciplinary approach. By removing the disciplinary bias in the above example, the problem could be stated like this: “Sex Education in Public Education: An Interdisciplinary Analysis.” Adding “An Interdisciplinary Analysis” alerts the reader that the problem is going to be approached from multiple disciplinary perspectives, not just the perspective of education.

Disciplinary Jargon

The second tendency is to use **disciplinary jargon**, which means using technical terms and concepts that are not generally understood outside a particular discipline. If a technical term or concept must be used in the statement introducing the problem, then it must be defined in the next sentence or two. *A rule of thumb is to assume that the reader is unfamiliar with a technical term or concept.* Here is an example of a statement that introduces a problem that is appropriate to interdisciplinary inquiry but contains disciplinary jargon: “The recidivism of domestic batterers is a significant problem in the United States because of the short-term and long-term psychological effects on the victim.” This statement contains three technical terms that are probably unfamiliar to most readers and thus require definition: *recidivism*, *domestic batterers*, and *psychological effects*. (If the researcher wants to limit the investigation to “psychological effects on the victim,” then a simple disciplinary approach will do. Otherwise, the statement should omit the term *psychological* to expand the search to other disciplines. Researchers must learn what terms mean and factor them into the interdisciplinary frameworks they construct.) Even disciplinary experts working on interdisciplinary research teams must first develop a common vocabulary before the work of research can begin.

The following are student-written examples of discipline-neutral statements introducing a problem that involves multiple disciplines:

- “Euthanasia is the intentional killing by act or omission of a dependent human being for his or her alleged benefit, be it voluntary or involuntary. The controversy over euthanasia was rekindled in the 1993 case of *Sue Rodriguez v. British Columbia (Attorney General)*, which involved a woman in

her forties who was suffering from Lou Gehrig's disease and who wanted to choose the time and manner of her inevitable death." This student carefully defines what would otherwise be disciplinary jargon. From this wording, the reader can readily discern that the three disciplines deemed by the student as most relevant to the problem of euthanasia are ethics, medicine, and law.

- "Recent ACT scores show that a growing number of students are failing to grasp basic scientific knowledge. Science and technology play an integral role in modern society. Without scientifically and technically trained students, there will be a shortage of trained professionals in critical fields such as medicine, biology, engineering, and information technology. Even fields that are not normally thought of as scientific, including business, agriculture, journalism, and sociology, now rely heavily on science and technology." The disciplines that the student found to be most relevant to this topic are biology, psychology, and education.

In summary, the statement of an interdisciplinary problem should not privilege any one discipline. Using (perhaps unconsciously) disciplinary jargon or terminology tacitly favors one disciplinary perspective at the expense of another.

Personal Bias

A third tendency is to inject **personal bias** or one's own point of view when introducing the problem. While appropriate in many academic contexts, injecting your personal bias is not appropriate in most interdisciplinary contexts where the goal is quite different: to construct a more comprehensive understanding. Some fall into the trap of collecting evidence from various disciplines that supports their bias on the issue. This only adds their personal bias to the biased insights of disciplinary authors. *An interdisciplinary understanding cannot be "more comprehensive" if your personal bias dominates and if you exclude insights that differ from yours.*

We note personal bias in this introduction of the problem: "Taxpayer dollars should not be used to finance sports complexes for professional teams." The student obviously believes this and would evidently prefer to write a paper advancing this point of view. However, the interdisciplinarian is not to play the role of prosecuting attorney or defense counsel for the accused. *The role of the interdisciplinarian is to produce an understanding of the problem that is more comprehensive and more inclusive than the narrow and skewed understandings that the disciplines have produced.* This calls for approaching the problem with a frame of mind that is decidedly different from that of the disciplinarian. This frame of mind is one of neutrality (or at least suspended judgment) and objectivity until all the evidence is in. This means openness to different disciplinary insights and theories, even if these challenge your deeply held beliefs. *A defining characteristic of interdisciplinary work should be to mitigate conflict by finding common ground among conflicting perspectives, including your own.* A neutral question such as "Should taxpayer dollars subsidize sports complexes for professional teams?" would guide the researcher to evaluate competing arguments and seek common ground among them.

