#### Scientific Method

All scientists use common methods for their enquiry. All sciences whether natural or social agree up on methods of studying phenomena. But their materials differ. A biologist studying the structure of some flowers, a chemist studying radioactive properties of an element and a sociologist studying crime situation in an urban slum. All follows similar scientific methods of inquiry. But their subjects of study are different. Therefore, they use different techniques of investigation for their study. As their materials are different, their purposes also differ. All of them will observe the phenomenon and analyze them to find out their sequences this is called scientific method. Thus scientific method is a systematic step-by-step procedure following logical process of reasoning.

 According to **prof. Morgan** “scientific method being highly elastic, can be applicable to all domain of human activity where the discovery of truth is the objective”.So the scientific method is means for gaining knowledge of the universe.

 **Karl Person observed** “there is no short-cut to truth, no way to gain knowledge of the universe expect through the gate way of scientific method”.

 ***Meaning and essentials of scientific method***

Scientific method is a way in which one can test opinion, impressions or guess by examining available evidences for and against them. So it is controlling lot of things and establishing stable belief.

Essentials of scientific method are,

* + - Scientific method aims at discovering facts.
		- It is itself corrective in nature.
		- It is itself based on systematic doubts.
		- Scientific theories are abstract in nature.

In the preceding sections, we described science as a knowledge derived by systematic procedure. Therefore science is a knowledge acquired through a scientific method. So what exactly is the “scientific method”? **Scientific method** refers to a standardized set of techniques for building scientific knowledge, such as how to make valid observations, how to interpret results, and how to generalize those results. The scientific method allows researchers to independently and impartially test preexisting theories and prior findings, and subject them to open debate, modifications, or enhancements. The scientific method must satisfy four key characteristics:

* *Logical:* Scientific inferences must be based on logical principles of reasoning.
* *Confirmable:* Inferences derived must match with observed evidence.
* *Repeatable:* Other scientists should be able to independently replicate or repeat a

                         scientific study and obtain similar, if not identical, results.

* *Scrutinizable:* The procedures used and the inferences derived must withstand critical

                                scrutiny (peer review) by other scientists.

* Objectivity: The inferences should be objective.
* Generalizability: Generalization is an act of reasoning that involves drawing broad inferences from particular observations. It is widely-acknowledged as a quality standard in quantitative research, but is more controversial in qualitative research.

[**THE SCIENTIFIC METHOD**](#page6) **AND ITS PARTICULAR FEATURES**

When social workers question things and search for evidence as the basis for making practice decisions, they are applying the scientific method. A key feature of the **scientific method** is that *everything is open to* *question*.

**Keep an Open Mind**

That means that in our quest to understand things, we should strive to keep an *open mind* about every-thing that we think we know or that we want to be-lieve. In other words, we should consider the things we call “knowledge” to be *provisional* and *subject to* *refutation.* This feature has no exceptions. No matterhow long a particular tradition has been practiced, no matter how much power or esteem a particular authority figure may have, no matter how noble a cause may be, no matter how cherished it may be, we can question any belief.

Keeping an open mind is not always easy. Few of us enjoy facts that get in the way of our cherished beliefs. When we think about allowing everything to be open to question, we may think of old-fashioned notions that we ourselves have disputed and thus pat ourselves on the back for being so open-minded. If we have a liberal bent, for example, we may fancy ourselves as scientifi c for questioning stereotypes of gender roles, laws banning gay marriage, or papal decrees about abortion. But are we also prepared to have an open mind about our own cherished beliefs—to allow them to be questioned and refuted? Only when a belief you cherish is questioned do you face the tougher test of your commitment to scientifi c notions of the provisional nature of knowledge and keeping everything open to question and refutation.

**Observation**

Another key feature of the scientific method is the search for *evidence based on observation* as the basis for knowledge. The term *empirical* refers to this valu-ing of observation-based evidence. As we will see later, one can be empirical in different ways, depending on the nature of the evidence and the way we search for and observe it. For now, remember that the scientifi c method seeks truth through observed evidence—not through authority, tradition, or ideology—no matter how much social pressure or political correctness of either the right or the left may be connected to partic-ular beliefs and no matter how many people cherish those beliefs or how long they’ve been proclaimed to be true. It took courage long ago to question fiercely held beliefs that the Earth is fl at. Scientifi cally minded social workers today should find the same courage to inquire as to the observation-based evidence that supports interventions or policies that they are told or taught to believe in.

