

Special Section: On the publication of the 26th issue of the Humanistic Mathematics Network Journal

Emerson said (and I'm sorry for not having the exact quote), that every institution is the work of a man. We can think about that on two levels; Alvin kept the torch burning for the rest of us to be sure, but the shadow of the man is also the "human" in Humanistic Mathematics.

The past decades have seen mathematics in unimaginable transition. The WWII years may have been a period which experienced an admirable collaboration of thinker, but its legacy, the 50's, was a period in which you had to take sides: "applied" or "pure." Either way you were stuck.

In the 60's, pure math was filtering into textbooks to create what might be (in your mind) "the only decent Calculus book" or something entirely unreadable. One-third of the female freshman class at Brown/Pembroke in those Sputnik years declared math as their incoming major; but non-standard analysis killed most of them off. Often a student's text was the teacher's notes, and that minimal, purple-printed test asked you to prove the Fundamental Theorem of Calculus and solve some problems. (Perhaps your text had problems, but there weren't many!)

In the 70's, during the Vietnam War we saw the vague emergence of the computer and simultaneously distrust began to brew about putting pure mathematicians into the position of guardians of engineering research centers. I remember teaching at Washington and Lee in those days, trying my hardest to persuade my class that the computer would be useful! (We were using it to add three floating point numbers and if your punch cards didn't spill all over the floor in transit to the computer room, you found Fortran couldn't do the problem accurately.)

The 80's were a period good for women and minorities. Cultural concerns, including issues of teaching flourished. Note, 1986 marks the inception of the Humanistic Math Network.

The 90's! What can one say? They went by in a micro-second, raising issues of the calculator, the computer and the web, but equally, a brand new interest in teaching (e.g. calculus reform). Teaching can be the "tar-baby" of mathematics, and we have to temper our interest in being converts to a religion-of-one with the needs of unthinking, financially driven governing bodies.

How then will we, in the future, hang onto the spirit of humanism, collaboration, and gentleness that learners from previous decades enjoyed and shared? My own feelings are quite optimistic. We are again benefiting from the blending of the applied and the pure, and we have a greater awareness of student-teacher relations and issues of assessment with which we must always focus on the need to possibly remodel ourselves.

To create this last issue of the "hand-held" HMNJ, I essentially asked Alvin to step aside as I asked for contributors from the journal's past. Touching these people enriched me. It reminded me of all that was best about mathematics; the people I contacted were people whose books or articles I may have read, in some comfortable reading corner—books "about" mathematics—how we do it and what we mean by it and why we do it. But there are many warm and wonderful members in my immediate mathematical community.

Web generation we now may be, and the terms of the web will be broader, more scattered, faster and yet more time-consuming. But we can exploit the web version of HMNJ by tuning in, to create a new community which retains that understanding of the "human" for which our institution of mathematics is merely the shadow. Thanks, Alvin, for keeping us remembering!

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Alvin White and the HMNJ

When I first met Al White at the winter mathematics meeting in San Antonio in 1987, I already knew his name. We both had links to Stefan Bergman. Alvin did his doctoral dissertation under Bergman at Stanford, and I, a few years previously, had been a graduate student taking Bergman's courses (at Harvard) and later post doc'd for him. Al and I both had high regard for Bergman as a human being, which was not always the case in the mathematical community. This was an initial basis for our friendship. The second basis and more significant one, was our mutual concern for the humanistic aspects of mathematics, however you care to define that term.

Al saw the need for a periodical devoted to promoting the humanistic aspects of mathematics. In those days he was one of the few voices crying in a wilderness of unreflective accomplishment. He told me about the HMNJ and his plans for it. I was fooled by his soft-spoken and occasionally stumbling manner. But Al carried through with his plans.

Things don't just happen; they don't just sprout like mushrooms after a penetrating rain. When one looks closely, there is always an individual who conceives, then creates and nurtures what has been created. In the case of the HMNJ, that person is Alvin White, and over the years the journal has become the leading outlet disseminating articles on the humanistic aspects of mathematics. I congratulate Al for piloting the HMNJ with skill for so many years and I hope he will be able to guide it through its present crisis.

Today when, on the one hand, society is ever increasingly mathematized, and when, on the other hand, mathematics offers many an escape from the difficult dilemmas of civilization, the necessity of relating mathematics to the lives of those who create it and those who are affected by it is increasingly important. Hence the need for reflecting on and publicizing such reflections. Looking over several past issues of the HMNJ, I observe that it contains a wide variety of subjects. There are, among others, didactics at all levels of instruction; biography; linguistics; heuristics; methodology; history and futurology; esthetic; poetry; the spiritual element; women's issues; ethnomathematical issues, book reviews.