Follow Three Guidelines for Stating the Problem or Posing the Question

If a problem appears suitable for interdisciplinary inquiry, it should be phrased in conformity to these important guidelines:

- *The problem should be stated clearly and concisely.* This statement demonstrates lack of clarity: “The majority of complaints registered by the Childcare Licensing Agency (CLA) concern unsafe child care facilities.” It is unclear what the focus of the investigation is: the complaints, whether or not they are valid, lack of enforcement of safety regulations by the CLA, lack of funding of the CLA by the federal government, or lack of legislation that establishes strict enforcement procedures. Sometimes greater clarity can be achieved by stating the problem as a question.
- *The problem or focus question should be sufficiently narrow to be manageable within the specified limits of the essay.* The problem of “Securing the southern border of the United States” was too broad for an essay requiring only three disciplinary perspectives. Upon discovering that the literature on border security was vast, the student narrowed the problem to the more manageable one of “Perspectives on securing the southern border of the United States against human smuggling: An interdisciplinary study.”
- *The problem should appear in a context (preferably in the first paragraph of the introduction) that explains why it is important—that is, why the reader should care.* The following introduction (developed in class) places the problem of wife battery in a context that not only engages the reader but, more important, indicates why the problem warrants the reader’s interest:

Wife battery is a widespread problem in the United States. It is urgent that a solution be found because of its devastating effects on the victim, including debilitating depression and redirected violence against her children. The wife’s extended family and associates also feel the effects of her physical and emotional pain. Most tragically, studies show that children who grow up in abusive homes tend to be abusive to their own children, thus perpetuating a vicious cycle of violence.

Examples of Statements of an Interdisciplinary Problem or Question

The following are examples from published work and student projects of well-written statements introducing the problem that illustrate the above criteria. The student projects are identified by an asterisk (*). Students should note how each example accords with each of the guidelines outlined above.

From the Natural Sciences. Dietrich (1995), *Northwest Passage: The Great Columbia River*. William Dietrich introduces the problem of how dams on the Columbia River

system in the Northwest are impacting the salmon populations and the people who depend on them for their livelihood:

To a Pacific Northwest journalist such as myself, the river was inescapable as a subject. Its energy powered the region and its history dictated the region's history. . . . Many of the people I encountered, however, looked at the river from the narrow perspective of their own experience. One colleague said it was as if everyone was looking at the Columbia River through a pipe. . . . Each interest group looked at the Columbia and saw a different river.

That experience dictated the approach of this book. One of the mistakes of the past . . . has been the tendency to focus narrowly on development of some part of a river without considering the consequences for the whole. "When we [whites] are confronted by a complex problem, we want to take a part of the complexity and deal with that," remarked Steve Parker, a fish biologist hired by the Yakima Indian tribe. The Henry Ford assembly line is an example of this kind of specialization, Parker said. Its economic success is why narrow focus and admiration of specialists became ingrained in American culture. (pp. 23–24)

From the Natural Sciences. Smolinski (2005), *Freshwater Scarcity in Texas*. Joe Smolinski introduces the problem of freshwater scarcity in Texas in this clearly written introductory paragraph:

There is little doubt among experts that freshwater is one of the most valuable natural resources in the state of Texas. Experts, in a variety of disciplines, have not yet been able to reach agreement as to the cause and effect of the widespread freshwater shortages currently experienced across the state. With population predictions calling for a dramatic increase in the number of residents over the next fifty years, the competition between these uses will only become more intense. How we address the use and allocation of water will have a dramatic impact on the environment and the quality of life for all Texans. (p. 1)

From the Social Sciences. Fischer (1988), "On the Need for Integrating Occupational Sex Discrimination Theory on the Basis of Causal Variables." Charles C. Fischer introduces the problem of occupational sex discrimination (OSD) in the workplace as follows:

