


The Art and Craft of Teaching

ELLIOT W. FISSER



My aim in this essay is to recover on a theoretical level what I believe practitioners—teachers and school administrators—have never relinquished in the private, quiet moments of their professional lives. I wish to help re-establish, to legitimize, to publicly acknowledge the art and craft of teaching. To write about the art and craft of teaching in a period in which we are sending a space shuttle through the heavens, when we are able to place man on the moon and, as Frank Buck used to say, “to bring ‘em back alive” is seemingly to hearken back to a bygone era. We pride ourselves, and we should, on the achievements of science and the technology science has made possible.

Indeed, to write about the craft of teaching today is likely to evoke images of the elderly working painstakingly on a handcrafted item in a tiny cottage located in a small village sitting next to the delicate but limited glow of a flickering fire. Our images of science and technology are much sleeker, and these images have penetrated contemporary education. In education we talk about diagnosis and prescription, of entry and exit skills, of the use of token economies, and of feedback loops for inputs that fail to meet specifications when they be-

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come output. Such talk reminds me of the story of a conversation between the senior officer of a large corporation and a new business school graduate:

"Sir, I think that by bringing up a small model to simulate aggregate income-expenditure alternatives over various time frames, by integrating those results with appropriate ZBB reviews to assess minimum core expenditure levels, and then by relating to managers in an MBO framework, we can get this administration moving again," said the young colleague with eagerness and authority.

The senior man gazed out the window, pondered the words so redolent with modern techniques, then spoke:

"Shut up," he explained.¹

Why is it the art and craft of teaching—and of school administration—should seem so quaint? Why is it that the art of teaching should be regarded as a poetic metaphor, but like poetry, more suited to satisfy the soul than to inform the head? Why is it that one so seldom hears of workshops or conferences devoted to the art and craft of teaching? And what would re-emergence of such concepts mean for the improvement of teaching and for educational administrators? To find out we must first look back in time.

When one examines the intellectual history of American education, particularly as it emerged during the 19th century, one finds that a distinctive form of professional preparation developed with the creation of the first state normal school in 1839.² By the end of the 1870s, 80 such schools had been established and by 1900 there were over 150.³ When schools are established for training practitioners, it's nice to have something to teach them. During the same period in Europe and later in America the field of psychology was itself being formalized, and the work of Wilhelm Wundt in Germany, Francis Galton in England, and G. Stanley Hall and William James in the United States provided much of the substance on which to build a profession of education.⁴ Hall, the first person to receive a Ph.D. in psychology from Harvard University in 1878,⁵ was the father of the child study movement⁶ and editor of the influential *Pedagogical Seminary*.⁷ James, whose *Talks to Teachers*⁸ remains a classic, was himself influenced by Wundt and later was to train the giant of American psychology, the man to whom B. F. Skinner once wrote: "I

seem to identify your point of view with the modern psychological view taken as a whole. It has always been obvious that I was merely carrying on your puzzle box experiments. . . ." That man was Edward L. Thorndike.

Thorndike was a great psychologist. He did about everything. He studied children's drawings, he studied handwriting, he studied aptitude and motivation, he wrote yards of books and articles, but what he did most was study learning. It was Thorndike who developed the idea of the S-R bond and who coined the term "Connectionism"¹⁰: Learning, he argued, was the result of connections in the cortex, connections strengthened by reinforcements provided to responses to particular stimuli. To the extent to which each stimulus was unique, the responses to be learned were also unique. Rationality was a concept fit for philosophy of mind, but not for a scientific psychology of learning.

As for the transfer of learning, Thorndike believed it was quite limited: One was able to transfer what one had learned only insofar as the elements in one situation were identical with those in the next. It was, as he called it, a theory of identical elements.¹¹ Memory drums, rat mazes, positive and negative reinforcement, frequency, recency, and intensity were the metaphors with which he worked. Thorndike's task was to develop a science of learning so that brick by brick a science of education could be built. For those seeking a respectable basis for teacher training and school administration, such a view was understandably attractive.