What I, personally, would like to see in future issues of the HMNJ is much more discussion of how mathematics has entered our daily lives and what its effects have been for good, for bad, or for neither. As examples, (some of which have indeed been discussed in past issues), product striping, ATM's, voting schemes, the impossibility of counting (census results are a matter of litigation), other parts of mathematics that are litigious (e.g., what math can be copyright), use of mathematical statistics as court evidence, the role of mathematics in social and economic decision making, gambling schemes, the role of mathematics in "green" issues, the role of mathematics in defense.

Thus, referring to the last topic, there is to be in August of this year a conference in Sweden discussing the role of mathematics in war. I would think that a number of papers presented at this conference would be appropriate material for reprinting in the HMNJ. What I would caution against is the HMNJ becoming a journal that deals more and more with classroom issues. There are many journals that concern themselves with pedagogical techniques and curricular questions. There are indeed serious problems in the classroom that need consideration, but despite the inadequacies in the teaching and learning of mathematics, the fact is that the mathematization of society is going forward at an increasing pace, often set in position by the fiat of a techno-competent elite, and which require constant reexamination and discussion. The HMNJ should be characterized by its concern for the problems that mathematizations create.

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Reflections on the Founder

For me, the Humanistic Mathematics Network is inextricably linked with Alvin White, its founder and editor. In this special edition of the Journal, it is probably appropriate to describe what I know of Al, a man whose life and career embody the principles that the many readers of the newsletter find so compelling.

My first meeting with Al White has become a caricature in my mind; the remembered emotion of the events has exaggerated the details. This is probably not what happened, but it is what I remember happening.

I came to Harvey Mudd College for one semester to teach a few courses. Al had written me a very kind e-mail to welcome me, and so I decided to stop by his office and introduce myself. He was seated with a student, both of them at a desk far across the vast room from where I stood in the doorway. I stuck my head in the room; I excused the interruption to say my name; I said that I would come back later.

But Al jumped up, papers flying from him the way pigeons fly from a cat. He clambered past piles upon piles of books to grasp my hand in both of his. Welcome, he said, and I am so glad to meet you. He asked me about an article I had written about mathematical writing, and gazed into my eyes earnestly while he professed his own passion for teaching. For several minutes he explained his philosophy on the importance of teaching well, of communicating well, of keeping the next generation always in mind. Students, he said, students come first. Always. I remember looking past Al at the student still sitting on the chair by the desk, on the other side of piles of books, on the far side of a vast room. Al followed my gaze back and laughed at himself. It is so good to have you here, he said to me, and he clambered back to his student.

My deepest obligation to Al is for a panel discussion that he organized. I was still a young, untenured mathematician, but Al invited me to be one of the panelists. On one side of me sat Leonard Gilman, the author of "Writing Mathematics Well", and whom I had idolized from afar. On the other side sat JoAnne Growney, a mathematician/poet whose books still travel back and forth between my shelves and my lap.

I remember Leonard Gilman playing the piano to describe mathematics in music, and I remember that JoAnne Growney read poems of her own and of others. (I don't really remember what I did at all, but maybe you do: there were 500 people or so in the audience). It was a wonderful evening, and a wonderful opportunity, and I am deeply grateful to Al for including me.

Alvin White has made his career at a small school (about 600 students) that is probably the only Liberal Arts/engineering School in the nation. While you might think that this combination would naturally engender a newsletter like "Humanistic Mathematics", in fact I found during my semester there that the students (and even many of the faculty) were invariably practical-minded, with little room for fluff. Given the choice between truth and beauty, they would choose truth.

And yet Alvin White began a journal-and a national movement-that combines mathematics with poetry, that says that people come first, that defines mathematics as a human endeavor. Given the choice between truth and beauty, Al does not choose. Instead, like Plato and Keats, Alvin White says there is no choice:

Truth is beauty, and beauty is truth: that is all ye know, or need know, on earth.

Thank you, Al!

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On the Twenty-Sixth Edition of HMNJ

I am indeed saddened by the news that HMNJ in its hard copy form will be coming to an end. I'm grateful that EXXON has supported it as it has. But I don't think on-line journals are nearly as useful, as they are hard to read and often text and diagrams get changed on the screen as far as layout is concerned. Anyway, online journals are much harder to keep track of. With HMNJ, I often recall the color of the issue even if not the date, so can find it again more easily. Also, I can browse through it by my nightstand—something I can't do if it is only on the computer!