The majority of complaints filed with the Equal Employment Opportunity Commission under Title VII of the Civil Rights Act involve sex discrimination. Complaints of sex discrimination pertain mainly to pay discrimination, promotion (and transfer) discrimination, and occupation discrimination. Occupational sex discrimination (OSD) is particularly serious since other forms

of sex discrimination are, to a large degree, symptomatic of a lack of female access to “male” occupations—those occupations that pay good wages, that are connected to long job ladders (that provide opportunities for vertical mobility via job promotion), and that offer positions of responsibility. (p. 22)

From the Social Sciences. Delph* (2005), *An Integrative Approach to the Elimination of the “Perfect Crime.”* Janet B. Delph introduces the growing problem of unsolved homicides, which she calls “perfect crimes,” in these stark terms:

Modern day criminal investigation techniques do not eliminate the possibility of the “perfect crime.” . . . A “perfect crime” is one that will go unnoticed and/or for which the criminal will never be caught (Fanton, Tolhet, & Achache, 1998). The public is all too aware of these likely outcomes and consequently feels unsafe and vulnerable. Parents experience silent fear each time their child wanders beyond their reach. While “men are afraid women will laugh at them, women are afraid that men will kill them” (DeBecker, 1997, p. 77). Deviant minds should not be allowed to think that they can commit murder without suffering the gravest consequences. (p. 2)

From the Humanities. Bal (1999), “Introduction,” *The Practice of Cultural Analysis: Exposing Interdisciplinary Interpretation*. Mieke Bal’s introduction serves two purposes. The first is to decipher the complex meaning of the object she is subjecting to interdisciplinary scrutiny: an enigmatic love poem written in yellow paint on a red brick wall (e.g., a graffito) in post–World War II Amsterdam, the Netherlands. The second and closely related purpose is to introduce the reader to the interdisciplinary process of cultural analysis, of which she is a leading practitioner, and illustrate its ability to reveal new meaning in an object or a text like the graffito.

Cultural analysis as a critical practice is different from what is commonly understood as “history.” It is based on a keen awareness of the critic’s situatedness in the present, the social and cultural present from which we look, and look back, at the objects that are already of the past, objects that we take to define our present culture. . . .

This graffito, for example, has come to characterize the goals of the Amsterdam School for Cultural Analysis (ASCA). . . . In the most literal translation the text means:

Note

I hold you dear

I have not

thought you up

This graffito fulfills that function because it makes a good case for the kind of objects at which cultural analysis would look, and—more importantly—how it can go about doing so. (pp. 1–2)

From the Humanities. Silver* (2005), *Composing Race and Gender: The Appropriation of Social Identity in Fiction*. Lisa Silver writes an informal personal narrative of how she became interested in her subject, the appropriation of social identity in fiction writing. Her story begins with her trip to Mexico during spring break of her junior year. When she returned, she had a story due in her creative writing class, so she tried writing about the people she met in the mountain villages in Oaxaca, Mexico.

And that's when the interdisciplinarity kicked in. . . . In Mexico we learned it would be offensive for us, as outsiders, to assume we could fix their problems. What could we, carrying our Nalgene bottles, comprehend of the effects of water privatization and pollution? How could we listen to the plight of maquiladora workers while wearing Nikes and stonewashed jeans? How could I understand the lives of the indigenous Oaxacan villagers enough to write about them—especially from their own points of view? I couldn't separate the sociological and political lessons I'd learned in Mexico from my fiction. I ended up writing my story from the first-person peripheral perspective of a white college-aged female looking in at the village. I got good critiques in class, but was never personally satisfied with the story. It felt like I'd written a nonfiction piece. I wanted to create characters with backgrounds unlike my own, but suddenly didn't know how. (p. 2)

Summary of STEP 1

All of these examples conform to the above criteria: They are *appropriate* to interdisciplinary inquiry, they carefully *define* the scope of the problem, and they *avoid the three tendencies* that run counter to the interdisciplinary process: disciplinary bias, disciplinary jargon, and personal bias. They also *follow the three guidelines* for introducing the problem: The problems are stated clearly and concisely, are sufficiently narrow in scope to be manageable (depending on the scale of the writer's project), and appear in a context that explains why the problem should interest the reader.

