
Redefining the Science–Practice Relationship and Professional Training

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A revised conception of the relationship between psychological science and professional practice is proposed in the light of postmodern changes in perspectives on knowledge. Positivistic science, which has dominated the traditional interpretation of scientist–practitioner training, is considered from a constructivist point of view to be only one possible foundation of psychological knowledge. It is argued that the knowledge base of the profession should be derived with diverse methods and from multiple sources, including the knowledge of practice. The mutuality of science and practice is emphasized. An evolving framework for understanding the epistemology of practice, based on cognitive psychology, is presented. Emphasis on broadened choices of research methods, the development of reflective skills, and better linkage between teaching in the domains of research and practice are urged. Suggestions for research related to scientific training and the knowledge processes of practice are offered.

The relationship between our science and practice has continued to be a professional issue in the aftermath of the proposed reorganization of the American Psychological Association and the formation of separate interest groups for academic researchers and practitioners. The training of the professional psychologist in clinical, counseling, organizational, educational, and other areas of practice requires a more complete integration of science and practice than is the case at present. The traditional interpretation of the scientist–practitioner model has tended to bifurcate science and practice into separate domains and thus contribute to the division within the profession (Albee, 1970). In our judgment, an alternative conception of the science–practice relationship is needed that emphasizes the mutuality of science and practice, in which psychological science as a human practice and psychological practice as a human science inform each other. Although it may not be possible to reconcile entirely the differing interests of academically oriented researchers and service-oriented practitioners, an alternative vision of professional education may suggest a new relationship between the academic research and the practitioner culture referred to by Kimble (1984) and Peterson (1985).

There is at present no single articulated framework that would provide a sufficiently unified vision for psychology. There are a number of separate, although confluent, perspectives associated with the more general movement called *postmodernism* that represent promising ways of moving us in a new direction. Postmodernism rejects the pictorial metaphor of knowledge in favor of a constructivist metaphor (Lyotard, 1984). We will explore the implications of the postmodern perspectives and show how they challenge the traditional renderings of science and practice. We begin by briefly examining the phenomenon of professionalization and the problems and challenges ensuing from the historical interpretation of the scientist–practitioner training model for professional psychology (Frank, 1984; Meltzoff, 1984; Raimy, 1950; Shakow, 1978; Strickland, 1983). Alternative perspectives on different dimensions of the science–practice relationship will be discussed. An interdependent relationship between science and practice is conceived, based on methodological pluralism, a better articulation of the epistemology of practice, and greater emphasis on practice-based professional inquiry. Recommendations for professional training will be made on the basis of this new conception, drawing on the literature on expert practice and the processes of practical knowledge generation. Suggestions for research on the epistemological processes of professional inquiry and practice will be offered.

Professionalization and Problems With the Traditional Model of Knowledge

Society's dependence on professionals in nearly all sectors stems from the fact that knowledge has become the special property of particular professions. This phenomenon of professionalization of knowledge is partly the result of the dualistic distinction between mind and body—the spiritual and the scientific—whereby each aspect of the human being was parceled out for separate attention in

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the wake of scientific inquiry during the Enlightenment. Contemporary society shows a tolerance for the continuing division of the field of knowledge by professional specialties, a division reflected in the decentralization of educational institutions and the educational enterprise (Altman, 1987). Underlying these divisions is implicit support for a model of knowledge that reflects a prevailing positivistic view of science (Bernstein, 1976; Hanfling, 1981). This model has the following characteristics: (a) It accepts as a legitimate knowledge base only the knowledge generated by the experimental and objective modes of theory testing, (b) it is committed to a mathematical language as an expression of the logical relationship among categories presumed to be naturally occurring, and (c) it depends on procedural integrity and public scrutiny for establishing claims of scientific validity.

The essential position of positivism is that humans can, with the help of the tools of science, gain true knowledge of a reality that exists outside of human thought. Implied in the belief that formal procedures of science will produce a progressively accurate picture of reality are the notions that other modes of reasoning are inadequate for generating valid knowledge, and that everyday language is too imprecise for scientific description. The kinds of practical reasoning and problem solving such as those employed in practice are presumed to be inferior to the modes of thought associated with the scientific reasoning used in research. The natural language used in the communication between practitioners and clients is presumed to be less suitable for capturing the scientific understanding of reality than are mathematically derived statements framed in technical language.

For the professions claiming specialized knowledge, the positivistic model implied a single foundation for knowledge and encouraged the belief in a one-way relationship between research-tested theory and practice. Under this dominant model of knowledge, only knowledge statements justified by positivistic methods of research are admissible as the knowledge base of a discipline. Practitioners are assigned a secondary role as appliers rather than contributors of knowledge. Practice may serve as a source of hypotheses for science, but not as a means of generating valid knowledge. Schein (1972), writing about professional education, proposed a hierarchy of professional knowledge, with basic science or the underlying discipline viewed as highest in rigor and purity, and those individuals involved in basic sciences ascribed higher status than the practitioners of applied science. Glazer (1974) expressed a similar view by distinguishing between the "major" and "minor" professions, believing that the service-oriented and problem-solving professions that make up the minor professions are inferior. The belief was premised on the assumption that these professions could not possibly have a rigorous knowledge base when some of their practitioners seem to act on the basis of practical experience or trial and error, in ways that seem unsystematic and unpredictable (Schön, 1983). This prevailing positivistic view is also reflected, over the past century, in the government's relatively stronger support

of the hard sciences and in the pecking order for different disciplines and colleges in the university. As Odegaard (1987) noted, this state of affairs has resulted in a juxtapositioning of practice-oriented and research-oriented faculty in the American university, which continues to be under the research imperative and pattern of discipline specialization.

