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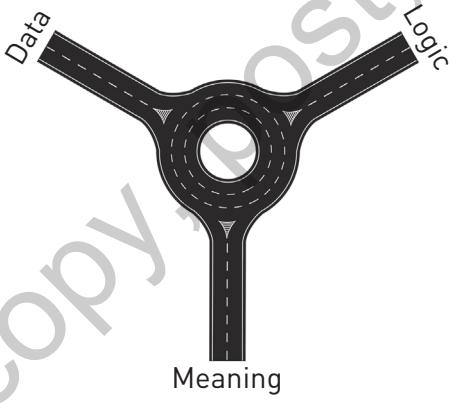
THREE DIMENSIONS OF KNOWLEDGE FOR SOLVING COMPLEX PROBLEMS

Meaning, Data, & Logic



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To understand and resolve the big problems of the world, we conduct program evaluations and other applied research. In this chapter you will discover the following:

- How we can better connect research and practice for the benefit of all
- Three interconnected dimensions of useful/actionable knowledge
- Research ethics

TOWARD BETTER MAPS FOR SOLVING COMPLEX PROBLEMS

As practical researchers and program evaluators, our job is to provide new understandings that inform planning and action. We can think of those understandings as knowledge maps. Decision makers use those maps to develop new solutions and to improve existing solutions that address problems such as poverty, injustice, and public health.

DEFINITION

Knowledge is the understanding of a topic that potentially enables effective action. That understanding may be in our minds, communicated verbally, or in writing as text or diagrams.

We wrote this book to provide you with techniques for building better knowledge maps. This way, you can maximize the usefulness of your research and have a greater positive impact on the world.

In our attempt to understand the big problems of the world and make effective decisions to resolve those problems, we are like early ocean voyagers, navigating by simple lists of waypoints that we will encounter as we sail from our town to distant ports. These early proto-maps might look something like Figure 1.1.

Such a list of waypoints—or an itinerary—would not be as useful as a map.

DEFINITION

A ***knowledge map*** is a diagram representing knowledge. Knowledge maps make it easier to clarify logic, identify data, and confirm relevancies for making better decisions for reaching important goals.

Ancient cartographers were able to synthesize many of those itineraries to create the first simple maps. However, with so few facts, those maps contained many blank spaces (and occasionally listed the locations of dragons).

As time went on, those maps, tested and improved on voyage after voyage, formed a foundation of modern navigation, enabling safer and more reliable travel around the world. Today, we have Global Positioning Systems (GPS). A swarm of satellites backed by powerful computers tell your smart phone exactly where you are in the world—and how many minutes to the nearest coffee shop or pub. With more complete and more accurate maps, we can navigate our world with greater chances for success at safely reaching our desired destinations.

While geographic maps have improved, our knowledge maps for addressing big problems, such as poverty, injustice, and public health, have not. The

FIGURE 1.1 ⬢ List of Waypoints for Navigators in Ancient Times

- Hometown
- Mountain
- Waterfall—fresh water
- Forest—good hunting
- Bigger mountain
- Other town

maps we make from research to guide program evaluations and other applied research projects have changed little since the early days of the field. Figure 1.2 shows a typical map (often called a logic model), which is used to show how a program is expected to function (adapted from figure in GAO, 2012, p. 11).

DEFINITION

Research is a scientific process of investigation and discovery that may include program evaluation and policy analysis. This book focuses on ***applied research***, that is, research conducted to inform decisions and action to address social issues.

These kinds of simple maps may be useful for showing a few key things that a program is supposed to do. And they may be useful for showing what an evaluation of that program might want to measure. However, each is only a small scrap of a map, so there are many blank spaces.

Small maps have not been sufficient for dealing with problems such as poverty, hunger, injustice, war, and ignorance. Some call these problems "wicked," not because they are "evil," but because they are so very difficult that they defy understanding and so persistent that they defy all efforts to end them.

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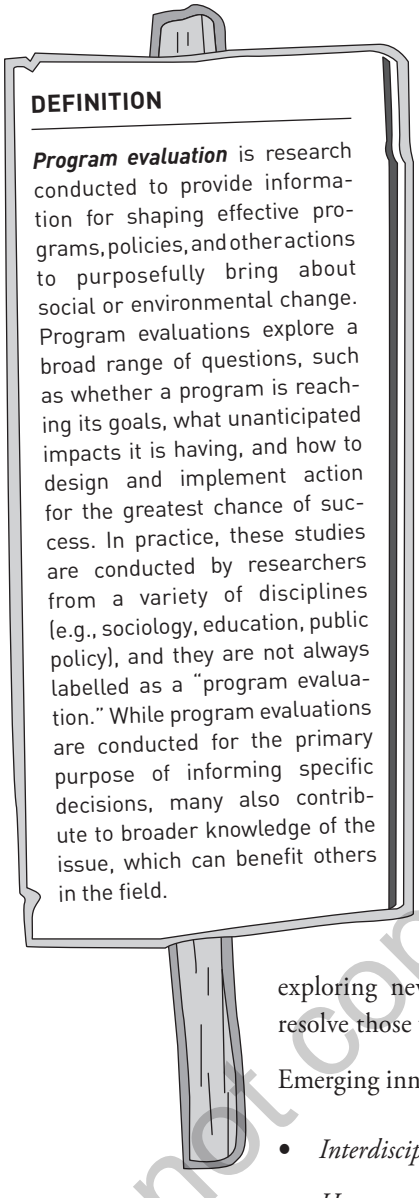
Map for sailors in olden days.

Generally, researchers have tried to understand these wicked problems in two ways. First, by involving more participants in the process. Second, by seeking more data—including "big data" approaches in which information is obtained from social media platforms, government data bases, and other sources that aggregate large amounts of data. Despite the explosion of information in terms of the number of studies and the amount of data, researchers have not



reached consensus on how to solve these problems, in part, because each study has served to create only a scrap of the larger picture.

Without a good way to make good maps, research is inefficient and we are unable to make progress toward solving our big problems.

In our observations of the field, most studies start almost from scratch, grounded in knowledge from just a few previous studies. It is like our practitioners are relying on an ancient hand-drawn map of a few well-worn paths. What we need is more like a GPS map that lets you quickly assess alternative routes and find the best path to achieving your goals, using the best available knowledge of all the waypoints and routes between them.

For practitioners to be able to better understand and solve complex problems, they need more than disconnected insights and data points. Because all those things in the real world are interconnected, practitioners need a map with more interconnections.

Like ancient mariners, we are sailing in dangerous waters with sadly simplistic maps. We are avoiding areas that warn us of (fictional) dragons, and we avoid the blank parts of the map because we fear that we might fall off the edge of the world. Fortunately, some scholars and practitioners are exploring new directions to redefine knowledge to better understand and resolve those wicked problems.

Emerging innovative approaches include the following:

- *Interdisciplinary research* to bring in more expertise
- *Human-centered design* to use a variety of research methods, make improvements, and then re-study the problem (and repeat)
- *Implementation science* to make the process of research, learning, and change an ongoing process
- *Systems thinking,* increasingly used to understand the world as an interconnected network

- *Mapping tools* to provide more realistic and interconnected diagrams—such as logic models, concept maps, theories of change, and mind maps—to provide a better picture of the situations we face

This book provides an approach to research that is both scientific and highly useful for addressing the seemingly unsolvable problems we face around the world and in our own communities. We do this by understanding what useful/actionable knowledge is in terms of three interrelated dimensions.

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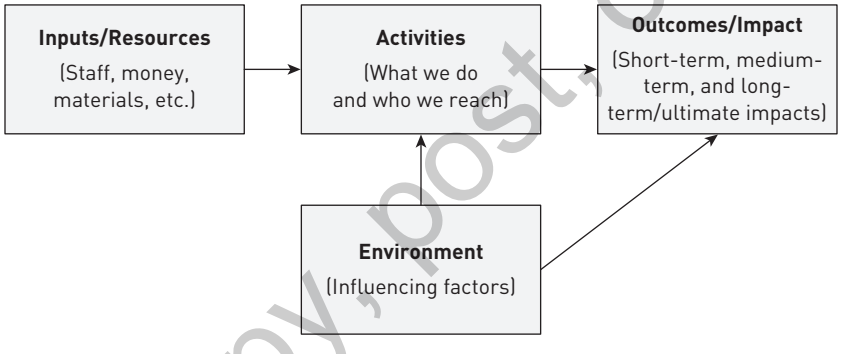
Map for driving in the 21st century.