As further STEPS are taken, you are likely to encounter new information, receive new insights (including flashes of intuition), or encounter unforeseen problems that will require revisiting the initial STEP and modifying the research question. This is a normal part of the interdisciplinary research process.

CREATIVITY AND STEP 1

We established in Chapter 1 that the IRP is a creative process. While we can identify useful strategies for each STEP, students still need to think creatively at various STEPS. With respect to the research question, students (or scholars) face a tradeoff. A narrow question may prove easier to answer, but the answer may not be particularly exciting. A broader question

may prove harder, but it may yield an answer that is both novel and useful. We recommend above that students read a bit on a topic of interest to identify a good question. If students read in quite different disciplines (physics and literature, say), they may find it hard to make a useful connection. But they may make a very creative connection: one that has never been made before. If they instead read only in disciplines that are somewhat similar (sociology and anthropology, say), they may find it easier to develop a manageable research question but leave less scope for creativity. While undergraduate students should generally stress manageability, graduate students and scholars may want to lean toward creativity. If so, they may find it useful to ask, “What is the real problem?” Such a question may guide them to look for deeper causes of the problem they are addressing. It may also guide them to worry about the adoption of their solution: Creative solutions almost inevitably face resistance and so the creative researcher (especially) may want to reflect on the barriers to adopting solutions (why is inner city poverty so intractable?) even as they frame their research question (Szostak, 2017a).

STEP 2: JUSTIFY USING AN INTERDISCIPLINARY APPROACH



A. DRAWING ON DISCIPLINARY INSIGHTS

1. Define the problem or state the research question.
2. **Justify using an interdisciplinary approach.**
 - **Determine that the problem is complex.**
 - **Determine that important insights concerning the problem are offered by two or more disciplines.**
 - **Determine that no single discipline has been able to explain the problem comprehensively or resolve it satisfactorily.**
 - **Determine that the problem is an unresolved societal need or issue.**
3. Identify relevant disciplines.
4. Conduct the literature search.
5. Develop adequacy in each relevant discipline.
6. Analyze the problem and evaluate each insight or theory.

STEP 2 is to justify using an interdisciplinary approach. Though typically absent from professional writings, this STEP is worthwhile for undergraduates (and even graduate students) to take because it provides an opportunity to see if their projects meet the four criteria (bullet pointed in the graphic) commonly used for justifying an interdisciplinary approach and supported by the National Academies (2005).

Determine That the Problem Is Complex

The **operational definition of complexity** used in this book is that the problem has multiple parts studied by different disciplines. The definition of interdisciplinary studies appearing in Chapter 1 states that *complexity requires interdisciplinarity*. We know of no way other than interdisciplinarity to study specific complex problems such as climate change, freshwater scarcity, and terrorism. That is, *interdisciplinarity is necessary for the study of complexity* (Newell, 2001, p. 2). The criterion of complexity also extends to problems that those in the humanities typically examine, such as the contextual meaning of an object or a text.⁴

Examples of complex questions include these: What is consciousness? What is freedom? What is a family? What does it mean to be human? Why does hunger persist? Admittedly, these problems are so fundamental and complex, requiring sophisticated analysis from so many disciplines, that they are beyond the capacity of most undergraduates to address comprehensively. Nevertheless, movement toward a more comprehensive understanding of these questions is possible even if students are limited to using only a few relevant disciplines.

Confirmation of complexity will be forthcoming as additional STEPS are taken, especially STEP 3 that involves mapping the problem to reveal its disciplinary parts (see Chapter 4), and STEP 4 that calls for conducting a full-scale literature search (see Chapter 5).

