REBUTTING TWO CLAIMS THAT EDUCATION CANNOT BE A SCIENCE

Greg Seals
College of Staten Island/CUNY

As early as 1928 Dewey had both openly declared his dream of a science of education and described some details of it.[1] According to Dewey, creation of systematic methods of inquiry into issues of education will enable educators to understand education better; control it less haphazardly and with less routine; promote steady and cumulative growth of intelligent, communicable insight and power of direction in schooling; and liberate schooling practice from uniformity of approach by describing far-reaching purposes of schooling with their source in conditions wider and deeper than daily need of educational practice (SSE, 1-8).

In his vision, Dewey saw teachers and researchers working in tandem to promote continuous development and refinement of principles able to provide practitioners with strong warrant for their professional judgments. Dewey outlined the research agenda for his approach to the science of education in "Progressive Education and the Science of Education," written in the same year as "The Sources of a Science of Education." Dewey asserts that, first, progressive education must disassociate its efforts to be scientific from the test, measure, average, and classify scheme still largely in use by traditional forms of education science. These forms of assessing educational effectiveness tend to confine consideration of student achievement to measurable actualities and restrict exploration of possibilities for continued student growth (PESE, 260).

Second, Dewey suggests a procedure for the generation of relevant data for the science of education. His system ties researchers and teachers closely together in pursuit of continuous improvement of education practice. On Dewey's scheme, teachers collect data from their experiences as educators. Researchers survey the data searching for patterns in it, identifying, testing, and refining patterns expressed in instances of teacher success and teacher failure. Researchers' tests serve to rework and reconceptualize conditions of success and of failure in the classroom. Lessons learned in reworking and reconceptualizing teacher success provide teachers with new ideas to test in their own classes. Teachers rework and refine researchers' ideas as they apply them. Those experiences of applying research are added to the data on teacher success and failure. Teachers respond to this data by..., and so on, in a self-perpetuating process of data collection and hypothesis testing on the problem of creating classroom conditions favorable to learning. In this process teachers and researchers are literally involved in the same task. Teachers primarily study particular items in the data set. Researchers primarily study the data set as a whole. Both contribute continuously to improvement in the work of the other.

Both contribute materially to the logic or methodology of the science of education: the latter formulating universal ways of acting on which teachers can depend, the former fashioning methods by which those universal ways of acting may be applied to particular instances of instruction (PESE, 266-267).

However, as Dewey is quick to point out, moving beyond mere protest at older conceptions of education practice and improvisation in use of new educational ideas requires intellectual organization of progressivism. By engaging in efforts aimed at intellectual organization of progressive education researchers may begin a process of actual construction of principles able to guide the work of the progressive educator. Dewey insists that when progressive educators

> enter upon organized constructive work, they are bound to make definite contributions to building up the theoretical or intellectual side of education. Whether this be called science or philosophy of education, I for one, care little; but if they do not *intellectually* organize their own work, while they may do much in making the lives of the children committed to them more joyous and more vital, they contribute only incidental scraps to the science of education. (PESE, 263, Dewey's emphasis)

Dewey's dream of the development of an organizing principle for a science of progressive education is long deferred due in large part to the inability of educational theorists to get beyond educational science as promulgated by Edward L. Thorndike and other administrative progressives.[2] Recently, several theorists of education and of educational psychology have argued that many if not most of the more damnable features of add, average, and classify approaches to educational research are directly traceable to Thorndike's elitist worldview, his eugenicist philosophy of education, and the faulty logic of his system in which statements on the order of definitions are treated as if they had the status of scientific laws.[3] Many of these critics of Thorndike suggest provisional adoption and exploration of Dewey's approach to educational science as a palliative to somber years of Thorndikian influence. However, none supply the organizing principle Dewey thought crucial to drawing out the scientific potential latent in progressive education.

Hopes for the development of an organizing principle able to catapult progressive education into the status of a science of education still face two logical difficulties neither of which has yet been dealt with adequately by educational theorists. These two interrelated problems, call them the problem of the lawlike statement and the problem of the unfamiliar content, block any attempt to discuss education as an autonomous science. The former denies the status of science-in-its-own-right to education on the grounds that educational theory has yet to formulate general statements of the sort able to support research endeavor worthy of the honorific appellation "scientific." The latter blocks

education from the status of an autonomous science on the grounds that educational theory has yet to supply educational research with a content, a set of objects of study, not already included as a part of some other, previously established psychological or social science. I will try to resolve these two difficulties by providing a lawlike statement of Dewey's views on pedagogy and by supplying broad notions of the proper objects of study for effective educational research as described by Dewey's law. Finally, construction of a framework for a science of education Deweyan in its design raises questions about the need to rethink at very general levels notions of validity in education research.

