
THE CASE STUDY

What is a Case?

Bringing to Science Education the Established Teaching Tool of Law and Medicine

Clyde Freeman Herreid

The following article by Clyde Freeman Herreid, Distinguished Teaching Professor of Biological Sciences at SUNY-Buffalo, is the first in a series of articles to be published in this new JCST department, "The Case Study." The column will examine the case study method, now an established and successful method of teaching science.

The first sign that a baby is going to be a human being and not a noisy pet comes when he begins naming the world and demanding the stories that connect its parts. Once he knows the first of these he will instruct his teddy bear, enforce his world view on victims in the sandlot, tell himself stories of what he is doing as he plays and forecast stories of what he will do when he grows up. He will keep track of the actions of others and relate deviations to the person in charge. He will want a story at bedtime.

Kathryn Morton

Cases are stories with a message. They are not simply narratives for entertainment. They are stories to educate.

Humans are story-telling animals. Consequently, the use of cases gives a teacher an immediate advantage; he has the attention of the audience.

The best way to start this column is with a glance at the history of case study teaching in academia. I do not propose to start with *Homo erectus* in my search for the origin of cases, but you can be sure that those of us interested in historical antecedents and animal behavior might pick up the elements of story telling even in bee

hives, where workers return from their flower hunts and dance out messages to their apian colleagues. Avoiding such temptations, I leap ahead to Harvard Law School at the turn of the twentieth century, where the formal use of cases entered the academic scene. I am helped in my historical musings by a 1991 article by Katherine Merseth, "The Case for Cases in Teacher Education," an AAHE publication.

Law as a discipline is essentially composed of criminal and civil cases. New decisions, new cases, and new laws are built upon old decisions. Students learning the profession must study the cases of the past and use them as examples of judicial reasoning.

Students come to appreciate that there is a correct answer to many of the cases they see in the classroom. Socratic interrogation, as seen in the popular movie and television series, "The Paper Chase," is a common method of instruction. We witness Professor Kingsfield leading, nay browbeating, his law students through cases leading to predetermined correct answers. The cases are closed ended.

The use of the case method in medicine is not much different. The life of a physician is nothing if not a succession of cases—particular examples of general physiological systems gone awry. His job is to reason deductively from

general principles to reach the solution of a particular problem. Correct diagnoses exist and "woe be unto you" (and lawsuits) if you make mistakes.

Modern medical education in the United States prepares students for their awesome responsibilities by having them spend two years taking basic courses in anatomy, physiology, embryology, and biochemistry before unleashing them into the clinical setting where they are allowed contact with patients. Recently, a couple dozen medical schools have revolutionized their curricula and set up physician education completely around the study of cases. Small groups of students and faculty tutors work through one case after another as they learn about medicine. This is the Problem-Based Learning Curriculum pioneered by McMaster University in Canada.

Thus, in both medicine and law, cases are real stories dealing with people in trouble. Students attempt to figure out what went wrong and how to fix it. The cases are chosen because they serve to illustrate general principles and good practices; correct answers and facts have a high priority.

In the 1940s, after the ravages of World War II, chemist James Conant returned from the Manhattan Project to life as a professor at Harvard convinced that our educational system in the sciences was flawed. He realized

Clyde F. Herreid is Distinguished Teaching Professor in the department of biological sciences, State University of New York at Buffalo, Buffalo, NY 14260-1300.

THE CASE STUDY

that laymen and politicians did not understand how scientific discoveries were made. Determined to correct this academic oversight, Conant began what he called "case study teaching" using the lecture method.

Conant would take an important historical event such as the discovery of oxygen and the overthrow of the phlogiston theory and painstakingly describe the steps and misadventures of the protagonists in the setting of the time. His book, *On Understanding Science*, describes his case method as he reveals scientists in action, following false leads, stumbling upon correct ideas, having brilliant insights one minute and making stupid errors the next, and serendipity always popping up unexpectedly.

Once again, cases are real stories—examples for us to study and appreciate, if not emulate. Facts and principles have importance but the value of the case is to show great scientists in action. Since these are historical lessons, the student is not an active puzzle solver but an observer of human nature. The instructor is a story teller. The student is the audience.

