Explaining the Importance of Integration

In 2000, an interdisciplinary team of cognitive psychologists, curriculum specialists, teacher educators, and researchers updated Bloom’s classic taxonomy of levels of intellectual behavior that are important in learning. They identified six levels within the cognitive domain, from the simple recognition or recall of facts at the lowest level through increasingly more complex and abstract mental levels, leading ultimately to the highest order ability, creating, shown in Figure 5.1.

Figure 5.1  The Updated Bloom’s Taxonomy
SOURCE: Anderson et al. (2000).
NOTE: One of the features of the Anderson et al. (2000) taxonomy that differentiates it from Bloom’s 1956 taxonomy is that it reverses the order of evaluation and synthesis or integration, placing “creating,” which involves integration, at the highest level of cognitive activity. For a comparison of Bloom’s taxonomy with Anderson et al.’s revision of it, see the useful discussion by Leslie Owen at www.uwsp.edu/education/lwilson/curric/newtaxonomy.htm.
The significance of this taxonomy for interdisciplinary research is that it elevates the cognitive abilities of creating and integrating to the highest level of knowledge. Creating involves putting elements together—integrating them—to produce something that is new, coherent, and a functional whole. The focus of this chapter is on integration: what it is, its importance to interdisciplinary inquiry, the prerequisites for integration, and the product of integration. Integration is central to understanding the nature of interdisciplinary studies and is its distinguishing feature. Integration is also at the heart of the interdisciplinary research process.

What Integration Is

Interdisciplinarians substantially agree on the centrality of integration to interdisciplinarity and the interdisciplinary research process, and they are moving toward consensus about what integration should encompass. Though achieving integration is not easy, it is possible, even for those new to the field.

Toward a Definition of Integration or Synthesis and Its Critical Elements

The verb integrate means “to unite or blend into a functioning whole.” Interdisciplinary integration, then, is the activity of critically evaluating and creatively combining ideas and knowledge to form a new whole or cognitive advancement. A synonym of integration is the noun synthesis. Klein (1996) states, “synthesis connotes creation of an interdisciplinary outcome through a series of integrative actions” (p. 212, italics added). What these “integrative actions” or steps involve is the subject of Chapters 10–12. Several traits attend the terms integration and synthesis:

- They are synonyms.
- They convey the meaning of activity leading toward a certain result.
- Central to the integrative process is critically evaluating and analyzing.
- The nature of the activity or process is combining or uniting.
- What is combined or united are ideas, data, and knowledge. (Since the ideas and knowledge take the form of insights into a specific problem, the combining, uniting, and integrating of these insights is valid only for that context. This topic is explored in later chapters.)
- The object of this activity is the creative formation of something new and greater than the sum of its individual parts—a new whole.
- The distinctive characteristics of the new whole are that it is more comprehensive and is a cognitive advancement. (The complexity of the object of interdisciplinary scrutiny implies that the “whole” achieved via integration only partially coheres and has only quasi-stability and quasi-predictability.)
Because the terms integration and synthesis are so close in meaning, many practitioners use them interchangeably. This book uses the term integration because it appears in the prominent definitions of interdisciplinary studies noted in Chapter 1. To be complete, the definition of integration must reference three critical elements: the nature of the “new whole,” the cognitive activity involved in integration, and the contribution of the disciplines to its formation.

The Nature of the “New Whole”

The new whole that the activity of integration produces is greater than the sum of its constituent parts. The “constituent” or essential “parts” are those individual disciplinary insights into a particular problem or object. Though separate, they relate directly to the problem or question.

Interdisciplinarians have not always been clear about integration. Newell (1990), for example, relates how he used to think of integration as analogous to completing a jigsaw puzzle (p. 74). For a time, this analogy was commonly used. However, comparing the product of integration to a completed jigsaw puzzle is problematic in several critical respects. For one thing, the pieces of a jigsaw puzzle are finely milled to fit together as tightly as possible. This is not so with disciplinary insights. Disciplinary insights pertaining to a particular problem or object fit to varying degrees. The problem of fit is minimized in the natural sciences where fit is achieved merely by reconciling alternative conceptualizations of the same phenomenon. For example, when addressing the energy crisis, physics may focus on how a power plant works (i.e., the alternative formulations of thermodynamics) and chemistry on how energy is released from chemical bonds in coal. The insights may be fully complementary but require using the integrative technique of redefinition (see Chapter 11), perhaps to address differences in scale (Newell & Green, 1982, pp. 25–26). When an issue connects the natural sciences to the humanities or social sciences, however, as in the embryonic stem cell research controversy, insights become less complementary, so the problem of fit becomes more challenging (Kelly, 1996, p. 95).