Social workers should also examine the nature of that evidence. To be truly scientific, the observa-tions that accumulated the evidence should have been *systematic* and *comprehensive*. To avoid overgener-alization and selective observation (errors we will be discussing shortly), the *sample* of observations should have been *large* and *diverse*. The observational *pro-cedures should be specified* so that we can see thebasis for the conclusions that were reached, assess whether overgeneralization and selective observation were truly avoided, and judge whether the conclu-sions are indeed warranted in light of the evidence and the ways in which it was observed.

**Objectivity**

The specifi ed procedures also should be scrutinized for potential bias. The scientifi c method recognizes that we all have predilections and biases that can dis-tort how we look for or perceive evidence. It there-fore emphasizes the *pursuit of objectivity* in the way we seek and observe evidence. None of us may ever be purely objective, no matter how strongly commit-ted we are to the scientifi c method. No matter how scientifically pristine their research may be, research-ers want to discover something important—that is, to have fi ndings that will make a significant contri-bution to improving human well-being or (less nobly) enhancing their professional stature. The scientifi c method does not require that researchers deceive themselves into thinking they lack these biases. In-stead, recognizing that they may have these biases, they must fi nd ways to gather observations that are not influenced by their own biases.

Suppose, for example, you devise a new interven-tion for improving the self-esteem of traumatized children. Naturally, you will be biased in wanting to observe improvements in the self-esteem of the children receiving your intervention. It’s okay to have that bias and still scientifically inquire whether your intervention really does improve self-esteem. You would not want to base your inquiry solely on your own subjective clinical impressions. That approach would engender a great deal of skepticism about the objectivity of your judgments that the chil-dren’s self-esteem improved. Thus, instead of relying exclusively on your clinical impressions, you would devise an observation procedure that was not influ-enced by your own biases. Perhaps you would ask colleagues who didn’t know about your interven-tion or the nature of your inquiry to interview the children and rate their self-esteem. Or perhaps you would administer an existing paper-and-pencil test of self-esteem that social scientists regard as valid. Although neither alternative can guarantee complete objectivity, each would be more scientifi c in refl ect-ing your effort to pursue objectivity.

**Replication**

Because there are no foolproof ways for social sci-ence to guarantee that evidence is purely objective, accurate, and generalizable, the scientific method also calls for the replication of studies. This is in keeping with the notion of refutability and the knowledge’s provisional nature. *Replication* means duplicating a study to see if the same evidence and conclusions are produced. It also refers to modifi ed replications in which the procedures are changed in certain ways that improve on previous studies or de-termine if findings hold up with different target pop-ulations or under different circumstances. The need to replicate implies that scientifi cally minded social workers should have the courage to question not only cherished beliefs that were not derived from scientifi c evidence but also the conclusions of scientifi c studies and the ways those studies were carried out.

[**OTHER WAYS OF KNOWING**](#page6)

The scientific method is not the only way to learn about the world. As we mentioned earlier, for ex-ample, we all discover things through our personal experiences from birth on and from the agreed-on knowledge that others give us. Sometimes this knowledge can profoundly influence our lives. We learn that getting an education will affect how much money we earn later in life and that swimming be-yond the reef may bring an unhappy encounter with a shark. Sharks, on the other hand, may learn that hanging around the reef may bring a happy encoun-ter with unhappy swimmers. As students we learn that studying hard will result in better examination grades.

We also learn that such patterns of cause and ef-fect are probabilistic in nature: The effects occur more often when the causes occur than when they are absent—but not always. Thus, students learn that studying hard produces good grades in most in-stances, but not every time. We recognize the danger of swimming beyond the reef without believing that

every such swim will be fatal. Social workers learn that being abused as children makes people more likely to become abusive parents later on, but not all parents who were abused as children become abusive themselves. They also learn that severe mental illness makes one vulnerable to becoming homeless, but not all adults with severe mental illnesses become home-less. We will return to these concepts of causality and probability throughout the book. As we’ll see, scien-tific inquiry makes them more explicit and provides techniques for dealing with them more rigorously than do other ways of learning about the world.

**Tradition**

One important secondhand way to attempt to learn things is through tradition. We may test a few of these “truths” on our own, but we simply accept the great majority of them. These are the things that “every-body knows.” Tradition, in this sense of the term, has clear advantages for human inquiry. By accepting what everybody knows, you are spared the overwhelming task of starting from scratch in your search for regu-larities and understanding. Knowledge is cumulative, and an inherited body of information and understand-ing is the jumping-off point for the development of more knowledge. We often speak of “standing on the shoulders of giants”—that is, on the shoulders of pre-vious generations.

