Chapter 1
An Agenda

After everything else has been done and provided – the money raised; the schools erected; the curricula developed; the administrators, supervisors, and teachers trained; the parents and other citizens consulted – we come to teaching, where all of it makes contact with students, and the teacher influences students' knowledge, understanding, appreciations, and attitudes in what we hope will be desirable ways. Teaching is well-nigh the point of the whole educational enterprise and establishment aimed at producing student learning.

Teaching is also important in terms of a kind of ethical imperative. Nations require that their young people have frequent contact, for long periods, with adults called teachers. When such a relationship is legally imposed on young people, it seems only fair that society should do whatever it can to make that relationship a beneficial one.

The literature of the behavioral and social sciences is full of conceptions and research on learning and memory. Teaching is comparatively a stepchild, neglected by those who have built a formidable body of conceptions of learning and memory. The uses of learning conceptions for teaching constitute a tool-kit that has been left to rust. It is as if the theoretical work of, say, Faraday, had never given birth to the tremendous applications of electrical energy so that when Einstein turned on his lamp, he could read his notes. This book seeks to give teaching the kind of attention that learning and memory have received. Teaching is where learning and memory conceptions should pay off.

Finally, teaching is worth studying simply because of the intrinsic interest of the phenomena to which teaching gives rise. Even if such research had no practical value, it would be worthwhile for the same reasons that astronomy and archaeology are worthwhile. As part of our universe and our human condition, teaching cries out to be studied and understood.

Conceptions are both the guide and the outcome of research, including research on teaching. Research is the process of seeking relationships between variables. That simple definition applies to any science, whether it is in the natural or the behavioral sciences. To explain, we search for logical relationships; e.g., if time is indispensable for learning, lack of time prevents learning. To predict, we search for temporal relationships; e.g., knowing a teacher's high school grade-point average, we can predict with better than chance accuracy, her grade-point average as a college freshman. To control or improve, we search for causal relationships; e.g., knowing that teachers who receive training in question-asking do better than similar teachers

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who do not receive such training, we can use that knowledge to bring about better teaching. Explanation, prediction, and control, or one or more of these, are the purposes of all scientific research, including research on teaching.

And what is teaching? We can define it as one person's influence aimed at improving the learning of other persons. Usually, we think of teaching as occurring in face-to-face interaction between the teacher and the learner, but it can also occur when a teacher creates influential events, in which he or she does not participate. In that way, the authors of books and the developers of computer programs may also be considered teachers. But we will restrict our concern to teaching that occurs while a teacher is in the presence of students.

So research on teaching may be defined as the search for relationships between variables where at least one of the variables is a behavior, a thought, or a characteristic of teachers. The teacher variable may be an independent variable, e.g., a way of teaching; or a dependent variable, e.g., the teacher's response to advice; or an intervening variable; e.g., a teacher's thoughts during a student's response to a question, a classroom situation, or some other kind of variable. But at least one teacher variable must be involved if the research is to be research on teaching.

The study of teaching as a concern of the behavioral and social sciences has matured from its philosophical beginnings in antiquity to its present robust youth at the recent turn of the millennium. It is still young, having begun to thrive only during the 1950s. But it is now flourishing with an abundance of scholarly publications by a large number of active researchers on teaching. The result over the centuries, especially the last half-century, has been an accumulation of ideas, concepts, distinctions, insights, empirical findings, and conceptual formulations that seem ready for an attempt at a theory of teaching. Notice the indefinite article: "A." It signifies that mine is just one of an indefinite number of conceivable theories. The various models of teaching described by Joyce, Weil, and Calhoun (2000) could be theorized, i.e., explained in terms of "covering laws," of the kind described in Chap. 8. Why do the authors of the models consider them to be effective, in what ways?

This chapter sketches the development and scope of the conceptions of teaching to be presented. After discussing the choices I have made among various possible emphases and directions, I will summarize each chapter to provide a brief introduction to the rest of the book.

Choices Among Alternative

The theory to be proposed in this book reflects choices made in the early stages of its development.