The reason why fit is so challenging when investigating a problem such as human cloning that spans the natural sciences, the social sciences, and the humanities is that there are deep epistemological fissures between these disciplinary categories. Although the sciences are “geared up to tell us what the facts are,” says James S. Kelly (1996), science does not ascribe value or morality to these facts. “The only recognized epistemological powers operative in the scientific realm are those of the five senses. And we do not (literally) see, hear, smell, touch, or taste wrongness or rightness.” Kelly calls this understanding of interdisciplinarity “narrow” (not to be confused with the earlier definition narrow interdisciplinarity) because it focuses on factual situations and structures in need of modification, not on the rightness or wrongness of the activity, which is the realm of the humanities. This
conception of interdisciplinarity would, therefore, focus on cloning techniques, not on the rightness or wrongness of cloning. Instead, Kelly argues for practicing a “wide interdisciplinarity,” which enables interdisciplinary practitioners from the sciences and the humanities to work together to identify, solve, or resolve normative problems, both practical and theoretical, having to do with the satisfaction of human needs (p. 96). This book embraces Kelly’s wide interdisciplinary approach.

Second, the jigsaw puzzle and its pieces are designed according to a predetermined pattern or picture that appears on the cover of the puzzle box. With disciplinary insights, however, there is no predetermined pattern that the student can consult to see if the “new whole” or new understanding or new meaning or cognitive advancement is consistent with it and if one is “getting it right.” In fact, working with disciplinary insights is comparable to working with puzzle pieces from different puzzles mixed together with no picture for guidance. The absence of pattern is particularly challenging when working in the social sciences and the humanities where insights from different disciplines tend to conflict more sharply. For example, in examining the meaning of the Temple Mount in Jerusalem to Judaism, Christianity, and Islam, religious studies scholars may focus on the sanctity of the Mount based on the sacred writings of these faith traditions, whereas political scientists may focus on the political benefits and symbolism of physical control of the site. Because the disciplinary insights conflict, they make the task of discovering the common ground theory, concept, or assumption difficult, though not impossible. Once common ground is created or discovered and the new understanding achieved, the student can see whether the new understanding is consistent with or can accommodate the conflicting disciplinary insights.

Third, the jigsaw puzzle pieces, when assembled, form a picture that is not new because it existed before the pieces were assembled. However, when disciplinary insights are integrated, they generally form something that is truly new—a new understanding, a new meaning, or a new solution. When a disciplinary expert produces an insight into a problem and the insight appears as a book aimed at a disciplinary audience or as an article published in a peer-reviewed journal, the insight is considered new, complete, and authoritative in the view of the discipline. It is not perceived as missing some piece from another discipline.

From an interdisciplinary standpoint, however, the same insight is only partial and only one of many possible explanations of the problem or interpretation of the object, especially if other disciplines have produced insights into the problem. In fact, students should view the integrated result, though new, as only partial. In her study of interdisciplinary cognition, Svetlana Nikitina (2005) argues for the notion of “provisional integration” and for researchers to critically question the interdisciplinary understanding (p. 390). This is sound scholarly advice.

This understanding—i.e., interdisciplinary insight or integrated insight—is “new” because it is the result of the integrative process and encompasses
Explaining the Importance of Integration 119

the conflicting disciplinary insights. It is truly new because it did not exist prior to the integration of the separate disciplinary insights. It is new also because it is not merely a reassemblage of the separate disciplinary insights or a juxtaposition of them in a multidisciplinary fashion.

Janet Delph’s (2005) student essay, “An Integrative Approach to the Elimination of the ‘Perfect Crime,’” provides one example of how an interdisciplinary understanding is new compared to any of its contributing disciplinary insights. Delph mined insights from criminal justice, forensics, and psychology. Insights from criminal justice emphasize the necessity of protecting, searching, and documenting a crime scene so as not to compromise the investigation and infringe on suspects’ constitutional rights. Insights from forensic science or “criminalistics” emphasize how scientific findings (DNA, drugs, etc.) are interpreted by law, whereas insights from forensic psychology focus on gathering information on the behavior, personality, and physical attributes of the offender. Her new understanding is that criminal profiling would greatly benefit from combining the investigatory and profiling methods of all three approaches in order to increase understanding by law enforcement officials about what each branch needs to solve the crime.

Fourth, the puzzle picture before it was cut up encompassed a predetermined area expressed in square inches or centimeters. When the pieces are fitted together, the completed puzzle is not larger (or smaller) than the sum of its pieces. By contrast, the new whole created by the activity of integration is larger than its constituent parts (i.e., insights), not in spatial terms but in cognitive terms. Delph’s (2005) interdisciplinary understanding or integrated insight is larger than its constituent parts because it involves a new approach to criminal investigation that is inclusive of all three major disciplinary approaches.

This example shows that the interdisciplinary understanding is more comprehensive than what could be achieved by merely gathering up individual specialty insights and using them to view the problem from a series of disciplinary perspectives the way multidisciplinarity does. The new whole is larger than its constituent parts because it cannot be reduced to the separate disciplinary insights from which it emerged (Newell, 1990, p. 74). The interdisciplinary understanding is likewise new in that nothing relevant has been excluded. Disciplinarity tends to exclude, whereas interdisciplinarity strives for inclusion. The new humanities field of cultural analysis, for example, uses integrative interdisciplinary analysis of objects from everyday culture, the very “rejects” of the conventional disciplines (Bal, 1996, p. 11).