Viewed in this context, the alignment of the discipline of psychology with the dominant scientific model and the subsequently observed tensions within the psychology community are only to be expected. A science-based profession is in a better position to assert its legitimacy (Goldfried, 1984). Academic psychology and university training programs for the practice of psychology generally share the same foundational assumptions. Theory and research are expected to be the primary means of producing a knowledge base that is then translated into techniques for use by practitioners. Other institutional structures such as accreditation and licensing bodies also support the dominant model of knowledge by requiring a core curriculum intended to impart theory-tested knowledge and hypothetico-deductive methods of scientific inquiry. Even alternative professional training or PsyD programs have modeled their curricula after academic programs, as many continue to seek accreditation or affiliation with universities out of concern for achieving societal recognition (Peterson, 1985).

In spite of the initial unifying force of the positivistic value system, however, psychology as a profession is experiencing tensions of division (Altman, 1987). The division between researchers and practitioners has been attributed to a basic conflict of epistemic values and world views (Kimble, 1984; Woolsey, 1986). Practitioners depend on knowledge derived from experience and direct interaction with clients, a type of knowledge not formally admissible by the accepted scientific model. Differences in orientation and demand characteristics between research and practice settings further add to the problem of bridging science and practice (Kanfer, 1990). The disjuncture between the two realms of activities is experienced early in graduate training, where separate curricula and orientations are often involved in the teaching of research and practice. Unless attention is given to the nature of the processes involved in both realms of activity and how these processes may be related, there would be little change in the science-practice relationship dialogue. We need an epistemology of professional inquiry that (a) can bridge the gap between the formal knowledge base of research and the knowledge processes of practice and (b) would allow practitioners to contribute to the knowledge base of the profession.

Concern with the science-practice integration has been expressed in terms of the relevance of academic research to practice (Barlow, 1981a; Gelso, 1985; Goldman, 1977; Howard, 1985, 1986; Levy, 1981; Masters, 1984; Ross, 1981; Schover, 1980; Strupp, 1981). There is a need for theories of action that can inform practice and provide more adequate maps of the social realities of practice. The minimal instrumental use of research

literature and low participation in research by practitioners (Barlow, 1981b; Barlow, Hayes, & Nelson, 1984; Barrom, Shadish, & Montgomery, 1988; Cohen, 1977; Gelso, 1979; Morrow-Bradley & Elliott, 1986) has been especially disconcerting to those who subscribe to a linear view of the science-practice relationship. Among the reasons for practitioners' low participation in research were low interest and the perceived incompatibility between research and clinical activities (Haynes, Lemsky, & Sexton-Radek, 1987). Clinical practitioners have been found to be less satisfied with the scientist-practitioner model of training than have academic clinical psychologists (J. D. Tyler & Clark, 1987). A recent study that also found practicing clinicians producing fewer publications pointed out that PhD and PsyD training backgrounds do not differ in course work in research and statistics, and that a positive attitude toward research is a better predictor of research activity, in addition to external contingencies (Barrom et al., 1988). It appears that the integration of research and practice would require overcoming some degree of antiscientific attitude or at least practitioners' low interest in scientific activity as currently defined.

There have been criticisms of professional training under the traditional scientific model. The positivistic interpretation of the scientist-practitioner model emphasizes competence in the formal procedures of science and the special modes of reasoning involved in their use. Development of practitioner skills often comes later in graduate training (Kanfer, 1990). A partition is placed between the kind of thought that informs science and the kind that informs practice. This division in ways of knowing promotes a dissociation of science and practice, rather than fostering an integration between the scientific and practicing functions of the professional. Some critics feel that the academy has socialized students into a research culture based on this dominant model of knowledge, and only in a limited way has it nurtured the attitudes, values, and skills of professional practice (Dana, 1987; Peterson, 1985). As in other fields, it is observed that many practitioners who are trained in the prevalent mode tend to confine themselves to a narrow technical practice or to a limited class of problems, developing formal models that are divergent from the complex and uncertain contexts of actual practice (Schön, 1983). The technical rationality of formal logic and mathematics associated with a relatively value-free objective science has not been a sufficient guide for the profession in making value decisions about its social role and the types of problems it should address (Sarason, 1981, 1984). Professional education needs a framework of purpose, attitudes, and values that would guide its methods and aims of knowledge.