When the first issue of the *Journal of Educational Psychology* was published in 1910, it was Edward L. Thorndike who had the lead article. He wrote:

A complete science of psychology would tell every fact about everyone's intellect and character and behavior, would tell the cause of every change in human nature, would tell the result which every educational force—every act of every person that changed any other or the agent himself—would have. It would aid us to use human beings for the world's welfare with the same surety of the result that we now have when we use falling bodies or chemical elements. In proportion we get such a science we shall become masters of heat and light. Progress toward such a science is being made.¹²

What we see here is a noble ambition, an expression of faith in the power of scientific inquiry to shape, indeed to determine the future, and thus to enable

humankind to create a better, more predictable world. Science is, after all, associated with progress. To have a science of education is to have know-how, to understand not only what works, but why. A scientific technology of teaching would reduce noise in the system, make the system more systematic, more efficient, and hence give taxpayers the products they wanted schools to produce.

Science became the faith: scientific technology, the good works that the faith made possible.

It is hard to underestimate Thorndike's legacy. His ideas, his research, but even more his faith in science, helped set the tone for educational research for the next 70 years. To understand that tone is to understand why it is that the art and craft of teaching were and are regarded as relics having only marginal relevance to the study and practice of education.

But even as influential as Thorndike was, he was not alone in shaping assumptions on which current conceptions of teaching and education rest. During the same period the concept of scientific management, developed by Francis Taylor and applied to the problems of making industrial plants more efficient, also entered the educational scene.¹³

School administrators embraced scientific management as a way to reduce their vulnerability to public criticism and to make schools more efficient. In

this approach management of education was hyper-rationalized. Teachers were regarded as workers to be supervised by specialists who made sure that goals were being attained, that teachers were performing as prescribed, and that the public who paid for the schools were getting their money's worth.

The guiding metaphor was industrial and the scope for personal ingenuity on the teacher's part was accordingly diminished.¹⁴ The task was to get teachers to follow the one best method, a method that scientific management of education

would prescribe. Thorndike's ideas, working in conceptual tandem with Taylor's, set a tone for American education that is still with us.

There are several characteristics of scientifically oriented ideology in education that deserve more than a casual mention. I say ideology because any perspective one embraces comes replete with values and assumptions about what is valid and trustworthy, what methods are legitimate, what counts as evidence, and hence helps determine the ends that are worth pursuing. If an aim cannot be accommodated within the dominant ideology, it is dropped from view; it is not considered meaningful.¹⁵

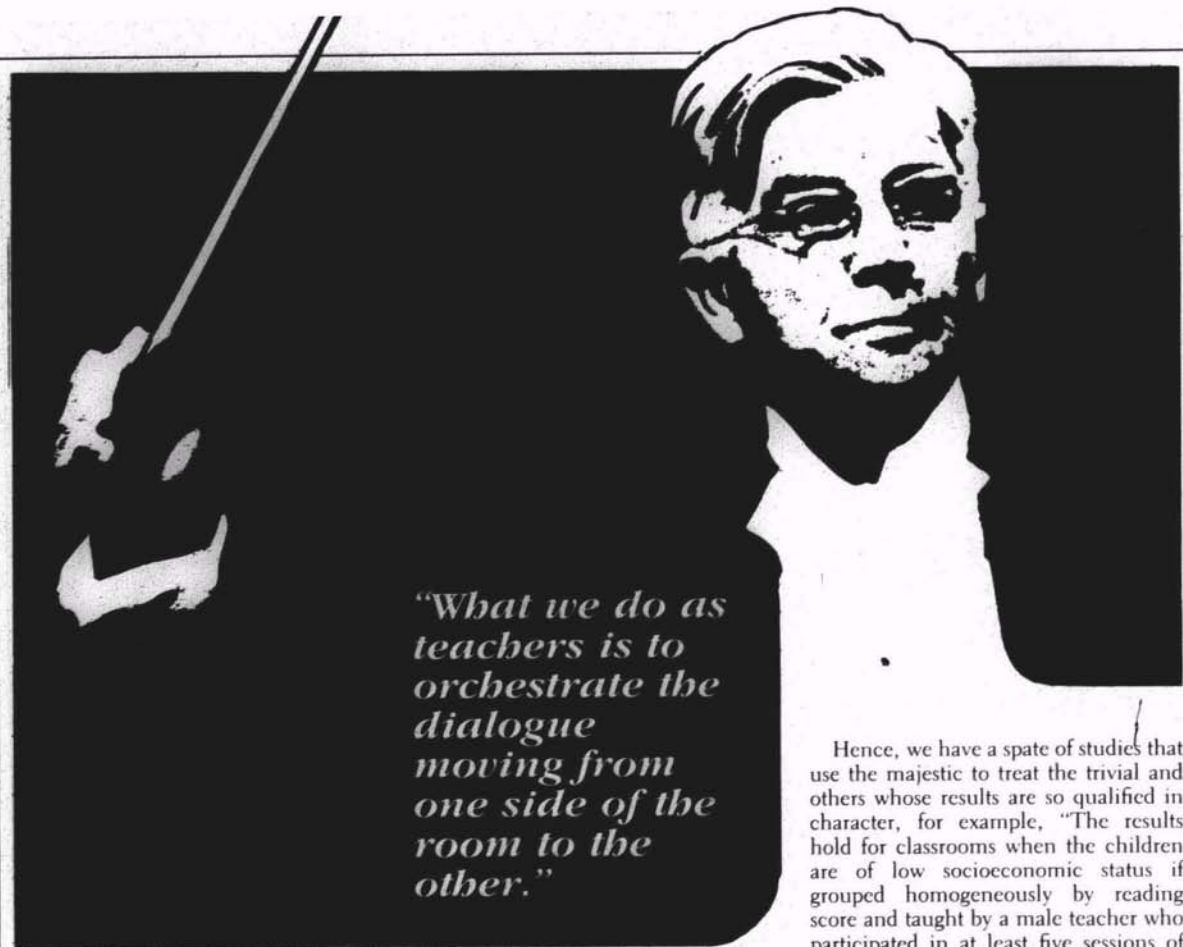
One assumption used in the effort to build a science of educational practice is that education cannot in principle become a discipline in its own right. It is rather "an area of study" and the most promising way to study that area is through the social science disciplines. The ramifications of this view were then and are today substantial. Consider only one—its impact on theory.

