Happy Seventy Fifth: A Hedge Against Insularity

For as long as I can remember I thought of myself as a teacher. After all, I belonged to XYZ—a math tutoring society in high school. In college I was a member of the college tutoring society. One small event while in college, however, should have given me a clue that I had a lot to learn.

In my senior year at college, I was a substitute teacher one day for a friend of mine who was a teacher of a third grade class. After about twenty minutes of doing mathematics with them after lunch, the kids began to clamor for their homework assignment. I had not actually given any thought to homework, but since they wanted it, I made something up on the spot. I felt good about the fact that third graders were so interested in what I was teaching that they wanted more. As soon as I gave the assignment, the class rose in unison and walked out the door. When I spoke to my friend that night, he told me that assigning homework was always the last event of the day, and that once they had gotten the assignment, they knew that school had ended and they were free to leave!

Of course, the fact that I had tried to impart to third graders the wonders of finite dimensional vector spaces—a topic I was studying in a graduate mathematics course in college at the time—may have had something to do with their desire to exit as quickly as possible. As I said, I had a lot to learn.

UB'S GRADUATE SCHOOL OF EDUCATION: A "MOVING" EVENT

Some of that learning took place as a graduate student and faculty member at Harvard's Graduate School of Education between 1960 and 1972. It was there that I began the transformation from teacher (naïve at best) to educator. The bulk of that transformation, however, took place between 1973 and 1998 during my tenure as a faculty member of the Graduate School of Education at UB. What impresses me most is how much I was encouraged to use those years as a hedge against insularity. One of the most significant contributory events occurred in 1982 under the direction of our new dean, Hugh Petrie. It was the laborious and painful act of the reorganization of GSE.

When I first joined the faculty, I was a member of the mathematics education area. It was one of about ten disparate areas, each with some degree of structural autonomy. That reorganization streamlined these disparate subprograms into three main units: (1) Learning and Instruction, (2) Educational Organization, Administration and Policy, and (3) Counseling and Educational Psychology. Being the Hamlet that I am, I was not able to select just *one* department that best defined my interests. I chose (1) and (2).

These two departments captured my interest in mathematics education and philosophy of education, respectively. Consolidation and name change could possibly be viewed as pouring old wine into new vessels. That was not the case for me. It had the psychological effect of breaking up fiefdoms, encouraging greater scholarly and teaching collaboration with colleagues and graduate students, and (in my case) validating an area of interest (philosophy of education) that was perceived by many as tangentially related to mathematics. A dual commitment, however, was not without its tension, for it limited the number of meetings I could attend and it encroached upon the time I could spend on activities in each area. I was fortunate to have received generous support from many of my colleagues, who may have felt slighted by my decision.

Even before formal reorganization, however, I had begun to collaborate in teaching and writing with Gerry Rising, as we sought alternatives to what was then a highly quantitative and limited view of research in mathematics education. The collaboration was both joyful and supportive.

MATHEMATICAL THINKING

One aspect of the dual affiliation is that it provided me with the courage to pursue and expand upon a more robust view of mathematics itself in relation to education. This was so regardless of the specific

department within which my course work was eventually taught. Implicit in this robust view is a challenge to mathematics as rule driven, impersonal, dependent exclusively on logical analysis, lacking in drama and conflicting points of view, sharing little in common with other fields of inquiry. When mathematics is viewed in relation to the "real world," it is usually seen as being applied to some real world situation. That is, it is seen as a *model* to explain, predict, and cleanse rather than as a discipline that shares important qualities with the ways in which we view the "messy" world.

Mathematics is often perceived (especially by scholars in other disciplines) as a field in which intelligence and hard work are the coin of the day, and if problems have not been solved, it is popularly believed that it is not because they are unsolvable, but rather that they may not have been well formed. Such a view has been rigorously demonstrated to be mistaken. In the 1930s, Kurt Gödel proved that within any "interesting" mathematical system, there must exist true statements that cannot be proven. Furthermore, we often cannot tell if the recalcitrance of a problem is a result of ignorance or its "Gödelian" quality.

