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Book Reviews

Gage, N. L. *The Scientific Basis of the Art of Teaching.* New York: Teachers College Press, 1978, $4.95 (paperback), 122 pp.

In the later pages of this volume, Gage reminds us that only months before the Wright brothers' first flight, a distinguished mathematician and astronomer proved conclusively that heavier-than-air flight was impossible; that, in 1935, it was persuasively argued that a journey to the moon was impossible; and that, "in medicine, anyone writing in the 1930s could have lamented the therapeutic fruitlessness of the preceeding sixty years of research on microbes and microbial diseases. Medicine still had no cure for lobar pneumonia, tuberculosis, syphilis, scarlet fever, typhoid . . . and a host of other microbial diseases" (p. 92).

As this may suggest, Gage's book is optimistic. Thus: research shows that there is an emerging scientific basis for teaching; that there are viable ways of applying that scientific base in teacher education; and that there are a raft of promising ideas about how to enhance the scientific basis of teaching.

These conclusions frame the three chapters of this work which is an extension of the 1977 Sachs Memorial Lectures presented at Teachers College. Gage directs the Program on Teaching Effectiveness at Stanford's Center for Educational Research. He is the author or editor of dozens of books, chapters, and articles on teaching methods, educational psychology, teacher education, and educational theory and research. He edited the AERA's first *Handbook of Research on Teaching* (1963), and is past president of both the AERA and the APA's Division of Educational Psychology.

This book is short, well-written, and contains an index to work cited. While it deals almost entirely with research at the primary and secondary school level, the issues, analyses, and conclusions touch teaching generically. The book is sometimes, and intentionally, elementary. Much more often, it is insightful and challenging. Gage raises important issues and wastes no time at their periphery. His perspectives are sometimes novel and powerful. There are limitations: this is not a review or synthesis of research findings on teaching at any level. While it may have been beyond Gage's scope for the book, we learn little about instructional methods or the com-

ponents of teaching (e.g., feedback, participation, practice) which cross-cut them. A useful contrast is Kulik and Kulik's "College Teaching" in Peterson and Walberg's *Research on Teaching* (1979). Gage devotes little attention to links among instructional procedures, types of learning, and student and class attributes.

Those in instructional development may find the book particularly useful as they work with faculty who view teaching as an art which is not amenable to systematic analysis or purposive improvement. Gage's intriguing title introduces and frames his answer to such teachers.

"By teaching," he writes, "I mean any activity on the part of one person intended to facilitate learning on the part of another." Teaching is viewed as a "useful, or practical art," similar to medicine or engineering, because it calls for "intuition, creativity, improvisation, and expressiveness," and that "leaves room for departures from what is implied by rules, formulas, and algorithms." Teaching *always* involves art, "in the choice and use of motivational devices, clarifying definitions and examples, pace, redundancy, and the like." Gage distinguishes between a science of teaching (rigorous laws that yield high predictability and control) and the scientific basis for the art of teaching. In teaching, as in medicine and engineering, there is much science: "concepts, or variables, and their interrelations in the form of strong or weak laws, generalizations, or trends. But using the science to achieve practical ends requires artistry—the artistry that enters into knowing when to follow the implications of the laws, generalizations, and trends, and especially when *not* to, and how to combine two or more laws or trends in solving a problem" (p. 18).

Most laws—in teaching, as in many other fields—contain but a small number of variables and hold only under limited, controlled conditions. Hence, laws often have limited practical applications—unless applied, combined and modified by the artistic worker.

Gage's review of the results of recent research is largely limited to reanalysis of work, in Dunkin and Biddle's *The Study of Teaching* (1974), on teacher indirectness and student learning. He criticizes the usual methods of "counting-up" significant vs. non-significant findings and concludes that "The path to increased certainty becomes not the single excellent study which is nonetheless weak in one or more respects, but the convergence of findings from many studies which are also weak but in many different ways. The dis-

similar or nonreplicated weaknesses leave the replicated finding more secure" (p. 35). While conclusions of this type are based on correlations and do not demonstrate causation, Gage argues that they provide a firmer basis for the teacher's classroom acts than "logic, insight, raw experience, common sense and the writings of persuasive prose stylists" (p. 41). Researchers will want to carefully scrutinize Gage's proposal for "testing the significance of combined results."

In his chapter "Applying What We Know: The Field of Teacher Education," Gage has three themes. First, teacher education should focus on *knowledge how* rather than *knowledge that*. Thus, we want to avoid the situation where teachers learn "*that* reinforcers strengthen responses but [do] not know *how* to reinforce a pupil as to strengthen the child's tendency to participate in class discussion" (p. 44). Second, he urges tighter connections among teacher education processes, research on teaching, and educational outcomes for students. Finally, Gage reviews programs, techniques and materials for changing teacher behavior. He concludes that several offer fruitful opportunities to help teachers be more effective (i.e., be more successful in—artistically—applying the scientific basis of teaching).