Two Criticisms of Education as Science

Paul Hirst was among the first to give general form to some logical problems facing attempts to talk about educational theory as scientific theory. According to Hirst, acceptance of education as an autonomous discipline requires demonstration that educational theory involves or contains or consists in some unique forms of judgment. "As we cannot lay down a priori that this is or is not impossible," Hirst graciously allows, "the only way for the question to be decided is for those who claim there are such to produce examples of these judgments."[4] The odds are stacked against successful demonstration, however, because, stuck as it is with no unique form of judgment to characterize it, education must draw upon other disciplines for knowledge and beliefs on which to base its theories. In this way education also surrenders claim to any unique subject matter. Without autonomous educational theory to test and refine, educational researchers may more properly be said to study application and adaptation of the ideas of other disciplines to contexts of schooling.[5]

The general charges raised by Hirst in the early 1960s were stated with greater specificity in the late 1960s by Dewey's former student, Ernest Nagel.[6] Nagel carefully distinguished four senses of "theory" ranging in a hierarchy from 'natural law' at the top to 'systematic analysis of related concepts' at the bottom. In Nagel's opinion most of the propositions of educational theory sit on the bottom rung of the theory ladder and none have climbed to the top. As a necessary first step in achieving theoretical statements of the strongest sort, statements like Newton's law of gravity, Nagel urges educational theorists to ponder the following methodological problem:

> "You are going to have a theory of this comprehensive kind only if you succeed in thinking up the right kind of ideas which are very abstract and remote, and don't, perhaps, correspond to anything that is familiar, and nevertheless find ways of supplementing such assumptions by appropriate supplementary definitions or correlations which enable you to apply them." (15)

Dewey's Law of Educative Force

Now Nagel has inadvertently created an interesting opportunity for speculative play with the idea of a lawlike statement of educational theory. By mentioning Newton's law, which by the way Dewey also admired as a paradigm of achievement in scientific theory, Nagel suggests a pattern to follow in beginning to develop the sort of lawlike statement of educational theory it will take to refute the claim that education cannot be a science.

Recall that Newton's law says that four variables describe attractive force between two bodies. These are the gravitational constant, the masses of the bodies, and the distance between them. Taking the product of the masses of the bodies, dividing it by the square of the distance between them and multiplying the result by the gravitational constant determines gravitational attraction. Dewey provides elements and opinions in *Experience and Education*[7] that allow analysis of the educative force of an experience eerily akin to Newton's law.

In articulation of his philosophy of educative experience, Dewey gives a four-part analysis of the concept of experience and equates it to education. Dewey argues that the educative force (EE, 42) of an experience is dependent upon the quality of an experience as assessed in terms of two criteria, both universal features of experience, continuity and interaction (EE, 44-45). Dewey defines interaction as the disparity or congruity of the external (physical and social) environment encompassed in an experience with the internal state (the needs, desires, capacities, purposes, and so on) of the person having that experience (EE, 37 and 42-45). Continuity is a threefold concept. Because events and things continue only over time, continuity implicitly makes reference to the past, the present, and the future. Thus, full assessment of the continuous quality of an experience must include evaluation of what the person having the experience brings to the experience, how internally coherent the present experience is, and how the experience will effect other, future experience (EE, 46-47). Applied to education in schools, Dewey's theory states that the educative force of any school lesson depends primarily upon relations among four things: the experiences brought by students to the lesson, the coherence of the lesson, the continuity of the lesson with subsequent experiences had by students outside the context of the lesson, and the nearness of the external environment of the classroom to the inner states of the students filling it.

Dewey's variables are not entirely unrelated to Newton's. The coherence of a curriculum and the continuity of it with extra-school life are measured, in what may very well be their least complex but most straightforward sense, by amounts of time—a tightly integrated curriculum providing a full school day of acquaintance with curricular content and a fully continuous one increasing time in contact with the curriculum as students find curricular content useful in negotiating their extra-school lives. Interaction seems to require a measure of

distance between what Dewey calls the total social set up of the classroom and the minds of the students learning in it. The more socially distant the classroom from the students, the lower the educative force of the lesson. Previous experience, finally, carries with it what may be called a curiosity constant. From the early psychology to the later logic, Dewey saw at the starting point of the experiential continuum the familiar facts of need and want. Restlessness or constant, significant firing along the reflex arc is what moves us to learn from our world.[8]

