Letters to the Editor

Compumatics versus Mathematics?

I was appalled when I read the letter written by Dr. J. J. Uhl, entitled "Steven Krantz versus Calculus & Mathematica" (AMS *Notices*, vol. 43, no. 3, March 1996, pp. 285–286). The style of the letter surprised me the most. Why is Dr. Uhl so angry? What tempted him to use such words as "peeve… bogus… attacked… infuriated… sputter…"? I read a short note, "Math for Sale", by S. Krantz in the *Notices* of October 1995. It does not contain such terms, despite Dr. Uhl's qualification [of it] as "a sarcastic personal attack".

Dr. Uhl et al. have written a textbook *Calculus & Mathematica* (C&M). They like it; their students like it. So, good luck, go ahead! Why be angry?

I should confess right away: I did not read that text, nor did I try the software. To those who are unaware, it is worth noting that Mathematica is not mathematics; it is computer software that allows one to manipulate and visualize formulae. I have attended a demonstration of that software. In fact, the title *Calculus & Mathematica* is misleading because it sounds like *Calculus & Mathematics*, a change in just one letter which one may overlook (as I did at first). A proper unambiguous meaning of the title is "Calculus via Compumatics".

Compumatics is mathematics that can be done by computer. There is nothing wrong or offensive in this term; it reflects a fact of life. Mathematicians use computers and computer software as a tool in mathematical research and applications. Computer scientists (programmers) use mathematical products (algorithms, iterative methods, tables of formulas) to produce software packages. Compumaticians can use both mathematics and software packages to produce new educational tools, such as computer-assisted interactive books, CM-videocassettes, CD-ROMs, etc. Here I use the abbreviation CM to stand for CompuMatics.

Disclaimer. As is now common in the software market, the author of this note does not bear any responsibility for the quality of compumatical products nor for any consequences therefrom. In simple words it means the following. Once in use, a computer with its software is detached from its creators and represents a separate entity whose creators are forgotten by users. The creators, however, are usually engineers and programmers who are not mathematicians by profession. Their products naturally carry only their knowledge and experience and may present restrictions, not the best solutions, and other inconveniences for a teacher and for a student. In this note, a CM product is not evaluated nor discussed. We discuss certain aspects of the phenomenon, not its particular realizations.

Compumatics can speed up and enhance the teaching process, upgrade the art of problem solving, intensify the thought processes, and downsize departments related to mathematics. For these qualities, compumatics has immediate and visible dollar value. Nobody talks about this aspect, as if it were unethical. Perhaps it is time to discuss the issue, since corridors are already full of rumors on the subject. In order not to be blamed or labeled (libeled), I have to stress that I am not passing judgment nor weighing the pros and cons of a current trend in society. I would simply like to raise some points which are now in a mist.

1. Compumatics puts the accent on computer-assisted education, similar to CAD (computer-aided design) and CAM (computer-aided manufacturing), with the difference that it introduces elements of computer automation into the human brain. We know there are wonder people who can easily multiply ten-digit numbers faster than computers. It is probably this kind of automation, on a somewhat higher level, that compumatics may introduce into the brain of some students. Whether it is good or bad, I do not know. However, if CM succeeds in addicting students, especially in high school, to the constant use of some software, it will boost computer and software sales, making profits and creating jobs, which is now the first priority.

2. With the introduction of compumatics in schools and universities, teaching mathematics as it is now can be gradually phased out with downsizing and consolidating corresponding departments, since compumatics obviously requires fewer teachers than mathematics (there are hidden costs, but these are out of sight yet). This process has already begun with the pioneering innovation of the University of Rochester (see AMS *Notices*, vol. 43, no. 3, March 1996, pp. 300–306). Clearly, it seems to save many tax dollars, which is another first priority nowadays.