Since the concepts and categories that constitute theory in the social sciences were originally designed for noneducationally specific phenomena—rat maze learning, socialization in prisons, churches, and the home, for example—what such categories and theories illuminate is largely what education has in common with other phenomena rather than what is unique or special about schools, classrooms, teaching, or curriculum. The theoretical windows through which we peer circumscribe that portion of the landscape we shall see.

A second widely accepted assumption is that what we can learn through research about learning will be less ambiguous if the units treated are segmented and small. The operating belief is that once these small units are brought under control, variables can be isolated, effective educational treatments identi-



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Hence, we have a spate of studies that use the majestic to treat the trivial and others whose results are so qualified in character, for example, "The results hold for classrooms when the children are of low socioeconomic status if grouped homogeneously by reading score and taught by a male teacher who participated in at least five sessions of inservice education," that their practical utility is next to nil.

Fourth, and finally—although this critique could be extended further—is the assumption, and the primary one as far as I am concerned, that (1) a prescriptive educational science will make prediction and control of human behavior possible, and (2) such achievements are educationally desirable: the more prediction and control, the better. Prediction and control are of course virtues in the space program. The last place we want surprises is on the launching pad or on the moon. The best thing that can be said for such operations is that they were uneventful. But are such aspirations quintessential in education? Do we want—even if we could achieve it—to be able to predict and control all or even most of what a student will think, feel, or be? Is E. L. Thorndike's aspiration an appropriate one for education? Is Francis Taylor's model of scientific management what students need today? By this time you might have guessed that I have my doubts.

fied and then, finally, aggregated in order to build a technology of educational practice. First you learn how to introduce a lesson, then how to pose questions to students, then how to demonstrate a principle, then how to bring a lesson to closure, and when these and several other dozen—dare I say hundreds?—of teaching skills are learned, the ability to teach skillfully will have been achieved.¹⁶

Because long periods of experimental treatment time tend to lead to confounding—that is, long experimental periods increase the probability that uncontrolled variability will contaminate the treatment making the results difficult to explain—experiments in classrooms tend to be "cleaner" if they are brief.¹⁷ The result is that much educational experimentation takes the form of commando raids designed to get in and out of classrooms in as little time as possible or consists of very short micro-experiments that compare the effects of bits and pieces. The modal amount of

experimental treatment time in experimental studies reported in the *American Education Research Journal* in 1977-78 was about 45 minutes. Studies are undertaken that are designed to determine if giving an example first and then an explanation, or an explanation first and then an example make any difference. The tacit assumption is that such knowledge, although discrete, is cumulative and independent of context. The variations that are possible in such approaches are, of course, endless. Like tadpoles they come forth filling the pages of learned journals.