The defining characteristics of the new whole created by the integrative interdisciplinary process, then, are these:

- It is formed from disciplinary and specialty insights that do not fit together naturally or easily, though they may be somewhat complementary.
- It is created without benefit of a preexisting integrative pattern (though a recognized approach is used).
• It has never existed before and has characteristics that differ from any of those of the specialty insights.
• It is inclusive of relevant information, and in this sense it is integrative (since complexity reduction is inevitably part of the process).

The Cognitive Activity Involved in Integration

At least two cognitive activities are involved in integrative activity: perspective taking and holistic thinking.

Perspective Taking

Perspective taking involves viewing some problem, object, or phenomenon from a particular dimension or viewpoint other than one’s own. As applied to interdisciplinary work, perspective taking involves examining a problem from the standpoint of interested disciplines (in serial fashion) and identifying the differences between them. Hursh et al. (1983) illustrate this type of perspective taking through a simple analogy where items of fruit are compared to disciplines:

If four pieces of fruit—an apple, an orange, a pear, and a peach—are placed on a table, specialists in each of those varieties may readily describe their differences. Their very existence as separate entities invites discrimination, given the predilections of Western thought toward specialization and analysis. (p. 47)

If, however, these four pieces of fruit are placed tightly together in a basket, the specialists must shift their perspectives to recognize that a new entity is created: a fruit basket. This is a higher order construction, fitting into one construct the common attributes of the four entities. The sheer existence of the basket creates order—or unity—out of four disparate yet related items (Hursh et al., 1983, p. 47). Hursh et al.’s attempt to represent interdisciplinary integration of insights with the fruit basket analogy, however, fails to depict what integration produces because the fruit, though situated compactly in the basket, retain their separate identities. Nissani’s (1995) metaphor of the smoothie, noted in Chapter 1, comes closest to depicting the disciplinary insights once integrated because the parts (i.e., individual fruit) are indistinguishable from the whole (i.e., the smoothie). The actual process by which integration takes place is explained as Step 9 in Chapter 12.

Another type of perspective taking is role taking, which is used by interdisciplinary research teams. This is the act of adopting a set of perspectives associated with a person, a culture, or even an animal. The literature from social psychology and its research on role taking offers
insights that are applicable to interdisciplinarity. The first is that people’s judgments are biased in the direction of their own knowledge. This was one of the important findings of a series of studies conducted by Susan G. Fussell of Carnegie Mellon University’s Human-Computer Interaction Institute and Robert Kraus of Columbia University. Their studies found that judges are prone to “false consensus bias,” meaning that they assume that others are more similar to themselves than they actually are (Fussell & Kraus, 1991, 1992). The implication of Fussell and Kraus’s research for students involved in interdisciplinary teamwork and solo research is that they need to be aware of their own biases, including disciplinary biases, so that these do not color (consciously or unconsciously) the integrative outcome.

Other insights on perspective taking come from research on leader-member exchange (LMX) theory, an approach to understanding leader-member relationships in the workplace (Martin, Thomas, Charles, Epitropaki, & McNamara, 2005, p. 141). Central to this theory are the three role-taking aspects of perspective taking. Each of these aspects is pertinent to interdisciplinary integration. The first role-taking aspect is that role-takers must accurately perceive how others see and understand the world. This finding of the Society for Industrial and Organization Psychology (1998) echoes the research by Fussell and Kraus on “false consensus bias.” Students, whether as solo researchers or members of a research team, need to see themselves as role-takers. To integrate differing insights, students must consciously assume in turn the role, if only briefly, of a disciplinarian researching in each of the disciplines relevant to the problem.

LMX theory also calls for role-takers to have “large role-taking ranges.” This simply means that role-takers should be able to view a situation from many perspectives (Martin et al., 2005, p. 141). The implications for integrative work are obvious: Students must not limit their inquiries to only those disciplines with which they are familiar or to those insights with which they agree.

A third role-taking aspect is that role-takers “should be able to perceive the other’s perspective in depth and have a full understanding of the other’s perspective” (Martin et al., 1995, p. 141). In interdisciplinary work, achieving depth of understanding sufficient for full understanding of another’s (i.e., discipline’s) perspective is called developing adequacy in the discipline, the focus of Chapter 8.

The key points of perspective taking as it pertains to interdisciplinary integration are as follows:

- Students must reflect on their biases, disciplinary as well as personal.
- Students must assume the role of disciplinarian, though briefly, as they mine each discipline for insights into the problem.
- Students must not limit their inquiries to only those disciplines with which they are familiar or to those insights and theories with which they agree.
Holistic Thinking

The second cognitive ability required for integrative work is holistic thinking, a skill characteristic of interdisciplinarians noted in Chapter 2 and discussed more fully here. This is the ability to understand how ideas and information from relevant disciplines relate to each other and to the problem (Bailis, 2002, pp. 4–5). Holistic thinking differs from perspective taking in this important respect: Whereas perspective taking (the subject of Chapter 3) is the ability to understand how each discipline would typically view the problem, holistic thinking is the ability to see the problem in terms of its constituent disciplinary parts (i.e., its defining elements identified in Chapter 4). In holistic thinking, the focus is on the relationships of parts to the whole and on the differences and similarities between these parts. The object of holistic thinking is not unified knowledge and a unitary concept of the world; that is the goal of transdisciplinarity. The object of holistic thinking is to view the problem in the broadest possible context rather than under controlled or restrictive conditions favored by disciplinary specialties. Holistic thinking sees characteristics of a problem that are not apparent when studying the problem in disciplinary isolation (p. 7). For example, a study of community art, usually seen as separate from urban economic development, may show how the community benefits socially, culturally, and economically (i.e., holistically) from various kinds of art. The goal or product of holistic thinking is a more comprehensive understanding of the problem.