Relations among these four variables may be pieced together from comments made by Dewey in discussion of experience and educative force. To match the form of Newton's law we might say that taking the product of the amounts of time spent with the curriculum, dividing it by the square of the distance between students and classroom culture and multiplying the result by the strength of interest students bring to the lesson determines in large part educative force. Continuity may be said to be divided by interaction to capture the significance of Dewey's claim that interaction influences the way continuity applies in a given experience. Importance may be given in the numerator to the experiences brought by students to a lesson in order to accommodate Dewey's use of stages-of-normal-development talk and his insistence that no subject matter is intrinsically educative considered independently of the stage of growth a learner has achieved (EE, 42-43 and 46). The elements of the numerator are multiplied together because they are all three elements of a single concept, continuity. Smaller values on any item in the numerator threaten large reduction of educative force. Interaction is squared in the denominator in order to stress the importance of interaction to Dewey's understanding of the organic connection between experience and education. As distance between inner and outer in an experience increases, educative force decreases exponentially, not merely linearly.

Admittedly these are ad hoc, fanciful, it may even seem forced explications of Dewey's meaning. The argument, if it may be called that in any strict sense, relies in its present form on conceptual play, *dancing* on the shoulders of giants as it were, to make its point; but at the same time results in a statement of educational theory that is logically analogous to Newton's law.[9] Note, too, that Dewey discusses the ideas he presents in *Experience and Education* in extremely strong terms saying, "I assume that amid all uncertainties there is one permanent frame of reference: namely, the organic connection between education and personal experience." (EE, 25)

However, it is just at lawlike statement of Dewey's views that many philosophers of education might balk. In opposition to this timidity towards laws Dewey embraces laws as scientific truisms, *pro forma* expressions of dialectical intent not matter of fact. According to Dewey, the ancient Greeks achieved the idea of science without themselves becoming the best of scientists.

They accomplished this by insisting that observations of and beliefs about natural events be focused away from the artisan's concern with occasions of use and focused on discovery of logical relationships among existences. Concentration on description of formal relationships among existences expresses the distinctive intellectual characteristic of science. Science converts qualities to relations thereby infusing things with forms they did not have until subjected to scientific scrutiny. The implement the scientist employs to accomplish conversion of properties to relations is the law.[10]

Laws convert qualities to relations by describing some qualities as constant functions of some other qualities. Constant functions of related qualities find expression in lawlike statements because it is a truism or a tautology to say that ordered relationships are mathematical in character. That is simply what it means, says Dewey, to say it is possible to regulate events in ways that achieve desired outcomes. "The technique of equation and other functions characteristic of modern science is, taken generically, a method of thoroughgoing substitutions. It is a system of exchange and mutual conversion carried to its limit." (EN, 119) Dewey's law of educative force substitutes a certain kind of experience for education and in so doing presents progressive educators with a principle under which to organize their work intellectually.

Nonetheless, the lawlike statement of Dewey's views on education should not be construed as a widely accepted or generally implemented idea which does in fact govern education practice. Instead, it is a heuristic device developed for the specific purpose of rebutting specific objections raised by two philosophers of education against the very idea of a science of education. Construction of Dewey's law shows that, contra Hirst and Nagel, it is *possible* to construe education as a science in the sense of education being a law governed activity. Thus, creation of a permanent, even if putative frame of reference is required to appease Nagel and Hirst on the problem of the lawlike statement. While Nagel says aright that any lawlike statement requires test and verification to earn the status of law, he also admits that you can't have a law without first having a lawlike statement to subject to test. In what that test may consist depends in large part on resolution of the problem of the unfamiliar content, the second logical obstacle erected by Hirst and Nagel against the possibility of talking about education as a science.

An Unfamiliar Content for Dewey's Law

Dewey's law does not offer analysis of the educative force of experience in general. Instead, in *Experience and Education* Dewey is clear that his aim is analysis of the relation of changes in personal experience to changes in educative force. As James W. Garrison and Emanuel I. Shargel pointed out some years ago, the fact that Dewey's philosophy and philosophy of education deal so

directly, so consistently, and so fundamentally with experience creates the interesting possibility of using ideas associated with phenomenology to supplement Dewey's work.[11] A phenomenological approach to education requires a dialogical process of schooling grounded in the lived experiences, the lifeworlds, the worlds of the everyday lives of those engaged in learning.[12] There are, according to Alfred Schutz, three broad categories of the lifeworld elements of which coalesce to create for any individual at any given time a biographically determined situation. These are the person's stock of knowledge, her own experiences, and the pragmatic tasks set him. The lifeworld, Schutz continues, is a world in which the person is wide-awake and a world treated as the paramount reality of one's life.[13]