Professional psychology is faced with additional challenges. The pressures of a changing society are felt continuously by the mental health professions and educational institutions (Altman, 1987). Complex social and psychological problems, the system of third-party payment, accreditation, and state licensing controls all demand a high level of professional expertise and accountability. New competencies are needed for policy research

and the delivery of an increasingly technologized service (Crawford, 1985; Masters, 1984). If psychology is expected to be a problem-solving profession, it is crucial for both academic researchers and practice-oriented members of the profession to respond to the challenges of professional training. The coming together of these two communities, however, requires a new relationship and understanding of the nature of knowledge in a human science and practicing profession.

Relationship of Theory, Research, and Practice

Because of different orientations to knowledge, there are significant differences between the positivistic view and postmodern perspectives on the relationship of theory, research and practice. Although few members of the academy would presently claim allegiance to an extreme positivistic position, the positivistic attributes of science that had informed the understanding of theory construction and research in the theoretical sciences are still reflected in academic psychology. The main function of scientific activities is expected to be that of theory testing. The formal knowledge base of the discipline generated by research is considered to be the *only* legitimate source of knowledge for the profession. Little recognition is given to other knowledge processes at work, including those involved in the context of practice. A related consequence of the emphasis on theory testing has been the relative neglect of discovery research (Danzinger, 1988; Mahrer, 1988; McGuire, 1983; Wachtel, 1980), a type of inquiry that is essential to professional practice. In those unfamiliar terrains of practice in which problems are ill formed, intensive observation and comprehensive description ought to precede hypothesis testing.

The continued commitment to the traditional understanding of science and practice is reflected in the profession's response to the lack of integration of science and practice by only urging practitioners to attend to and be informed by the research-generated knowledge of the academy. These calls have mainly emphasized integration at the level of utilization of *content* knowledge (Stricker & Keisner, 1985; Weary & Mirels, 1982) or the application of traditional modes of scientific reasoning in situations of practice (Barlow et al., 1984). We propose a more radical effort of integration whereby the *processes* of knowledge in the two domains are considered under a new conception of psychology as a human science of practice.

Whereas the postmodern approach to science does not eschew the use of traditional modes of knowledge generation and the theory-testing function of scientists, it regards organized theoretical research as only one approach to knowledge (Polkinghorne, 1991). A variety of cognitive processes including the practical reasoning used in practice may serve the purpose of science. The processes of human science are understood as varied ways of applying category systems to psychological phenomena in particular contexts, drawing attention to different aspects and their regularities. Theories and the interpretive schemes used by researchers are considered to have

a local and historical character, rather than being universal frameworks of truth (Geertz, 1983). Generalizations from particular uses of construct systems and limited sets of contextually dependent data retain the partial and perspectival character of all human knowledge.

In this interpretation of science, the test of knowledge is not whether it corresponds exactly to reality, as it is impossible to ascertain whether there is such a direct correspondence. Instead, the test for knowledge is whether it serves to guide human action to attain goals. In other words, the test is pragmatic (Margolis, 1987), not logical. This has profound implications for the role of practice. Practice is no longer the mere application of scientific findings, but the locale for knowledge development through practical reasoning processes and for the pragmatic test of knowledge claims. An expert practitioner constantly evaluates the fit of scientific knowledge to the requirements of practice. Through trial and error, construct systems are modified as a new understanding produces better results than the old. When practice exceeds the bounds of science, the practitioner calls on investigative efforts to verify progressive changes in the science-practice enterprise. Science advances as understanding evolves, for both individuals and cultures, with more effective knowledge replacing the less effective (Campbell, 1974; Toulmin, 1972).

Hence, under the postmodern perspective, the science-practice model is reframed from two separate activities based on disparate modes of reasoning into a unified, interactive system of purposeful inquiry and action. This way of uniting knowledge, thought, and theory with professional skills, action, and practice is consistent with the philosophy of praxis. The history of science has testified to the influence of human activity on human thought. Reciprocally, practice does not speak for itself; the comprehension of praxis requires conceptualization, and its verification involves the testing and refinement of such conceptualizations. Praxis is a theoretico-practical activity (Vazquez, 1977). Neither theoretical research nor practice alone can be viable without the other.

Examples of the development of a professional knowledge base that overcome the traditional split between science and practice can be found in field research and practice-based inquiry in organizational, educational, and clinical practice. Boehm (1980) explained how practical problems can serve as the starting point for research and knowledge utilization in organizational practice. Tharp and Gallimore (1982) described how the personal knowledge derived from the experience of long-term program development and evaluation can inform decisions about method choice in their field project. Such personal knowledge comes, in this case, from field observations of the effects of program implementation and the testing of elements of practice that have grounding in learning theory and cross-cultural models of cognition. Tharp and Gallimore (1988) also called for a new theory of schooling that unites social and behavioral research and the practice of schooling through an "emergent contextualist and interactionist view of human development" (p. 6). Amerel

(1989) described a developmental teacher education program in which practitioners were presented with Piagetian theory and were encouraged to construct practice solutions in teaching. The constructing process is shaped by the experiential knowledge of practice. Kanfer (1990) cited the iterative influence of attribution theory and the cognitive-behavioral treatment of depression as yet another example of the interdependence of theory and practice. These examples illustrate the interplay of theory and practice over the varied topography of professional practice.