The Role That the Disciplines and Interdisciplinary Fields Play

Achieving this new integrated whole involves, primarily, the disciplines but also includes interdisciplinary fields as well as schools of thought. The premise of interdisciplinary studies is that the disciplines themselves are the necessary preconditions for and foundation of interdisciplinarity. The student’s task is to identify the perspective of each discipline and interdiscipline and their defining elements relevant to the problem, the subjects of Chapters 3 and 4. The process involved in achieving integration involves identifying, evaluating, and rectifying differences between disciplinary insights (Klein, 1996, p. 221).

A Definition of Interdisciplinary Integration

From the discussion of what integration is, two important ideas about integration emerge and should appear in its definition:

- The “new whole” is something larger and more complex than the sum of its constituent parts. (This statement is designed to emphasize the distinctiveness of the new whole from its constituent parts, that is, from the disciplines themselves.)
• Achieving this new whole involves combining insights and knowledge from disciplines, interdisciplines, and schools of thought.

Additionally, practitioners repeatedly refer to interdisciplinary integration as a process as opposed to an activity. This is deliberate. Process conveys the notion of making gradual changes that lead toward a particular (but often nonlinear) result, whereas activity has the more limited meaning of vigorous or energetic action not necessarily related to achieving a goal. Consequently, the earlier partial definition of interdisciplinary integration is amended as follows:

Interdisciplinary integration is the process of creatively combining ideas and knowledge from disciplinary and other sources to produce a more comprehensive understanding or cognitive advancement.

The Importance of Integration to Interdisciplinarity and the Interdisciplinary Research Process

Since interdisciplinary studies became an academic field, leading interdisciplinarians have insisted that it should be defined in terms of integration. The concept appears in one of the first attempts to define interdisciplinary studies by Newell and William J. Green in 1982 and in the more prominent definition offered by Klein and Newell in 1997 (noted in Chapter 1). Jay Wentworth and James R. Davis (2002), writing on interdisciplinary learning, stress the importance of teachers moving students “patiently toward integration or new conceptualization” (italics added). And as students develop the habit of interdisciplinarity, “the search for integration can be intensified” (pp. 17–18, italics added). Michael Seipel (2002) concurs, writing “interdisciplinary analysis requires integration of knowledge from the disciplines that is brought to bear on the issue, question or problem at hand” (p. 3, italics added). Boix Mansilla (2002) states, “Individuals demonstrate interdisciplinary understanding when they integrate knowledge and modes of thinking” (p. 9, italics added).

Increasingly, practitioners are recognizing that integration is what ultimately distinguishes genuine interdisciplinarity from multidisciplinarity. According to Donald G. Richards (1996), multidisciplinarity merely seeks to “arrange in serial fashion the separate contributions of selected disciplines to a problem or issue, without any attempt at synthesis” (p. 124). Klein (1990) is even more explicit in identifying the deficiencies of multidisciplinarity, stating that it “signifies the juxtaposition of disciplines [and] is essentially additive, not integrative” (p. 56, italics added). The critical failure of the multidisciplinary approach to learning, explains Richards, is that “it leaves the task of providing integration largely or entirely to the student without explicit guidance from the course or instructor(s). Under these
circumstances the interdisciplinary relations will be lost if they are ever identified in the first place” (p. 116, italics added).

The critical importance of integration to interdisciplinary studies and the interdisciplinary research process is summarized in this important statement by Newell (1998):

The pragmatic and epistemological value of interdisciplinary study is ultimately determined by the success of interdisciplinarians in carrying out . . . integration, because all save the antidisciplinarians identify that as its distinguishing feature. Theoretical clarity and agreement concerning the nature of interdisciplinarity, its outcomes, the role of the disciplines, and the nature of . . . integration would be of no avail if interdisciplinarians were unable to accomplish integration. The respect of disciplinarians in the academy, the demand for interdisciplinarians to assist in solving complex societal problems, the success of radical critiques, and the long-term prospects for interdisciplinary education are all dependent on the proven success of integration. (p. 550, italics added)

While integration is not the goal of interdisciplinary work, it is the means to attain it. The goal is to produce an interdisciplinary understanding of the problem and apply this understanding to solving the problem that prompted the inquiry.

The Prerequisites for Integration

Interdisciplinary studies requires the triangulation of depth, breadth, and integration. Triangulation, in an interdisciplinary sense, means achieving balance between disciplinary depth, disciplinary breadth, and interdisciplinary integration, as shown in Figure 5.2.