3. Eventually, compumatics teachers will also be eliminated, since CM

can be taught by a CD-ROM in a teacherless classroom. Imagine a classroom for twelve hundred students (the University of Western Ontario has such a classroom) with small screen PCs on each desk and a big-screen TV with CD-ROM at the front. The students will have great fun and enjoy unlimited freedom without the boring supervision of an instructor. Sensing an objection ("a CD-ROM cannot answer questions!…"), I have to disappoint opponents of compumatics. Yes, a CD-ROM can answer all questions from a student audience of any size. Proof? Very simple. To count the maximum volume of questions, suppose that future computers take questions directly from the brain, without using voice, paper, or keyboard, and transmit answers also directly to the brain of every individual student who has asked that question, this being done for all the different questions in a classroom of any number of students. Due to the finite speed of light and a finite number of students on earth, we get a finite number of questions that can be asked during a 45-hour one-semester course. Usually, it is not more than one hundred questions that are asked during a normal course. It is a trivial matter to supply a CD-ROM with a finite number of prerecorded answers or to produce a software that can gradually incorporate correct answers into a CD-ROM online with the flow of questions being actually asked by students. I am not going to argue this apocalyptic scenario. The only point I want to make is that a CD-ROM can replace all CM teachers, with seemingly great savings in public dollars.

Such are the immediate economic gains from substituting compumatics for mathematics in education. At least, it seems so. There are expenditures, of course. Accountants can calculate the net savings and profits. Doctors can treat some exhausted, burnt-out students. In a decade or so, the country will see the results of such efficient and speedy education. Students, however, may render their judgment much faster.

In the meantime, compumaticians will get all the funding they need. Mathematicians are unlikely to get funding. However, they can survive as their forefathers did in the last century. Of course, they would have to downsize and restructure (not downgrade) their activities. Most basic mathematical research will go underground or relocate to "less efficient" countries.

Do we need a debate? I doubt it.

I remember there was a popular explosion in favor of tele-education some ten or fifteen years ago. We were invited to a nice lecture hall with a TV for every ten seats, where we were given an excellent presentation of how fascinating it would be to have a tele-university with direct home broadcasting. Imagine a genius from Göttingen or Harvard giving a lecture worldwide for students sitting at home with a cup of good Irish coffee, taking notes or simply videorecording. … It failed, and we do not hear about it any more. Maybe the Internet can revive the enterprise? Or compumatics with a CD-ROM in a teacherless classroom? Hey, why a classroom? [Why not] direct home broadcasting? Dreams, dreams, … Or losing touch with reality?

People need a clean, clear-cut experiment, preferably not on the scale of a country, as recommended by Dr. Uhl ("…in so doing we can help to renew an infrastructure that will support research mathematics and mathematics education into the next century.…", *Notices*, vol. 43, no. 3, March 1996, p. 286).

Maybe the University of Rochester can turn its innovative initiative into creating compumatics faculty to promote the shining path of computer-generated science for the everlasting progress of mankind.

Efim A. Galperin
Université du Québec à Montréal

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Gender Bias in Advertisements

In the February issue of the *Notices* the AMS published a job announcement from the University of Basel. This announcement should not have been printed, as the *Notices* has an equal opportunity policy for job announcements. Presumably the sexist bias of this announcement went unnoticed [because] it was written in German. At four points in the advertisement the University of Basel used "Assistent" (i.e., a male assistant) in addition to referring to "Studenten" and "Bewerber", again male candidates.

For over twenty-five years women in German-speaking parts of Europe have fought to at least be mentioned in job announcements, i.e., that such announcements should at least address potential women candidates. (Compare the announcement of the ETH in the same issue of the *Notices*.) There are people who would argue that traditionally the German language uses the masculine noun even though women are also meant. Also, traditionally, these same men would never dream of employing a woman: i.e., when they write in masculine form, they also mean only men need apply. In Germany, job announcements for the civil service, which includes all mathematics departments, must address both genders or be gender neutral.

It is a slap in the face to all women to ignore this.

A university which does not care about addressing job announcements to women cannot hope to have a credible equal opportunity policy. Moreover, it is surprising that the University of Basel seems to have changed its previous policy of announcing positions in a gender-neutral formulation (see their previous announcements in the *Notices*). It is all the more surprising that the University of Basel fails where the École Polytechnique of Lausanne, from a French-speaking canton of Switzerland, can solve the problem when announcing a position in German.

Mara D. Neusel
Institut für Algebra und Geometrie, Germany

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Hiring Practices at Italian Universities

The *Notices* of the AMS (vol. 43, no. 2) published a letter by A. Ursini which denounces "corruption and bribery" in Italy, making oblique and unsupported references to academic hiring in mathematics.