Math as Problem Posing

One way of softening the above perceptions of mathematical thinking and of personalizing it as well, is to shift a focus from problem *solving* to problem *posing*. Much of the coursework I have taught at GSE had its origins in that domain. My early thinking about the topic derived from my co-teaching a course at Harvard with my colleague, Marion Walter in the 1960s. A defining moment occurred as we reflected upon an event in one of our classes. Having in mind a conclusion that we wanted the students to explore, we presented them with an algebraic statement: The Pythagorean relationship ($x^2 + y^2 = z^2$). Expecting students to come up with some well-known triples (like 3, 4, 5; and 5, 12, 13) we asked them for some answers.

In our discussion afterwards, we realized that we were asking them to "solve" a problem that had never been posed. In fact, it would be possible to view the equation as an inert statement, not requiring any reaction at all. At the time, we thought we had hit upon something interesting, but relatively minor. In fact, we had created a lifetime's worth of investigation.

This new focus led to questions such as: Given a problem, what can one do with it other than solve it? How can we go about posing problems? What are different starting points for posing problems? One of the many schemes that we came up with is one we deemed "What if Not" thinking. We investigated how we can perceive what we are "given" as being otherwise.

Math and X

One way in which I collaborated with graduate assistants was in teaching courses that acknowledged connections between mathematics and the real world—connections that highlighted qualities shared between mathematics and other ways of experiencing the world. Several different x's became the subject matter for math and x connections.

One of the earliest ones was Math and Magic. This was taught to students with an interest in early childhood education, as well as those who viewed themselves as focused primarily on more advanced subject matter. The purpose was to find wonder and surprise in a field that was frequently perceived as devoid of these qualities. We made use of card tricks, and concrete materials, events with unexpected probability, and a variety of anti-intuitive situations. The interaction between students who perceived themselves to be miles apart in terms of mathematical sophistication was itself a source of surprise. By use of models, some who were petrified of formal symbolism were able to understand and predict better than their supposedly more sophisticated colleagues what would happen when concrete materials were used to exemplify the symbolism. Eventually the students created a "math and real world" carnival as a culminating event to which the entire GSE community was invited. Students who helped organize the carnival were Joan Eschner and Betty Krist. Doctoral students who accompanied

me in expanding ideas of this course later on were Dorothy Buerk, Bernard Hoerbelt, Maureen O'Grady, and Fran Rosamond.

Another Math and X course was Math and Humor. I explored philosophical analyses of humor in general, and eventually applied those theories to mathematical areas. First, we sought to find common qualities that humor and mathematics enjoy (some being those from the Math and Magic course). Then we moved in another direction. Instead of asking what qualities math and humor share, we explored in a frontal way the humor that can be found in mathematics *per se*. An example of a "howler" is what turned out to be the first crack in solving a long time problem in number theory: that every even number greater than 2 can be expressed as the sum of two primes—a 1742 conjecture of Goldbach. No headway was made for nearly two centuries. Then Schnirelman proved that any even number greater than 2 can be expressed as a sum of not more than 300,000 primes! What theory(ies) of humor might explain what is so funny about that theorem?

Finally, I designed a course that selected x to be just *one* element from within the larger well established system {1,2,3,4,…}. What was behind this choice was the realization that courses are frequently defined in terms of a gradual accretion to include a wide variety of properties or topics. The implication is that once you have "covered" a topic, you move on. But what is involved in "covering" a topic? In order to push the envelope for reducing content as normally defined, I designed the entire course around one concept as *foreground*, while others were background and used only to illuminate something about the foreground. I chose the *distributive property* as my example, and then spent the entire semester seeking what it might reveal about the nature of mathematics, and understanding/creating ideas. [If you answer the question "What is (83*62) + (17*62)?" completely in your head, you have used some form of the property]:

Some of the issues we discussed in Mathematics and Distributivity were:

- The rich interplay of algebraic and geometric thinking.
- An intuitive, playful, and non-technical exploration of the concept of "same-different" in mathematical thought with an implicit focus on the concept of isomorphism.
- A challenge to what is normally believed to be the logic of extending number systems to new territory.
- The role of imagery and metaphor in proof and understanding.
- The consequences of shifting background and foreground in our thinking.

