

IISERs: new initiative towards excellence in science

Avinash Khare

In this note I discuss in some detail how the IISER initiative towards excellence in science originated and how was it pursued, which culminated in the sanctioning of IISERs. I will also discuss similar other initiatives, like NISER, CBS, IISc, CMI and ISI towards excellence in science. Finally, based on my experience in the last four and half years at IISER Pune, I will point out the strengths as well as shortcomings of the IISER programme.

Early initiative

After independence, a large number of research institutes were started by the Government of India (GoI) to carry out first-rate research work in various branches of pure and applied sciences. However, these institutes were completely detached from the universities and colleges where teaching at the undergraduate (UG) and postgraduate levels is carried out. Further, while most of these institutes were well-funded, most of the universities (not to talk of colleges) had poor infrastructure, meagre funding for research and development, and high level of bureaucracy. Not surprisingly, many of the bright researchers chose to join the research institutes instead of universities and colleges. As a result, there was complete divide between teaching and research in the country. This is unlike in most of the developed countries, where teaching and research are integrated. It is quite common in these countries that a top scientist teaches and motivates UG students. Many educationalists have strongly felt about this serious defect of our higher education. The Indian Institutes of Science Education and Research (IISERs) initiative should be viewed in this perspective. I think one important reason why the GoI agreed to this initiative was that after the IT boom in the country, bright students were by and large not coming to science. So much so, the major science establishments in the country, like the Department of Atomic Energy, Department of Space, CSIR laboratories as well as DRDO laboratories were not getting enough good-quality manpower. In short, IISERs have been set up with the primary goal of integrating high quality research with UG teaching to enhance the number and quality of future researchers in basic science.

The IISER initiative was started by the GoI in 2006 to achieve excellence in sci-

ence and it is worth recalling how it originated, its salient features as well as its shortcomings. It is not very well known that the Government took some other initiatives for the same purpose and it is worth mentioning their salient features as well.

As early as 1996, Govind Swarup and late V. G. Bhide first thought about the IISER initiative towards achieving excellence in science. Their proposal was to start IISERs as autonomous centres within universities. In an article in *Current Science*, Govind Swarup discussed in some detail how their initial draft went through several modifications before Murali Manohar Joshi, the then HRD Minister in the first NDA Government announced the setting up of four IISERs at Allahabad, Bhubaneswar, Chennai and Pune in collaboration with the concerned universities. However, because of the concerns from some of the universities as well as objection from MHRD, this initiative never saw the light of the day. After the UPA Government came to power in 2004, the Scientific Advisory Committee to the Prime Minister led by C. N. R. Rao approved and vigorously pushed the IISER initiative. As a result, Arjun Singh, then the HRD Minister, announced the formation of two IISERs, one at Kolkata and the other at Pune, which started functioning from August 2006. Subsequently, a third IISER started functioning from 2007 at Mohali, near Chandigarh, while two other IISERs started functioning in 2008 from Bhopal and Thiruvananthapuram. I would like to add here that from August 2015, a sixth IISER has started functioning from Tirupati while from August 2016 two more IISERs are going to start functioning, one from Berhampur (Odisha) and another from Nagaland. The IISERs have been given generous funding by the GoI for building infrastructure as well as for research and development work by the faculty members.

BS-MS dual degree programme

The most important programme run by IISERs is the 5-year BS-MS dual degree programme. Admission to this programme is a centralized process for all IISERs. All students admitted to this programme secure INSPIRE fellowship of Rs 5000 per month, provided they maintain good academic standing during each semester. In addition, they also receive an annual contingency grant of Rs 20,000 which may be used for purchasing books, stationary and carrying out small research project in various institutes and universities across India.

There are three channels for admission to this programme: (i) Students who have been awarded the Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship either during their class XI or class XII years, are eligible for direct admission to the programme after their class XII examination. (ii) Students who qualify in the IIT Joint Entrance Examination (Advanced) (JEE Advanced) with ranks in the main merit list are also eligible for direct admission to the programme. (iii) The third channel of admission (through which majority of students seem to join IISER at present) is a direct aptitude test conducted jointly by the IISERs. In order to be eligible to appear for this test, the candidate must belong to the top 1% of students graduating class XII in that year (or the immediate previous year) from any of the state or central school boards. Last year, the aptitude test was conducted in 18 cities.

During the first two years of the 5-year BS-MS programme, students study all the science disciplines, i.e. biology, chemistry, mathematics and physics. In some of the IISERs, few courses on earth and atmospheric sciences as well as social sciences are also offered. During the first two years, all the courses are compulsory.

After two years, in most IISERs the students pick a subject as their major and

complete a set of in-depth courses in their chosen area with a few possible courses in minor areas in the next two years (four semesters). IISER Pune is an exception. The students are not required to choose their major and are free to choose any course during the fifth to eighth semester. One highlight of the IISER programme is that the students can do either a laboratory or a theory project during each semester, where they are attached to a faculty member. I think this has immensely benefited a number of students.

