

India has in the past produced some outstanding mathematics and mathematicians. In recent years, there has been deep concern among mathematicians and other academics about the quality of mathematics in the country, and the need to take steps to attract young talent to this important field. A number of mathematicians from reputed institutions were in Bangalore recently for a discussion meeting on 'Harmonic Analysis' organized by the Indian Academy of Sciences and the Indian Statistical Institute. The participants also met in a session to discuss the state of mathematics in India and the remedial measures that may be necessary to improve it. A report of this meeting is published below. We feel that we should take note of their recommendations. The proposals made are simple, the funds required would be modest, and, what is important, the younger mathematicians are willing to give their time and energy to this programme of teaching and introducing talented and motivated students to different streams of exciting mathematics. There is a fair chance of this idea succeeding and as such we feel that the suggested experiment should be supported by our funding agencies. This programme visualizes methods of attracting talent from colleges. Should we also think of promoting good mathematics at the school levels?

Our Academies which aim at promoting excellence must, we feel, help and participate in this important task of 'catching them young'.

—Editor

Can we do something about our mathematics education?

V. S. Sunder

The purpose of this report is to try and describe some of the ills afflicting the state of mathematics education at both the under- and postgraduate levels in India, as well as to record some of the proposals that were put forward by a group of about thirty professional mathematicians during the course of a special session devoted to this topic during a discussion meeting on harmonic analysis (organized jointly by the Indian Academy of Sciences and the Indian Statistical Institute, 11–13 March 1992) at the Indian Institute of Science, Bangalore.

In most of the elite institutions in India where active research in mathematics is carried out, one often hears the complaint that there is a dearth of good students; the two main reasons given for this are: (a) most good science students pursue a career in engineering or computer science, typically going through one of the IIT's and culminating in one of the American universities, and (b) the students that do pursue mathematics usually have such a poor background in the basics that the first year or more of their doctoral programme is invariably spent teaching them what should normally be covered during a decent undergraduate programme. (It goes without saying that more often

than not, students from such an underprivileged background feel quite frustrated by their inability to cope with what the instructor obviously considers as straightforward, and this frustration can cause serious damage to the morale of the student.)

In order to combat these problems, it is obvious that what is needed is for bright young minds at the finishing undergraduate level or starting graduate level to be shown that mathematics can be, and is, an exciting human pursuit. They must awake to the fact that mathematics should make one think, and that the teacher who forces the learning of an endless list of seemingly boring propositions by rote is guilty of the highest form of treachery. One way this can be accomplished is through an intelligently planned programme of summer schools where the students could be exposed to exciting ideas in mathematics by lecturers carefully chosen from a pool of active young research mathematicians with a flair for teaching. Further, once such a programme of summer schools became a permanent feature of the national academic calendar, it would be only a matter of time before the quality of students entering research, as well as of college

teachers, showed a marked improvement.

During the meeting, Krishna Maddaly (Institute of Mathematical Sciences, Madras) convened a session with the express purpose of getting the mathematicians gathered together at the meeting to address the problem of what they could, or should, do towards achieving some of the goals outlined earlier. What follows is a description of some of the more concrete proposals that came out of an animated discussion at that forum (which included several mathematicians of a non-trivial standing from such institutions as the Tata Institute of Fundamental Research, the (three main branches of the) Indian Statistical Institute, some of the IIT's, and Bombay University).

Pool of lecturers

There is a definite need for a concerted and well-conceived training programme aimed at spotting talent as well as providing basic training, at both the pre-PhD and beginning PhD levels. The teaching faculty at these programmes must be carefully picked by a pre-determined coordinating committee; these teachers should be reasonably active

research mathematicians who, besides being known to be good lecturers, should be prepared to offer their services for this programme once every three or four years. (An *ad hoc* coordinating committee set up at the meeting—consisting of S. Kumaresan (University of Bombay), U. B. Tewari (Indian Institute of Technology, Kanpur) and this author—has already drawn up a list of about 80 such potential lecturers from all over the country.)

Pre-Ph D programme

Each summer, talented students from each of the following three levels must be selected (on the basis of a nationwide search through fliers sent to various colleges and universities) to attend a four-week summer school: (a) students finishing their BSc programme, (b) students finishing the first year of their MSc programme, and (c) students finishing their MSc programme. Interested and talented students with a background in engineering or physics should also be included in this programme.

Initially, about 35 students in each category should be selected, and it goes without saying that their travel to and from the location of the summer school, as well as their living expenses should be met by the organizers. Typically, each of these 'batches' should be exposed to about four courses, with each day of the 'school' being devoted to at most two lecture hours and an extended problem-solving and tutorial session where they would be trained to think and to ask the right questions. Apart from these regular courses, each participant should be assigned topics that they should master by themselves and present at 'seminars'.

The instructors at these summer

schools should strive to bring to light the unity and beauty of various mathematical concepts, as well as the inter-connections between the different streams of mathematics. A vital off-shoot of this programme should be the preparation of lecture notes which are best suited to the Indian context.

In order to better spot and nurture talent, bright participants at a summer school must be encouraged to apply and participate in succeeding summer schools. It would not be difficult to direct such bright and motivated students to good centres for their further mathematics training at the end of their master's programmes.

Beginning Ph D teaching

Each year, a six-month programme should be organized—during July–December, for instance—in which students joining various universities/institutes could undergo beginning graduate-level courses in algebra, analysis and geometry (and topology). (Naturally, all that was said above, about the desired qualities in a lecturer at a summer school for pre-PhD students, remains doubly valid in this case.) The purpose of this programme is to help overcome the handicap caused by the fact that every mathematics department in the country is deficient in experts in at least one of these three different (and basic) areas of mathematics. Various colleges and universities must be convinced of the advantage of having one or more of their students undergoing such a programme, and every effort should be made to ensure that a student selected for participation in this programme is not prevented from making the best use of such an opportunity due to the bureaucracy and red tape that strangles most of our institutions.

A permanent venue

In the interest of permanence of each of the above programmes, it is desirable that each of these 'summer schools' must preferably be conducted at the same place, at approximately the same time each year; this is to ensure that this becomes a regular part of the academic calendar, so that most students all over the country would become aware of the programme and try to benefit from it.

Conclusion

What remains to be done is to convince the 'powers that be' that these are truly pressing needs of the country, and that immediate steps must be taken to ensure that funds are forthcoming for the fruition of these goals. For a change, now, there is a reasonably large number of committed and competent individuals who are ready to do something with no foreseeable profit other than the satisfaction of a job well done. The agencies which are given the responsibility of managing science administration in India should be convinced that nothing comes in the way of a desperately needed reform when there are willing hands to do the dirty work.

Finally, and probably most importantly, in order to bring an enthusiasm and fresh outlook to the running of this programme, the organization and other details must be left to some young and energetic mathematicians with a commitment to the causes underlying the programme, rather than to a senior mathematician who may already have various other administrative responsibilities between which to divide his time.

V. S. Sunder is in the Indian Statistical Institute, Bangalore 560 059, India