Nevertheless, while hoping that the HMNJ continues to be a fruitful place to visit online, something must be said about what it has been til now. Namely, it has been a unique place for publishing diverse kinds of articles. For example, where else could long, valuable, and thoughtful articles like, "Will you Still be Teaching in the Twenty-First Century" (#23), "Tilings in Art and Science" (#12), and the timeless, "The Classroom Encounter" be found?

Also, the book reviews have been very thoughtful. Thinking of this as the last issue, I now wish I had shown my appreciation to Alvin more directly, and certainly I never thought of writing to EXXON to tell them what a valuable contribution they made.

So if nothing else, I do want, in this last issue, to thank Alvin for his vision, which he created this journal and for all the hard work he put into it. I think he and the journal have given encouragement to a lot of people whose work and teaching will have greatly benefited from it. His great chapter, "Teaching Mathematics as if Students Mattered," in the book "Teaching as if Students Mattered" (1985), should be read by older folk again, or used to introduce younger ones who have never heard of this book, to ideas now considered innovative, published over 15 years ago. I think this chapter is even more relevant now than then because of the onslaught of testing and the "TELL the facts" type of teaching.

AN ALPHABET FOR THE TWENTY-SIXTH EDITION OF HMNJ

Alvin with his ideas of the need to teach
Better by encouraging

Concepts and
Dialogues
Encouraged us all to learn about
Fascinating subject matter with
Good ideas.
Humanistically Hearing (not just listening) and providing
Inspiration and Intuition tempered with
Judgment and always with
Kindness, he showed us
Learning that
Matters, that seems
Natural, that
Opens students' eyes to
Posing of problems and
Question-asking, together with
Reaching to
Solve those problems by
Thinking in new ways—
Usefully, and in a
Variety of ways, demonstrating the importance of
Writing.
eXxon supported this journal over the
Years so as to provide us with the
Zest to continue our teaching so others, too, will love
math.

Good luck to the HMNJ of the future!

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Being an editor of a periodical is a tedious, thankless job. So many details to worry about. So many chances to do or not do something that somebody will complain about. When readers are satisfied, they thank the author, not the editor. When they are dissatisfied, they blame the editor, not the people who could have contributed articles but didn't get around to it.

And then, what about the courageous, heroic individual who actually dares to found a new publication, and that newsletter miraculously makes it, endures, finds an angel and an audience! Do we remember him or her, when years later we benefit from his or her creative and daring impulse?

So, I say that what Alvin has done is awesome. Now, what about the down side? HMNJ—(Alvin White, actually) accepts what comes. Some is more original, some less. Some is less profound, some is more. The literary-scientific quality of each issue has to be variable. But it is authentic! HMNL is a an outlet, a vehicle for the large inchoate mass of math teachers who want to humanize mathematics. As such, it is incomparable and irreplaceable.

Thanks, Alvin.

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Humanistic Educational Mathematics

My first memory of the notion of (if not the term) humanistic mathematics is of the Pasadena meeting of mathematics educators in March of 1986. Alvin White assembled quite a few impressive people, including some of my heroes of the time and later. We had a great time not reaching consensus about what humanistic mathematics was.

Fortunately, the lack of consensus didn't deter Alvin from forming the network and newsletter. Without a need for consensus on the definition of the term, members seem to fall into at least one of two camps: embracing mathematics as a human activity (usually meaning as part of humanities, having strong connections to literature and history and the fine arts), or teaching mathematics with attention to how humans think and feel and learn.

My own interest is in teaching mathematics as a means of educating humans. I use "educating" in the sense of encouraging development in intellectual, ethical, and identity domains. I'm especially interested in the maturing of peoples' conceptions of knowledge, as described by Perry (1970) from believing that every statement is either right or wrong to seeing truth as relative to context. As Perry found, this cognitive development is intertwined with ethical and identity development. Letting students in on the ambiguity, warmth, imperfections, and elegance of this field that is commonly seen as precise and austere and perfect

can help shock them out of the comfort of a black and white world.

So I'm interested not so much in mathematics education-i.e., in helping students come to attain mathematical skills or to understand mathematical ideas or even to "think like mathematicians'~-but in how mathematics can be taught to enhance education. Back in the 1970's, Steve Brown coined the term "educational mathematics" for that interest-a term included in the title of the Institute I direct. That Steve continues to share this interest is evident in his most recent book (Brown, 2001).