At the same time, tradition may be detrimental to human inquiry. If you seek a fresh and different un-derstanding of something that everybody already understands and has always understood, you may be seen as a fool. More to the point, it will probably never occur to you to seek a different understand-ing of something that is already understood and obvious.

When you enter your fi rst job as a professional so-cial worker, you may learn about your agency’s pre-ferred intervention approaches. (If you have begun the fi eld placement component of your professional education, you may have already experienced this phenomenon.) Chances are you will feel good about receiving instructions about “how we do things in this agency.” You may be anxious about beginning to work with real cases and relieved that you won’t have to choose between competing theories to guide what you do with clients. In conforming to agency tradi-tions you may feel that you have a head start, ben-efiting from the accumulated practice wisdom of previous generations of practitioners in your new work setting. Indeed you do. After all, how many re-cently graduated social workers are in a better posi-tion than experienced agency staff to determine the best intervention approaches in their agency?

But the downside of conforming to traditional prac-tice wisdom is that you can become too comfortable doing it. You may never think to look for evidence that the traditional approaches are or are not as effec-tive as everyone believes or for evidence concerning whether alternative approaches are more effective. And if you do seek and fi nd such evidence, you may find that agency traditions make your colleagues unreceptive to the new information.

**Authority**

Despite the power of tradition, new knowledge ap-pears every day. Aside from your personal inquiries, throughout your life you will benefit from others’ new discoveries and understandings. Often, accep-tance of these new acquisitions will depend on the status of the discoverer. You’re more likely, for exam-ple, to believe the epidemiologist who declares that the common cold can be transmitted through kissing than to believe a layperson who says the same thing.

Like tradition, authority can both assist and hinder human inquiry. Inquiry is hindered when we depend on the authority of experts speaking outside their realm of expertise. The advertising industry plays heavily on this misuse of authority by having popu-lar athletes discuss the nutritional value of breakfast cereals or movie actors evaluate the performance of automobiles, among similar tactics. It is better to trust the judgment of the person who has special training, expertise, and credentials in the matter, especially in the face of contradictory positions on a given ques-tion. At the same time, inquiry can be greatly hin-dered by the legitimate authority who errs within his or her own special province. Biologists, after all, can and do make mistakes in the fi eld of biology. Biologi-cal knowledge changes over time. So does social work knowledge, as illustrated in the box “An Example of How Social Work Knowledge Changes Over Time.”

Our point is that knowledge accepted on the au-thority of legitimate and highly regarded experts can be incorrect and perhaps harmful. It is therefore important that social work practitioners be open to new discoveries that might challenge the cherished beliefs of their respected supervisors or favorite theo-rists. Also keep an open mind about the new knowl-edge that displaces the old. It, too, may be flawed no matter how prestigious its founders. Who knows? Perhaps some day we’ll even fi nd evidence that cur-rently out-of-favor ideas about parental causation of schizophrenia had merit after all. That prospect may seem highly unlikely now given current evidence, but in taking a scientifi c approach to knowledge we try to remain objective and open to new discover-ies, no matter how much they may conflict with the traditional wisdom or current authorities. Although complete objectivity may be an impossible ideal to at-tain, we try not to close our minds to new ideas that might conflict with tradition and authority.

Both tradition and authority, then, are two-edged swords in the search for knowledge about the world. They provide us with a starting point for our own in-quiry. But they may also lead us to start at the wrong point or push us in the wrong direction.

**Common Sense**

The notion of *common sense* is often cited as another way to know about the world. Common sense can imply logical reasoning, such as when we reason that it makes no sense to think that rainbows cause rainfall, since rainbows appear only after the rain starts falling and only when the sun shines during the storm. Com-mon sense can also imply widely shared beliefs based on tradition and authority. The problem with this sort of common sense is that what “everyone knows” can be wrong. Long ago everyone “knew” that the Earth was fl at. It was just plain common sense, since you could see no curvature to the Earth’s surface and since hell was below the surface. At one point in our his-tory, a great many people thought that slavery made common sense. Terrorists think terrorism makes com-mon sense. Many people think that laws against gays and lesbians marrying or adopting children make common sense. Most social workers think such laws make no common sense whatsoever. Although com-mon sense often seems rational and accurate, it is an insufficient and highly risky alternative to science as a source of knowledge.