Interdisciplinarity requires all three, not just depth and breadth. The depth required for successfully engaging in the first half of the interdisciplinary research process (i.e., drawing on disciplines and their insights) is developing adequacy or sufficiency in each discipline relevant to the problem (the subject of Chapter 8). The depth required for engaging in the second half of the research process (i.e., integrating insights) involves identifying conflicts between insights and locating their sources, creating common ground, integrating insights and producing an interdisciplinary understanding of the problem, and testing the understanding.

Adequacy (the subject of Chapter 8) means that the student borrower does not claim expertise or professional command of all the disciplines used but rather acquires a sufficient understanding of each discipline’s cognitive map and is thus able to identify the insights, concepts, theories, and methods necessary to understand a particular problem, process, or phenomenon (Klein, 2005a, p. 68). How much adequacy is required depends on what each project requires. The notions of “depth” and “rigor,” says Klein (1996),
are usually associated with disciplinarity. However, in interdisciplinary work, they are redefined: “Depth in interdisciplinary work derives from competence in pertinent knowledges and approaches, and rigor derives from attention to integrative process” (p. 212). Interdisciplinary rigor, then, derives from attention to integrative process, the product of integration, and the testing of that product.

Interdisciplinary breadth refers to interdisciplinary work that draws on disciplines that are epistemologically distant (e.g., a natural science discipline and a humanities discipline) in contrast to narrow interdisciplinarity that draws on disciplines that are epistemologically close (e.g., physics and chemistry). Clearly, the burden on the interdisciplinary student is far greater than it is for the disciplinary student.

Integration, explains Klein (1996), does not result from “simply mastering a body of knowledge, applying a formula, or moving in linear fashion from point A to point B. . . . It requires active triangulation of depth, breadth, and synthesis [i.e., integration]” (p. 212). Integration requires using (1) disciplinary knowledge (i.e., depth and breadth), (2) integrative skills, (3) integrative knowledge, and (4) an integrative mind-set.

**Figure 5.2** Triangulation of Disciplinary Depth and Breadth and Interdisciplinary Integration

NOTE: In her discussion of the metaphor of the triangulation of “depth,” “breadth,” and “synthesis,” Klein (1996) uses the term “synthesis” because, as she explains, it “connotes creation of an interdisciplinary outcome through a series of integrative actions” (p. 212, italics added). Her preference for synthesis over integration in this context is understandable. However, in my graphic that attempts to depict this metaphor, I substitute the term integration because it is the term used in the definition of interdisciplinary studies that this book embraces. See the Association of American Colleges (1991, p. 74) for an early reference to the notion of interdisciplinary triangulation.
Disciplinary Knowledge

Disciplinary knowledge includes (1) an understanding of the overall perspective of each relevant discipline and (2) adequacy in each discipline’s defining elements that pertain to the problem. These elements and the discipline’s overall perspective are generally reflected in its literature, from which insights into particular problems are drawn. The movement here is from the most general knowledge of a discipline—its overall perspective—to more specific knowledge about the discipline’s defining elements, to still more specific knowledge of how each of its elements informs its insights into the problem. The movement, in short, is from understanding a discipline’s overall perspective on reality, to more focused reading on the defining elements, to intensive “digging” into the discipline’s scholarly literature.

Integrative Skills

The second prerequisite for conducting integration is having integrative skills. These include (1) familiarity with models of integration, (2) familiarity with techniques of integration, (3) self-conscious awareness of the interdisciplinary research process, and (4) critically evaluating disciplinary insights.

1. Familiarity With Models of Integration. Students should be aware of the models of integration because they characterize much of the interdisciplinary work occurring inside and outside the Academy today. These models are approaches to interdisciplinary work and are described in terms of their vision, theory, practice, and primary strength or weakness.

Model #1: Integration as an Overarching Conceptual Framework

- **Vision**: Proponents of this transdisciplinary approach share a lofty vision that is succinctly described by Joseph J. Kockelmanns (1979) as “the discovery of overarching conceptual frameworks” (p. 142). By overarching conceptual framework or conceptual bridging is meant a single concept, principle, or law that accounts for phenomena typically studied by a broad range of disciplines (Boix Mansilla, 2002, p. 18). These “overarching conceptual frameworks,” Kockelmans (1979) believes, “will facilitate the unification of the sciences and eventually the solution of important problems with which the existing disciplines acting in isolation are incapable of dealing effectively” (p. 142). Creating them, however, is admittedly a formidable task even for expert researchers.

- **Theory**: Regarding the theory that undergirds this transdisciplinary vision, Kockelmanns further explains that those who work exclusively in the realm of the natural sciences usually have no great difficulty in discovering a common framework. “In most cases,” he says, “it will consist of the basic principles and methods of physics, chemistry, or biology. On the other hand, [interdisciplinary] research projects in the social sciences, and particularly those involving both the natural and the social sciences, confront us with great theoretical and methodological problems” (1979, p. 142).
• **Practice:** In practice, this approach to interdisciplinary work is conducted most effectively by groups of scientists trained in various scientific disciplines. Cooperation among them requires that they “try to discover common ground . . . [that] could serve as a basis to deal meaningfully with all large-scale problems” (Kockelmans, 1979, p. 145).