Educational mathematics depends on humanistic mathematics in a variety of ways. To use mathematics as a tool for education, we need to be aware of how humans think and feel and learn. We can use links with humanities astorce to encourage students to grow and change. But the goals are somewhat different. And, while focused on these goals, the major issues of mathematics education-reform curricula, assessment, etc.-are of interest only peripherally. I've written about these issues in various places, and I support myself by working with them, but what I consider my most enthusiastic publications have been about using mathematics to encourage development on the Perry Scheme (e.g., Copes, 1982, 1993).

What about the future of humanistic mathematics education and educational mathematics? To the extent that, as Postman & Weingartner (1969) claim, teaching is a subversive activity, many teachers will continue to teach humanistic mathematics by teaching humanely. A few will communicate the aspects of the field that make mathematics like the humanities.

As for educational mathematics, I suspect that we are not much further ahead than we were 20 years ago. NCTM's influential publications (1989, 2000) ignore this role of mathematics. The reform movement refers to areas outside mathematics only as a source of applications or as a means to help students understand mathematics better. The political battles are about what to teach of and about mathematics: primarily, as facts and procedures or as a set of tools for problem-solving. The justification of mathematics as a means to the end of self actualization isn't appearing in the newspapers.

But learning is a subversive activity as well. I am optimistic that many students, with or without the help of teachers, will experience mathematics in ways that encourage their own development.

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It is hard to say what is the BEST thing about Al White, but one VERY GOOD thing is that he always has time to hear and consider new ideas. The Humanistic Mathematics Network and its journal have for many years provided a source and a forum for the new and the different as well as the old and not-to-be-forgotten.

As a mathematician with strong interests in literature and the arts, I was delighted to find, through HMN, others with similar interests. Al White has been untiring in his support of special sessions at national meetings and journal publication so that teachers and mathematicians of diverse interests may exchange ideas.

Now a poet, my memories of HMNJ focus particularly on poetry from it and I am ever grateful that I met on its pages the Czech poet, Miroslav Holub (1923-

98). Both a scientist (an immunologist) and a poet, Holub's interests paralleled my own and he has become a favorite poet for me.

Below I include a brief poem by Miroslav Holub (translated from the Czech by Ewald Osers) that has been included in *NUMBERS AND FACES: A Collection of Poems With Mathematical Imagery*, an HMN publication that Al and I worked on together in 2001.

THE PARALLEL SYNDROME

Two parallels
always meet
when we draw them by our own hand.
The question is only
whether in front of us
or behind us.
Whether that train in the distance
is coming
or going.

Al's contributions to mathematics and its teaching are legion. He has had new ideas when others were dormant; he has continued when others were idle. He has lived, at least, nine lives. Always a supporter of the artists among mathematicians the visual artists, the musicians, the writers. I have appreciated his support of my poetry and close with this brief poem of my own.

GOOD FORTUNE

is good numbers,
the length of a furrow,
the count of years,
the depth of a broken heart,
the cost of camouflage,
the volume of tears.

Alvin White, may you always have good numbers!

Thank you for your years as chief of the Humanistic Mathematics Network and as editor of the Humanistic Mathematics Network Journal (and, before it, the Newsletter). I am sorry that the years of paper publication have ended for I love the feel of paper in my hands; however, I will find HMNJ on-line, and I hope everyone else does too.

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Teaching as Though Students Mattered

A BIOGRAPHY OF ALVIN WHITE AS TOLD TO SANDRA KEITH



I was born 1925 in New York; served in the U.S. Navy in 1943-1946 during WWII; was sent to Radio Technician School and then served in the Pacific (the battle of Okinawa). Subsequently, I was sent back to the States for Officer Training School at Columbia University. I graduated from Columbia College in 1949 with a major in math but I took many other subjects, of course. Among my most memorable professors and courses were Moses Hadas teaching "Greek and Roman Mythology" and Bernard Stem in "The Family Past and Present." I feel I learned the most (and got the most enjoyment) from one course that required me to write a paper independently in Autumn and Spring term; in that course, I chose to learn and write about the history of public housing in New York City. Special apartment houses had been built in New York City for the waves of immigrants coming to the USA in the early part of the 20th century. These early houses were instant slums. Eventually, a law was passed that required every room to have a window; even that minimal ruling was barely satisfied. But I spent many happy hours in the Columbia Architectural Library reading Jane Jacobs and other architects and historians on the history and progress (albeit slow) toward improving public housing.