Third, because the believability of conclusions can be no greater than the reliability of the instruments used, instruments used to measure classroom practice and student learning need to be very reliable indeed. What this has meant all too often is that what is educationally significant but difficult to measure or observe is replaced with what is insignificant but comparatively easy to measure or observe.

The critique I have provided concerning the aspiration to develop a science of education and the assumptions and consequences of that approach should not lead you to believe that I see no place for scientific study in education or that I believe that scientific metaphors should be replaced with artistic ones. This is not the case. What I do not believe holds promise in education is a prescriptive view of science. I do not believe that with greater specificity or by reducing the whole to its most essential parts we can produce the kind of prescriptions that have made the space shuttle, radar, or laser beam possible. The aspiration to create a prescriptive science of educational practice is, I believe, hopeless.

What I think scientific inquiry can provide in education are rules of thumb, not rules.¹⁸ Rules of thumb are schematics that make interpretation and judgment more acute. Scientific inquiry can provide frames of reference that can sophisticate our perceptions, not mechanisms that will control the behavior of students, teachers, or administrators. In short, if a distinction can be made between the *prescriptive* and the *interpretive*, between rules and schematics, between algorithms and heuristics, in the human situation I opt for interpretation, schematics, and heuristics, rather than prescriptions, rules, and algorithms.

To assert these views is not to provide for holding them. Let me provide a few. First, those of us who work with human beings work with people who do not, despite Thorndike's view, simply respond to stimuli. Human beings *construe* situations, they make sense of classrooms, they anticipate the world in which they live. What constitutes a stimulus depends not simply on what is injected in the classroom but what students take from it. And what various students take from the classroom and what they make of what they take differs. It differs because of their prior experience, their capabilities, their friends, their predispositions, and their relationship with the teacher. Because the perspectives they bring are multiple, no teacher can depend on a script or a pre-structured sequence for guarantees about effective teaching. Indeed, the more opportunities a teacher provides to students to idiosyncratically *construe* and express what they have gotten out of a lesson, the less the teacher controls

what they are likely to learn: the students teach each other.

Second, what students learn from educational encounters increases the differences among them.¹⁹ Students with high levels of interest and aptitudes for particular subjects are likely to go farther and faster. Their satisfactions are likely to be greater than their opposite. Students who are ingenious arrive at answers that are often unpredictable. Where in all of this is the power of a prescribed method of instruction? Unlike automobiles rolling down an assembly line where an additive model works fairly well, (interaction effects are small), the children a classroom teacher deals with are unique configurations that change over time. Unlike electrons or billiard balls, students have ambitions and purposes and refuse to be treated as lumps of clay or sheets of steel passively awaiting the impact of a scientifically based teaching technology that provides little or no scope in its assumptions for what the students make of all of this. Our roles as teachers are closer to those of negotiators than to puppeteers or engineers. And even when we succeed in shaping our students' surfaces, unless we touch their souls we will be locked out of their inner lives. Much of contemporary education in both the public school and the university seldom gets more than skin deep.

Third, the idea that the skills of teaching can be treated as discrete elements and then aggregated to form a whole reflects a fundamental misconception of what it means to be skilled in teaching. What skilled teaching requires is the ability to recognize dynamic patterns, to grasp their meaning, and the ingenuity to invent ways to respond to them. It requires the ability to both lose oneself in the act and at the same time maintain a subsidiary awareness of what one is doing.