FIGURE 1.2 ⬢ A Fairly Typical Knowledge Map



STOP/REFLECTION/DISCUSSION

On your own or in small groups, consider these questions:

- What are some local, national, or global issues on which two (or more) sides have disagreed over the best course of action?
- Do all sides agree on whether or not enough research has been conducted?
- How long has the problem gone on?
- Has progress been made in understanding and solving the problem? Why or why not?

DEFINITION

A ***practitioner*** is a person such as a worker, manager, supervisor, or leader who uses knowledge to make decisions and take action to accomplish goals.

THREE DIMENSIONS OF KNOWLEDGE

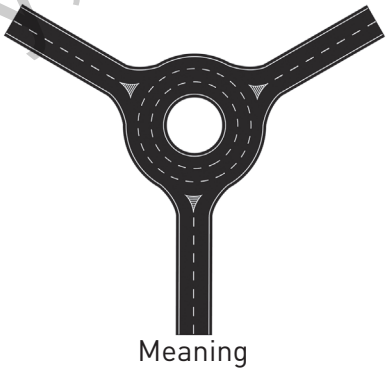
We, as researchers (or knowledge cartographers), must improve the quality of our knowledge maps if we are to connect multiple scraps of maps, bridge the chasm between research and practice, and solve the wicked problems of the world. With a more effective process of creating and connecting maps, researchers can be clearer in their communication with practitioners. With better maps, practitioners can have better understanding and make better decisions so that they can better serve their constituents. Overall, this improves our collective ability to make effective decisions to reach our program and policy goals while avoiding unintended consequences.

DEFINITION

Meaning, as a dimension of knowledge, refers to the relevance and importance of the concepts on a knowledge map to the people involved and the situation at hand.

There are three dimensions of knowledge. When properly put together, they will help you conduct more effective research for understanding and solving problems that seem impossibly complex. Those three dimensions are *meaning, data*, and *logic*. This section introduces those three dimensions. We will delve into them in more depth in following chapters.

Meaning—The First Dimension



Meaning

In developing a knowledge map, the first step is to identify the *concepts* on the map that have *meaning* or relevance for the stakeholders.

A *concept* is something that relates to the real world but is held in our minds. For example, when we think about "income," "education," or "teachers," we are thinking

in concepts of things that we believe are important or meaningful. A good knowledge map is one that includes many relevant concepts. A critical question for researchers to explore throughout the research process is, *"What concepts will we include when we make our map?"*

Answering that question starts with the person who decides to conduct a study and selects research questions to explore. When writing a paper for a class, your process might begin with you deciding what topic you want to study. Working as a program evaluator, you might receive an assignment to conduct a study to explore specific questions or topics—for example, to explore what effects an after-school program is having on students' academic performance. As such, your knowledge map might begin with concepts such as "participation in after-school programs" and "academic performance."

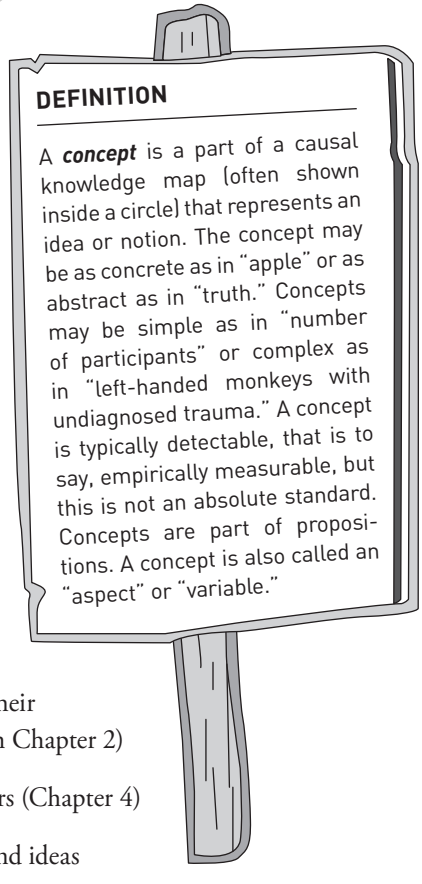
A typical next step is to learn all you can about your topic. You can find that kind of background material from talking with program managers and others involved in the program, reading program materials, and reviewing the existing academic literature and professional publications. From that information-gathering, you can find additional concepts to add to your knowledge map.

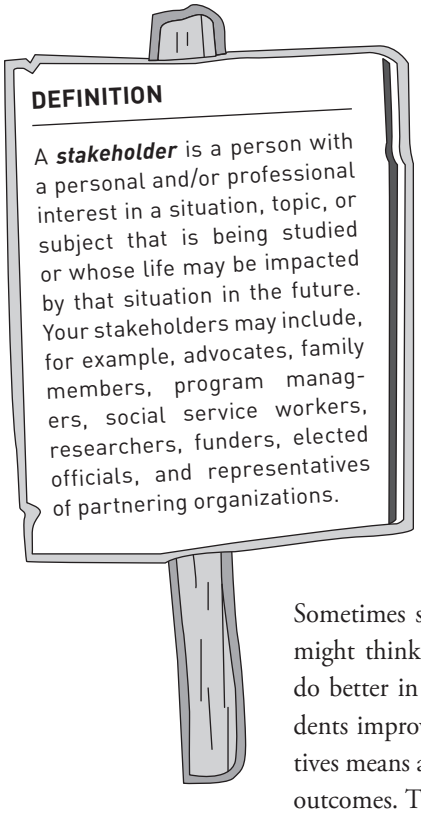
Good practical research includes the perspectives of all stakeholders (those with a vested interest in your subject of study). For a study on after-school programs, for example, stakeholders might include (but are not limited to) students, parents, teachers, school administrators, professional associations, advocacy organizations, experts, policymakers, and the public.

The more stakeholder groups that you include in your research, the more you are able to understand the broader picture—avoiding the "pothole" in your research road of having too narrow a focus. Also, the more stakeholder groups you include, the greater chances for success at getting the trust and cooperation needed for effective action.

You can engage stakeholders and acquire concepts that stakeholders find meaningful in a variety of ways:

- Organize a collaborative mapping session for people to share their understanding of the issue and how to address it (as detailed in Chapter 2)
- Conduct individual or focus group interviews with stakeholders (Chapter 4)
- Hold a community forum for people to share their thoughts and ideas





- Convene an advisory group of people with knowledge and experience in your topic to contribute ideas and feedback throughout a project
- Find what stakeholders have written or talked about through review of related literature and materials (Chapter 3), such as
  - Speeches
  - News articles
  - Press releases
  - Reports by agencies
  - Previous studies that elicited the perspectives of stakeholders
  - Other sources . . . just start looking around!

Sometimes stakeholders have different priorities and perspectives. One group might think that the purpose of after-school programs is to help students to do better in school, and another group might see the purpose as helping students improve their social skills. Taking into account all stakeholders' perspectives means acknowledging and exploring the effects of the program on all these outcomes. This provides a more complete picture of the program's true effects, enabling decision makers to make more informed decisions than if they only explored outcomes important to one stakeholder.

The greater number of knowledgeable stakeholders you can include, the more concepts you will have from those closest to the situation. That added information will strengthen the quality of your research and your ability to build a knowledge map that is useful to that community for understanding, collaborating, and working together to solve their shared problems.

TRAVEL TIP

More heads are better than one: While the focus of this section is on stakeholders and their perspectives, we also want you to remember that research is better (and often easier) when you work in collaboration with other researchers. For more on this, see Chapter 6.