I received an MA in math from UCLA and went on to Palo Alto where I enrolled at Stanford. I worked with Stefan Bergman on partial differential equations re-

lated to fluid dynamics and received my Ph.D. 1961. I was hired by Harvey Mudd College, but spent the year 1961- 1962 at the Math Research Center at the University of Wisconsin, Madison.

While teaching traditional courses at HMC, I had found and read "Freedom to Learn," by Carl Rogers. As an attempt to apply my understanding of Rogers' book, I offered a seminar on Calculus of Variations in my living room. I received a small grant to purchase portable blackboards (green actually) and bean bags for sitting. (I visited the California Institute of Technology some time later and found that they had a room similarly furnished that was used every hour by many departments to teach various courses!) I wanted the course to be "student centered", as I understood that concept. At the first meeting I introduced ten or twelve books on the subject and explained the problems and topics from the early history of the subject. Each student was to report on a topic. I met with those six students once a week for three hours. As it worked out the students' reports paralleled the usual course. The reports were also distributed and used. But at the end of the course some students remarked, "I enjoyed the seminar and learned a lot. But I think that I would have learned more with lectures and a textbook." I was not aware of anyone teaching mathematics in this way at that time.

I tried to publish my experiences in that course with "The American Mathematical Monthly" but was rejected with the remark, "No numerical data." However, Carl Rogers, while guest editor of the journal *Education*, published my article under the title "Humanistic Math: An Experiment." A physicist from Purdue was inspired by another book by Carl Rogers and also taught a laboratory course in physics in the same student-centered manner. His students had a similar response:

"We enjoyed the course but we would have learned more with a text and lectures." His comment, in an article, was: "I doubt that they would have learned more ... although they might have suffered more."

In the early 70's, I began to organize informal, interdisciplinary discussions among faculty of the Claremont Colleges. The discussions drew not only mathematicians but physicists, philosophers, histori-

ans, and psychologists. At this time, writing unsuccessful grant proposals was to become a repeated occupation of mine. In 1976-77, however, I was one of ten Danforth Faculty Fellows awarded year-long grants to study at various universities. I studied at Stanford, took a short stay at Northwestern, and spent the spring semester at Massachusetts Institute of Technology (MIT)-Harvard, where I taught a seminar at the Division for Study and Research in Education (DSRE). The seminar was described by a set of questions:

"How does one acquire knowledge? What are the limits of certainty? What is the relationship between scientific knowledge and general knowledge? What is the role of beauty, simplicity or intuition in creative discovery? Our present knowledge in the arts, humanities and sciences is the legacy of creative imagination. How can this legacy influence education at all levels?"

There were twelve students in the course, representing Math, Art, Linguistics, Electrical Engineering, Biology, Artificial Intelligence, and Computer Science. We sat around a table discussing our readings and thoughts. We met twice, for an hour and a half, the first week. After that, everyone dropped their other courses and we ended up meeting the whole morning until we were eventually displaced by lunch hour. We became a community that cared for one another and learned from each other. Students invited other professors to participate. Visitors to MIT-DSRE would ask permission to observe quietly, although they usually joined in the discussion. One student remarked that the popularity of our seminar among visitors was probably due to the openness, honest listening and caring that were evident. We accepted all contributions in a non-judgmental way. No one was forced to speak, and everyone had a chance to speak. In that course, we examined writings of Dewey, Kant, Polanyi, Russell and others. The last week of the term became a time to discuss and evaluate the seminar. Why was it so successful? What had happened to us? How had we been transformed from a mere collection of strangers to a group of friends and colleagues? It was as if we had chanced upon a semester-long celebration, and, like Alain-Foumier's "Wanderer," we had been caught up in the "spirit of the place." A student observed that this was the first course where her

presence in the room had "made a difference." We wondered: what had we learned and what should we do if we wanted to find that spirit of celebration again? An unexpected answer emerged, one that simultaneously addressed some of the questions of the seminar as well as questions about the seminar. The answer from one of the students was: "we learned with love and trust." This was more food for thought: what did that response mean? In my opinion, the meaning is well discussed in E.A. Burt's book: "In Search of Philosophic Understanding."