Determine That Important Insights Concerning the Problem Are Offered by Two or More Disciplines

A problem that is controversial, such as climate change, has likely generated interest from two or more disciplines, each offering its own insights or theories in the form of books and journal articles. This condition makes the problem researchable. Sometimes, however, scholars from the disciplines you plan to consult have not yet published on the problem because its occurrence is recent.

NOTE TO READER

Undergraduates should work on problems that have been studied by more than one discipline. Graduate students and especially senior scholars may be able to project how a hitherto silent discipline might address the problem and what

insights it might offer into the problem. In this circumstance, they may choose to conduct basic research on the problem themselves and then integrate their insights or theory with existing disciplinary insights or theories.

Determine That No Single Discipline Has Been Able to Explain the Problem Comprehensively or Resolve It Satisfactorily

A problem is ripe for interdisciplinary inquiry if no single discipline has been able to explain it comprehensively or resolve it satisfactorily. For example, several disciplines consider terrorism within their respective domains, but no one discipline has been able to create a single comprehensive theory explaining terrorism in all of its complexity, let alone propose a holistic solution to it. For instance, political scientists typically use rational choice theory to explain terrorist behavior, but the theory fails to address religious and cultural variables. Other topics that no single discipline has been able to address comprehensively include undocumented immigration, human cloning, and genetically engineered food. The value of an interdisciplinary approach over a single disciplinary approach is that it can address complex problems in a more comprehensive way.

Determine That the Problem Is an Unresolved Societal Need or Issue

Societal/public policy problems necessitate what is widely referred to as **problem-based research**, which focuses on unresolved societal needs, practical problem solving, and intellectual problems that are the focus of the humanities, such as the meaning of some artifact. What distinguishes problem-based research from other applied research is its holistic focus that involves more than one discipline.

Examples of Statements That Justify Using an Interdisciplinary Approach

The rationale for using an interdisciplinary approach should be made explicit in the introduction to the research project. After all, this rationale distinguishes truly interdisciplinary research from multidisciplinary, not to mention disciplinary, research. Stating the rationale has the added benefit of alerting the researcher to possible problems with the topic. Spending extra time in carefully screening a potential topic according to these criteria will minimize the possibility of investing in an enterprise that later may prove unprofitable.

Satisfied that the proposed problem or topic meets one or more of the above criteria, it is then possible to present a clear rationale for using an interdisciplinary approach. Common practice is to include this statement of justification in the introduction to the study, as shown in these examples of professional work and student projects (marked with an asterisk) from the natural sciences, the social sciences, and the humanities.

From the Natural Sciences. Dietrich (1995), *Northwest Passage: The Great Columbia River*. Dietrich is struck by how narrowly people continue to look at the Columbia River. This narrowness of perspective and the lack of systems thinking provide his justification for taking an interdisciplinary approach, as follows:

My work as a writer on environmental issues, particularly the old-growth forests of the Pacific Northwest, had introduced me to the idea of ecosystems and the interrelationships of many parts to a greater whole. I wanted a comprehensive understanding of the river embracing history, Earth science, biology, hydrology, economics, and contemporary politics and management. (pp. 23–24)

From the Natural Sciences. Smolinski* (2005), *Freshwater Scarcity in Texas*. Smolinski is concerned that after years of study, disciplinary experts have not been able to reach agreement on the cause and effect of the worsening problem of freshwater scarcity. This failure provides ample justification for taking an interdisciplinary approach.

The causes and effects of freshwater scarcity across Texas are beyond the ability of any single discipline to explore. A review of the professional literature in political science, Earth science, and biology shows that these disciplines are most relevant to the problem. Each has produced its own well-defined theories about how the shortages impact the state of Texas and its communities. While each of these theories reflects the perspective of its particular discipline, none of these explanations comprehensively addresses the issues posed by the statewide shortage of freshwater. (p. 3)

From the Social Sciences. Fischer (1988), “On the Need for Integrating Occupational Sex Discrimination Theory on the Basis of Causal Variables.” Fischer provides an example of professional work from the social sciences that presents a clear rationale for taking an interdisciplinary approach.