We propose that effective integration of science and practice cannot be achieved if the profession continues to regard (a) academic research as the *sole* source of the knowledge to be applied by a practicing discipline, and (b) organized research efforts as the only means of testing and verifying knowledge. The view that holds that a practicing discipline recognizes *only* the formal body of knowledge generated through standard research procedures is problematic for practitioners. Hypotheses derived from nomothetic psychological theories are often tested under restrictive operational conditions. Such findings do not match the particular circumstances of a unique case or allow practitioners to interpret or predict the complex actions and events encountered in practice. A novice practitioner is often unable to make sense of problems of practice until he or she has had the opportunity to apply the conceptual understanding and inquiry skills developed in academic training and to modify them according to the requirements of practice. In spite of the demonstrated superiority of actuarial prediction over clinical prediction in certain situations (Meehl, 1954, 1957), practitioners tend to rely on their clinical experience or consultation with colleagues in making judgments. Perhaps this is because personal experiences with clients typically provide more direct, more vivid, and more concrete information for practitioners than do scientific reports and statistical summaries of empirical research. In actual practice, at least *two* types of knowledge are available: one contained in the theoretical and research literature (usually in the form of actuarial statements) and the other derived from the experience of actual practice (usually in the form of interpretive patterns derived with practical reasoning). There are indications that the use of both types of knowledge is more effective in practice than is either alone (Allport, 1981; Meehl, 1959).

A study by Martin, Slemmon, Hiebert, Hallberg, and Cummings (1989) indicated that experienced and novice counselors did not differ so much in theory-driven conceptualizations of counseling process and client concerns as has been reported for formal well-structured domains such as physics or mathematics. We would speculate that differences as a function of experience and level of expertise consist in the tacit procedural knowledge derived from the ambiguous and complex context of practice, rather than declarative theory-based knowledge alone. It is the knowledge structures derived from the experience of practice that immediately shapes the methods of practitioners and informs their actions with clients in an in-

strumental sense (Cohen, Sargent, & Sechrest, 1986). We propose that such knowledge derived from the experiences of skilled practice by expert practitioners can and does inform practice in a significant sense. This body of knowledge has been transmitted through the oral tradition, from one generation of practitioners to the next, and is described in some of the writings of master practitioners. Van Strien (1987) suggested that these maps of practice be regarded as practical paradigms that can be potentially linked with nomological theories of the field. They should be subjected to reflective analysis and systematic study. These practical paradigms have, unfortunately, not been given the type of attention received by research-generated knowledge. Without critical conceptual analysis and legitimate links to the existing knowledge base, the personal theories held by practitioners would continue to have an informal status in the profession (Martin, 1988).

Recognition of practice as a legitimate source of knowledge, in the tradition of Dewey (1929, 1933) and Lewin (1948, 1951), requires a well-articulated *epistemology of practicing knowledge* that illuminates the relationship among conceptual understanding, instrumental knowledge, and professional expertise. With a better understanding of the knowledge processes of practice, our profession will be in a better position to include the experientially based body of knowledge that is tested in expert practice as part of its professional foundation. This will complement the formal body of theoretical knowledge available for our background understanding and conceptual use (Cohen et al., 1986).

A discussion of the relationship between scientific knowledge and practice will not be complete without acknowledging the issue of values in research and theorizing. Description and theorizing in the social sciences are perspectival and represent value-based portrayals of human realities (Morgan, 1983). Beyond their descriptive functions, psychological theories could have prescriptive biases (Prilleltensky, 1989). M. B. Smith (1990) warned that the guild interest of psychology as a science and a profession can impinge on the public interest. The application of theorized understanding to the context of practice must be given balance by input from practitioners and the public. Solicitation of such input is less likely under the traditional relationship between researchers and practitioners and the prevailing definition of the professional as the expert and the lay person as the nonexpert. Our models of professional education and inquiry must be modified in philosophy and approach to permit collaborative roles for all. The prospect of such changes is closely linked with our definition of psychological science.

Redefinition of Psychological Science

A more fundamental way of considering the science-practice relationship is to redefine the nature of psychological science and its methodological orientation. The problem with our valuing of a single type of knowledge as a basis for practice is magnified by the fact that our traditional scientific inquiry has been limited by the pre-