• **Strength or weakness:** Students should be mindful of two problems with the overarching conceptual framework approach. For one thing, so much effort is consumed in theory construction that little educational or practical benefit has yet come forth. Another problem is that it seeks to eliminate tension among the disciplines and their perspectives, the very thing that drives interdisciplinary studies. An overarching theory that unifies everything (if this were possible) would remove that tension. Since reality is so complex, the very nature of complexity militates against the unity of reality, and thus knowledge of that reality.

**Model #2: Integration as Comprehensive Perspective**

• **Vision:** Advocates of this model have two goals in mind. The first goal is educational and seeks to balance increasing disciplinary specialization with interdisciplinarity. Barbara Hursh, a social/educational psychologist, Paul Haas, an economist, and Michael Moore, a humanist, propose developing an integrative interdisciplinary approach that stresses multiple perspectives on specific issues in order to teach skills of comparison, contrast, analysis, and, above all, synthesis (1983, p. 43). The second goal is more practical and calls for interdisciplinary studies to be pragmatic and to focus on real world problems. It is the practicality of interdisciplinary studies that is attracting growing interest in the field.

• **Theory:** This comprehensive perspective model is grounded in the theories of learning associated with John Dewey, Jean Piaget, and William Perry and emphasizes **generic skills**. These skills “include such cognitive functions as recognizing and defining problems; analyzing the structure of an argument; assessing the relationship of facts, assumptions, and conclusions; and performing **hypothetico-deductive processes**” (Hursh et al., 1983, pp. 43–44). These involve proposing hypotheses and testing their acceptability or falsity by determining whether their logical consequences are consistent with observed data.

• **Practice:** Hursh, Haas, and Moore (1983) illustrate this model by using the metaphor cited earlier of a fruit basket that creates a new entity out of four distinct entities—an apple, an orange, a peach, and a pear—and thus unity, order, and synthesis. The utility of this model is its focus on generic skills and multiple perspectives, which, they argue, are “essential in the search for solutions to such [complex] problems as energy depletion, environmental pollution, health care delivery, and urban decay, or in considering aesthetic qualities of line, color, form, and texture from the standpoint
of music, art, dance, or theater” (p. 45). Their model calls for identifying interdisciplinary salient concepts such as “power,” “energy,” “modernization,” “globalization,” or “progress,” which require students to examine the concept from the perspectives, assumptions, and modes of reasoning of different disciplines.

- **Strength or weakness:** The virtue of this model for many practitioners is that it calls for “a more comprehensive perspective,” that is, “a larger, more holistic understanding of the question, problem, or issue at hand” (Newell, 1998, p. 547). While this is, in itself, no easy task, it is far more manageable for a single researcher in the social sciences, the humanities, or the applied fields to deal with integrating disciplinary insights than it is to construct an overarching theory that encompasses the disciplines as described in the first model. Integration as comprehensive perspective is the model that this book embraces, but with modification. For one thing, Hursh, Haas, and Moore’s (1983) model is too general because it fails to address how integration actually occurs. Also, their model fails to identify what is integrated. This book stresses that the product of integration (the subject of Chapter 12)—the interdisciplinary understanding or cognitive advancement—should correspond more closely to Nissani’s metaphor of the smoothie than to a basket of different fruit.

**Model #3: Integration as Interpenetration**

- **Vision:** Interpenetration is a term Steve Fuller (1993) uses to describe his model of interdisciplinary research. It calls into question the differences between the disciplines involved and calls for the “renegotiation of disciplinary boundaries” (p. 33). Supporters of this third model critique the way disciplines divide rather than connect knowledge and call for nothing less than the redefinition of disciplines in the same ways that feminism and cultural studies have already done. Jeffrey M. Peck (1989), who takes a postmodern deconstructionist view of boundaries, argues that disciplinary boundaries should not be dissolved but continually crossed, enabling alternative knowledge structures and new inquiries to emerge (as cited in Klein, 1996, p. 7). What Peck (1989) and others have in mind is that these multiple border crossings between disciplines, or interpenetrations, will reveal “new emerging places where our [interdisciplinary] profession can be practiced” (pp. 179–180).

- **Theory:** This interpenetration model of interdisciplinarity is based, in part, on the ideas of cultural archeologist Michael Foucault, whose pioneering work in cultural history cut across disciplinary boundaries and revealed patterns of cultural domination and oppression. Under his influence, for example, the concept of “culture” has undergone a radical redefinition in which literary texts are products of historical, social, political, and economic environments once deemed “outside” of the text but which are now seen as shaping it (Klein, 1996, p. 152).
• Practice: Peck (1989) applies this model of interdisciplinary analysis to German cultural studies that, in the past, had been characterized by “a particularly German form of intellectual domination” (p. 179). Peck sees German studies as the kind of in between space where one can study the clash of multiple disciplinary perspectives and the variety of discourses about Germany—the literary, political, and sociological (p. 184). Peck believes the interpenetration model of cultural analysis is applicable to the study of other cultures, whether advanced or so-called primitive, and allows scholars to “uncover and ‘make visible’—in Foucault’s archeological sense—patterns of domination and oppression” (p. 179).