[Tom Giambrone, a graduate student at the time, assisted me in teaching this course.]

Humanizing Mathematical Formats

As significant as content may be, the manner in which subject matter is learned has the potential to redefine the nature of the discipline as well as one's perception of self as student. My dominant model was that of class as editorial board—intended to place the student in the dual role of author and critic. I borrowed that from one of my most powerful educational experiences as a graduate student: member of the editorial board of the journal *Harvard Educational Review.*

Though selected by professors on the faculty, the editorial board of the journal is composed, not of seasoned academics, but of a dozen or so graduate students, who remained on the board for approximately two to three years. The board met bi-weekly for five to seven hours at a stretch in order to discuss and evaluate articles that had been submitted by scholars from throughout the world. The identity of the authors was not revealed to us until after we had evaluated their essays. The discussions were invigorating, and we were all expected to operate as if we were competent to judge articles that were usually outside each of our areas of specialization. In each case the board would decide whether to accept, reject, or require revisions for each article. With the "chutzpah" of neophytes, we rejected over ninety percent of them. What was humbling, however, is that we had to compose detailed letters of

evaluation for each article we read, and especially for those we rejected. What was particularly embarrassing was the occasional need to craft a letter of rejection when an author turned out to be a doctoral advisor for some of the board members.

Though it went through many stages of revision, I adapted major pieces of this model in the teaching of several courses. I organized the class into three or four editorial boards, and the students assumed the roles of both author and critic. As authors, they submitted their articles anonymously to editorial boards of which they were not members; as critics, they read and evaluated articles submitted by students from other editorial boards. Each board then created a journal that consisted of articles they had accepted, which sometimes included earlier drafts of ones that had been revised based upon initial criticism.

What was particularly challenging was dealing in an open way with the organizational issues that arose in teaching it. Students were sometimes concerned about matters of compatibility with their editorial board colleagues. They also occasionally found it difficult to evaluate articles written by their classmates. Though everything was done to temper the unusually high rejection rate of articles submitted to the *Harvard Educational Review,* in some courses, students wanted recourse when they felt their articles had been judged unfairly. Frequently they came up with excellent suggestions for revising the format of the journal they produced. The issues raised by these conversations were personal in nature and were frequently as educationally valuable as the actual subject matter of the course. In recent years, Tom Schroeder and Deborah Moore-Russo in the Department of Learning and Instruction adopted versions of that format for their own problem posing courses, and they have offered some valuable criticism and improvement.

I introduced two other formats in course work that had the potential to redefine not only classroom discourse, but a conception of knowledge in mathematics. In one (with my graduate assistant, Fred Reiner), we explored the use of the Talmudic format—a text that was devised over two thousand years ago for the study of religious issues—and applied it to secular study. The format is particularly interesting because the actual page of the Talmud has dialogue and debate built in. A conflict is presented in the center section of the page and, around that, text layers of commentary appear that attempt to cope with it. We created positioning of the commentary on each page to indicate by its location the category of the conflict.

I designed the second "novel" format for students in the undergraduate honors program. In an effort to expand their view of mathematics, my graduate student Raffaella Borasi and I created several vignettes dealing with youngsters who are trying to understand such non-intuitive ideas as the following: "If I were a very small bee crawling along a number line from zero as a starting point, what would be the first number my feet might touch?"