After I returned to HMC from MIT and the exciting, warm relationships that I had experienced there with students, I was disappointed by the relationships that students assumed or insisted upon between them and me as their teacher at HMC. To them the classroom could not be a community of mutual learning and teaching, and for some there was an invisible line between teacher and students. In an attempt to overcome some of these barriers, I started teaching my course in Calculus upon returning to HMC by reading with the class, J. Bronowski, "Science and Human Values." I wanted to investigate with my class Bronowski's statement that "the society of scientists is more important than their discoveries. What science has to teach us here is not its techniques but its spirit: the irresistible urge to explore." I have to admire the students' tolerance. Their fear was that they would not understand calculus and that we would not complete the syllabus. As it turned out, we completed the syllabus with time to spare, and students and I agreed that they understood the calculus more deeply than they would have in a traditional course of straight lectures. In addition to homework problems, students were encouraged to modify problems, for example, by increasing the dimension of the space or by changing a constant to a variable. They invented original problems and challenged classmates to solve problems. We also consulted several textbooks although we followed, more or less, the traditional syllabus of the "official" department text. Instead of one text, however, the students consulted at least two books for each topic in the course outline. The hope was that the difference in approach and notation would motivate the students to a deeper understanding of the material. Most students commented that the multiple text approach resulted in a deeper, more creative understanding of the material although it took more effort.

Although some calculus texts have over 500 pages, these books may represent a narrow path of the known. The problems students invented, for which solutions were known or not, were given to the class as challenges which many students accepted. They struggled, guessed, reasoned by analogy and tested their tentative solutions. Many students were highly motivated by these challenges. We were a society participating in doing mathematics. It often happened that a problem that was impossible to solve was the topic of a future chapter, which led us into the new material naturally. The most controversial (at the time) innovation was the cooperative exam where the whole class could discuss the problems and solutions. Students could not catch on to this idea on the first exam, but the second exam was more successful with students learning more by cooperating. My hope was to use cooperative exams to bring intellectual excitement into the mathematics classroom. One student, in a later evaluation, remarked that the cooperative exam was "one of the best of the innovations but is not suitable for performance evaluation."

In those experimental classes at HMC, in addition to cooperative testing, term papers were required. Students were asked to write a term paper on any topic. There were essays on creativity, responsibility of scientists, fractional integration, computer generated poetry and other topics. Class time was spent answering questions, comparing different approaches, and discussing invented problems and non traditional problems. The non traditional material and approach gave us insights about mathematics and learning that were wholly unexpected. Many students responded positively (one a year later!) and some were indifferent. A few were hostile. But class attendance was consistently high. Section A of the class then sent a message to section B, inviting them to meet in a large lecture hall on the weekend to discuss some solutions to problems. One student presented a solution that was rejected. Another student presented a different solution. There was arguing and some shouting. Finally a solution was presented that survived criticism. A consensus was achieved. The students were exhilarated. Most students remarked how much they had learned and how good they felt about themselves and their relationship to the material. In "A New Paradigm for the Mathematics Classroom" (*Int. J. Math Educ. Sci Technol* 1976 vol7, no2) I raised a number of issues..

Mathematics is exciting. Can it compete with a literature course where students are caught up in the intellectual clash of ideas? Can students recognize mathematics as a creative activity? After the article was published, I learned of others who had tried cooperative testing, some of whom were inspired by my account.

Before I embarked on my Danforth Fellowship, my colleagues and I submitted a proposal to FIPSE in 1976: "New, Interdisciplinary, Holistic Approaches to Teaching and Learning." The beginnings were informal, interdisciplinary discussions that I had organized among the faculties of the Claremont Colleges. While I was at MIT, I learned that proposal was denied. One reviewer said the idea was trivial; another said it was impossible! I traveled to Washington, DC, to consult with the FIPSE staff, who encouraged me to reapply the next year. The second application to FIPSE was successful and resulted in a three-year grant. Faculty from six colleges (all of the Claremont Colleges, a nearby state college and the neighboring community colleges) participated. The goal of the project was to make every participant an interdisciplinary scholar/teacher—to introduce scientists to the humanists' viewpoint and knowledge-and visa versa. Each faculty member was encouraged to understand and appreciate the viewpoints and problems of the whole range of knowledge. Prominent scholars from all over the US came to speak to us. We had as many as two speakers with discussions per day, every academic day for three years. A project which had begun as a personal vision of a few became a major part of faculty culture. Approaches that were first viewed with skepticism became accepted and even expected. Ideas which were on the radical fringes of academe about the benefit of integrating the sciences and humanities moved into the main stream of desired educational outcomes. Some faculty members who were timid about trying new modes of teaching or introducing new content, such as values and ethics, were supported and encouraged by the newly created setting. For example a chemist introduced humanistic themes into his classes and began holding discussions in his classes. We ended on a high note, with a three-day conference addressed by some of the nations' leading educators. Among the presenters were Nevitt Sanford of Berkeley's Wright Institute, Benson Snyder of DSRE and Harold Taylor of Sarah Lawrence. A participant commented that she had never expected to see any of

these educational leaders in person, but here she was seeing so many altogether!