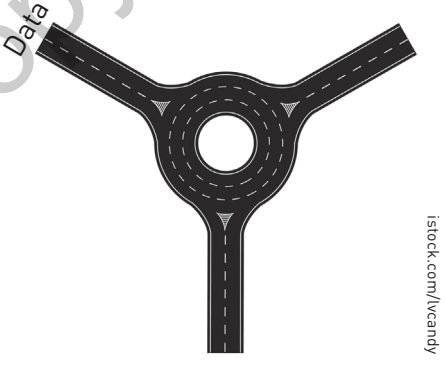
Just Because Everyone Believes It Doesn't Make It True

There can be problems with relying only on meaning. You might do a very good job of accessing many stakeholder groups. And they all might agree that the concepts on the

Stakeholders as individuals, teams, and large groups

map are relevant. Sometimes, however, what "everyone knows to be true" turns out to be wrong. "Groupthink" can lead people down the wrong road. Also, people do not always know what effects their activities are having. Sometimes, our activities have unanticipated effects that we are not aware of. So for solving tough problems, we need more than a list of concepts that are relevant to people. We also need data.

Data—The Second Dimension



Concepts exist only in the mind. They could be very real, or they could be completely fictional. Data, on the other hand, can be measured, touched, or viewed. Data are the facts or information acquired by research and from experience. The notions of data and meaning overlap because studies can use methods such as interviews and surveys to collect data for understanding what's meaningful to people.

After you've identified the meaningful concepts for your preliminary map, the next step is to look for data related to those concepts. For example, if one of the concepts on your map is "attendance in after-school programs," the data may include the number of children in attendance—as determined by observation and/or a review of the school records.

Research data may be obtained from a variety of sources including the following:

- Your own data collection and analysis (surveys, interviews, experimental studies, etc.)
- Existing academic research (from books and journal articles)
- Industry sources (including reports from government agencies, associations, and other organizations)
- Online sources (such as websites of key organizations and government agencies)
- Expert knowledge (from informal conversations, expert workgroup meetings, interviews/surveys of experts)
- Presentations (professional conferences, webinars)

We will cover data in greater depth in Chapters 3 and 4.

A good way to strengthen your data is by gathering data using multiple methods. For example, to examine whether an after-school program helped students get better grades, you might conduct interviews with students, teachers, parents, and others to get their perspectives on how the program affected them and their perceptions of how it affected others. You could analyze administrative data that show the effects of the program on grades. You could also synthesize data from existing studies of similar programs.

TRAVEL TIP

The more sources of data you have to support your findings, the greater confidence you can have in those findings.

As you collect and analyze data throughout your study, you may discover additional meaningful concepts and relationships that you hadn't thought to consider. For example, you might expect that well-designed after-school programs help improve students' math and literacy skills but discover that the programs also help increase graduation rates.

Data—Just the Facts

In this section, we've provided a brief introduction to data (we will go into this topic in greater depth in Chapters 3 and 4). While data are important for making decisions, all observations and measurements have limitations. That's why practitioners need more than

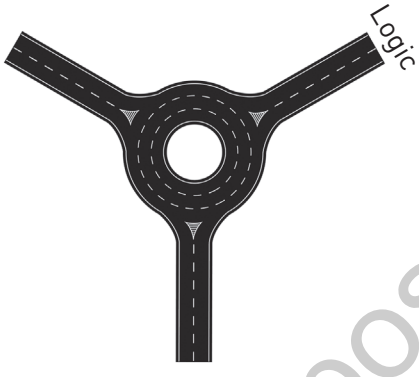
"just the facts" to plan effective action. Even if they know that A causes B (because that relationship is supported by many reliable facts), leaders still need to know how to make A happen! They need to know what others are doing to get to B (does C cause B?) and what affects does C have on all the other activities of the organization?

In addition, data may be misinterpreted by accident or on purpose. With sufficient manipulation, statistical results may be slanted in order to convince or confuse. So for solving tough problems, the data must be presented logically.

DEFINITION

Data are the facts or information gained from research/measurement or from experience. Examples include survey results, interview results, and everything you see and hear.

Logic—The Third Dimension



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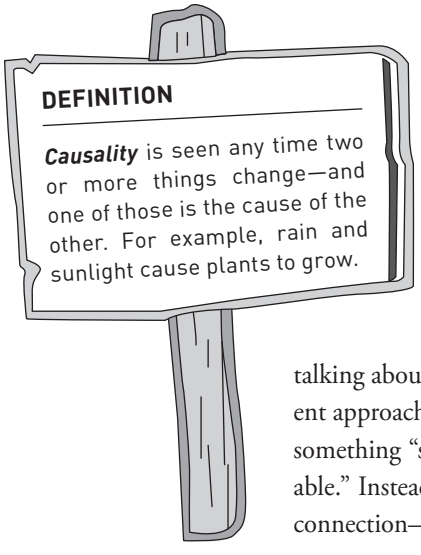
Previously, we talked about maps as guides—because maps help you get where you want to go. For planning a cross-country road trip, for example, your map will be more useful if it includes more dots (locations of cities, points of interest, gas stations, etc.) and more lines (roads and highways connecting the dots). The more lines and dots on your map, the more options you have for places to visit and the more choices you have for what road to take to get there.

DEFINITION

Logic represents an understanding of the causal relationship between two or more things—basically the "arrows" we've been talking about in the book. ***Logic structure*** (or more simply, ***structure***) is about the way those arrows interconnect (much more on this throughout this book).

Maps with no lines (maps that do not show clear relationships between the dots) are not very useful. Consider, for example, a knowledge map that says, "After-school programs and students' academic performance are related." That does not tell us HOW they are related. It's like saying "Chicago is close to New York." It only brings up more questions, such as "How close, and in what direction?" A map with no lines does not provide useful guidance for how to solve the challenge of improving students' academic performance.

Knowledge maps work on much the same principle as the maps you use for driving. Instead of physical locations on a road map, we have concepts on



a knowledge map; instead of roads, we have arrows showing causal connections (changes in one thing lead to changes in another). Generally, the more concepts and arrows on your knowledge map, the more useful that map will be for understanding, making decisions, and resolving problems. Because everything in the real world is interconnected, the concepts on our maps must also be interconnected if they are to provide useful guides for decision-making.

When we talk about the *logic* of a knowledge map, we are talking about the causal connections between the concepts. This is a very different approach to logic than you might be used to. Often when people think that something "seems logical," they are thinking it "makes sense" or "seems reasonable." Instead, for this book, something is logical when we understand a causal connection—showing how changes in one thing cause changes in another.

Causality

When you are creating a knowledge map from your research, arrows are used to represent *causal* logic. Causal logic is necessary for any deep, scientific understanding of your research topic. And equally important for practitioners, decision makers must be able to look at a map and see how doing more (or less) of some actions will lead to changes in the world.

In this book, we will show causal relationships by using arrows. Typically, we will use arrows that have solid lines to represent "causes more." We will use arrows that have dashed lines to represent "causes less," as in Figure 1.3.