• Strength or weakness: The weakness of this postmodernist model is its heavy emphasis on conflict and on exposing competing and culturally imposed disciplinary vocabularies struggling for power. Identifying disciplinary insights, critically evaluating them, and identifying the sources of conflicts is certainly part of the integrative process. As important as these steps are, they are but preparatory to further steps that include creating or discovering common ground, integrating insights, and producing a more comprehensive understanding or new meaning.

What These Models Agree on

Though marked by sharp differences, all three of these models of interdisciplinary integration agree on three important points:

• The integrative activity should be limited to the specific problem or question at hand. This means, in practical terms, that the integration produced cannot necessarily be used as a template to solve other similar problems. The ideas and knowledge take the form of insights into the specific problem, and their integration is valid only for that specific context.

• The problems selected for investigation should be clearly beyond the ability of any one discipline to address comprehensively or resolve.

• The disciplines, interdisciplines, and professional fields are essential for the conduct of interdisciplinary work.

Two Fundamental Questions Raised by These Models Concerning the Nature of Interdisciplinary Integration

• Question #1: What does integration change? Does integration change only the contribution of each discipline, or are the disciplines themselves somehow changed? The answer is that depending on which model is used, integration can change both and is, in fact, doing so. The model that is most “user friendly,” typical to students new to interdisciplinary studies, and favored in this book is the second: integration as comprehensive perspective. Most interdisciplinary scholars agree that disciplinary contributions—i.e., insights, theories, and concepts—must change for interdisciplinary integration to proceed. Precisely how this occurs will be demonstrated in Chapters 10–12, which focus on the integrative process.
• Question #2: Must integration result in a clear-cut solution to a problem for a study to be “successful” and truly interdisciplinary? As Newell (1998) has observed, “Most authors talk about solving complex problems as though they have clear-cut solutions,” which, of course, many do not (p. 548). To conclude that the integrative effort has “failed” because of the absence of a feasible solution, even though the effort revealed a new understanding or new areas to be investigated, would be a mistake. Any integrative work that contributes something “new” to the understanding of a complex problem, even an increased appreciation of its complexity, should be viewed as successful.

2. Familiarity With Techniques of Integration. Familiarity with techniques of integration (Chapter 11) is another critical integrative skill. Integration involves comparing and contrasting disciplinary insights, creating or discovering common ground among them, integrating insights, and producing a new understanding or new meaning. The identity of specific proven integrative techniques commonly used in creating common ground is reserved for Chapter 11.

3. Self-conscious Awareness of the Interdisciplinary Research Process. Students must understand the interdisciplinary research process because it is the way in which interdisciplinary knowledge is created. This process consists of two parts that arise out of the integrated definition of interdisciplinary studies stated in Chapter 1: (1) It draws critically on disciplinary insights, and (2) it integrates these to produce an interdisciplinary understanding. This process is introduced in Chapter 6.

Integrative Knowledge

The third prerequisite for conducting integration is having integrative knowledge. This means being able to identify the disciplinary elements relevant to the problem; identify conflicts between disciplinary insights and evaluate their sources; apply the appropriate integrative technique(s) to create or discover common ground; integrate these conflicting insights by applying the common ground theory, concept, or assumption to them; and produce the new understanding or cognitive advancement.

An Integrative Mind-set

The fourth and final prerequisite for conducting integration is developing an integrative mind-set. This means cultivating these five qualities of mind:

• Seeking what is useful even if it is problematic
• Thinking inclusively and integratively, not exclusively
• Being responsive to each perspective but beholden to none (i.e., not allowing one’s strength in a particular discipline to influence one’s treatment of other relevant disciplines with which one is less familiar)
• Striving for balance among disciplinary perspectives
• Maintaining intellectual flexibility
Explaining the Importance of Integration

These five integrative qualities correspond to several of the traits and skills of interdisciplinarians identified in Chapter 2.

The Goal of Integration

Not a Position But a Motion

The integration that results from the integrative process is valued not as an end in itself but for the interdisciplinary understanding or cognitive advancement it makes possible. Marsha Bundy Seabury (2002), an expert in interdisciplinary pedagogy, writes of her hope that interdisciplinary studies students will move toward integration, and thus reach a more comprehensive understanding. The metaphor of “moving toward integration” does not mean “a graph-like progression whereby students gradually move from lower forms of thinking on up to more holistic, abstract thinking, ending in the upper-right quadrant of the page.” Sometimes the “goal” may be not a position but a motion, meaning that students should be able to move among levels of abstraction and generalization,” which is part of the integrative process (p. 47, italics added).

It May Be Messy

Michael Seipel (2002) cautions students and teachers alike that the focus on integration should not imply that the outcome of interdisciplinary analysis will always be a neat, tidy solution in which all contradictions between the alternative disciplinary insights are resolved. “Interdisciplinary study,” he writes, “may indeed be ‘messy,’” meaning that sometimes the attempt at integration will succeed only partially or not at all. Differing insights into a problem and accompanying tensions between disciplines may not only provide further understanding, he says, but should be seen as a “healthy symptom” of interdisciplinarity. The richest interdisciplinary work is that resulting from a research process that works through these tensions and contradictions between disciplinary systems of knowledge with the goal of integration, the creation of new knowledge (p. 3). One such example of integrative work is William Dietrich’s (1995) Northwest Passage: The Great Columbia River, which will be referenced in later chapters to illustrate certain steps of the integrative process.

