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REVIEWS

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CREATIVE TEACHING: HERITAGE OF R. L. MOORE. By Reginald D. Traylor with William Bane and Madeline Jones. Houston, Texas (University of Houston), 1972. 478 pp. \$8.50.

REVIEWED BY P. R. HALMOS
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This is a book about a great man.

The greatness of R. L. Moore is in his personality, his mathematics, and his "method". If you ever met him and saw him in action, or if you saw the film about him (*Challenge in the Classroom*, Mathematical Association of America, 1964-1965), or even if you just talked to a Moore student, then you know that his personality is powerful. He exudes strength of conviction and purpose; he speaks quietly but forcefully; and he generally behaves with courtesy and charm.

As a mathematician he will be judged, as will all of us, by history, but he certainly touched all the bases that are objectively describable. He wrote an influential book that came out in two editions (thirty years apart); the list of his published papers (as given in the book under review) has 64 items in it (the titles of 32 of them begin with "Concerning..."); he was president of the American Mathematical Society (1937-1938); and he is a member of the National Academy of Sciences.

It may be that "the Moore method" is the contribution for which Moore will be remembered the longest. It is a method of teaching, a method of creating the research attitude in a student, that is a mixture of what Socrates taught us and the fiercely competitive spirit of the Olympic games. The method, sometimes with modifications, has been adopted by many of Moore's students, and by some others. In Moore's own hands it was a tool that enabled him to produce 50 Ph.D. students in 53 years; some of them are among the best and most highly respected mathematicians in America.

All this is not meant to say that Moore, as a man, as a mathematician, and as a teacher, has no faults. He has, but in Professor Traylor's book they become either amusing eccentricities, mentioned with fond tolerance, or virtues, treated with respect bordering on adulation. Here, to illustrate the point, are three quotations, dealing with Moore's personal attitudes and behavior; Professor Traylor relates them with apparent approval.

Moore's strong feeling concerning the teaching methods employed at Princeton is indicated by an incident which occurred at the University of Texas over forty years after Moore left Princeton. Professor Lefschetz was an invited speaker at the University of Texas and had for many years been on the Princeton faculty, though he came there following Moore's departure. Moore normally did not attend such lectures but, to show courtesy to a Princeton mathematician of high reputation, Moore did attend Lefschetz' lecture, taking pains though to sit toward the back of the room. At the end of Lefschetz' talk, as questions were being raised, Lefschetz asked Moore's opinion of his comments. Moore had not gone to the talk seeking an argument, but as he later put it, Lefschetz looked up at him and said, "Well, do you agree with everything that I have said, Dr. Moore?" Moore, realizing that Lefschetz was not about to let him be at peace, stood up and asked, "Do you still teach algebra at Princeton the way you did when I was there?" (Page 74.)

Moore's personal values were not to be tampered with. He felt strongly about his southern heritage, honor, and gentlemanliness. One of his office mates was named Beal, a pleasant person who was slightly crippled. He and Moore were good friends, often lunching together. Moore seemed to some, including Beal, to prefer having girls in his classes. Perhaps he felt they were easier to draw out. Once Beal began kidding Moore over his preference for female students and Moore took offence. He didn't wish to hit Beal, but wished to make his protest effective. So, he quickly arose, picked Beal up from his chair and dropped him on the floor as he left the room. By taking that tack, the incident could be considered as humorous, but the point was well made. Later, someone reportedly asked Moore, "Well, what about that? Why did you do such a thing?" And Moore said, "Well, I couldn't hit a cripple!" (Pages 88-89.)

[At a faculty meeting] Moore "asked for the name of one person of first class ability who had refused to come to the university because of segregation." Two faculty indicated that they had considered that aspect of the University with grave reservation before coming to Texas. The Minutes record that Moore stated "he believed that integration would have nothing to do with recruiting first class men for the University." Student lore, gained from reports of those at the meeting, is to the effect that Moore said, "I asked for a first rate man who did not come

here, not for two second rate men who did come here." (Pages 179-180.)

Moore's attitude toward the doing of mathematics (or at least what Professor Traylor tells of it) is typified by a single passage.

Sometimes he would attend a mathematics lecture. His custom was to seldom attend such, but in those rare circumstances in which he decided to, he would invariably ignore the speaker and contemplate problems of his own. In one instance, he did notice the theorem the speaker proposed to prove. He found it interesting and began to work it out for himself. At the end of the talk, when the speaker was responding to questions, Moore spoke up, stating that he, too, had a proof of that theorem. Upon going to the board and indicating his proof to the speaker, he learned, only then, that his proof was the same as that just presented by the lecturer. Another time, after he had received high office in the American Mathematical Society, he wandered into a classroom, while attending a meeting, to find two mathematicians, Lefschetz and Weiner [this is misspelled in the index also], in deep discussion at the board. Moore said, "What are you doing?" They replied, "Well, it's a mathematics meeting, isn't it? We're discussing mathematics." Moore's response came, "Well, it's a mathematics meeting, but it seems to me that's the last thing you ought to be talking about." When he related this conversation later to a class of his, he added, "They didn't understand what I meant." (Pages 9-10.)