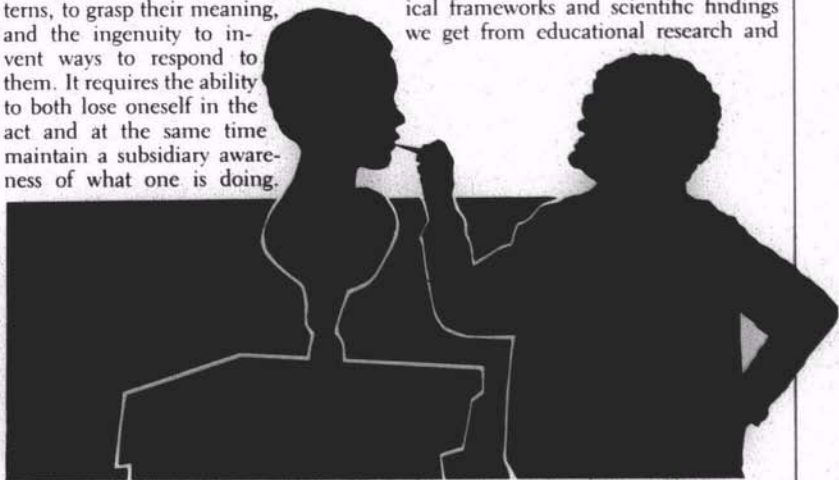
Simply possessing a set of discrete skills ensures nothing.

The importance of perceiving patterns in motion while at the same time being able to monitor oneself should not come as a surprise to anyone who has reflected on what being in a social situation requires. Humans have a built-in need to seek structures of signification. They find it necessary to make sense of the world. They learn to improvise within a changing field, whether in the classroom, the board room, or the principal's office. The mechanical application of prescribed routines is the surest way I know of to get into trouble.

But what of the art and craft of teaching? Thus far I have discussed our intellectual heritage in education, but have said little that is explicit about the art and craft of teaching. The time has come to address these concepts.

Given what I have already said about the kind of science appropriate for education, it should be clear that the space is very large between the ideas that science can provide and the kinds of decisions and actions a teacher must take. Classrooms and students are particular in character. Theory is general. What the teacher must be able to do is see the connection—if there is one—between the principle and the case. But even where such a connection exists, the fit is never perfect.

An imaginative leap is always required. But if we have no rules to follow, then how shall we take this leap? How shall we decide how to act? How do we fill the space between the theoretical frameworks and scientific findings we get from educational research and





the concrete realities that we face on the job.

I suggest that it is in this space—the interstices between framework and action—that the art and craft of teaching is most crucial. We face a class, we raise a question, we get little or no response. Theoretical frameworks and the findings of research studies provide only limited help. What we do is to look for clues. We try to read the muted and enigmatic messages in our students' faces, in their posture, in their comportment. We look for a light at one end of the room and then at the other. Our sensibilities come into play as we try to construe the meaning of the particular situation we face.

And what do we face? Do we call on a particular student to get the ball rolling? Do we recast the question? Do we keep on talking and hope for the best? Our educational imagination begins to operate and we consider options. Theory

helps, but as a guide not a prescription. It helps us consider options and once selected, we listen for messages given in the tone and pace of our students' conversations and questions. But even these options are options considered in the preactive, rather than in the interactive phase of teaching.

Teaching is typically too dynamic for the teacher to stop in order to formulate hypotheses or to run through a series of theories to form a productive eclectic relationship among them as the basis for deciding on a course of action. Students are not inclined to wait—and teachers know this. Teaching action is more immediate than reflective—unless we have a problem that we cannot solve—and even then reflection is likely to occur outside of the class. The teacher reads the qualitative cues of the situation as it unfolds and thinks on her feet, in many cases like a stand-up comedian. Reflection is not absent, theory is not

irrelevant, even research conclusions might be considered, but they provide guidance, not direction. They are more in the background than the forefront of the action.

What we do as teachers is to orchestrate the dialogue moving from one side of the room to the other. We need to give the piccolos a chance—indeed to encourage them to sing more confidently—but we also need to provide space for the brass. And as for the violins, they always seem to have a major part to play. How is it going? What does the melody sound like? Is the music full enough? Do we need to stretch the orchestra further? When shall we pause and recapitulate the introductory theme? The clock is reaching ten and we have not yet crescendoed? How can we bring it to closure when we can't predict when a stunning question or an astute observation will bring forth a new melodic line and off we go again? Such

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are the pleasures and trials of teaching and when it goes well, there is nothing more that we would rather do.

Is such a story apocryphal? Clearly teachers are not orchestra conductors. Yet teachers orchestrate. The analogue rings true. Is artistry involved? Clearly it is. But where does it occur and of what does it consist? Let me suggest that it occurs first of all in those places—and they are legion—in the conduct of teaching when rules fail.