dominant choice of objectivist research methods from the positivistic paradigm (Cronbach, 1975; Koch, 1981a; Sanford, 1965; Stanovich, 1989; Wachtel, 1980). This restrictive choice of methods and the tendency to test empirical hypotheses under highly restrictive operational paradigms have been partly responsible for limitations on the types of problems selected for study (McGuire, 1983; McKay, 1988) and probably for a tendency to engage in a narrow band of technical application. Positivism as the sole foundation for knowledge has become an outmoded philosophy of science (K. J. Gergen, 1982; Manicas & Secord, 1983; Reason & Rowan, 1981; Rorer & Widiger, 1983). In recent decades a new understanding has emerged, in which knowledge consists of human constructions of our encounters with reality and is not its mirrored reflection (Aanstoos, 1990; Anderson, 1990; Baynes, Bohman, & McCarthy, 1987; Rorty, 1979). This emergence of the postmodern position was due to the erosion of the principles undergirding the positivistic model of knowledge. Philosophers of science found internal inconsistencies in the structures of formal logic (Polkinghorne, 1983; Suppe, 1977). Historians of science called into question the assumption that positivistic methods could produce a cumulative fund of knowledge (T. S. Kuhn, 1970). Sociologists and anthropologists argued that formal scientific reasoning is not a universal and superior mode of thought, but is rather a reflection of particular masculine and European values (Anderson, 1990; M. Gergen, 1988). In addition, studies in cognitive development (Kroll & Black, 1989) and cognitive science (Gierre, 1988; Lakoff, 1987) support the idea of individual differences as well as social influences in the construction of knowledge and of a science that consists of multiple modes of rationality.

Whereas positivism has favored a single mode of knowledge, postmodern perspectives regard different approaches to knowledge as alternative social constructions (Arbib & Hesse, 1986; Manicas & Secord, 1983). Constructivism (Berger & Luckmann, 1966; Bruffee, 1986; K. J. Gergen, 1985) calls for multiple paradigms of knowledge. The potential of multiple rationalities and methods of construction is recognized by the cognitive interpretation of science (Gierre, 1988; Lakoff, 1987). Cognitive patterns seem to make use of a variety of relational structures for explaining the relationship among parts, consistent with the notion of multiple rationalities. The mathematical logic that forms the basis of the prevailing types of research is only one of several possible languages that can be used in the constructive process of our science. Other methods of knowledge can use the language of consciousness and experience, as in phenomenological inquiry (Giorgi, 1985), and the use of the narrative plot as a source of meanings (Polkinghorne, 1988; Sarbin, 1986). Postmodern philosophy of science and constructivism suggest that scientific psychology has not been wrong in its historical conception, but rather, partial in its approach to knowledge (Polkinghorne, 1991; Rorty, 1979). Science consists of many knowledge-generating activities, each with strengths and weaknesses.

It is now widely acknowledged that psychological research in the areas of professional practice could benefit from a broader range of methodological paradigms (Dana, 1987; Gelso, 1984; Goldman, 1989; Helmes, 1989; Hill & Gronsky, 1984; Howard, 1986; Keeley, Shemberg, & Zaynor, 1988; Koch, 1981a; Seeman, 1990; Wickers, 1985). For psychological science to be the scientific base of a practicing discipline, we must grant the methodological extensions appropriate for research in the human domain (Guba & Lincoln, 1990; Polkinghorne, 1983). Among the reasons for considering these paradigms are the fact that they give primacy to experience and meanings and treat the human subject with respect. Training in the related modes of inquiry entails the development of attitudes and values congruent with professional practice (Dana, 1987; Rogers, 1985). The similarities between participant modes of field inquiry and the clinical methods used by practitioners (K. K. Smith & Berg, 1985), for instance, may help reduce the disjuncture perceived by those who feel any conflict between their role as researcher and practitioner. Examples of new paradigm research and the fruitful application of such methodological extensions have been documented (Hoshmand, 1989; Lincoln, 1985; Reason, 1988; Reason & Rowan, 1981).

With a broadened definition of psychological science, its relationship to practice could be revised. A key factor in the issue of relevance of science to practice is the contextual or ecological validity of our theories and research findings (Argyris, 1980). Just as skilled practitioners have to understand the contextual differences that determine the appropriate use of methods of practice, researchers have to recognize the contextual instability of their theories and the embedded nature of their research findings. The use of theories developed without sufficient grounding in the context of practice would only perpetuate the misconception of a unidirectional, linear relationship between science and practice. The system's view anticipated by Lewin (1948, 1951) places generative theorizing (K. J. Gergen, 1982) and theory testing within the context of practice. It is only through this type of interdependent relationship and mutual feedback that researchers and practitioners can benefit from each other (Sprinthall, 1981). Examples of discovery and theory testing in the context of practice can be found in action research (Argyris, Putnam, & Smith, 1985; Pine, 1981; Torbert, 1976, 1981), a mode of research not given sufficient emphasis in current professional education. This type of scientific activity, as well as the attitudes and values that support it, definitely requires collaboration among researchers, practitioners, and the public (F. B. Tyler, Pergament, & Gatz, 1983). The productive interaction of theory and practice in a primarily practice-based approach to inquiry can contribute to what we regard as the knowledge of practice.

Epistemology of Practice

The postmodern view of science retains the idea that knowledge propositions are the product of methodolog-

ically sound inquiry and communal scrutiny. To grant a role for the knowledge of practice does not mean the abandonment of a critical stance in favor of undisciplined subjectivism. If psychological science were to include the knowledge of practice as part of its foundation, the profession would need to agree on the appropriate criteria and standards for judging practice-based inquiry and the experiential knowledge of practitioners. At this time, the methods of generating practicing knowledge and the criteria used to judge its value and acceptability have not been clearly delineated. In order for us to understand the nature of practicing knowledge, the tactics and approaches used to generate the knowledge of practice must receive further explication. The procedures by which psychology's community of scholars can function as critical reviewers must be fully developed. We will present in this section an evolving conception of the knowledge processes of practitioners of psychological service and those engaged in field research and practice-based inquiry, on the basis of developments in cognitive psychology.