Elements of the lifeworld fold nicely into Dewey's analysis of educative experience. Stocks of knowledge parallel Dewey's idea about the importance of the relation of students' previous experience to the educative force of the lessons presented to them. Pragmatic tasks set students in their extra-curricular lives form a content which the most effective school lessons use in extending contact with curriculum beyond school walls. Finally, student assessment of the usefulness and appeal of school lessons is what Dewey describes as interaction and points clearly to the importance of constructing social relationships in the school that invite students to participate in rather than reject out of hand school lessons. In short, Dewey's emphasis on the relation of education to personal experience requires acceptance of the fact that there is an ineradicable phenomenological aspect to educational science because improvements in student learning require collection and use of information about persons' lives, their biographically determined situations. School lessons are inserted, smoothly or roughly, pleasantly or in off-putting ways into the lifeworlds, the paramount realities persons carry with them to class. This phenomenological account of three of the main variables in Dewey's law seems to satisfy Hirst and Nagel on the necessity of an unfamiliar content with which to fill in the blanks of a judgment unique to a science of education. Phenomenological investigation requires reconsideration of those things most familiar to us in order to move from what Ernesto Spinelli has described as an "I *or* you" position to an "I *and* you" position in an attempt to enter into each other's frameworks by bracketing our own sedimented beliefs long enough to figure out how the other person is looking at the world.[14]

It should neither confuse nor surprise that phenomenological variables have found their way into a conceptual structure logically analogous to Newton’s law of gravitational attraction. The mathematical structure in which a law may find expression puts few formal restrictions on the variables which it comprises. The variables must describe relevant phenomena in terms of amount or degree; but substitution instances of the variables may be of any sort, once their relevance and measure have been determined. The law describes regular relations among

the variables, their "habits" or the ways in which "they behave similarly under typically similar circumstances," as Edmund Husserl turns the phrase.[15]

Dewey's law asserts that it is possible to determine habits of instruction that associate educational outcomes with four broad features common to all personal experiences. Thus, Dewey calls ignoring the personal experiences of students "the fundamental fallacy in methods of instruction" and, to avoid commission of this fallacy, recommends orienting instruction to "the sort of situation that presents itself outside of school; the sort of occupations that interest and engage activity in ordinary life."[16] On the basis of comments such as these Garrison and Shargel see Deweyan educational theory as closely connected to Husserl's phenomenology. As they point out, "That thinking originates in everyday life experience is a leading principle of Dewey's naturalistic metaphysics. This epistemological principle readily yields the corresponding pedagogical principle that learning should originate in life-experience."[17] Thus, it should come as no shock that Dewey's law comprises a set of phenomenological variables.

Finally, use of qualitative data in the construction of mathematical models descriptive of the workings of human experience is a commonplace in the human sciences.[18] Patterns in experience can be usefully summarized in formulaic structures, math serving as a convenient way for social scientists to express relationships among variables of interest to them. Dewey's law simply serves as another example of the compatibility of phenomenological data with mathematical expression.

The Valid in Educational Research

If Dewey is right that educative force is accounted for primarily in terms of a set of phenomenological variables that surround a curriculum and make it meaningful or not so meaningful to the students engaged in studying it then education research is required to take into account factors that describe the biographically determined situations of students. Yet, most assessments of the quality of schooling still rely primarily on tests and measurements of student achievement interpreted according to the averaging and classificatory scheme introduced by Thorndike so long ago. Dewey sees this style of educational research as unfortunately and narrowly focused on the measurable actualities exhibited by students rather than the transformative possibilities presented by existing capacities and experiences of students. What has been absent from and enervative of attempts to develop a science of progressive education is a general, intellectual organization of the factors progressive educators believe useful in improving student learning (PESE, 261-263). Dewey's law addresses just that issue. By providing progressive educators with a set of variables to examine and by specifying a set of relationships among those variables Dewey's law puts

progressive education in a position to begin to examine causal relationships among differing approaches to curriculum delivery with diverse sets of students.