When rules cannot be used to decode meaning and when prescriptions cannot be used to control practice, the teacher must rely on art and craft. To function as an artist or a craftsman one must be able to read the ineffable yet expressive messages of classroom life. It requires a level of what I have called in previous writings "educational connoisseurship"—the ability to appreciate what one has encountered.²⁰

But appreciation, even by an educational connoisseur, is not enough. A teacher—like a school administrator—must act. And it is here that another characteristic of the art and craft of teaching comes into play: The ability to draw on the educational imagination. Like an artist, a teacher must be able to invent moves that will advance the situation from one place in a student's intellectual biography to another. What to do? What kind of question to raise? Do I keep on talking? Do I raise another question? Or do I do something that I never did before? Do I create a new move in another way? Do I let myself fly and thus take the risk of failing? It is here in this pedagogical space that the distinction found in the title of this essay can be explained—"The Art and Craft of Teaching."

What is it that distinguishes the art of teaching from the craft of teaching? It is

precisely the willingness and ability to create new forms of teaching—new teaching moves—moves that were not a part of one's existing repertoire.²¹ The craftsman in the classroom has the repertoire, is skilled in its use, and manages the performance quite well indeed. But the craftsman creates essentially nothing new as a performer. This person's mark is known by the skill with which he or she uses known routines.

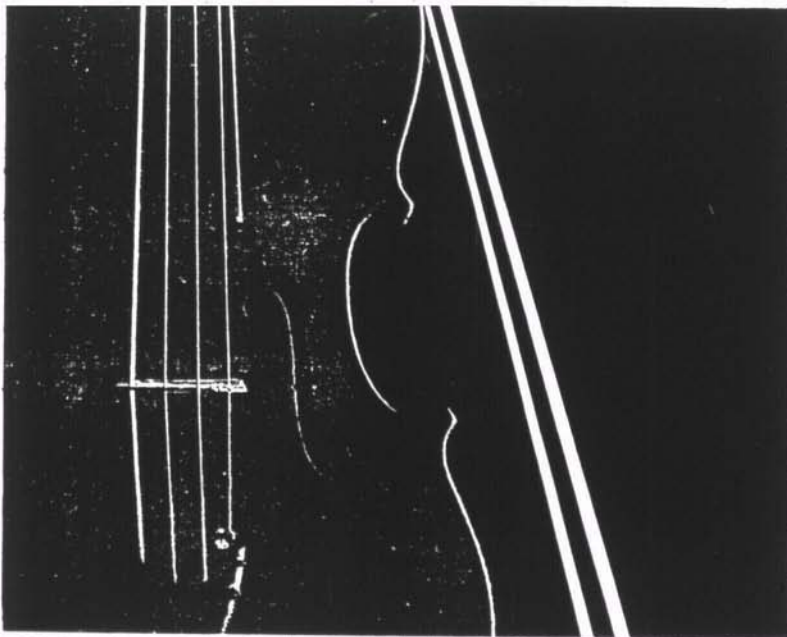
The artist in the classroom invents new ones in the process. Such modes of performance are not plentiful, and they require ingenuity and all of the skill that the person possesses. The artist is rarer than the craftsman. Is the notion of the artist in the classroom really obsolete?

What can we say thus far about what the art and craft of teaching means? First, it means that we recognize that no science of teaching exists, or can exist, that will be so prescriptive as to make teaching routine. The best we can hope for—and it is substantial—is to have better tools from science with which teachers can use their heads.

Second, because the classroom, when not hog-tied or mechanically regimented, is a dynamic enterprise, teachers must be able to read the dynamic structures of signification that occur in such settings. Such reading requires attention to pattern and expressive nuance created by the students and the teacher's own activities.

Third, appreciation is not enough. The teacher must be able to call on or invent a set of moves that create an educationally productive tempo within a class. When we say of some lesson, "It went flat," we mean it both visually and aurally: It had no life, it didn't take hold. What is needed is either, or both, a better reading of the class by the teacher or a more imaginative set of teaching acts.

Fourth, it means that we acknowledge that artistry in teaching represents the apotheosis of educational performance and rather than try to diminish or replace it with rule-governed prescriptions, we ought to offer it a seat of honor. Artistry in teaching is always likely to be rare but it is even rarer when one works in an educational climate that is so concerned about academic achievement that it often stifles intellectual risk-taking on the part of both students and teachers.