In recent years, several authors have begun to work in the direction of depicting the knowledge processes involved in professional practice. Dreyfus and Dreyfus (1986) described five stages in the acquisition of the knowledge of practice and the types of cognitive processes used by practitioners at each of these levels of proficiency. In the first stage—the novice stage—the source of knowledge is primarily external to the practitioner, and practice consists of applying the rules and procedures derived from academic training. In the fifth stage—the expert stage—the source of knowledge is foremost the practitioner's experience, and practice involves accommodating previous understanding to the uniqueness of a particular clinical situation. In other words, experts work with knowledge differently than do novices. It suggests that an epistemology of practicing knowledge should be based on the processes of expert practitioners, not on the deliberative procedures and theoretically derived rules that constitute the practicing knowledge of novices.

According to the Dreyfus model, expert knowledge differs from a compilation of independent facts or sets of rules. Rather, it is a dynamic and contextualized understanding that is the result of the interaction of cognitive patterns or meaning gestalts with environmental cues. This type of knowledge has received considerable attention in the literature of cognitive psychology (Gardner, 1985; Lakoff, 1987; Margolis, 1987). Although Dreyfus and Dreyfus called these organizing schemes *patterns*, they have also been designated by such terms as *frames*, *schemata*, *scripts*, *attunements*, and *working theories* (Abelson, 1981; Hollon & Kriss, 1984; Taylor & Crocker, 1981; Tomkins, 1979). Chi, Glaser, and Farr (1988) found that in the practicing knowledge of experts, mental designs are revised and adjusted in the light of professional experiences and reflective thought. Schön's (1983) study of the knowledge processes of skilled professional practitioners parallels the findings of Dreyfus and Dreyfus and Chi et al. He found that patterned knowledge and response routines are constructed through learning by trial

and reinforcement. Furthermore, they can be refined by deliberate or reflective attention.

The process of reflection performs a crucial function for a science of practice by checking on the validity of practicing knowledge. Through reflection the practitioner can bring to the surface and criticize the tacit understandings that have grown up around the repetitive experiences of a specialized practice and can make new sense of the situations of uncertainty or uniqueness that he or she may experience (Schön, 1983, p. 61). The process of reflection involves a frame experiment in which the pattern used to understand a situation is altered to provide a better fit to the complexity of the situation. When we reflect, we change from thinking with our patterns to metacognitive awareness (Forrest-Pressley, McKinnon, & Waller, 1985). We focus on the possibility that the situation may not fit any pattern of understanding in our repertoire or that we have tried to make the situation conform to a pattern with which we are comfortable. Schön (1983, p. 281) described the capacity to engage in reflection-in-action as a double vision that does not require us to stop and think; rather, it is the capacity to keep alive, in the midst of an action, a multiplicity of views of the situation.

The ability to reflect has been linked to cognitive development. The practice of reflection seems to differentiate mature cognitive operations from immature ones. Vygotsky (1962), in his pioneering work on cognition, explored children's development of the ability to apply their structured interpretations explicitly and reflectively. Using the example of grammar, which young children can use correctly but of which they have not yet become aware, Vygotsky introduced the idea of metacognition. Inhelder and Piaget (1958) presented the level of formal operations as the culminating stage of cognitive development. At its core is the advent of reflection or "operations on operations." D. Kuhn, Amsel, and O'Loughlin (1988) further conceived of reflective skill as a learned inferential ability to judge the capacity of a pattern to fit the context of a situation.

Although adults are developmentally capable of reflecting on their patterns of knowledge and of changing them when necessary, research in cognitive psychology has documented shortcomings in mature judgments (Nisbett & Ross, 1980). Errors can occur in the choice of a pattern when one is interpreting a given situation. Disproportionate weight can be given to situational cues that are more vivid or otherwise more likely to stand out in a person's memory. Patterns originally used to interpret a situation tend to persevere, even after further evidence has discredited them. Tversky and Kahneman (1974) identified two heuristics, availability and representativeness, that hamper accurate judgment. The former is an estimate of the probability of an event on the basis of the ease with which an instance of it can be recalled; the latter is the focus on a salient single-case example that leads to underestimating of the importance of base rate information. In a collection of essays, Turk and Salovey (1988) related cognitive errors to clinical practice. These

studies, by shedding light on errors of judgment in practice, can contribute to our understanding of the knowledge processes in professional practice. They also remind us of the limits of practicing knowledge and the need for disciplined reflection as a check on errors of judgment in practice.

Much of the research on the cognitive processes of practice has been focused on clinicians. An epistemology of practice must also include an understanding of the epistemic skills and knowledge orientations of researchers in field-based inquiry. Studies of expertise in general problem solving suggest that experts have a rich knowledge of basic problem types that guides them in their strategies (Hinsley, Hayes, & Simon, 1977; Robinson & Hayes, 1978). Mitroff and Kilmann (1978) suggested that researchers have different epistemic styles. Further understanding of those epistemic skills and attitudes of experienced researchers that maximize the fruitful interaction of theory and practice in field inquiry would add to an epistemology of professional practice.