The simplest logic that provides an explanation is in the form of "A causes B" statements because these statements are made of a single cause and a single effect. Examples include "after-school programs improve students' academic performance" and "after-school

FIGURE 1.3 ● Causal Arrows Show How More of One Thing Cause More or Less of Something Else

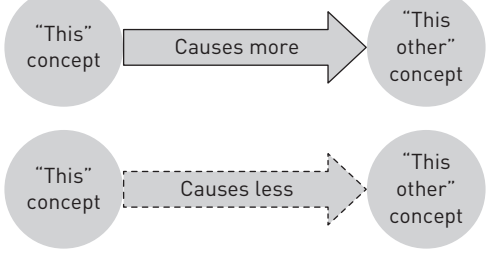
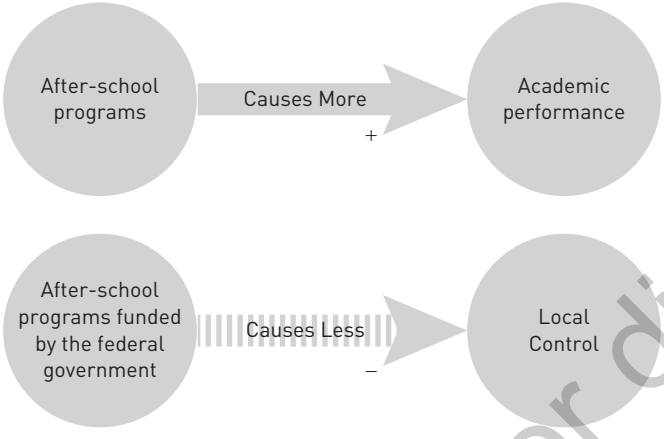


FIGURE 1.4 ⬢ Two Examples of Simple, Low Structure Causal Relationships



programs reduce local control of schools." Mapped out, these simple causal connections appear as two circles connected by an arrow as in Figure 1.4.

TRAVEL TIP

Note here that when we are talking about the dimension of logic, our focus is on the number of circles and what connections we see *between* the circles, not what is *inside* the circles.

One weakness of previous approaches to research was having too narrow a focus. Researchers would spend too much time, energy, and effort trying to decide if "A causes B." That is like having a map with only one road connecting two places of interest (and spending all your time studying that one road).

Instead of focusing our efforts on those small scraps of maps, we want to develop more useful explanations by creating maps with more circles and more causal arrows. For example, a broader study of after-school programs might include many things that contribute to school success, such as quality of teaching, attitudes toward school, dropout rates, and attendance.

Because focusing on the meaning and data may be distracting for our discussion on logic and structure, we will sometimes present maps that are more abstract. That helps us focus on what is *between* the circles rather than what is *inside* the circles.

For example, instead of saying what the concept "is," we write something like "Concept A" in the circle, as we did in Figure 1.5.

Notice here that we are using a more abstract representation—"Concept A" instead of, for example, "parental involvement." This abstract view helps you focus on the "structure" of the map—looking at the number of circles and the arrows connecting the circles—instead of looking at the concepts inside the circles.

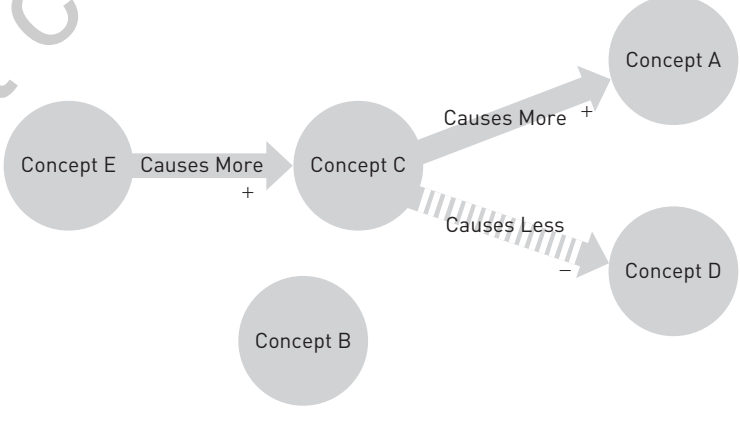
It Sounds Good in Theory, but There Are Limits to Logic

While having multiple causal arrows is good, logic alone is not enough. An entertaining story, for example, might present many causal relationships and make us feel good, but it won't provide useful guidance for planning and action. For example, stories about Sherlock Holmes provide a rich, complex, and interconnected world where clues make sense and lead us to a better understanding of the crime, the motives, and (usually) the murderer. Indeed, one reason those stories have been so popular for so long is that they make sense. They provide logical explanations.

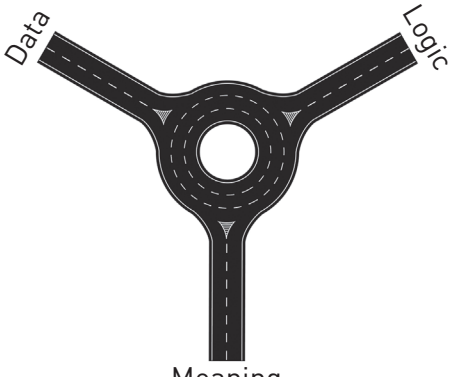
However, a highly logical fictional story does not provide useful direction for solving real problems. For highly useful knowledge maps in the real world, we need all three dimensions:

1. Concepts that are meaningful to the stakeholders
2. Data found by measuring the concepts
3. Logic supported by data that show causal connections

FIGURE 1.5 Abstract Example of Concepts and Causal Connections



PUTTING THE DIMENSIONS TOGETHER



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Many researchers and practitioners are calling for higher quality research for solving complex problems. However, they disagree on how to assess research quality. The most expensive and most time-consuming studies are not always the best quality.

We know that research is of higher quality when it is more useful for making decisions to solve complex problems. High quality research (among others)

- Helps managers make plans for effective action to reach meaningful goals
- Supports innovation
- Demonstrates the value of programs and services to funders and stakeholders
- Helps to shape effective public policy
- Provides useful direction for future studies

In this section, we will show how the three dimensions of knowledge (meaning, data, and logic) are interrelated and how you can evaluate each of them to be sure that you are conducting the highest quality research possible. In the following chapters, we will provide more advanced methods for evaluating research and building better knowledge maps.

You can see the interrelationship between meaning, data, and logic from a variety of perspectives. Stakeholders identify concepts that have meaning. Research provides data on those concepts and shows causal, logical relationships. By using knowledge maps, stakeholders find insights leading to effective decisions. Decisions lead to actions, including observable behavior. Reports based on those actions provide more data, raise awareness and understanding, and improve the quality of the map's logical structure. Most importantly, improving our maps helps to improve the human condition—the lives of people everywhere.

TRAVEL TIP

By using all three dimensions in your research, each piece helps you to avoid the limits of the others.

An important part of any research project is the ability to show that your efforts have resulted in a map that improves upon maps shown in previous research. A knowledge map helps you to show this on each of the three dimensions of knowledge.

- *Meaning*: Your knowledge map shows concepts and connections that are supported by more perspectives/stakeholders than previous maps.
- *Data*: The concepts and connections in your knowledge map are supported by better quality and quantity of data.
- *Logic*: Your knowledge map contains new concepts and connections (circles and arrows) not shown in previous maps.

An easy and effective way to evaluate the quality of existing research and to show the quality of your planned research is to use the Knowledge Appraisal Matrix (Table 1.1).

To use the matrix, start by considering a map, then mark or circle the appropriate boxes on the matrix that best reflect how well the study might meet each consideration.

You can use the matrix to evaluate the *results* of existing studies. You can also use the matrix to quickly evaluate (and show directions for improving) research projects that you are planning.

Test-Drive

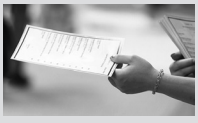
Let's take a simple hypothetical example and walk through it one step at a time. Then we'll go into a more complex example.

In this scenario, a white paper published by a major think tank states the following:

> In an interview with a leading expert on after-school programs, sociologist Dr. Mary Smith told us, "My research provides the best answers to this important question. We just completed a major study in which we interviewed hundreds of teachers, faculty, and parents in New York City. Their priorities are to increase after-school programs because funding is available, students are important, and our society needs this kind of support."

Figure 1.6 shows a knowledge map of that story.

KNOWLEDGE APPRAISAL MATRIX



This matrix provides a quick-and-easy appraisal of research projects.

We will show you how to use the matrix in the Test-Drive section. You can use the matrix to compare research results for the following demonstration and class activity.