Gage's final chapter explores the adequacy of current research paradigms and asks what fruitful research in the future will look like. The substantive and methodological issues he explores are too many and too complex to be reviewed briefly. Here are a few highlights: Gage thinks that teacher variables (which usually have far less explanatory power than student variables) have been placed in an unfair comparison. He argues that the cumulative effect of teacher variables, over successive teachers, may be quite powerful. He sees correlational and experimental designs as valuable but notes that they often produce results too complex to be useable by the teacher. He discusses Doyle's analysis of paradigms for research on teacher effectiveness, arguing that Doyle's work requires modification but not replacement of the process-product model. He notes the distinctive contributions offered by both qualitative and quantitative studies, and by research using different models of learning (e.g., respondent, contiguity, cognitive, operant); he urges attention to newer fields such as teachers' implicit theories of teaching.

For the forseeable future, Gage does not expect any major breakthroughs: research on teaching will proceed in terms of what Kuhn

calls "normal science." He expects research will "dampen the oscillation of educational fashion—between progressivism and traditionalism, open education and direct instruction, heuristic and didactic teaching." But Gage is optimistic about the future. Knowing that many people, including some researchers, view teaching as so complex as to be intractable, he reminds us of what we *have* learned about effective teaching, and cautions that "pessimism as well as optimism can be blind." Finally, Gage says that none of the progress he expects in research "will diminish the need for artistry in teaching. Like physicians and engineers, teachers will need to go beyond the scientific basis as they go about their work. . . . Research on teaching promises no millennium; it merely holds out a reasonable prospect of improving on the way teaching is" (p. 94).

CHARLES A. GOLDSMID

Guba, Egon. *Toward a Methodology of Naturalistic Inquiry in Educational Evaluation.* Number 8 in the *CSE Monograph Series in Evaluation.* Center for the Study of Evaluation, University of California, Los Angeles, 1978.

In this compact (86 p.) volume, Egon Guba (no jargon intended) performs a most valuable service for those of us who find that evaluative methodologies in the "experimental," positivist tradition are not very useful or appropriate for assessing programs for individual and organizational change. Guba reliably charts the ground between what Uri Bronfenbrenner calls a "rock" (the need for rigor) and a "soft" place (the need for relevance). Guba is an adroit theoretician —a synthesizer of an emerging twenty-year evaluative tradition to which he has been an important contributor. Building on that foundation, he defines an exacting standard of ethical professional behavior.

Logically, plausibly, Guba accepts and meets his own initial challenge: "If any other method [than the conventional experimental one] is to be taken seriously as an alternative, bases for . . . trust will have to be convincingly argued." He begins by positing the failure of conventional methodology to be useful "as the handmaiden of decision-making and social policy development." He concludes

with the bold assertion that "naturalistic inquiry offers a more congenial and responsive mode of evaluation than any other practiced today." And so, he tells us we need not be ashamed to admit that our presentations of data are not clerically (that is, statistically) dressed. In this sense, Guba and, indeed, the whole naturalistic movement in evaluation establish a firm connection to the older and broader tradition of historical, literary, legal, and sociological scholarship.

Guba is not a polemicist, however. He does not decry the experimental tradition; he simply notes its limitations for certain kinds of assessment and argues sensibly that both the experimental and the naturalistic methodologies have legitimate, complementary, if polar, places on the evaluative continuum. What separates them, according to Guba's analysis of leading practitioners' work, are differences along three dimensions: a) the degree to which the investigator manipulates conditions antecedent to investigation (experimental = low to none); b) the degree to which the investigator controls subject outputs (experimental = high; naturalistic = low to none); and c) the assumptions investigators hold about the basis, role, and organization of inquiry. Guba usefully defines 14 areas of disagreement.

Despite differences, Guba insists that practitioners in both traditions must work their ways, publicly, through standard methodological problems. For the naturalistic inquirer, the most pressing of these are issues of "boundaries" (defining the limits of inquiry), "focusing" (defining categories of analysis and the sufficiency of data), and "authenticity" (persuading peers and public of the soundness and fairness of investigation and interpretations). Guba's discussion of each of these is illuminating and provocative.

The volume has flaws. There is no index. Guba does not mention action-research which, surely, must be included in the naturalistic tradition. His sketches of several leading methodologies, while no doubt accurate, are not much of a guide to practice.

But Guba does what he sets out to do: he constructs a necessary, perhaps even sufficient, apologia for evaluative methodologies which embrace values and aim to aid decisionmakers. His is a book that POD members can ill-afford to ignore.

LANCE C. BUHL