Implications for Scientific Training and Professional Development

The perspectives on psychological science and its relationship with practice, as well as the evolving conception of the knowledge of practice presented here, have a number of implications for scientific training and the development of the professional psychologist.

The implication for research training in terms of expansion of content emphasis would be coverage of alternative research paradigms or what has been termed *human science methodology* (Polkinghorne, 1983), with greater exposure of students to action research and collaborative field inquiry, as was mentioned earlier. Koch (1981b) was critical of the models of humans implied in psychology's treatment of its clientele. These proposed paradigms of professional inquiry are supposed to be more collaborative and empowering toward one's subjects or clients. Traditional research training has also been criticized for its overemphasis on technological inquiry, to the neglect of scientific training and discovery-oriented inquiry (Altmaier & Claiborn, 1987; Betz, 1986; Borgen, 1984; Forsyth & Strong, 1986). Scientific training should encompass an understanding of the philosophy and process of science and the development of attitudes and habits of mind, in addition to technical procedural competency. The teaching of alternate research paradigms can be done in accordance with these goals of scientific training, as explained by Hoshmand (1989). Students can be presented with more than one model of knowledge and encouraged to evaluate the merits and limitations of each methodological paradigm. This would enhance their ability to make informed choices. Many of these systems of inquiry, being more inductive in approach, are well suited for discovery purposes. They can be especially useful in professional inquiry into populations and problems that are unfamiliar to the practitioner.

In terms of process, professional education should be focused on the development of reflective judgment of

the type conceived in expert practice. Extensive training is necessary to develop reflective skills of a high level. The purpose of developing skillful reflection is to enhance the capacity of deliberative control over the biases that hamper full understanding and lessen practitioners' effectiveness in the context of practice. D. Kuhn et al. (1988, pp. 228–233) outlined an educational procedure for developing reflective skill to this higher level. They were critical of programs that base abstract thinking skills on the idea that reflection is a function of formal logic and assume that abstract principles of sound reasoning can be generally applied to a wide range of contexts. They proposed that development to an advanced stage of reflection is assisted by reflective thinking in concrete instances such as those encountered in practice. The use of reflection to understand specific situations is likely to serve not only to perfect its execution but also to promote metacognitive awareness of the strategy itself (p. 231). The strategy of D. Kuhn et al. resembles Kohlberg's (1984) strategy in using specific moral dilemmas to facilitate advancement to a higher stage of moral development. D. Kuhn et al. hold that the use of reflective strategies in concrete cases may promote their generalization, whereas teaching the same strategies in a more abstract form may fail to achieve the same results. This suggestion is also supported by Schön (1987), who advocated the use of case studies and practicum experiences as the context in which to develop skillful reflective thinking. Similar training in the form of apprenticeship in field research under experienced field researchers can be beneficial. These approaches aimed at the development of reflective habits of mind should be central to our professional training. Professional wisdom should include the ability to evaluate and critique one's own understanding and actions.

There should be better linkage between the teaching of research and the teaching of practice. An appreciation for scientific inquiry as an open, multidimensional, and creative process must be a unifying goal of professional training, whether in the domain of research or in the domain of practice (Hoshmand, 1991). Teaching knowledge generation in deliberative research and practice should promote informed judgment in the choice of methods and flexibility in professional inquiry. Furthermore, there has to be greater emphasis on the ecological validity of research and the interaction between theory and practice in all aspects of academic training. Research practicum that provides apprenticeship experiences for doctoral students with seasoned field researchers should be arranged whenever possible (Kanfer, 1990). Attention should be given to the reflective processes used by skilled practitioners and field researchers as legitimate methods of generating knowledge. Students should be given ample opportunity to frame questions of practice as questions for research and evaluation. The implementation of these changes in professional training may narrow the gap between education for science and education for practice (Glaser, 1984; Hoshmand, 1991; Strupp, 1981).

Finally, we recommend the use of the cognitive–developmental perspective as a framework for designing

professional training. Both cognitive theory and developmental research have implications for the design of teaching–learning in terms of concept development, motivation, and personal orientation (Ames & Ames, 1984; Gilligan, 1982; Glaser, 1984; Kohlberg & Mayer, 1972; Perry, 1970). Teaching that is consistent with the models of knowledge implied in the proposed methodological extensions subscribes to the view of information processing as largely a personalized process of meaning making. The cognitive–developmental perspective directs educators to consider the student's knowledge world, assumptions, and level of conceptual functioning (Hunt, 1970; Weinstein & Alschuler, 1985; Wittrock, 1986). It also provides a framework with which to monitor the professional psychologists' development of pattern recognition and other abilities essential to dealing with the contextual differences that determine the validity of their methods and approach. The professional practice of psychology requires optimal degrees of cognitive differentiation for understanding clients and situations of practice. A certain level of epistemic development is similarly needed for effective functioning as field researchers. Process-oriented epigenetic models of psychological differentiation associated with the developmental and system perspectives (Mahoney, 1988) can be helpful in understanding the process of personal sense making and tacit learning in developing the knowledge of practice.