After the FIPSE project I was elected president of SIGMA Xi, AAUP, and co-president of the faculty senate (not concurrently!) The FIPSE project, 1977-81 was an exciting time for me as well as for many faculty colleagues.

My interest in interdisciplinarity led me to solicit authors and articles for one of the Jossey-Bass series, "New Directions in Teaching and Learning (0)" titled "Interdisciplinary Teaching," which I edited. The other authors --Geoffrey Vickers, Ralph Ross, Kenneth Boulding, David Layzer, C. West Churchman, Richard M. Jones, Arthur Loeb, Owen Gingerich, Barbara Mowat, Carl Hertel, Miroslav Holub --were well-known people from many disciplines: Business, Law, Education, English Literature, General Systems Theory, Astronomy and Environmental Design. They included a professor of design science at Harvard whose degree in chemical physics led to a collaboration with R. Buckminster Fuller, a professor of art and environmental design, and a Czech poet who became chief research immunologist for Clinical and Experimental Medicine in Prague. My article in this series discussed my seminar at MIT, and gave the title, for the Jossey Bass Series (#21): "Teaching as Though Students Mattered."

All my experiences contributed to my seeing mathematics as one of the humanities. I wrote to the Exxon Foundation for a grant (of a million dollars) to develop the concept of Humanistic Mathematics; to create an approach to teaching and learning mathematics that would be nonthreatening, but inviting to students, who would participate in a cooperative spirit with each other and with teachers. My dean was very discouraging about the whole idea and the possibility of receiving the grant. Within a week of sending the letter to Exxon, however, I received a phone call from the program director, who wanted to discuss the proposal and negotiate the particulars. After three weeks of conversations on the phone he suggested that he could give me \$10,000 within a month to have a "Planning conference" for my colleagues and I to talk about the ideas and program of humanistic mathematics. There was no time for complicated arrangements and advertising. I asked some friends if they would come and recommend other friends for a three-

day conference. For me this would be a singular moment in time. As I recall, the attendants were Stephen Brown of SUNY Buffalo, Marion Walters of Oregon, Phil Davis of Brown, Reuben Hersh of New Mexico, Jeremy Kilpatrick of Georgia, Bob Borrelli of HMC, Paul Yale of Pomona College, Tom Tymozko of Smith College (who said at the 1992 Quebec meeting of ICME, "Alvin White started all this"), Sherman Stein of UC Davis, Ed Dubinsky of Purdue, a psychologist from Boston, two mathematicians from Cal Poly San Luis Obispo, several others, and myself -- thirty in all.

After three exciting days, we decided to start a newsletter; this was the birth of the Humanistic Mathematics Network Journal. Exxon Education Foundation graciously agreed to support this newsletter-journal. The first issue was sent out to thirty people, one year later in 1987. The second issue was sent to sixty people, and then distribution grew rapidly. The first three issues were unedited pages which I xeroxed and stapled together. The fourth issue was edited and retyped by Susie Hakansson's staff at the Graduate School of Education, UCLA. I arranged for it to be printed with a blue cover with a painting by Blake and a poem fragment by Milton. Subsequent issues have been typed by a student from Harvey Mudd College and printed by a local printer. It now became possible to edit the articles before printing. The Foundation continued to pay for hardware and software, typing, printing, and mailing the issues. The typing (production manager) has been a student. Proof reading and refereeing etc. are done by worldwide colleagues and myself. We have a minimum of promotion, but people hear of the journal by word of mouth or by mention in an article in another publication; they eventually subscribed by contacting me, usually through e-mail. Most articles have been sent to me unsolicited, although I have invited some articles and made requests to reprint some.

The launching of the journal was followed by a number of conferences and workshops on Humanistic Mathematics across the country--a session in Boston and another in New York. At the 1987 winter meeting of the math societies in San Antonio, I organized an afternoon panel on "Mathematics as a Humanistic Discipline," that lasted 4 or 5 hours. We held somewhat shorter sessions as well as poetry readings at subsequent national meetings as well as conferences

with the same title at a small Catholic college and a community college in New York.

A strong encounter in my life, although I'm not absolutely sure where it fits in, chronologically, was with the book "Personal Knowledge," by Michael Polanyi. I discovered it from a footnote in a paper by Abe Maslow that a psychologist at the campus counseling center had given me..