TABLE 1.1 ⬢ Knowledge Appraisal Matrix

		LEVELS OF QUALITY		
DIMENSIONS OF KNOWLEDGE		**Level 1**	**Level 2**	**Level 3**
	1. Logic (arrows between concepts/ circles)	Map has one or no causal connections.	Map has more than one causal arrow connecting concepts.	Most or all concepts are connected by two or more arrows.
	2. Meaning (concepts within circles)	Concepts (in circles) on map are relevant to one knowledgeable person or stakeholder group.	Concepts on map are accepted as relevant to the topic by multiple stakeholder groups.	Concepts are accepted by general consensus across the entire field of study.
	3. Data (facts or information relating to concepts and arrows on the map)	Facts for one or more concepts have been found from one reliable study or research method.	Facts for multiple concepts have been found from multiple reliable studies or methods.	Most or all of the concepts have data from multiple reliable studies or methods.

Source: Adapted from Wright and Wallis (2017).

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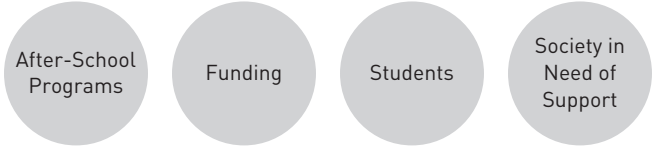
Looking at the Knowledge Appraisal Matrix (Table 1.1), we can identify the level of quality for each dimension of knowledge.

First, looking at the dimension of *meaning*, you will notice that the researcher is a sociologist. That would count as one knowledgeable person. You will also notice that her research drew on insights from other groups (teachers, faculty, and parents). That is a fairly good number of stakeholder groups but does not include everyone who might be interested. Other stakeholder groups could be included (students, community members, elected officials, etc.). Research might also be done by other sociologists and by professionals in other fields

FIGURE 1.6 ⬢ Very Simple Knowledge Map



(e.g., economists, psychologists, policy analysts). So we would rate that research at a Level 2 for meaning. To get to Level 3, we'd need to increase the number of stakeholder groups, which would probably result in an increase in the number of meaningful concepts. Also, we would need to share the map widely with the field and reach consensus that the map contains all meaningful concepts. We will look into stakeholders more in Chapter 2.

On the dimension of *data*, while the map is supported by interviews, there does not seem to be a lot of data. Although there may be more data that we haven't accessed, it seems that the researcher was only able to identify some top priorities. So we would rate the data as Level 1. The level of data could be improved by including more methods besides

TABLE 1.2 ⬢ Marked-Up Knowledge Appraisal Matrix

		LEVELS OF QUALITY		
DIMENSIONS OF KNOWLEDGE		**Level 1**	**Level 2**	**Level 3**
	1. Logic (arrows between concepts/circles)	Map has one or no causal connections.	Map has more than one causal arrow connecting concepts.	Most or all concepts are connected by two or more arrows.
	2. Meaning (concepts within circles)	Concepts (in circles) on map are relevant to one knowledgeable person or stakeholder group.	Concepts on map are accepted as relevant to the topic by multiple stakeholder groups.	Concepts are accepted by general consensus across the entire field of study.
	3. Data (facts or information relating to concepts on the map)	Facts for one or more concepts have been found from one reliable study or research method.	Facts for multiple concepts have been found from multiple reliable studies or methods.	Most or all of the concepts have data from multiple reliable studies or methods.

Source: Adapted from Wright and Wallis (2017).

interviews and by adding findings from more studies by researchers across disciplines (psychology, social work, etc.). We will further explore how to evaluate the quality and quantity of data in Chapters 3 and 4.

Last, let's look at logic. You will note that nothing in that white paper identifies a causal relationship. So for logic, we would rate this as Level 1. The logic can be improved by adding more causal connections between the concepts (if, of course, they are supported by data). We will explore logic further in Chapter 5.

Table 1.2 shows a Knowledge Appraisal Matrix that we've marked up to reflect the analysis.

You can see in the boxes to the right of each marked circle directions for improving the quality of each dimension of knowledge. Those boxes show what new research we could conduct that would improve understanding of and ability to address the big problems of the world.

CLASS ACTIVITY 1.1

Evaluating Evidence

In this section, we provide a hypothetical example, based on real events, to help you understand how to use mapping and to evaluate the quality of mapped research based on the three dimensions presented in this chapter. As you read the study, note how meaning, data, and logic are represented. Then, use the Knowledge Appraisal Matrix (Table 1.3) to evaluate the quality of the knowledge map (Figure 1.6). Afterwards, consider the questions for reflection and discussion and describe how you could conduct a better research project.

Background: A national debate has emerged over whether or not to continue funding for a billion-dollar program that provides support for after-school activities for children across the United States. Both sides present their perspectives. Opponents of the program say it should be cut because it doesn't have enough evidence to support its continued operation. Advocates for the program say it has enough evidence.

Your Role: A political organization hires you to conduct an independent analysis of the evidence from one recent study of the program. Your task is to read the following study and describe some of its strengths and weaknesses (your findings will be used to inform the organization's advocacy strategies).

The Study: In the study, the U.S. General Accountability Office (GAO, 2017) examined what was known about the effectiveness of after-school programs funded by the Department of Education's 21st Century Community Learning Centers (21st Century) grants program. GAO reviewed findings from a total of

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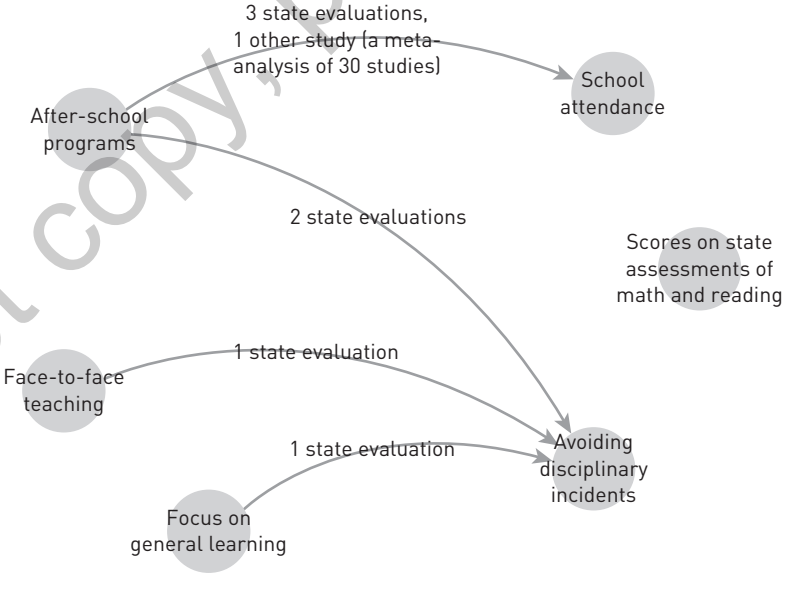
ten studies—four state program evaluations and six other studies that examined student outcomes.

- Of the four state evaluations that GAO reviewed, three found that after-school programs had a positive effect on school-day attendance. One of the studies that GAO reviewed, which was a meta-analysis of 30 studies, also found a positive effect of after-school programs on school attendance.
- Two of the state evaluations found that after-school programs had a positive effect on school-day discipline (reducing disciplinary problems). The Texas evaluation showed that centers that taught students face-to-face rather than via computer and those that focused on general learning strategies rather than on specific subject area skills were associated with fewer disciplinary incidents.
- None of the 10 studies in GAO's review found consistently better scores in either math or reading in program participants' state assessments.

Figure 1.7 presents a map created from the key findings of the GAO study. In the figure, each arrow shows which of the study(ies) that GAO reviewed provided evidence for that arrow (more on this kind of presentation in Chapter 7).

FIGURE 1.7 ⬢ Knowledge Map of GAO (2017) Study of 21st Century After-School Programs



Source: Authors' map created from GAO (2017) study of 21st Century after school programs.

Instructions: Consider Figure 1.7 and circle the appropriate boxes on the Knowledge Appraisal Matrix on Table 1.3.