Such thinking seeks a common theme in mathematics and theology. In both cases, we are flirting with some form of the question: "What is the first?" There is much possibility for debate here. We can explore questions like: "Are the two situations analogous?" The mathematical question assumes a starting point, 0. The one about the first act in the creation of the universe appears not to. "How does that difference affect how we view the two questions in relation to each other?"

Eventually I introduced them to a mathematical novel I had written entitled *Posing Mathematically*. It involves a number of different perspectives regarding what is or should be expected of students and what is involved in mathematical thinking. The protagonists are two teachers who come across the value of thinking of mathematics as problem posing, and wonder how to introduce their ideas to teachers. In self-referential spirit, the protagonists decide to write a novel on problem posing. Students then wrote their own short stories based upon different mathematical ideas that had intrigued them for one reason or another.

NON- MATHEMATICAL CONTEXTS

Once GSE had been re-organized, there were a number of collaborations that enabled me to continue to expand and redefine my interests. Within the Department of Educational Organization, Administration, and Policy (whose name was subsequently changed to Educational Leadership and Policy), philosopher of education, David Nyberg, and I began sharing both published work and drafts of work in progress. We decided to co-teach a course on ethics and education.

At about the same time, having just become a member of that newly formed department, I designed the first department-wide required course together with Marjorie Hanson (professor from educational administration) and my graduate assistant, Randy Hollister (philosophy of education). It was entitled The Nature of Inquiry. As much as we enjoyed teaching the course, the most intellectually stimulating part of the experience was our semester long preparation for it, especially as we considered and rejected many competing orientations among ourselves and in interviews with colleagues. That course has since undergone numerous transformations, but our version started with the assumption that how each of us inquires is largely a function of explicit as well as unarticulated *beliefs* about teaching, learning, the place of subject matter, our personalities, the comparative roles of education in formal and informal settings, and the sort of control we feel we need over a domain of inquiry (to name a few). We created research strategies to enable our students and ourselves to uncover implicit beliefs and prejudices that we all held in many of these categories.

Another course I devised in the newly formed department had the effect of tempering the seriousness of The Nature of Inquiry. The course, The Philosophy of Humor, divested from its intimate relationship to mathematics, was actually inspired by a wonderful compliment I had received many years before when I first started teaching. It turns out that my appointment as a junior faculty member at Harvard was to replace the brilliant satirist and songwriter, Tom Lehrer (of "That was the Week that Was" fame). While still a graduate student, I sat in on some of his classes, and I looked forward to his display of humor. Surprise: There was none! It was as if his popular performance, and his teaching persona were disjoint pieces of his personality. I vowed then not to hide myself as a person from my students, and in particular, I learned to share my humor with my classes not only as a form of integrating elements of my personality, and as a way of relaxing students, but as a vehicle for better understanding the development of ideas. I was successful to a degree (no pun intended) since my students who had taken course work with Tom Lehrer and with me told me that I was funnier than he…in the classroom. Unfortunately, I could not hold a candle to him on stage.

I began the humor course with a half a dozen jokes that I heard the philosopher Max Black of Cornell deliver. As he had done at the lecture, I challenged the class to come up with one coherent theory that covered what was funny in the disparate jokes. After trying to come up with a theory, we then read a number of philosophical essays that sought a unifying perspective, and again approached those jokes to see if we could find one that covered them all.

Another course I was able to create in the new department was entitled The Educational Potential of Problems. We explored philosophical perspectives on the concept of problem itself and on "near relatives" of it. Literature in the philosophy of science, as well as in social sciences was helpful. We dug deeply into personal issues related to differing levels of abstraction, inclinations to share problems, and interconnections with other problems.