The letter contains a misrepresentation of facts from which slanderous conclusions are drawn. Let's start with the facts. It is true and well known that Italian universities adopt a centralized system to hire and promote senior faculty (associate professors and professors). This means that a nationally elected committee evaluates all the applications for all positions in a given subfield (e.g., geometry). Some people believe (and perhaps Prof. Ursini is one of them) that this centralized system is cumbersome and that it would be better to let each department choose its own members. This is a legitimate opinion, which, however, is not shared by many Italian mathematicians, who believe on the contrary that a measure of control by a national scientific community is necessary to avoid extreme cases of scientific inbreeding or outright nepotism. But whatever one's opinion may be on this matter, it is absurd to claim, as does Prof. Ursini, that a national system of hiring makes it more difficult to read and evaluate the research work of all candidates. One should expect that with local decisions almost all candidates would apply for all positions. Local hiring committees, just like the national committee, would be faced then with the problem of reading and evaluating the same large amount of material. It is also false that letters of reference are not used in the evaluation of candidates in Italy. Members of the hiring committees in mathematics often seek and obtain expert opinions on the research work of candidates. Sometimes these opinions are even mentioned in the minutes of the meetings of the committee. But when this happens, the opinion of an outside referee cannot be kept confidential. In any case, there is no way one can draw from these facts the conclusion that the decisions of the hiring committees must necessarily be dishonest, as Prof. Ursini does in his letter.

It is also false that accusations of "corruption and misappropriations" have ever been raised in connection with mathematics hiring in Italy. Thus Prof. Ursini's innuendos in this respect are totally unfounded. Of course, any competitive evaluation of scientific merits of different mathematicians depends largely on the knowledge, taste, and prejudices of whoever does the evaluation. As such it always leaves room for criticism. But any criticism should be directed to specific decisions and to the people who made them, so that these people can be allowed to respond and state their arguments. This is what one should expect in a scientific debate among intellectually honest people. Slanderous oblique comments generically directed against all possible hiring committees in mathematics are not the proper way to express dissent in a scientific community. They should not have been published in the journal of a scientific society.

Alberto Conte
Presidente dell'Unione Matematica Italiana

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On Steven Krantz's Editorial, May 1996

In *The Hitchhiker's Guide to the Galaxy*, the philosopher Broomfondle threatens to take the philosophers out on strike. Just try getting along without philosophers for a few years and see how you like it, he says.

Just as a "thought experiment", what would happen if the same test was applied to mathematicians?

I think that the answer (assuming scabs from the chemistry department didn't cross our picket lines and start teaching and doing mathematics) is that America would begin to look more and more like a third-world country, unable to maintain our own infrastructure and unable to compete with other nations in the development of new products. Can you maintain a nationwide electrical power system without mathematics? Can you invent a VCR without mathematics? I think not. But then, what do I know? I'm a college professor and a topologist. I value what I do because of the intellectual challenge and am far removed from the reason society sees fit to pay me to do it.

Who studies the impact of mathematics on society? Who publishes this research if it is done? More generally, what research is done into the value, in dollars and cents, of education? I would guess that, in terms of increased productivity and decreased need for welfare, society gets a very good return on its investment in education. I would like to know where to go for facts to back up this guess.

Rick Norwood
East Tennessee State University

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Response to Jerry Rosen

At the end of his letter in the *Notices* for May 1996, "Mathematics Education and Policy", Jerry Rosen says: "Before further damage is done, I urge the mainstream mathematical community to get involved in these matters. Proposed changes in educational policy…need to be scrutinized by practicing mathematicians."

Under any reasonable definition, we are practicing mainstream mathematicians. We have also been involved in projects in mathematics education for many years. We have always welcomed the scrutiny of colleagues who are primarily concerned with research, as well as those primarily concerned with education. We would welcome even more their active participation and constructive criticism.

Daniel Flath
University of South Alabama
Andrew Gleason
Harvard University
William McCallum
University of Arizona
David Mumford
Harvard University
Brad Osgood
Stanford University
Wayne Raskind
University of Southern California
Thomas Tucker
Colgate University

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