TABLE 1.3 ⬢ Knowledge Appraisal Matrix for You to Use in Evaluating the GAO 2017 Study on After-School Programs

		LEVELS OF QUALITY		
DIMENSIONS OF KNOWLEDGE		**Level 1**	**Level 2**	**Level 3**
	1. Logic (arrows between concepts/ circles)	Map has one or no causal connections.	Map has more than one causal arrow connecting concepts.	Most or all concepts are connected by two or more arrows.
	2. Meaning (concepts within circles)	Concepts (in circles) on map are relevant to one knowledgeable person or stakeholder group.	Concepts on map are accepted as relevant to the topic by multiple stakeholder groups.	Concepts are accepted by general consensus across the entire field of study.
	3. Data (facts or information relating to concepts and arrows on the map)	Facts for one or more concepts have been found from one reliable study or research method.	Facts for multiple concept have been found from multiple reliable studies or methods.	Most or all of the concepts have data from multiple reliable studies or methods.

By evaluating the research of others and your own research, you can explain to your audience (client, employer, professor, etc.) the strengths, limitations, and opportunities for future research.

Download an electronic version of this handout at https://practicalmapping.com

STOP/REFLECTION/DISCUSSION

Reflect on and discuss the results of your assessment from Class Activity 1.1.

Compare your assessment with that of others in the class.

- What was similar or different between your assessments?
- If they were different in any way, why do you think they were different?
- What research could you conduct (that would be added to the research presented in Class Activity 1.1) to reach higher levels of knowledge on each dimension?

RIGHT OF WAY: RESEARCH ETHICS

In this section, we'll talk about ethics and why it is very important that we protect the participants of any research work we do. Simply put, if we fail in that task, the consequences can be terrible.

istock.com/3D_generator

A well-known example of an unethical study is the U.S. Public Health Service Syphilis Study at Tuskegee, Alabama. The study began in the hopes of being able to justify more treatment programs for African Americans. Local physicians were asked to withhold treatment from half the men in the study to provide a comparison with the men in the study who were receiving treatment.

In a terrible breach of ethics, the participants in the study were told that they were being treated for "bad blood" when, in truth, half the men in the study were not receiving the treatment needed for their condition.

The ethical failures became worse when the study continued even after penicillin became a widely used, effective treatment. Concerns were raised about the study; however, officials at the U.S. Centers for Disease Control and Prevention argued that the study was necessary. They also gained support from national medical societies. In 1972, news articles condemned the study and brought a halt to the personal and ethical tragedy. In 1974, a $10 million out-of-court settlement was reached. As we are writing this book, 12 offspring of the original participants continue to receive medical treatment as part of that settlement.

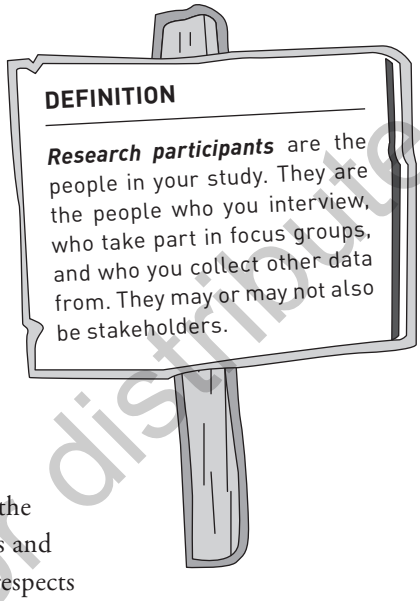
The significant human suffering and financial cost of those ethical breaches could have been avoided.

That study led to the creation of ethical guidelines and review boards to protect the rights and well-being of research participants. Still, the ethical thing to do in a specific research situation is often not obvious. Below are a few principles of ethical research that are relevant to many research situations. The Further Exploration section at the end of this chapter lists some resources for more information on research ethics.

Reading and being familiar with ethical guidelines relevant to your research focus will help you be prepared to handle ethical dilemmas that you may face.

- **Avoiding harm from research.** As with the Tuskegee Syphilis experiment, it is unethical to withhold a needed and beneficial program or service from participants for research purposes.

- **Informed consent.** The key idea for ethical research is that the subjects must be protected from harm. Part of this includes providing information to potential participants (and their parents or guardians, when applicable) about the study, its goals, and all risks and benefits that might be associated with it. Be sure the research participants know what to expect—and that they know that they can stop at any time. Their safety is more important than your research!



- **Research utility.** Be sure that your research will be beneficial—the time and expertise of your participants is very valuable.
- **Cultural responsiveness.** You should always be sensitive to the cultural norms of the participants. Make sure your questions and concerns are culturally relevant to them. Use language that respects individuals and their culture. To make sure that everyone can participate, you may need to translate materials into other languages. You also may need to make materials available in formats that are accessible to people with disabilities and people with low literacy.
- **Confidentiality.** Researchers should not share data without permission from the client and the research participants who provided the data. Researchers should have access to only the data they need to conduct the study.
- **Privacy.** Another part of ethical research means protecting the privacy of the research participants. This means keeping their names and other identifying information confidential (unless they make an informed choice and give permission to share it). If someone might read your study and make a good guess as to who the participants were and/or if they might be able to attribute a particular comment to a specific individual, then you need to provide more anonymity. A common approach is to say "several people said" rather than mentioning specific interview participants. Protecting research participants' privacy also means not collecting more private information than you need to conduct your analysis. It also means protecting data about participants from being stolen or accidentally seen by others.
- **Honestly reporting research results.** Honest reporting means more than not falsifying your data. It also means reporting results for all the questions you

explored and not suppressing results that are not what you expected. When results are not what you expected, that means opportunity for learning and for strengthening the program.

- **Authorship.** When reporting your research results, the authorship should accurately reflect who contributed to the study.

The American Evaluation Association provides five *Evaluators' Ethical Guiding Principles*, available on its website: https://www.eval.org/p/cm/ld/fid=51. Below is a summary; we encourage you to explore further.

1. **Systematic Inquiry:** Evaluators conduct data-based inquiries that are thorough, methodical, and contextually relevant.
2. **Competence:** Evaluators provide skilled professional services to stakeholders.
3. **Integrity:** Evaluators behave with honesty and transparency in order to ensure the integrity of the evaluation.
4. **Respect for People:** Evaluators honor the dignity, well-being, and self-worth of individuals and acknowledge the influence of culture within and across groups.
5. **Common Good and Equity:** Evaluators strive to contribute to the common good and advancement of an equitable and just society.

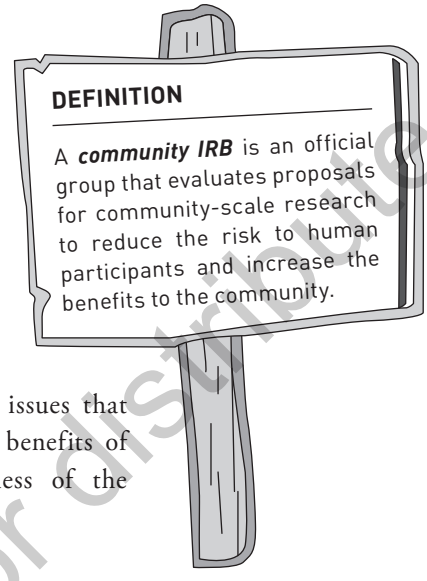
Institutional Review Boards

Institutional review boards (IRBs) are an important resource for protecting the rights of research participants. Many studies conducted by smaller organizations do not use IRBs. However, some grant-funded research projects require them, and they can be useful when you are dealing with studies that raise ethical challenges that require outside review.

Your institution's IRB. If you are a student or working as part of a university or large institution, you might have an IRB that sets standards and procedures for ethical research. You should contact them for more information and to see if they want to review your research project before you begin. If you (or your institution) do not have an IRB, you may be able to work with an IRB at a local college or university or a private IRB company.

Private IRBs. You can search for private IRBs at https://ohrp.cit.nih.gov/search/search.aspx?styp=bsc. The Further Exploration section at the end of this

chapter provides additional resources on research ethics that can assist you whether or not you are working with an IRB.