It appears that the problem of OSD is a good candidate for an IR [interdisciplinary] approach. OSD is a problem that a number of disciplines have separately analyzed, yet it is a problem of such complexity and breadth that its division among individual disciplines leads to incomplete and naïve views.

Another important advantage of IR is that it can . . . lead to [a] more complete understanding by providing a dynamic, holistic view of the problem. (p. 37)

From the Social Sciences. Delph* (2005), *An Integrative Approach to the Elimination of the “Perfect Crime.”* Having introduced the topic and explained its importance, Delph justifies using an interdisciplinary approach.

To achieve the level of expertise necessary to solve more crimes, the criminal justice system must integrate a wide range of skills from multiple disciplines. This synthesis of skills and insights could serve as a strong deterrent to crime and result in safer communities. (p. 2)

From the Humanities. Bal (1999), “Introduction,” *The Practice of Cultural Analysis: Exposing Interdisciplinary Interpretation*. The topic of the graffito is not a societal problem; it is an intellectual one that cries out for interdisciplinary understanding or meaning. Bal (1999) sees cultural analysis as an interdisciplinary practice and the field as a counterweight to critics who charge that interdisciplinarity makes objects of inquiry “vague and methodically muddled” (p. 2). Seeking to correct this mistaken view, she justifies using cultural analysis, an interdisciplinary approach, to find meaning in the graffito.

As an object, it requires interdisciplinarity [and calls for] an analysis that draws upon cultural anthropology and theology [and] reflection on aesthetics, which makes philosophy an important partner. . . . [T]he humanistic disciplines . . . brutally confront scholars with the need to overcome disciplinary hang-ups. . . . Museum analysis requires the integrative collaboration of linguistics and literary, of visual and philosophical, and of anthropological and social studies. . . . Instead of speaking of an abstract and utopian interdisciplinarity, then, cultural analysis is truly an interdiscipline, with a specific object and a specific set of collaborating disciplines. (pp. 6–7)

From the Humanities. Silver* (2005), *Composing Race and Gender: The Appropriation of Social Identity in Fiction*. From her fiction class experience, Silver (2005) discovered that she did not know how to write authentically about the people in the Mexican village whose backgrounds were very different from her own. Frustrated and disappointed with the artificial characters she had created for her fiction piece, she decided to use the topic of character appropriation for her senior project. Character appropriation refers to a writer’s attempt to write about, or an actor’s attempt to assume, another person’s identity. As Silver read, she developed “a sense of what different disciplines—sociology, psychology, cultural studies, and creative writing—[said] about the matter” (p. 2). Finding that each of these disciplines offered an important perspective on an important subject, she determined that an interdisciplinary approach was clearly called for (pp. 1–6).

Each of these examples conforms to one or more of the above criteria. In most cases, the writer also identifies the disciplines relevant to the problem that informs the reader which disciplinary insights the author will draw upon.

Chapter Summary

This chapter introduces the integrated model of the interdisciplinary research process (IRP) and its use of STEPS. It explains the importance of the research process to interdisciplinarity, describing it as a decision-making process that is overarching, heuristic, iterative, and reflexive and issues cautions concerning the use of the STEPS. STEP 1, “define the problem or state the research question,” involves making four decisions on how to select a problem, define its scope, avoid three tendencies that run counter to good interdisciplinary practice, and follow three guidelines for stating the problem.

STEP 2, “justify the use of an interdisciplinary approach,” involves meeting one or more criteria: (1) the problem is complex, (2) important insights concerning the problem are offered by at least two disciplines, (3) no single discipline has been able to address the problem comprehensively or resolve it, and (4) the problem is an unresolved societal need or issue.

Even after subjecting the proposed problem to these criteria, it is still too early in the research process to know with any certitude that the problem is researchable. This question can be resolved only by taking subsequent STEPS in the research process.