This leads me to the final points I wish to address in my examination of the art and craft of teaching. One of those points deals with what it is that we have come to expect from art and craft: the provision of a very special kind of experience we sometimes call aesthetic. Just what does the aesthetic have to do with teaching and education? What is its import? Is it the frosting that makes the cake palatable or is it the marrow of education?

By art in education I am not talking about the visual arts, or music, or dance, but rather about the fact that activities motivated by the aesthetic satisfactions they provide—those that are intrinsic—are among the few that have any durability.²² Extrinsic rewards for teachers are always likely to be small compared to those secured by people working in other fields. Despite longer vacation periods and sabbaticals, professional opportunities and satisfactions for teachers are limited largely to the lives they lead in their classrooms. Few people regard teachers as receiving handsome salaries—and they are right. The perks related to sabbaticals and vacation periods are distant and short-lived.

When one finds in schools a climate that makes it possible to take pride in one's craft, when one has the permission to pursue what one's educational imagination adumbrates, when one receives from students the kind of glow that says you have touched my life, satisfactions flow that exceed whatever it is that sabbaticals and vacations can provide. The aesthetic in teaching is the experience secured from being able to put your own signature on your own work—to look at it and say it was good. It comes from the contagion of excited students discovering the power of a new idea, the satisfaction of a new skill, or the dilemma of an intellectual paradox that once discovered creates. It means being swept up in the task of making something beautiful—and teachers do make their own spaces and places. They provide, perhaps more than they realize, much of the score their students will experience.

Such moments of aesthetic experience will not of course be constant. We could not, I am convinced, endure it if they were. Only a few scattered throughout the week are enough to keep us going. But without them teaching will be draining rather than nourishing and the likelihood of keeping in teach-

ing those who need and value intellectual stimulation and challenge is very small. The aesthetic moments of teaching are among the deepest and most gratifying aspects of educational life.

But such moments in teaching are not the children of mechanical routine, the offspring of prescriptive rules for teaching, the progeny of rigid lesson plans that stifle spontaneity and discourage exploring the adventitious. Formalized method, bureaucratized procedures, and pressure to get students to perform at any price are their eviscerating conditions. Teachers need the psychological space and the permission to maintain a sense of excitement and discovery for themselves as teachers so that such excitement can be shared with their students.

"We need, too, an attitude in schools that expects that experimentation in educational practices is a normal part of doing educational business."

Does the unabashedly romantic image of teaching I have portrayed have any implications for what we ought to be doing in the schools or is it simply an unrealistic conception of what it means to teach? A conception that will be amply corrected by a Betty Crocker view of teaching or by a teacher-proof curriculum?

I believe the image of the teacher as craftsman and artist is an ideal toward which we should strive. I believe that

our intellectual roots have mistakenly regarded such images as suspect. I believe that many of the solutions being proposed to cure what people believe to be educational ills, solutions such as minimum competency testing, state mandated evaluation procedures, and other legislative panaceas, to be fundamentally misguided. They were born of suspicion and tend to motivate by the stick. Human growth and development, whether for teachers or for students, need richer soil in which to flourish. How might such conditions be provided and what might they be? First teachers need to be de-isolated in schools. Hardly anyone knows how or even what their colleagues are doing.

What is the logic in assuming that teachers can be trained once and for all in preservice university programs and then assigned to classrooms for the bulk of their careers with nothing more than brief excursions for inservice education that are usually provided by university professors who themselves have not taught in an elementary or secondary school classroom for a decade or two? The school needs to become a professional community with space enough for teachers to grow as professionals. They have much to offer each other, but these contributions are not easily made when teachers are isolated.

It is well past the time that schools create the organizational structure in which teachers and administrators can reflect on their activities as a regular part of their jobs, not simply within the scope of an inservice education program. Staff development needs to be a continuing part of what it means to be a teacher. The overstaffing of one teacher for every ten would be a step in the right direction. Joint planning could help contribute to it. And a school community that would not judge the quality of its educational program by SAT scores or enrollment in AP courses would also help. Is our educational imagination so impoverished that the only thing we can think of doing for the most able college-bound students is to give them what they will get in college a semester or two later?