**Popular Media**

Much of what we know about the world is learned from the news media. We all know about the Sep tem-ber 11, 2001, attack on the twin towers of the World Trade Center from watching coverage of that tragic event on television and reading about it in news-papers and magazines and on the Internet. The same sources informed us of the victims and heroes in New York City, Pennsylvania, and Washington, D.C. They provided information on the perpetrators of the attack and a great many related issues and events. We did not have to conduct a scientific study to know about the attack or have strong feelings about it. Nei-ther did we need tradition or authority. We did not have to experience the attack fi rsthand (although we really did experience it—and probably were at least somewhat traumatized—by what we saw and heard on our television sets).

Although we can learn a lot from the popular me-dia, we can also be misled by them. Witness, for exam-ple, disagreements between cable news networks such as CNN and the more politically conservative Fox as to which news network is really more trustworthy, fair, and balanced. Although most journalists might strive for accuracy and objectivity, some may be infl u-enced by their own political biases. Some also might seek out the most sensational aspects of events and then report them in a biased manner to garner reader interest or appeal to their prejudices (ratings affect profi ts!). In 1965 and 1966, before the war in Vietnam became unpopular among the American public, news media coverage of demonstrations against the war typically focused on the most bizarrely dressed protestors engaging in the most provocative acts. You had to have been at the demonstrations to know that most of the protesters looked and acted like average American citizens. Those relying on media coverage were often misled into thinking that the only folks protesting the war at that time were unpatriotic left-wingers and deviant adolescents seeking attention via symbolically anti-American provocations.

Even when journalists strive for accuracy in their reportage, the nature of their business can impede their efforts. For example, they have deadlines to meet and word limits as to how much they can write. Thus, when covering testimony at city hall by neigh-borhood residents, some of whom support a proposed new economic development plan in their neighbor-hood and some of whom oppose it, their coverage might be dominated not by folks like the majority of residents, who may not be outspoken. Instead, they might unintentionally rely on the least representative but most outspoken and demonstrative supporters or opponents of the proposed development.

Then there are journalists whose jobs are to de-liver editorials and opinion pieces, not to report sto-ries factually. What we learn from them is colored by their predilections. The popular media also include fi ctional movies and television shows that can infl u-ence what we think we know about the world. Some fi ctional accounts of history are indeed educational; perhaps informing us for the fi rst time about African Americans who fought for the Union during the Civil War or sensitizing us to the horrors of the Holocaust or of slavery. Others, however, can be misleading, such as when most mentally ill people are portrayed as violent or when most welfare recipients are por-trayed as African Americans. In short, although we can learn many valuable things from the popular me-dia, they do not provide an adequate alternative to scientific sources of knowledge.

[**RECOGNIZING FLAWS IN UNSCIENTIFIC**](#page6)[**SOURCES OF SOCIAL WORK**](#page6)[**PRACTICE KNOWLEDGE**](#page6)

Scientific inquiry safeguards against the potential dangers of relying exclusively on tradition, authority, common sense, or the popular media as the sources of knowledge to guide social work practice. It also helps safeguard against errors we might make when we attempt to build our practice wisdom primarily through our own practice experiences and unsys-tematic observations. Scientifi c inquiry also involves critical thinking so that we can spot fallacies in what others may tell us about their practice wisdom or the interventions they are touting. Let’s now look at com-mon errors and fallacies you should watch out for and at some of the ways science guards against those mistakes.

**Inaccurate Observation**

Imagine that you are providing play therapy to a group of eight hyperactive children with various emo-tional and behavioral problems. At the end of each one-hour group session, you write your progress notes. It is unlikely that you will have observed every clinically meaningful thing that transpired for each child in the session. Even if you did notice something meaningful in one child, you may not have realized it was meaningful at the time, especially if it happened while two children across the room went out of con-trol and began fi ghting. Moreover, you may not re-member certain observations later when it is time to record your progress notes—especially if something happens that keeps you from recording your observa-tions until later that day. Recall, for example, the last person you talked to today. What kind of shoes was that person wearing? Are you even certain the per-son was wearing shoes? On the whole, we are pretty casual in observing things; as a result, we make mis-takes. We fail to observe things right in front of us and mistakenly observe things that are not so.

In contrast to casual human inquiry, scientific observation is a conscious activity. Simply making observation more deliberate helps to reduce error. You probably don’t recall, for example, what your in-structor was wearing the fi rst day of this class. If you had to guess now, you’d probably make a mistake. But if you had gone to the first class meeting with a conscious plan to observe and record what your instructor was wearing, then you’d have been more accurate.