The best part of the book is the one that describes the Moore method, but the description is brief (about a dozen pages, beginning on p. 142), and it gives almost no concrete details. Professor Traylor lists nine "criteria which characterize the Moore method of teaching"; here are three of them.

(2) Collecting the students in classes with common mathematical knowledge, striking from membership of a class any student whose knowledge is too advanced over others in the class.

(4) Allowing no collective effort on the part of the students inside or outside of class, and allowing the use of no source material.

(6) Fostering competition between students over the settling of questions raised. (Pages 149-150.)

There are also a few shorter references to the method, including some reminiscences of people who experienced it. Here is a sample.

He gave us a problem once which we worked on and which none of us got. He gave us a couple of weeks to work on it and none of us got it. And he said, "Well, I guess you needn't spend any more time on that. This is a problem mathematicians have been working on for centuries and nobody has ever solved it. I just thought you might, just by accident, be able to do something." (Page 85.)

The book consists of over 450 pages (typewritten), of which the first 200 are badly organized, repetitious, and mostly boring prose, and the rest are lists of various kinds. The prose contains some history (e.g., a description of the confederate brigade in which R. L. Moore's father served, and a short biography of each of the first eight professors at the University of Texas). It includes also some mathematics (e.g., E. H. Moore's definition of a limit point, and R. L. Moore's axiom system \sum_2), biographical facts about R. L. Moore, and many quotations from personal conversations between Professor Traylor and various students of R. L. Moore. Well over a third is about academic politics. Most of the references for this part are to the Minutes of the General Faculty, University of Texas; the subject, usually, is the effort of Moore's opponents to make him retire, and the countermoves of Moore's students to continue him in power.

The spelling, diction, and style are best described by examples.

Spelling. *Publizing* (publishing ? publicizing ?) on p. 80; *supercillious* on p. 100; *verbatum* on p. 123.

Diction. *And this same criteria, of course, apply to almost everything else* (p. 86). *That Moore was, in many respects, a teacher extra ordinaire is indicated by ...* (p. 185). *It became a national phenomena to hire as many faculty as possible ...* (p. 189).

Style. *To those who wish to teach after that fashion, perhaps it will be suggested herein that this is a very difficult manner with which to teach* (p. ii). *Moreover, those who argue that they are good teachers, though they have no research interests or accomplishments, should feel honor bound to offer, as an example, at least one of their past students about whom, it very probably is true, did realize success in some substantial endeavor but very probably would not have if deprived of that particular teacher* (p. iii). *A student could know that, once encountering Moore in class, there would thereafter be another class, immediately advanced to the last one under Moore, with which he could again encounter Moore, provided he acquired Moore's consent to enroll in that class* (p. 141).

On p. 195 all this ends, and on the next page the lists begin. The lists are: Moore's students (one page), Moore's publications (five pages), Moore's students' students, onto the sixth generation, and *their* publications (242 pages), index of names (15 pages), and footnotes (nine pages).

I want to know more about Moore. I am interested in knowing, exactly, his views on the Russell paradox, the empty set, non-separable compact Hausdorff spaces, the Brouwer fixed-point theorem, category theory, Gödel's incompleteness theorem, the continuum hypothesis, mathematical style, and academic and world politics. I want to know about his relations with students before, during, and after the time they actually worked with him.

And, more than anything else, I want to know as much as possible about the Moore method. What, exactly, does he say on the first day of classes? How does he handle the shrinking violet, the buffoon, and the loudmouth? What is the mechanics of his method? Who gets called on, when in what order? How much does Moore himself talk in class? Is it possible to use the Moore method to produce a broadly educated mathematician -- one who has a reasonable and usable acquaintance with algebraic topology, abelian categories, and pseudo-differential operators?

I should love to read a good book entitled "*Creative Teaching: Heritage of R.L. Moore.*" This is not it.

BIBLIOGRAPHY AND RESEARCH MANUAL OF THE HISTORY OF MATHEMATICS.

By Kenneth O. May. Toronto (University of Toronto Press), 1973. 827 pp. Can. \$20.

REVIEWED BY I. GRATTAN-GUINNESS
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With the help of many colleagues and assistants named in the preface, Professor May has produced a remarkably useful addition to the apparatus of the history of mathematics, a comprehensive classified bibliography for the subject. By its nature, therefore, it is a book to use rather than to read in the usual sense, and so it cannot be reviewed in the normal way. This review is based on its use in the ordinary course of work over a few months, together with an explicit examination of its contents over a short period.

The "research manual" referred to in the title is the first part (pp. 1-34), which contains much sensible advice on the organisation of research and of the information resulting from it. As the author rightly remarks (p. 5), such matters are not taught in the education system; and the result often is that students and scholars are hampered in the progress and success of their work by a lack of competence to control the material involved. The techniques required are usually only at the level of organised common sense, but they become sufficiently intricate to merit the kind of explicit discussion given here. May describes the kinds of available literature, and suggests systems of information filing. He also provides some useful warnings on the difficulties of historical analysis in a section (pp. 28-34) which might have been longer, especially concerning the mistaken method of posterior historical wisdom (called "Unhistorical Analysis" on p. 30) to which mathematicians and even mathematical historians often seem limited.

The "bibliography" of the title is in fact a sequence of five