Suggested Research on Training and Practice

The interpretation of the science–practice relationship offered here suggests the need for research in several areas. We need research on the cognitive development of graduate students as they receive training in the areas of psychological practice. We also need to evaluate the impact on students' epistemic development of methodological pluralism and an emphasis on informed choice of methods in research training and practice. The relationship of such development to the development of what we have referred to as skilled reflection and expert practice needs to be demonstrated. Again, the cognitive–developmental and system perspectives on psychological differentiation seem especially useful. We should enlist the help of cognitive and developmental researchers in pursuing research in these particular areas. The developmental changes in the knowledge processes used in the transition from being a novice practitioner to an expert practitioner should be illuminated.

We propose a new role for research on the body of practicing knowledge. In relating theory to practice, research traditionally served as gatekeeper for entry into a discipline's body of knowledge. Its logic of justification was used to determine which hypotheses should be admitted into the body of knowledge. The methods of justification are grounded in the assumption that true knowledge conforms to the principles of formal logic and mathematics. In practicing knowledge, however, the test for admission is carried out through the use of reflective thought. The data on which practitioners reflect are actual situations of professional practice. This knowledge base

is generated by practice itself, not by research efforts independent of the context of practice. Reflective research is conducted by practitioners in the field as they adjust their mental patterns to understand more fully the situations that confront them. We propose that the scholarly work of the academy should function differently in psychology, as a human practicing discipline, from the way it functions in highly theoretical disciplines, by encompassing the study of practicing knowledge. One of its roles would be to clarify the patterns of understanding developed in practice and to examine the process of skilled reflection. The emphasis should be broader than the current focus on diagnostic judgment or decision making relative to a specific outcome, such as documented in most studies of clinical judgment (Holt, 1988). Another would be to help sharpen the conceptual maps evolved by practice-based inquiry and to link them to the formal knowledge base. A third function would be to enhance our understanding of the differences between technical competence and professional wisdom.

Schön (1983, pp. 307–325) has identified four types of reflective research that complement a practicing knowledge base. Although his proposal is not complete, the ideas are suggestive of the type of direction we should take.

1. *Frame analysis.* Scholarly effort is needed to identify and describe the various frames and patterns contained in the dynamic and evolving body of practicing knowledge and to uncover the links among families of patterns of understanding. By revealing the multiple possibilities of making sense of similar situations, this scholarly work will help practitioners to advance from the tacit use of patterns to reflection on the variety of patterns available to them.

2. *Repertoire building.* There is a need to accumulate and describe exemplar cases of reflection-in-action. Illustrative cases that demonstrate the process of skilled reflective inquiry, from the initial framing of the situation through revisions to the eventual outcome, must be identified. They would illustrate not only skilled reflection-in-action but could also be useful in instruction. The scholar would transform the events of the evolving understanding into an explanation of the reflective process.

3. *Methods and designs of reflection.* This kind of research would use practical examples to discern the methods used to sense incongruities between a pattern of understanding and a situation. It would identify the designs followed in restructuring the initial pattern to fit more closely the aspects of a particular situation. Thus it would describe the overall strategies developed by skilled practitioners for use in a variety of situations.

4. *The process of reflection-in-action.* The impediments to skilled reflection merit study of the kind undertaken by D. Kuhn et al. (1988). It should include identification of the conditions that either encourage or inhibit skilled reflection.

The kinds of academic scholarship suggested here will require dialogue between academic researchers and

practitioner-researchers. In this sort of inquiry, the role of scholarship will extend from theory testing to (a) the discovery and description of the knowledge processes used in practice and field research or practice-based inquiry and (b) the clarification of practicing knowledge generated by skilled practitioners and field researchers. Such scholarly work will be directly useful for practice. The methods associated with human science paradigms will be especially appropriate for the first type of inquiry. Their syncretic use along with experimental methods will likewise contribute to inquiry for the second purpose.

Conclusion

We have approached the problem of the science–practice relationship in the light of postmodern changes in perspectives on knowledge by redefining psychological science and proposing multiplicity in our methods and sources of knowledge. It is argued that the current division between academic researchers and practitioners requires a revised conception of the relationship of science and practice, in which there is productive interplay rather than elevation of one form of knowledge above the other. Schön (1983) wrote “It is unlikely that the new roles and relationships of practice and research will wholly displace the old. . . . It is more likely that the two systems of relationship will coexist” (p. 325). Our hope is that at least more of a balance will be struck as our profession begins to regard practice as the appropriate context for constructing and testing our maps of instrumental knowledge. Furthermore, we propose a greater role for the knowledge of practice in the scientific base of the profession. To achieve this end will require of the academy a pluralistic view of knowledge, and demand of our discipline the effort to research the epistemology and products of practice. These changes imply new relationships among academic researchers, practitioners, and the public that grants the profession its legitimacy.

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