A poignant letter written by Tamar Jacobson comments about the course:

> As I put [my] scrapbook together, I think about the 'journey' of this past semester as we talk about the nature of problems: whether we need to solve them, neutralize them, be perplexed by them, be confused by them, how to deal with them, how to solve them, what they look like, what they do not look

> like....Didn't we all learn from experience and experiencing this semester?….We were encouraged to think, deeply, about so many issues and problems. We had lots of responsibilities with and for each other and Steve shared equally in all. He taught us the spontaneity of confusion and neutralization. He helped us make life messy. What a relief from the illusion of sterile control…

Towards the end of my tenure at UB, I collaborated with Bob Stevenson on a course that is his specialty: Action Research. It was a field I knew essentially nothing about, and I learned an enormous amount—including something about resistance to new paradigms. My experience in assisting him in the course suggests that it might be quite valuable for an experienced professor in a field to invite a more naïve colleague to co-teach a course. Such feedback can be enormously helpful to a colleague who is deeply entrenched in the field.

In the early 1980s I began not only to expand my collaborative efforts, but chose to do so by integrating my teaching and scholarship in new ways. Having begun to mature in my evolution from teacher to educator, I had become interested in the philosophical underpinnings of the progressive education movement. Shortly after joining the John Dewey Society, they asked me to edit a collection of readings from their defunct journal (1924 through 1957) *Progressive Education*. Since the once popular journal had become inaccessible, but nevertheless timeless in its analysis of educational issues, I took on the daunting task of culling the best of articles from its thirty-four year history.

Influenced once more by my experience on the editorial board of the *Harvard Educational Review*, I taught several classes over a two-year period in which I essentially "anointed" advanced graduate students as the editorial board of the collection. I selected students with an interest in education from fields as diverse as philosophy, psychology, science, reading, foreign languages, administration, and mathematics. The last time I taught the course, it turned out to be the final UB course that most of them were taking. To a person, they commented on the value of the course as an opportunity to integrate disparate threads of their specialties. This observation surprised me since that was not the intention of the course, but it does challenge popular beliefs about what are useful integrating experiences following several years of specialization.

After significant input from these different editorial boards, I solicited the help of two people to assist me in preparing the final collection for publication. My co-authors of the published collection were Mary Finn (an historian of education, who taught a number of *ad hoc* courses at GSE) and Eileen T. Brown (a social psychologist and wife extraordinaire). They helped pare down the collection, and joined me in relating the articles to each other and to the field. Students involved were Raffaella Borasi, Laurie Castiglione, Sharon Cichocki, Robert Dishner, Larry Feldman, Randy Hollister, Herbert Hough, Hyacinth Iwoha, Larry Heikkila, James Hilty, Nancy Monaco, Ann Marie O'Donnell, Yael Paley, James Rank, Bruce Reopolis, Fay Roe, Margaret Stempien, and Sindy Vertlieb.

BOTH CLOSURE AND OPENSURE

In closing, I would like to thank the numerous students and colleagues who contributed their own memories of GSE experiences in a 2006 book (edited by Frances Rosamond and Larry Copes) commemorating my retirement entitled *Educational Transformations: The Influences of Stephen I. Brown*. Though my recollections here are focused a bit narrowly on my teaching as a source of memories, some may have a more universal quality. I have highlighted elements that were conducive to collaboration, to integrating teaching and research, to fostering personal growth, and to relating to students in a way that honored them as both specialists and generalists—even when many of them initially had reservations about their competence in both domains.

I am left not only with fond memories of friendships acquired with former students and faculty, but with an infinite number of cartons in my basement. They contain treasures of student-produced material, my letters to them commenting on their papers, all the assignments for each course, notes that I have gathered to suggest further exploration of ideas raised in each of the courses, and student evaluations and criticism of the teaching strategies that were sometimes perceived as bizarre. I look forward to culling through this material over the next few years and to unearthing potential treasures, given the perspective of time, and of new as well as recurring educational mantras. On the other hand, either a new life or a flood that would render all those cartons mildewed and unusable might be a welcome alternative. Perhaps it would lead to a state of nirvana to be able to experience a clean basement AND a clean slate as integrally connected.

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