Every time I read Polynani's book, I underlined certain lines in colored pencil. When I reread it, I felt compelled again to underline many of the same passages in different colors. That cherished book is now quite personalized, in a colorful way. I cannot summarize the more than 400 pages of that book but I would like to close with a few tidbits and phrases From the preface "I start by rejecting the ideal of scientific detachment. In the exact sciences this false ideal is perhaps harmless, for it is in fact disregarded there by scientists. But ... it exercises a destructive influence in biology, psychology and sociology and falsifies our whole outlook beyond the domain of science.... "Tacit knowing is more fundamental than explicit knowing: we can know more than we can tell and we can tell nothing without relying on our awareness of things we may not be able to tell Thomas Kuhn in "Structure of Scientific Revolutions" expresses similar ideas. J.Hadamard in "The Psychology of Invention in the Mathematical Field" discusses the role of the unconscious in discovery and problem solving. According to Polanyi---" Such is the personal participation of the knower in all acts of understanding. But this does not make our understanding subjective. Comprehension is neither an arbitrary act nor a passive experience, but a responsible act claiming universal validity. Such knowing is objective in the sense of establishing contact with a hidden reality; a contact that is defined as the condition for anticipating an indeterminate range of yet unknown implications." Polyani mentions tacit skills of which we are not aware - such as swimming or riding a bike. "The complete objectivity as usually attributed to the exact sciences is a delusion and in fact a false ideal. "To learn by example is to submit to authority. You follow your master because you trust his manner of doing things even when you cannot analyze and account in detail for their effectiveness. By watching the master and emulating his efforts in the presence of his example, the apprentice unconsciously picks up the rules of the art, including those

which are not explicitly known to the master himself. These hidden rules can be assimilated only by a person who surrenders himself to that extent uncritically to the imitation of another."

When I first started to teach, my ambition was to present a complete and masterful lecture (and I have witnessed several such lectures.) After I read Polanyi and others, my ambition became not to present a perfect complete lecture, but to inspire my students (or rather, conspire with them) to become interested in the subject and learn the subject for its own sake. Perhaps I have made some progress toward that goal and have had some partial success, but I am continuing to learn in my teaching, now, at age 77.

Humanistic Mathematics: Personal Evolution and Excavations

Stephen I. Brown

The first online issue of HMNJ will feature a major article by Stephen Brown. To whet your appetite, we have included his introduction here.

Professionals from many different disciplines and perspectives who frequently do little more than greet each other politely, have come to appreciate, acknowledge, and even communicate with each other. Those interested in exploring a diversity of fields in relation to mathematics have set up tents around a bon fire that was lit by Alvin White's newsletter, *Humanistic Mathematics Network* of 1986—a newsletter that officially became a journal in 1993. Fields as diverse as cognitive psychology, education, history, literature, linguistics, history, philosophy, and poetry are represented in the journal. This journal has also inspired the humanistic mathematics movement, now represented by a well attended topic group at the annual meeting of the American Mathematical Society and Mathematical Association of America. In addition, it has been acknowledged as an emerging force in a recent international handbook of mathematics education published in The Netherlands (Brown, 1996a). From a personal point of view, the journal has meant a great deal, not only because of the direct impact of its articles, but more importantly because it was a contributing factor in giving me the courage to write about and integrate a variety of fields—a feat that stretched considerably the bounds of my perceived expertise.

With much appreciation for such encouragement, I reflect in this essay on the evolution of my own writ-

ing about the concept of humanistic mathematics. I do so by setting my first publication on the topic in *bas relief* against my writing that emerged some thirty years later. I will not in this brief space (shades of Fermat and his marginal notes!) have a chance to paint the variety of self-portraits that emerged over this time span. I will, however, point to a number of contributing factors that influenced the change. I propose this act of introspection as a case study of one person's struggle with new ideas.

My first article, published in 1973, that explicitly highlighted the word "humanistic" was playfully entitled "Mathematics and Humanistic Themes: *Sum* Considerations" (MHT). The evolved book, published in 2001 is less playfully entitled, *Reconstructing School Mathematics: Problems with Problems and the Real World* (RSM). As I look back at MHT, it becomes clear to me that this article planted the seeds for much of my subsequent writing. Perhaps the most dominant theme—maybe an obsession—has been a focus on problems and their educational uses. As will be obvious when I discuss some of the humanistic categories, part of that focus is ameliorative with regard to problems. That is, I point out "near relatives" of such concepts as problem solving, and indicate the educational short-sightedness of excluding them from the educational scene.