A Theory of Teaching Rather than Instruction

The differences between the terms *teaching* and *instruction* reside mostly in their connotative meanings. But those differences are clear enough to be relevant to the

scope of this monograph. "Teaching" is the term used more in formal educational settings, namely, in elementary schools, secondary schools, colleges, and graduate schools. "Instruction" is used more in sharply focused out-of-school training in business, industry, and the armed forces.

One way to distinguish the two terms was offered by R. M. Gagné and Briggs (1979), leaders in the field known as *instructional design*:

Why do we speak of "instruction," rather than "teaching"? It is because we wish to describe *all* of the events which may have a direct effect on the learning of a human being, not just those set in motion by an individual who is a teacher. Instruction may include events that are generated by a page of print, by a picture, by a television program, or by a combination of physical objects, among other things. Or… the learners may be able to manage instructional events themselves. Teaching, then, may be considered as only one form of instruction, albeit a signally important one (p. 3).

But research on teaching puts teaching, rather than the more general "instruction," at the center because it is the teacher who arranges for the students' interaction with all the media mentioned by Gagné, et al. Typically, the teacher oversees the students in their reading, interaction with computer programs, viewing of films and television, as well as the recitations, discussions, lectures, explanations, and tutoring that occur in schools.

Typically, the teacher directs all aspects of teaching, except for the content of the curriculum, which is usually prescribed for the teacher in varying degrees. The manner, style, and mode of teaching typically fall under the almost complete control of the teacher, especially the use of teaching materials other than the textbook, such as slides, audio tapes, movies, videotapes, digital video displays (DVDs), and computers. Teachers also control the use and arrangement of out-of-school learning experiences, such as excursions and visits to museums.

Instructors have less autonomy; they are more likely to follow the curriculum and materials approved by the organization that employs them. Teachers are formally trained in teacher education programs in colleges or graduate schools. Instructors are usually trained in the business, industrial, or military organization in which they will do their work.

In all of these ways, teaching differs from instruction, not in any formal, legalized, tightly regulated way, but rather in the connotative meanings of the terms as they have come to be used in the United States since at least the mid-nineteenth century when public schools became prevalent.

A Theory of Teaching That is Both Descriptive and Prescriptive

The theory will serve both the descriptive and prescriptive aspects of theory. That is, it will *describe* how teaching does occur and also *prescribe* how it should occur to optimize student achievement.

The idea that there are two kinds of theory, descriptive and prescriptive, is widely accepted (see, for example, Bruner, 1966; Reigeluth, 1999, p. 2). Descriptive theory describes a process as it *does* go on. Prescriptive theory describes how the process *should* go on if it is to be optimized according to some values.

But the distinction blurs when we realize that the same descriptive theory – its concepts and their relationships – can serve both descriptive and prescriptive purposes. That is, when we find that the relationship of variable *x* to variable *y* affects an outcome *z* (a descriptive theory), that relationship can be used to optimize *z* (a prescriptive theory). The optimization requires that we seek certain values of *x* and *y*.

For example, we can describe how teachers explain the Pythagorean Theorem. But if we evaluate the effectiveness of the explanation in terms of student understanding, we can use the explanation-understanding relationship to prescribe how the explanation should be made.

A Conception of Teaching for Both Cognitive and Affective Objectives of Education

The theory of teaching will focus on both the cognitive and the affective objectives of education. Of course, a good deal of teaching, especially in elementary schools, is concerned with the emotional and social development of students as well as with their cognitive development (see R. B. Smith, 1987). Still, teachers' concern with emotional development typically may tend to decrease gradually from the 1st to the 12th grades.