We also need administrators who are at least as interested in teaching and curriculum as in organizational maintenance and public relations. We need principals who think of themselves *both* as teachers of teachers and as their teachers' staff. We need school superin-

tendents who can help close the breach between administration and faculty and who remember from whence they came. But how can a principal be an instructional leader when he believes that he knows little about teaching or curriculum?

While it's true that legal mandates, problems between teachers and administrators, increasingly vocal community concern with the quality of schooling need attention and appropriate professional skills, it is the instructional program and the skill with which it is mediated for which all of the former issues are to be instrumental. Without attention to the instructional program and to the quality of teaching provided, successful arbitration and positive relationships with the community will amount to little from an educational point of view.

At a time when programs in educational administration are focusing on "policy studies" and the "politics of education," it would be ironic if administrators learned how to survive but forgot what survival was for. Our beneficiaries are the students—and without teachers skilled in the craft of teaching, and a curriculum worth teaching, schooling is likely to be educationally vapid.

We need, too, an attitude in schools that expects that experimentation in educational practices is a normal part of doing educational business. Where are the equivalents of Varian's, Xerox's, and IBM's think tanks in our schools? Where are our educational studios? Must we always be in a responsive posture or can we too dream dreams and pursue them?

I said at the beginning of this essay that I was intent on re-establishing the legitimacy of the art and craft of teaching. The image I portrayed at the outset was that of a single individual working painstakingly on something about which he or she cared a great deal. Craftpersons and artists tend to care a great deal about what they do, they get a great deal of satisfaction from the journey as well as from the destination, they take pride in their work, and they are among the first to appreciate quality. Is such an image really inappropriate today? I hope not. I hope such an image always has a place in our schools. And somehow, just somehow, I think that in the private, quiet moments of our professional lives, we do too. □

¹I am indebted to Ray Bachetti for this tale. Its source is a case study paper that he wrote for Education 279X, Managing in Higher Education, School of Education, Stanford University.

²Elwood P. Cubberley, *Public Education in the United States* (Boston: Houghton Mifflin Company, 1934), p. 380.

³*Ibid.*, p. 384.

⁴Lawrence Cremin, *The Transformation of the School* (New York: Alfred Knopf, 1961).

⁵*Ibid.*, p. 101.

⁶*Ibid.*, pp. 100-103.

⁷Hall was not only the first editor of *Pedagogical Seminary*, he was its founder. He served as editor from its inception in 1881 to 1924.

⁸William James, *Talks to Teachers on Psychology* (New York: H. Holt & Co., 1901).

⁹Geraldine Joncich, *The Sane Positivist: The Biography of Edward L. Thorndike* (Middletown, Conn.: Wesleyan University Press, 1968).

¹⁰*Ibid.*, p. 336.

¹¹Edward L. Thorndike and Robert S. Woodworth, "The Influences of Special Training on General Ability," *Psychological Abstracts* 7 (March 1900).

¹²Edward L. Thorndike, "The Contribution of Psychology to Education," *Journal of Educational Psychology* 1 (1910): 618.

¹³For a brilliant discussion of this period see, Raymond Callahan, *Education and the Cult of Efficiency* (Chicago: The University of Chicago Press, 1962).

¹⁴*Ibid.*

¹⁵Alfred Jules Ayer, *Language, Truth and Logic* (New York: Dover, no date).

¹⁶The concept of micro-teaching as the practice of discrete teaching skills is related to this view of the skills of teaching.

¹⁷The average amount of experimental treatment time for experimental studies reported in the *American Educational Research Journal* in 1977-78 is approximately 45 minutes per subject.

¹⁸The distinction I wish to underscore is between sciences like anthropology, archeology, and psychoanalysis that aim at explanation and those like physics that not only explain but lead to prediction and control.

¹⁹Because aptitudes for learning different skills and concepts differ among human beings, the effective school will tend to increase individual differences among students rather than diminish them.

²⁰Elliot W. Eisner, *The Educational Imagination: On the Design and Evaluation of School Programs* (New York: The Macmillan Company, 1979).

²¹This view of art is based on the work of R. G. Collingwood. See his *Principles of Art* (New York: Oxford University Press, 1958).

²²Mark Lepper, ed., *The Hidden Cost of Reward* (Hillsdale, N.J.: Erlbaum Associates, 1978).

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