Community IRB

A number of community–based organizations and community–academic partnerships have formed community-based research review processes (Shore et al., 2015). Some are U.S. federally recognized IRBs that approve, monitor, and review research involving human participants while others are advisory bodies. All of them routinely examine issues that institution-based IRBs typically do not, such as risks and benefits of the research for communities and cultural appropriateness of the research design.

Chapter 1 Key Points

- The "wicked problems" of the world are solvable.
- Too often, applied research and program evaluation are inefficient because they are producing scraps of maps.
- New approaches to research show how we can improve the usefulness and impact of our research by evaluating (and improving) our knowledge maps on the three dimensions of meaning, data, and logic.
- Ethics comes first.

Frequently Asked Questions

Q: Why the focus on causal logic instead of Toulmin's logic of "claim, evidence, warrant, support, etc."?

A: There are many types of logic, including inductive, deductive, and (what is sometimes called) Toulminian logic (named after the person who formalized the process). While these approaches to logic seem to have worked well for advancing a revolution in the natural sciences, they have not proved useful for revolutionizing the social/behavioral sciences. So instead, this book is focused on causal logic because it is even more fundamental to scientific understanding.

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Q: What if I want to do a study where the participants/subjects are unaware that they are being studied. Do I have to tell the truth if they ask me why I'm watching them?

A: For any kind of questionable research situation, the simple answer is to consult your IRB. See the following section for more resources on research ethics. You want your research to be so useful that it makes for happy headlines—not lawsuits!

Q: To narrow the gap between researchers and practitioners, could I be both?

A: Yes indeed! You should be careful, however, about potential conflicts of interest. Remember, there are benefits to having external perspectives—so we encourage collaboration because it provides different perspectives to deepen your knowledge and counter your biases.

Q: How is knowledge mapping different from concept mapping?

A: Some concept maps show how concepts are related to one another; however, they do not always show *causal* relationships. Without causal relationships, maps are not as useful for decision makers. For example, cats, mice, and wheat are concepts that are related to a greater or lesser degree. When you identify how they are causally related, you can better understand what goes on between them!

Q: How is knowledge mapping different from simulation modelling?

A: A computer simulation model is a hypothetical world reflecting (to a greater or lesser extent) a topic of study. You can adjust variables to see how those changes might lead to desired results—such as achieving program goals. While simulations provide useful insights, they also suffer from some limitations, depending on the assumptions of the programmers creating the models. They are generally limited to quantified data, while knowledge maps may include unquantified data. Knowledge maps may be used as guides for the creation of simulation models. With better maps, you could expect to create a better model.

Further Exploration

In this chapter, we've covered three basic dimensions of knowledge to help you better understand and resolve the wicked problems of the world. For those bold explorers who would like to learn more, this section provides additional information. For each section of the chapter, you will find sources on the foundational research and insights supporting this chapter. We've placed this information in this separate section for two reasons. First, so that it is here for those readers who want to explore the subject in greater depth. Second, to make other parts of the chapter easy to read.

Many of these publications are available for free online. Some may require a fee to access. If you are a student or affiliated with a university, you may be able to access these at no charge through your institution's library.

The Wicked Complexity of Problems Facing the World

The world is facing incredibly complex problems—just look at the news! For deeper understanding take a look at the following:

Camillus, J. C. (2008). Strategy as a wicked problem. *Harvard Business Review, 86*(5), 98. Retrieved from http://www.reshape.se/files/5914/2071/1790/STRATEGY_AS_A_WICKED_PROBLEM.pdf

Rittel H., & Webber M. M. (1973). Planning problems are wicked. *Polity, 4*, 155–169. Retrieved from http://www.ask-force.org/web/Discourse/Rittel-Dilemmas-General-Theory-Planning-1973.pdf

The Explosion of Information

There is an unbelievably large amount of information on the web and in our daily lives. Yet, science has not been very good about finding the "right" data or integrating the data that we do have.

Marr, B. (2018). How much data do we create every day? The mind-blowing stats everyone should read. *Forbes*. Retrieved from: https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#b6400cc60ba9

Russom, P. (2011). Big data analytics. *TDWI best practices report, fourth quarter, 19*, 40. *TDWI Research*. Retrieved from https://vivomente.com/wp-content/uploads/2016/04/big-data-analytics-white-paper.pdf

The Disconnect Between Research and Practice

A lot of research is going on, but the results of that research too often do not provide the knowledge that decision makers need.

Carden, F. (2017). Building evaluation capacity to address problems of equity. *New Directions for Evaluation, 2017*(154), 115–125. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/ev.20245/full

Dijkers, M. (2009). When the best is the enemy of the good: The nature of research evidence used in systematic reviews and guidelines. *NCDDR Task Force on Systematic Review and Guidelines. Austin, TX: SEDL*. Retrieved from http://ktdrr.org/ktlibrary/articles_pubs/ncddrwork/tfsr_best/

Moat, K. A., Lavis, J. N., Wilson, M. G., Røttingen, J. A., & Bärnighausen, T. (2013). Twelve myths about systematic reviews for health system policymaking rebutted. *Journal of Health Services Research & Policy, 18*(1), 44–50. Retrieved from https://www.researchgate.net/profile/John_Lavis/publication/235422986_Twelve_myths_about_systematic_reviews_for_health_system_policymaking/links/54a6dd840cf257a6360aa737.pdf

Rahman, A., & Applebaum, R. (2010). What's all this about evidence-based practice? The roots, the controversies, and why it matters. *Generations, 34*(1), 6–12. Retrieved from http://www.ingentaconnect.com/content/asag/gen/2010/00000034/00000001/art00001

Schorr, L., & Gopa, S. (2016). Broadening the evidence base without "defining evidence down." *Stanford Social Innovation Review.* Retrieved from https://ssir.org/articles/entry/broadening_the_evidence_base_without_defining_evidence_down

Smyth, K. F., & Schorr, L. B. (2009). *A lot to lose: A call to rethink what constitutes "evidence" in finding social interventions that work*. Malcolm Wiener Center for Social Policy Working Paper Series. Harvard Kennedy School. Retrieved from https://www.hks.harvard.edu/research-insights/research-publications

Stern, G. E., Stame, N., Mayne, J., Forss, K., Davies, R., & Befani, B. (2012). *Broadening the range of designs and methods for impact evaluations*. Retrieved from https://www.oecd.org/derec/50399683.pdf

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The Low Rates of Success in Using Data for Making Decisions

As a result of insufficient research methods, important decisions rarely lead to the desired results. National policies and organizational changes seem to succeed only about 20 percent of the time.

Dekkers, R. (2008). Adapting organizations: The instance of business process re-engineering. *Systems Research and Behavioral Science: The Official Journal of the International Federation for Systems Research, 25*(1), 45–66. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/sres.857/full

Hill, T., & Westbrook, R. (1997). SWOT analysis: It's time for a product recall. *Long Range Planning, 30*(1), 46–52. Retrieved from http://www.ftms.edu.my/images/Document/MOD001074%20-%20Strategic%20Management%20Analysis/WK6_SR_MOD001074_Hill_Westbrook_1997.pdf

Light, P. C. (2016). The 2015 John Gaus Award Lecture: Vision+ Action = Faithful Execution: Why government daydreams and how to stop the cascade of breakdowns that now haunts it. *PS: Political Science & Politics, 49*(1), 5–20. Retrieved from https://doi.org/10.1017/S1049096515001110

MacIntosh, R., & MacLean, D. (1999). Conditioned emergence: A dissipative structures approach to transformation. *Strategic Management Journal, 20*(4), 297–316. Retrieved from http://eprints.gla.ac.uk/24584/1/24584s.pdf

Smith, M. E. (2003). Changing an organisation's culture: Correlates of success and failure. *Leadership & Organization Development Journal, 24*(5), 249–261. Retrieved from http://www.emeraldinsight.com/doi/abs/10.1108/01437730310485752

Unanticipated Consequences From Policies and Programs

Duit, A., & Galaz, V. (2008). Governance and complexity—emerging issues for governance theory. *Governance, 21*(3), 311–335.