A Broadly Valid, Rather than Specifically Valid, Theory

The theory will apply to many varieties of teaching and have broad validity. It will formulate a set of widely valid concepts or variables to describe teaching and the widely occurring relationships between those concepts or variables. The breadth of the theory signifies its attempt to describe and explain teaching's many dimensions: the teaching of many kinds of *subject matter* at many levels of *student maturity*, toward many sets of *cognitive educational objectives*, to students of any *gender, social class, or ethnicity*, in many *school or classroom settings*, by *many kinds of teachers*, in many *cultures*. B. O. Smith (1963) expressed an even bolder aspiration toward a *universally* valid theory of teaching:

> Our most general notion is that teaching is everywhere the same, that it is a natural social phenomenon and is fundamentally the same from one culture to another and from one time to another in the same culture. Teaching is a system of action involving an agent, a situation, and an end-in-view, and two sets of factors in the situation: one set over which the agent has no control (for example, size of classroom and physical characteristics of pupils) and one set which the agent can modify with respect to the end-in-view (for example, assignments and ways of asking questions) (p. 4).

Any attempt at universality in a conception of teaching runs into the great variety of subject matters taught. For example, a book on subject-specific teaching (Brophy, 2001) included 14 chapters, each by a specialist on teaching methods and activities

for a specific subject: beginning reading, content area reading and literature, writing, mathematics of number, school geometry, biological literacy, physics, representations, earth science, history, physical geography, cultural geography, citizenship, and economics. Within each of these subjects, there are presumably optimal instructional methods specific to particular kinds of content. We can make further breakdowns for specific kinds of students in terms of their cultural backgrounds, levels of cognitive capability, cultures, communities, and so on.

Against the assumption underlying the Brophy-edited volume is the view of R. M. Gagné (1976): "Learning is not unique to subject matter. There is no sound rational basis for such entities as 'mathematics learning,' 'science learning,' 'language learning,' or 'history learning,' except as divisions of time" (p. 30).

Gage (1979) proposed that the generality-specificity issue be resolved by creating a hierarchy of levels of generality shown in Table 1.1.

The theory to be proposed takes the highly general tack. Although much of this book will seem to have been aimed at only elementary and secondary school teaching, it may also apply to college teaching, as was implied when Bellack (1976) noted that his formulation of the process of teaching had also been observed at the college level (see pp. 5–31). As Sirotnik (1983) observed, we can never understand teaching if we need a separate theory to explain each of the myriad forms that teaching can take in types of subject matters taught, of students, of community contexts, and of resources available.

Table 1.1 Possible levels of generality-specificity for a theory of teaching

Level I	All grade levels, subject matters, student types.
Level II	Major grade-level categories, such as preschool, early primary grades, late elementary grades, secondary, and college levels.
Level III	Major subject-matter categories, such as verbal, mathematical and scientific, aesthetic, and psychomotor.
Level IV	Major grade-level subject-matter combinations, such as primary-grade reading, upper-elementary social studies, high school geometry, and college physics.
Level V	Major grade-level subject-matter combinations for students at different points on various dimensions, such as general cognitive capability, academic motivation, ethnic identity, socioeconomic status, sensory and motor abilities.
Level VI	Major topics within grade-level subject-matter combinations such as the sound of "th," the Bill of Rights, the Pythagorean theorem, Ohm's law.

A Theory of Teaching Actions and Teacher Characteristics

The term "teacher actions" refers to what teachers *do*: explain, ask questions, etc.

The term "teacher characteristics" refers to what teachers *are*: recently trained, experienced, etc.

The term "*teaching* effectiveness" implies that the teacher's *actions*, such as her ways of explaining and questioning, account for her effects on students. The term "*teacher* effectiveness" implies that it is her *characteristics and personality traits,* such as her intelligence, knowledge, and emotional stability, that account for the teacher's effects on student achievement.

Much early research, reviewed by Getzels and Jackson (1963), showed that *teacher-characteristic* variables account for little of the variance in student achievement. More recent studies, however, reverse that trend. For example, Ehrenberg and Brewer (1995) found that teachers' verbal aptitudes boosted student achievement gains. Monk (1994) found that secondary school teachers' preparation in mathematics and science raised student gains in mathematics and science. Strauss and Sawyer (1986) showed that the cognitive abilities of teachers not only affected student achievement but also lowered student dropout rates.