Once the problem is defined (STEP 1) and the justification for using an interdisciplinary approach is stated (STEP 2), you must decide which disciplines are relevant to the problem which is STEP 3 (see Chapter 4). Making this decision requires that you understand the disciplines and the concept of disciplinary perspective as explained in Chapter 2.

Notes

1. Scholarly consensus exists on the following STEPS: The problem or focus question should be defined; relevant disciplines and other resources must be identified; information from these disciplines (concepts, theories, methods, etc.) must be gathered; adequacy in each relevant discipline must be achieved; the problem must be studied, and insights into the problem must be located and evaluated; conflicts between insights must be identified, and their sources must be revealed; disciplinary insights must be integrated; and a new understanding must be constructed or new meaning achieved. The models disagree on the number, order, and identity of STEPS, leaving students and instructors alike without a clear road map of the overall interdisciplinary research process. Of special concern is the lack of consensus on how many STEPS are involved in the integrative part of the process. Welch (2003) notes that when the participants in a Delphi Study recommended that students be provided “basic integrational methods,” the question arose as to which model and/or which particular STEPS within these models should be provided (p. 185).
2. Students interested in learning more about teamwork are urged to consult the websites of both Science of Team Science at www.scienceofteams-science.org/scits-a-team-science-resources and td-net at www.naturwissenschaften.ch/topics/co-producing_knowledge. Cooke and Hilton (2015) survey the literature. Dan Stokols has written extensively about team science. The About Interdisciplinarity section of the website of the Association for Interdisciplinary Studies (AIS) also surveys the literature on team research.

3. We thank Sharon Woodhill for making these points at the 2018 conference of the Association for Interdisciplinary Studies.
4. “What is contested is whether interdisciplinarity studies only complexity, or whether interdisciplinarity can appropriately study problems/issues/questions that are not complex as well. Some practitioners say that interdisciplinarity studies only complexity, but others remain unconvinced. Thus, the debate is not over whether interdisciplinarity is necessary for complexity, but whether complexity is necessary for interdisciplinarity” (William H. Newell, personal communication, January 7, 2011).

Exercises

The Best Approach

- 3.1 This chapter compared and contrasted the interdisciplinary research process to the disciplinary approach (in a general sense) and argued that both have utility, depending on the problem. Below are short descriptions of a problem, question, or topic. In each case, decide which approach is probably more appropriate and why:
 - What is the cost of building a high-speed rail system to connect two large cities?
 - Should the city build a new performing arts center in an area characterized by low-income housing and mom-and-pop stores?
 - What is the cause of obesity among teens?
 - What is the meaning of the science fiction movie *Avatar*?

The Integrated Model

- 3.2 The chapter introduced the integrated model of the interdisciplinary research process. What parts of the model are most similar to and different from disciplinary approaches to research?

Is It Researchable?

- 3.3 The chapter presented criteria for determining if a problem, topic, or question is researchable in an interdisciplinary sense. Which of the following meets one or more of these criteria?
 - The psychological dimension of Alzheimer’s disease
 - The loss of manufacturing jobs to China
 - The effects of closing fine arts programs in public schools

Stating the Problem

- 3.4 The following is an example of student work on the topic of the underachieving child. Based on the discussion of STEP 1, how could this introduction to the problem be stated differently so that it conforms to the criteria and guidelines set forth?

(Continued)

(Continued)

Many school-age children underachieve. Underachievement is when the performance of a child falls below what is expected and the ability of the child. Underachievement means to perform academically below the potential indicated by tests of one's ability or aptitude.

Justify Using an Interdisciplinary Approach

- 3.5 The chapter notes that it is common practice for practitioners to justify using an interdisciplinary approach. Compare the various examples and identify their commonalities. What would you change, if anything, in any of the statements?
- 3.6 In addition to justifying using an interdisciplinary approach, should you criticize the disciplines for taking narrow positions on the problem?

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