Perhaps the largest issue that remains is the meaning of measurement as applied to the constituent elements of Dewey's law. These notions do not seem amenable to measurement in any clearly quantitative way and, therefore, do not seem appropriate to scientifically guided improvement in pedagogical practice. Dewey is adamant in his response to this objection. Obsession with quantitative measures is as likely to mislead as it is to enlighten pedagogical practice for the straightforward reason that limiting measures to a single kind inclines researchers to learn to study what can be measured instead of prompting them to learn to measure what needs to be studied. It may be an unfortunate fact that pedagogical practice is better guided by assessment of qualitative factors than it is by quantifiable ones, Dewey argues, but if this is true, he goes on to say,

> the educator cannot sit down and wait till there are methods by which quality may be reduced to quantity; he must operate here and now. If he can organize his qualitative processes and results into some connected intellectual form, he is really advancing scientific method much more than if, ignoring what is actually most important, he devotes his energies to such unimportant by products as may now be measured (PESE, 260).

In other words, while it may be agreed that education is at present far from finding measures and methods appropriate to exact specification of the relation of experience and education, Dewey's law describes one way to start thinking about the details of that relationship. In providing a starting point for this kind of thinking about education, Dewey's law offers a clear example of the sort of proposition Hirst and Nagel thought unlikely in the extreme ever to be available to education and educational researchers. Their position is no longer tenable. Articulation of a lawlike statement of Dewey's views on pedagogy creates the *possibility* that education may properly be called scientific even in the strong sense Hirst and Nagel had in mind when denying education that status. Rebutting the claims of Hirst and Nagel, then, makes a philosophical contribution to educational research by changing our very conception of education and opening up new ways of talking about education.

Notes

1. See John Dewey, "The Sources of a Science of Education," in John Dewey, *The Later Works, 1925–1953*, Jo Ann Boydston, ed. (Carbondale: Southern Illinois University Press, 1984), Volume 5: 1–40 and John Dewey, "Progressive Education and the Science of Education," in John Dewey, *The Later Works, 1925-1953*, Jo Ann Boydston, ed. (Carbondale: Southern Illinois University Press, 1984), Volume

3: 257–268. These works will be cited in the text as SSE and PESE for all subsequent references.

2. For the story of administrative progressivism see Lawrence A. Cremin, *The Transformation of the School: Progressivism in American Education, 1876-1957* (New York: Vintage, 1964), 192–200. Details of Dewey's dim view of the efficiency movement in education may be found in Carmine A. Yengo, "John Dewey and the Cult of Efficiency," *Harvard Educational Review* 34 (1964):33–53.

3. See Jonas F. Soltis, "Dewey and Thorndike: The Persistence of Paradigms in Educational Scholarship," *Canadian Journal of Education* 13 (Winter 1988): 39–51 and 65–68; Robert A. Levin, "The Debate over Schooling: Influences of Dewey and Thorndike," *Childhood Education* 68 (Winter 1991): 71–75; Paul R. Pintrich, "Continuities and Discontinuities: Future Directions for Research in Educational Psychology," *Educational Psychologist* 29 (Summer 1994): 137–148; Paul Theobald and Ed Mills, "Accountability and the Struggle Over What Counts," *Phi Delta Kappan* 76 (February 1995): 462–466; Stephen Tomlinson, "Edward Lee Thorndike and John Dewey on the Science of Education," *Oxford Review of Education* 23, no. 3 (September 1997), 371; Kieran Egan, "The Analytic and the Arbitrary in Educational Research," in his *Children's Minds, Talking Rabbits, and Clockwork Oranges: Essays on Education* (New York: Teachers College Press, 1999): 169–181; and Alan Stoskopf, "Echoes of a Forgotten Past: Eugenics, Testing, and Education Reform," *The Educational Forum* 66, no. 2 (Winter 2002): 126–133. For the essential Thorndike see Edward L. Thorndike, *Psychology and the Science of Education: Selected Writings*, Geraldine M. Joncich, ed. (New York: Teachers College, 1962).

4. Paul Hirst, "Philosophy and Educational Theory," in Israel Scheffler, ed. *Philosophy and Education: Modern Readings* 2nd ed. (Boston: Allyn & Bacon, 1966): 78–95. Note, construction of just such a statement is the purpose of this paper.

5. Ibid., 86. I pass over another problem posed by Hirst. Hirst insists that educational theory cannot be scientific theory in any strong sense because education is at best an applied science and not a pure one (89–91). However, the distinction between pure and applied in science is not dichotomous. Donald E. Stokes, *Pasteur's Quadrant: Basic Science and Technological Innovation* (Washington, DC: Brookings Institution Press, 1997) has shown that while examples of pure and applied science do exist, the pure/applied distinction is better deployed as a continuum rather than a dichotomy. On Stokes' analysis it is possible for a science to be both pure and applied at the same time. Stokes calls such a science "basic-in-use science" and sites several examples from the history of science, most notably Pasteur's work with racemic acid, to support his position.