The proposed theory will assume that the teachers' verbal aptitudes, preparation in the subject matter, and cognitive abilities affect their decisions and behavior – all of which influence student achievement substantially. Accordingly, the theory will address both actions in "teaching" and characteristics of the "teacher."

A Theory of Classroom Teaching Rather Than Any of the Challenges to Classroom Teaching

Classroom teaching has long been decried and challenged. John Dewey's progressive education was an early challenger. As Cuban (1992) showed, it never took hold.

B. F. Skinner's (1968) programmed – and, later, computer-assisted – instruction has been greatly strengthened by the ongoing computer revolution, but it still is used by only a minority of teachers (H. Becker, 2000). Cuban (1986, 2001) has continued to find relatively little use of computers in classrooms. In a possible exception to this trend, H. Becker reported *relatively* abundant use of computers by the students of teachers who had at least five computers in the classroom, had some competence with computers, and were well above average in the strength of their belief in a constructivist (described in Chap. 5) teaching philosophy. So only under special conditions of teacher preparation do classrooms appear to be different than they have been for many decades.

Fred Keller's (1968) "personalized system of instruction" in the 1970s, Benjamin Bloom's (1968) "mastery approach" in the 1970s, Ann Brown's (1989, 1996) and others' "reciprocal teaching" in the 1980s, and Robert Slavin's (1990) "cooperative learning" in the 1990s, have not, in the absence of evidence to the contrary, been

adopted by the vast majority of 3.5 million U.S. elementary and secondary school teachers (National Center for Educational Statistics, 2000), to say nothing of teachers abroad.

The ubiquity and tenacious survival of conventional-direct-recitation (CDR) teaching (described in Chap. 5) is the main reason for my decision to focus on it to develop a conception. (For a brief summary of the early research on the survival power of conventional-direct-recitation teaching, see Sirotnik 1983.)

Observational studies in the United States (for example, Bellack, Kliebard, Hyman, & Smith, 1966; Hoetker & Ahlbrand, 1969; Mehan, 1979; Goodlad, 1984) have agreed in showing that, when they examine the observational evidence about what goes on in classrooms, conventional-direct-recitation (CDR) teaching prevails. In the *recitation cycle,* (a) the teacher "structures" the subject of the discussion, (b) then asks a question, (c) then either calls on a volunteer or selects a student to respond, and (d) finally reacts to the student's response. Although these cycles are repeated for much of a class period, the teacher may provide time for individual students to work alone or in a small group on an assigned task.

An Overview of Chapters 2–9

The following sections briefly describe the subsequent chapters. They orient the reader to the work as a whole and sketch the context into which I place the elements of the argument.

Chapter 2

The Need for a Theory of Teaching

I first describe the need in terms of the many affirmations from philosophers and behavioral scientists over the years. In the process, I consider whether scientific research requires a *prior* theory – a theory spelled out before any data are collected. The issue is resolved with ideas from *Conjectures and Refutations* by the philosopher of science Karl Popper (1963).

Chapter 3

The Possibility of a Theory of Teaching

This section – an updating of Gage (1996) – is relatively technical and not indispensable to a comprehension of the book as a whole. It deals with the negative responses to the possibility-of-theory question. Among others, two behavioral scientists

– Cronbach (1986), an educational psychologist, Gergen (1973), a social psychologist, and Thomas (2007), an educational psychologist – have argued that, because the requisite raw material of any theory consists of generalizations, and because lasting and broadly valid generalizations in the behavioral sciences are impossible, valid theories in the behavioral sciences or, at least, those in educational and social psychology, are impossible. The chapter rebuts their arguments with logical analysis and empirical evidence. It ends with an examination of their implied indeterminism and a defense of the possibility and value of *probabilistic* theory in the behavioral sciences.

Chapter 4

The Evolution of a Paradigm for the Study of Teaching

The proposed paradigm – or model of a scientific field – comprises six basic categories of related concepts that underlie the proposed theory. Because these concepts can take forms that vary qualitatively, quantitatively, or both, they will also be called *variables*. I describe and illustrate the variables in terms of how they have entered into analytical (logical) and empirical studies of teaching.