Rosegrant, M. (2000). *Transforming the rural Asian economy: The unfinished revolution* (Vol. 1). Asian Development Bank.

Schuler, S. R., Hashemi, S. M., & Badal, S. H. (1998). Men's violence against women in rural Bangladesh: Undermined or exacerbated by microcredit programmes? *Development in Practice, 8*(2), 148–157.

Human-Centered Design, Complexity, and Systems Thinking in Research and Evaluation

New ways of thinking about our world are leading to new insights into how we conduct research—and how we apply the results of that research to collaborative decision-making.

Christie, C. A., Lemire, S., & Inkelas, M. (2017). Understanding the similarities and distinctions between improvement science and evaluation. *New Directions for Evaluation, 2017*(153), 11–21. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/ev.20237/full

Lopez, A., & Lam, C. Y. (2016, February 21). Program design TIG Week: Angelina Lopez and Chi Yan Lam on the rise of design. [AEA365 blog post] Retrieved from American Evaluation Association website: http://aea365.org/blog/program-design-tig-week-angelina-lopez-and-chi-yan-lam-on-the-rise-of-design/

National Center for Biotechnology Information, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4573926/

National Implementation Research Network, https://nirn.fpg.unc.edu/learn-implementation/implementation-science-defined

National Institute of Health Fogarty International Center, https://www.fic.nih.gov/ResearchTopics/Pages/ImplementationScience.aspx

Richard, R. (2009). *The logic model and systems thinking: Can they co-exist*. PowerPoint presentation at the annual meeting of the American Evaluation Association in Orlando, FL. Retrieved from http://comm.eval.org/coffee_break_webinars/viewdocument/the-logic-model-and

Rogers, P. J. (2008). Using programme theory to evaluate complicated and complex aspects of interventions. *Evaluation, 14*(1), 29–48. Retrieved from http://journals.sagepub.com/doi/pdf/10.1177/1356389007084674

Rohanna, K. (2017). Breaking the "adopt, attack, abandon" cycle: A case for improvement science in K–12 education. *New Directions for Evaluation, 2017*(153), 65–77. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/ev.20233/full

Woolcock, M. (2013). Using case studies to explore the external validity of 'complex' development interventions. *Evaluation, 19*(3), 229–248. Retrieved from https://www.econstor.eu/bitstream/10419/93693/1/769160964.pdf

Three Dimensions of Knowledge

To understand knowledge and how to better apply it, we look at three dimensions (or "worlds") of knowledge and understanding theoretical models.

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Popper, K. (2002). *The logic of scientific discovery,* New York, NY: Routledge Classics. Retrieved from https://books.google.com/books?hl=en&lr=&id=LWSBAgAAQBAJ&oi=fnd&pg=PP1&dq=Popper+K.+(2002)+The+logic+of+scientific+discovery,+New+York:+Routledge+Classics.&ots=pzDmZ30HdL&sig=wQRUP9EJ_GazpXjHqh82wiUxdHo#v=onepage&q&f=false

Wallis, S. E. (2008). Validation of theory: Exploring and reframing Popper's worlds. *Integral Review, 4*(2), 71–91. Retrieved from http://integral-review.org/documents/Wallis,%20Validation%20of%20Theory,%20Vol.%204%20No.%202.pdf

Wallis, S. E. (2016). The science of conceptual systems: A progress report. *Foundations of Science, 21*(4), 579–602. Retrieved from https://link.springer.com/article/10.1007/s10699-015-9425-z

Wright, B., & Wallis, S. E. (2017, March 31). How good is your evidence? *Stanford Social Innovation Review (SSIR)*. Retrieved from https://ssir.org/articles/entry/how_good_is_your_evidence

Techniques for and Practical Examples of Knowledge Mapping and Logic Models

Recent advances in knowledge mapping, developed by the authors of this book, have provided easier ways to make maps that are more useful to practitioners.

Fotiyeva, I., Wright, B., Lewis, L, & Wallis, S. E. (2015). *A new model for engaging under-represented high school students in STEM using popular media and technology*. Poster presented at the 2015 American Evaluation Association conference, Chicago, IL. Retrieved from http://comm.eval.org/viewdocument/a-new-model-for-enga

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Wallis, S. E. (2013). How to choose between policy proposals: A simple tool based on systems thinking and complexity theory. *E:CO-Emergence: Complexity & Organization, 15*(3), 94–120. Retrieved from https://search.proquest.com/openview/b728a5140ab185e8533d6b88c573e7ae/1?pq-origsite=gscholar&cbl=28203

Wallis, S. E. (2014). Existing and emerging methods for integrating theories within and between disciplines. *Organisational Transformation and Social Change, 11*(1), 3–24. Retrieved from http://www.tandfonline.com/doi/abs/10.1179/1477963313Z.00000000023

Wallis, S. E., & Frese, K. (2017). *Strategic planning: A new state of the art*. [White paper] ASK MATT Solutions & TeamLMI. Retrieved from https://www.researchgate.net/publication/319220087_Strategic_Planning_A_New_State_of_the_Art

Wallis, S. E., & Wright, B. (2014). *The science of conceptual systems: Its history and usefulness for improved decision-making and organizational success*. [White paper] Retrieved from http://www.meaningfulevidence.com

Wallis, S. E., & Wright, B. (2015). *Strategic knowledge mapping: The co-creation of useful knowledge.* Paper presented at the Association for Business Simulation and Experiential Learning (ABSEL) 42nd annual conference in Las Vegas, NV. Retrieved from https://journals.tdl.org/absel/index.php/absel/article/viewFile/2899/2850

Wright, B. (2016, April 27). Getting to evidence-based policy: Three perspectives. *Stanford Social Innovation Review.* Retrieved from https://ssir.org/articles/entry/getting_to_evidence_based_policy_three_perspectives

Practical Example: After-School Programs

Brown, E. March 16, 2017. Trump budget casualty: After-school programs for 1.6 million kids. Most are poor. *The Washington Post*. http://www.washingtonpost.com/local/education/trump-budget-casualty-afterschool-programs-for-16-million-kids-most-are-poor/2017/03/16/78802430-0a6f-11e7-b77c-0047d15a24e0_story.html

Fessler, P. May 1, 2017. Trump's Budget Proposal Threatens Funding For Major After-School Program. *NPR*. http://www.npr.org/2017/05/01/526436087/trumps-budget-proposal-threatens-funding-for-major-after-school-program

Robinson, G., & Fenwick, L. (2007). *Afterschool programs as an oasis of hope for black parents in four cities*. Washington, DC: The Black Alliance for Educational Options. http://www.baeo.org/files/mottSummary.pdf

U.S. General Accountability Office (GAO). (2017, April). *Education Needs to Improve Oversight of Its 21st Century Program*. https://www.gao.gov/products/GAO-17-400

Right of Way: Research Ethics

We cannot emphasize enough the importance of maintaining high ethical standards. Here are some additional resources to help you maintain yours!

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Centers for Disease Control and Prevention. (2015). *U.S. Public Health Service syphilis study at Tuskegee.* (Web page). Retrieved from https://www.cdc.gov/tuskegee/index.html

The Collaborative Institutional Training Initiative (CITI Program) provides online research and ethics compliance training. Learners must affiliated with an institution that has an organizational subscription or pay the course fee. https://about.citiprogram.org/en/homepage/

Free Resources for Program Evaluation and Social Research Methods website. (2016). Protecting the public in research (web page). Retrieved from http://gsociology.icaap.org/methods/protect.html

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Wager, E., & Kleinert, S. (2011). *Responsible research publication: International standards for authors* [A position statement developed at the 2nd World Conference on Research Integrity, Singapore, July 22–24, 2010]. In T. Mayer & N. Steneck (Eds.), *Promoting research integrity in a global environment* (Chap. 50, pp. 309–316). Singapore: Imperial College Press/World Scientific Publishing. Retrieved from http://publicationethics.org/files/International%20standards_authors_for%20website_11_Nov_2011.pdf

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