At the other end of the spectrum, we have the cases used in business schools. Harvard professors introduced cases for the first time to give students practical experience for use in the real world. For instance, businessmen were invited into the classroom to tell students about actual problems. The students held discussions and offered solutions, thus the start of "The Case Method." It has become a model that is emulated across the world with thousands of cases now offered for sale. A typical business case may devote fifteen pages plus appendices documenting a business dilemma (e.g., a marketing decision by Coca Cola to change its classic formula). The student would be expected to prepare for the class discussion by closely analyzing the background data leading to the decision. The class would then

discuss the case in an organized way with the instructor moving through various critical topics as he outlined the problem on the board with help from the students.

Business cases employed in today's classrooms are real and told in narrative form. Instructors give the cases to the students in an incomplete state, and have the class analyze and discuss them to determine what action should be taken. Like cases in medicine they are puzzles to be solved, but unlike the latter there is no predetermined

that perception changes." In law and medicine, deductive logic and lines of precedent make the individual or specific context of a case less compelling. Merseth concludes "to a remarkable extent, the purposes and uses of the case method turn on the nature of the body of knowledge that exists in the professional field."

Given this historical preamble, what can we say in summary? First, it is evident that in all instances cases are stories, usually real stories. Second, it is evident that teachers using cases

Humans are story-telling animals. Thus, the teacher using the case method has an immediate advantage. It is the advantage of gaining the attention of the audience.

correct answer. The purpose of the method is to produce managers who both know and act. Harvard business school professor C. Roland Christensen states: "When successful, the case method of instruction produces a manager grounded in theory and abstract knowledge, and more important, able to apply those elements." Cases allow the student to deal with situation-specific dilemmas. Consequently, a business school instructor never expects a discussion to go the same way twice; there are always novelties and unexpected turns in the conversation.

Two characteristics distinguish the use of cases in law (and medicine) from business, according to Merseth. The first is that law and medical practice depend upon a well-defined knowledge base as a starting point whereas in business much of the knowledge is in flux. Conditions are always changing in the business environment. Second, business education stresses the human condition and the subjective view.

According to Christensen, "a problem may well be understood differently by individuals and groups and

are not all delivering these stories the same way. There is no "case method" (except perhaps in business). Conant used cases with the lecture method. Law school teachers use Socratic questioning. Business school instructors use discussion leading. Medical school tutors use small group cooperative learning called problem-based learning. Third, the subject matter definitely determines the nature of the cases and their expected conclusions. Some cases (and perhaps the method of teaching) are fact driven and deductive, *i.e.*, there is a correct answer. Other cases are context driven, *i.e.*, multiple solutions are reasonable. The best answer depends upon the situation at the moment.

Depending upon the case, instructors might employ different types of teaching methods. So where does this leave us on the matter of using cases in science? My answer is that we are in the catbird seat.

Science is a body of facts, concepts, principles, and paradigms that forms the core of scientific knowledge. This is textbook science. We want our students to know a substantial amount

THE CASE STUDY

of information, such as how the heart works, the definition of the Second Law of Thermodynamics, what pH is, the concept of Plate Tectonics, and so on. Instructors traditionally teach these subjects through lecture and need substantial work and creativity to come up with cases dealing with these scientific topics.

On the surface, the situation appears to demand closed-ended cases with correct answers. This is not necessarily the case. Instead, many fact-driven cases are open-ended and have multiple solutions because the data are inadequate or emotions are involved, and ethical or political decisions are at stake. Consider, for example, a case involving a mother trying to decide whether to enroll her child in an ex-

perimental program to cure a genetic disorder such as muscular dystrophy. Or think about cases involving government decisions on global warming, pollution control, human cloning, or NASA space probe funding to find life on Mars. All such cases can be loaded with facts but many of the decisions to be made are necessarily open ended. Moreover, all cutting edge science, "frontier science," is necessarily contentious. Science philosopher Stephen Cole put it this way: "In frontier knowledge different scientists looking at the same empirical evidence can reach different conclusions. Frontier knowledge is accepted by scientists not as true but as claims to truth of particular scientists." So all kinds of case structures should be available to us depending upon the goals at the moment.

Personally, I feel liberated knowing that I do not have to conform to a particular method or someone else's vision about what a case is. Nor do I feel obligated in any way to always use cases in my teaching. Surely there are moments when the standard lecture approach is appropriate, inspirational, and superior to other methods. Surely it makes sense to mix and match our teaching techniques to reach the best arrangement possible. Using cases is simply another arrow in our pedagogical quiver. But when we do choose to use cases, we are responding to the child in all of us, who once demanded there be heroes and heroines and mysteries galore in our stories at bedtime. ■