The Integrated Result

Consequently, the integrated result, which is the interdisciplinary understanding or cognitive advancement, must have the following characteristics:

- It must explain a specific phenomenon comprehensively.
- It must be greater than the sum of its separate disciplinary parts.
Methods for Assessing Integration

Lisa Lattuca (2001) identifies three methods for assessing the level of integration of an interdisciplinary teaching or research project:

1. **Examine the process by which interdisciplinary research is accomplished.** For example, one could count how often researchers meet to coordinate their work (p. 113). [One weakness of this approach, however, is that meetings may vary considerably in their productivity and movement toward integration of disciplinary terminology. However, this approach could profitably serve as a key indicator of integration if the process is sufficiently detailed, explicit, and proven.]

2. **Judge the final product of an interdisciplinary research project.** Typically, the participants or the researchers themselves do this (p. 113). [A weakness of this approach is that different groups of researchers may devise widely varying standards by which to judge the same or similar work. However, this weakness can be overcome if the standard is part of a widely accepted model of the research process; Wentworth & Davis, 2002, p. 33]. Jay Wentworth and James R. Davis argue, “The central purpose of evaluation ought to be to assess this integrative process in the work of students. Becoming explicit about evaluation is simply another way of gaining clarity about the integrative process” (p. 33).

3. **Look at the point of origin (i.e., the research question) to understand interdisciplinarity.** Lattuca (2001) argues for this third approach (p. 113). [A weakness of this approach is that it places the emphasis entirely on the question, even though initiating questions are frequently modified during the course of research. Also, the approach fails to explain and provide examples of why question posing is superior to approaches #1 and #2. Moreover, the approach does not recognize that the interdisciplinary research process is a whole and that its constituent parts contribute to achieving an integrated result.]

The issue is not which approach should prevail but how all three approaches—the research question, the research process, and the integrated result—should be used in performing integration and assessing its outcome.

**Chapter Summary**

Integration is a defining characteristic of interdisciplinary studies and of the interdisciplinary research process. It is what differentiates interdisciplinarity from multidisciplinarity and transdisciplinarity. This chapter examines the nature of the “new whole” resulting from integration, the cognitive activity involved in integration, and the contribution of the disciplines to its formation.
At least two cognitive activities are involved in integration: perspective taking and holistic thinking. The integration required for disciplinary depth and breadth in interdisciplinary work includes disciplinary knowledge, integrative skills, integrative knowledge, and an integrative mind-set. The chapter critiques various models of integration and discusses integration as the means to an end—a new and more comprehensive understanding of the problem. “Integration as comprehensive perspective” is a model that is widely accepted and the one this book embraces. Chapter 6 focuses on following this model and identifies the initial steps one would take in beginning an interdisciplinary research project.

Notes

1. Lattuca (2001), however, speaks for those interdisciplinarians who prefer to focus on the type of question justifying interdisciplinary research rather than on developing models of the interdisciplinary research process. She identifies three types of questions: “synthetic interdisciplinary questions” that bridge disciplines and are questions that cannot be answered completely by a single discipline; transdisciplinary questions that are applicable across disciplines and therefore transcend a single disciplinary identity; and conceptual interdisciplinary questions that have no compelling disciplinary basis” (p. 112). Integration, she argues, “seems too narrow a term for the other forms of interdisciplinary scholarship” because “only synthetic interdisciplinary questions are implicitly integrated in the sense that they bridge disciplines and require contributions from more than one discipline” (p. 115, italics added). The problem with limiting the notion of interdisciplinarity to the initiating questions is that questions often change during the research process. This book agrees with Lattuca on the importance of framing questions in a way that justifies using an interdisciplinary approach (see Chapter 6), but differs with her in emphasizing the importance of developing a model of the interdisciplinary research process that applies to all interdisciplinary work. What defines interdisciplinarity is not only the research question, but also the research process and the product resulting from it.

2. Cindy Atha-Weldon provided this insight (personal communication, March, 2006).

3. I have excluded grounding in particular theories because these typically fall outside interdisciplinary curricula.

4. It is most unlikely that undergraduate interdisciplinary studies students would be involved in such a daunting enterprise.

Review Questions

1. What are six statements that characterize interdisciplinary integration?

2. What is the difference between narrow interdisciplinarity and wide interdisciplinarity, as conceived by Kelly?
3. How is the analogy of the jigsaw puzzle deficient in describing the “new whole” resulting from interdisciplinary integration?

4. What two cognitive activities are involved in the integrative process, and what are the differences between them?

5. What role do the disciplines play in the integrative process?

6. What are three important ideas of what integration is?

7. What is a definition of interdisciplinary integration?

8. What is the importance of integration to interdisciplinarity and the interdisciplinary research process?

9. What are the prerequisites for integration?

10. Which of the three models of integration does this book embrace and why? What do these models agree on?

11. What two fundamental questions do these models raise concerning the nature of interdisciplinary integration?

12. What is the goal of interdisciplinary integration?