6. Ernest Nagel, "Philosophy of Science and Educational Theory," *Studies in Philosophy and Education* 7 no. 1 (Fall 1969): 5–27. I also skip an ancillary problem raised by Nagel. Nagel proposes that educational theory is normative in character so it cannot be scientific. This claim fails to recognize possible differences between various aspects of educational theory and so fails to take into consideration that

educational theory may be normative when, say, offering judgment on the content of a curriculum but not when, for example, offering judgment on how to deliver curriculum. Also, as Elizabeth Flower notes in a reply to Nagel's paper, "Comments on Philosophy of Science and Educational Theory," *Studies in Philosophy and Education* 7 no. 2 (Fall 1970): 143–153, fact and value statements are not as clearly differentiated in any theoretical field as Nagel seems to suppose.

7. John Dewey, *Experience and Education* (New York: Collier Books, 1963). This book will cited in the text as EE for all subsequent references.

8. See John Dewey, "The Reflex Arc Concept in Psychology" in Jo Ann Boydston, ed. *John Dewey: The Early Works, 1882–1898*, Volume 5 (Carbondale: Southern Illinois University Press, 1972): 97–113 and *Logic: The Theory of Inquiry*, Jo Ann Boydston, ed. *John Dewey: The Later Works, 1925–1953* (Carbondale Southern Illinois University Press, 1986), Volume 12. Paulo Freire has also made the point that teaching requires curiosity. See *Pedagogy of Freedom: Ethics, Democracy, and Civic Courage* (Lanham, MD: Rowman & Littlefield Publishers, Inc., 2001), 79–84.

9. For a more formal approach to the development of a Deweyan law of educative force see Greg Seals, "A Lawlike Statement of Dewey's Views on Pedagogy," in *Philosophy of Education 2001*, ed. Suzanne Rice (Urbana, IL: Philosophy of Education Society 2002): 255–261.

10. John Dewey, *Experience and Nature* (LaSalle, IL: Open Court Publishing Company, 1929), 105, 107, 215, and 309. This book will be cited in the text as EN for all subsequent references.

11. James W. Garrison and Emanuel I. Shargel, "Dewey and Husserl: A Surprising Convergence of Themes," *Educational Theory* 38 no. 2 (Spring 1988): 239–247.

12. Carmen Lopez Saenz, "The Child, the School, and Philosophy: A Phenomenological Reflection," *Thinking* 15 no. 2 (2000): 34–39.

13. Alfred Schutz, *On Phenomenology and Social Relations*, Helmut R. Wagner, ed. (Chicago: University of Chicago Press, 1970), 73-76 and 320.

14. Ernesto Spinelli, *The Interpreted World: An Introduction to Phenomenological Psychology* (London: SAGE Publications, 1989), 192

15. Edmund Husserl, *The Crisis of European Sciences* and *Transcendental Phenomenology: An Introduction to Phenomenology* trans. David Carr (Evanston, IL: Northwestern University Press, 1970), 31.

16. John Dewey, *Democracy and Education: An Introduction to the Philosophy of Education* (New York: The Free Press, 1966), 153–154.

17. Garrison and Shargel, "Dewey and Husserl," 245.

18. For some recent substantive studies employing mathematics to model the experiences of study subjects see Linda Moneyham, Brenda Seals, Richard Sowell, Michael Hennessy, Alice Demi, and Shannon Brake, "The Impact of HIV on Emotional Distress of Infected Women: Cognitive Appraisal and Coping as Mediators," *Scholarly Inquiry for Nursing Practice: An International Journal* 11, no. 2 (1997): 125-145 and Richard Sowell, et al., "Spiritual Activities as a Resistance Resource for Women with Human Immunodeficiency Virus," *Nursing Research*, 49, no. 2 (March/April 2000): 73–82. For methodological background see Herbert B. Asher, *Causal Modeling* (Beverly Hills, CA: SAGE Publications, Inc., 1976) and Janice M. Morse, Janice Swanson, and Anton J. Kuzel, eds. *The Nature of Qualitative Evidence* (Thousand Oaks, CA: SAGE Publications, 2001).

I wish to thank Haithe Anderson and two anonymous reviewers of this essay for useful criticism of an early draft of it.