In many cases, both simple and complex measure-ment devices help guard against inaccurate observa-tions. Moreover, they add a degree of precision that is well beyond the capacity of the unassisted human senses. Suppose, for example, that you had taken color photographs of your instructor that day.

**Overgeneralization**

When we look for patterns among the specific things we observe around us, we often assume that a few similar events are evidence of a general pattern. Prob-ably the tendency to overgeneralize is greatest when the pressure is highest to arrive at a general under-standing. Yet overgeneralization also occurs casually in the absence of pressure. Whenever it does occur, it can misdirect or impede inquiry.

Imagine you are a community organizer and you just found out that a riot has started in your com-munity. You have a meeting in two hours that you cannot miss, and you need to let others at the meet-ing know why citizens are rioting. Rushing to the scene, you start interviewing rioters, asking them for their reasons. If the fi rst two rioters tell you they are doing it just to loot some stores, you would probably be wrong in assuming that the other 300 are rioting just for that reason.

To further illustrate overgeneralization, imagine your practice instructor brings in a guest lecturer to talk about a promising new intervention that she is excited about. Although she has a sizable caseload and has been providing the intervention to quite a few clients, suppose her lecture just focuses on an in-depth report of one or two clients who seemed to benefit enormously from the intervention. You might be wrong in assuming the intervention was equally effective—or even effective at all—with her other clients.

Scientists guard against overgeneralization by committing themselves in advance to a suffi-ciently large sample of observations (see Chapter 14). The replication of inquiry provides another safe-guard. As we mentioned earlier, **replication** basically means repeating a study and then checking to see if the same results are produced each time. Then the study may be repeated under slightly varied condi-tions. Thus, when a social work researcher discovers that a particular program of service in a particular setting is effective, that is only the beginning. Is the program equally effective for all types of clients? For both men and women? For both old and young? Among all ethnic groups? Would it be just as effec-tive in other agency settings? This extension of the inquiry seeks to fi nd the breadth and the limits of the generalization about the program’s effectiveness.

Totally independent replications by other research-ers extend the safeguards. Suppose you read a study that shows an intervention to be effective. Later, you might conduct your own study of different clients, perhaps measuring effectiveness somewhat differ-ently. If your independent study produced exactly the same conclusion as the one you fi rst read, then you would feel more confi dent in the generalizability of the fi ndings. If you obtained somewhat different re-sults or found a subgroup of clients among whom the fi ndings didn’t hold at all, you’d have helped to save us from overgeneralizing.

**Selective Observation**

One danger of overgeneralization is that it may lead to selective observation. Once you have concluded that a particular pattern exists and developed a general un-derstanding of why, then you will be tempted to pay attention to future events and situations that corre-spond with the pattern. You will most likely ignore those that don’t correspond. Figure 1-1 illustrates the circular fashion in which overgeneralization can lead to selective observation, and selective observation can lead to overgeneralization.

Racial and ethnic prejudices depend heavily on selective observation for their persistence. However, selective observation occurs among all of us, not just in people with distasteful prejudices. Social work practitioners who have great compassion for their clients and who do the best they can to help their clients, for example, commonly engage in selective observation in ways that may limit their effective-ness. The practitioner trained to interpret problems in terms of family communication dynamics is apt to look vigilantly for signs of potential communi-cation problems and then magnify the role those problems play in explaining the presenting problem. At the same time, that practitioner is likely to over-look other dynamics or perhaps underestimate their impact.

Recall the overgeneralization example of the prac-tice instructor who brings in a guest lecturer to talk about a promising new intervention that she is ex-cited about and who focuses her lecture on one or two clients who seemed to benefi t enormously from the intervention. She may have selectively observed outcome only in those clients that seemed to be ben-efiting from her work. And even in those clients she may have selectively observed indicators of positive outcome and overlooked other indicators that might have cast doubt on how much the new intervention was really helping the clients.

Usually, a research design will specify in advance the number and kind of observations to be made as a basis for reaching a conclusion. If we wanted to learn whether women were more likely than men to support the pro-choice position on abortion, we’d commit ourselves to making a specifi ed number of observations on that question in a research project. We might select a thousand people to be interviewed on the issue. Even if the first 10 women supported the pro-choice position and the first 10 men opposed it, we’d interview everyone selected for the study and recognize and record each observation. Then we’d base our conclusion on an analysis of all the observations.

A second safeguard against selective observation in scientific inquiry also works against most of the other pitfalls. If you overlook something that contra-dicts your conclusion about the way things are, then your colleagues will notice it and bring it to your at-tention. That’s a service scientists provide to one an-other and to the enterprise of science itself.