The chapter presents these concepts in the historical order in which the categories were developed. But they are arranged spatially in a "pedagogical" order that makes sense for all amounts of teaching – whether they last a few minutes or a school term. In that order, some categories of concepts, logically at least, must precede others

The categories of concepts can be divided into two sets: (a) those that are logically prior to a teacher's teaching, i.e., her presentation of the process-and-content of teaching, and (b) those that logically occur *after* her teaching.

Chapter 5

A Conception of the Process of Teaching

This chapter discusses the thoughts and behaviors of teachers as they seek to foster their students' achievement of the objectives of the teaching. Many models of teaching have attracted some attention, but only one seems to have won the allegiance of the vast majority of teachers in elementary and secondary schools. The chapter describes that model and the evidence of its wide usage – not only recently, but in the whole twentieth century; not only in the United States, but in other countries; and not only in a few subjects, but in many. The chapter also examines the reasons for the persistence and prevalence of this model.

Chapter 6

A Conception of the Content of Teaching

This chapter presents a concept – *instructional alignment* – that has proven useful in a variety of contexts in which the content of teaching has played a part. These contexts consist largely of the roles content plays in teaching and also in assessing achievement. This discussion leads to an examination of the issue of teaching-to-the-test content, as in Popham's (1993) "measurement-driven-instruction," versus testing-to-the-content-taught. The issue is resolved in terms of making the curriculum dominate both teaching and testing.

Chapter 7

A Conception of Students' Cognitive Capabilities and Motivation

Cognitive capabilities consist of (a) the general cognitive ability (IQ) of students, (b) their multiple intelligences, and (c) their prior knowledge of the content being taught. Students in any class differ in their cognitive capabilities. The differences among students raise the problems of maximizing teaching's appropriateness to those differences. The chapter examines ways in which teachers can achieve that appropriateness. At its end, the chapter examines the behavioral and cognitive ways of influencing student motivation.

Chapter 8

A Conception of Classroom Management

The chapter begins with a presentation of the role of poverty in creating much of the problem of classroom management. The problem is much greater in schools and classrooms that serve students from impoverished families and neighborhoods. Classroom management is aimed at the proper use of classroom time: maximizing instructional time and minimizing counterproductive time. The model of classroom learning developed by Carroll (1963) lends itself to focusing on time as a basis for defining student aptitude, opportunity to learn, and perseverance in terms of time.

Students' thought processes are important aspects of instructional time because they provide a criterion of effectiveness in use of time. They are regarded as intervening variables, occurring between teaching and achievement.

Productive and counterproductive use of time can be related to classroom management practices. Research has identified such practices in elementary and secondary schools.

Avoiding various kinds of teacher bias on grounds of student gender, cognitive capability, ethnicity, and socioeconomic status is an important aspect of classroom management.

Chapter 9

Integrating the Conceptions

The chapter begins with the ideas of the philosopher of science Hempel (1965) concerning how a conception can consist of sub-conceptions. I illustrate sub-conceptions with an analogy: four sub-conceptions serving as an explanation of an automobile's motion.

Sub-Conceptions of Process

To optimize process, we must optimize the four components of the classroom-direct-recitation (CDR) model of teaching described in Chap. 5: structuring, soliciting, responding, and reacting. The empirically identified effectiveness of certain forms of these components is in each case regarded as a sub-conception consisting of: (a) a phenomenon in such teaching that calls for explanation and (b) a covering law providing that explanation.

Each of these phenomena is the concern of a sub-conception. Each sub-conception consists of a sample of research on that component that provides "an example of a phenomenon to be explained." Then an explanation of that phenomenon is provided by a "covering law." The conjoining of a phenomenon to be explained and an explanatory covering law occurs repeatedly to provide a sub-conception for each of the four components of the process of teaching.

Sub-Conceptions of Content

Then the chapter presents in a similar way a set of sub-conceptions of the *content* of teaching. The next section of the chapter consists of an integration of the sub-conceptions of process and content. Finally, the chapter introduces cognitive capability and motivation as modifiers of the relationships between process and content.