In the fifth year, each student carries out a 1-year project working closely with the faculty member(s) in their institute, thus getting valuable exposure to the methods of modern science. In addition, they also take few advance courses. IISER Pune is an exception, in that the students are free to carry out the project anywhere in the world and they are not required to take any course during the fifth year. Remarkably, a number of publications have occurred from IISERs in peer-reviewed journals with BS-MS students as the lead authors.

By and large, in each of the five IISERs, there are about 600 integrated BS-MS students and 250-400 Ph D plus Integrated Ph D students. The permanent faculty in the five IISERs varies from about 60 to 90.

Other similar initiatives in the country

The GoI has initiated other similar programmes in science which are also doing well. They may not be as widely known and hence I will briefly mention them here. One initiative which is similar to IISERs is NISER in Bhubaneswar and CBS in Mumbai. There are two important differences between IISERs, and NISER and CBS. First, admission to NISER and CBS is through a National Entrance Screening Test which is conducted at a large number of centres in the country. All the selected students automatically get the INSPIRE fellowship as well as the contingency money. The second difference is that unlike IISERs, in NISER and CBS, the students are required to study all four basic science subjects, i.e. biology, chemistry, mathematics and physics, for only one year.

The Indian Institute of Science, Bengaluru is running a 4-year Bachelor of

Science programme since 2011. The admission is either through KVPY, JEE or AIPMT. Chennai Mathematics Institute (CMI) runs a 3-year B Sc (Honors) course in mathematics. The admission is through an entrance test.

One man who had long ago recognized the need for integrating UG teaching with high-quality research was late P. C. Mahalanobis. It is not widely known that the oldest and one of the most internationally reputed programmes is the 3-year B Stat (Honors) started by Mahalanobis at Indian Statistical Institute (ISI), Kolkata as early as in 1959. Few years ago, ISI Bengaluru has started a 3-year B Math (Honors) programme. A joint entrance examination is held for both these courses at a large number of centres in the country. CMI and both the ISI programmes are of very high quality and my firm view is that any student interested in doing his/her major in mathematics or statistics should try to join one of these institutes.

Critical assessment

There is no doubt that the IISER initiative (and other initiatives mentioned above) is a positive step towards creating quality scientific manpower. With more and more emphasis on interdisciplinary research, it is hoped that IISER's broad-based training would help the students tackle challenging problems in interdisciplinary areas.

Let me now mention some issues which I feel need serious attention. These remarks are based on my first-hand experience while teaching at IISER Pune.

1. Majority of the IISER admission is restricted to only those students who are in top 1% in any state or central board. This deprives IISER from tapping a large pool of talented and motivated students who might have just missed being in the top 1%. It would be ideal for IISERs to either join the common test which is being jointly conducted by NISER and CBS, or conduct their own entrance examination allowing any student getting more than 60% (or could be 70%) marks in class XII examination to appear for the same. It is worth noting that this year about 50,000 students appeared in the NISER/CBS

entrance test. I am sure that with such a move, IISERs will get better quality students. I have seen that amongst the current students in IISERs, hardly 15-20% are really good and I have often wondered how the rest of the students were placed in the top 1%. This also raises deeper questions regarding the standard of the various boards in the country.

2. Another criticism which I have heard from many parents is that the IISER admission procedure (unlike say IITs) is not transparent. Without taking into account the preference given by the students and their performance, they are randomly allotted to the institutes. I understand that IISERs are following this policy so as to ensure that good students are broadly equally divided amongst them. I however feel that student interest should take precedence over such considerations and IISERs should strive to make their admission procedure transparent.
3. Another issue which bothers me is that the students are required to study all four science subjects for the first four semesters. While this is perhaps good for students wanting to major in biology or even chemistry and some areas of physics (which are interdisciplinary in nature), this is certainly bad for those who want to major in several areas of physics, including astronomy and astrophysics, and nuclear and high energy physics, and worst for students wanting to major in mathematics. Let me elaborate as I think this is one of the major problems with the IISER programme.

If one compares the 3-year B Math programmes at CMI or ISI Bangalore, or even the 3-year B Stat programme at ISI Kolkata, one finds (and few math faculty have agreed with me privately) that average students in these institutions learn more (pure) mathematics in three years than the average BS-MS students majoring in mathematics do at the IISERs in five years. In fact, a former director of one of the IISERs privately admitted that those students who are highly motivated to study mathematics should be joining CMI or ISI rather than IISERs and I completely agree with him. Similarly, having taught physics at IISER Pune,

I feel that while the breadth of average IISER (physics) students is good, they lack in depth. I think balancing depth versus breadth is a serious issue which IISERs need to address.

My personal feeling is that students should study all four science subjects for only two semesters and after that enough choices may be made available to them.

4. Teaching is an important responsibility of IISER faculty, but unfortunately very little credit is given to it at the time of promotion. Actually, this is a serious problem with all our teaching institutions. Some IISER faculty members have argued with me in private that since teaching counts very little for promotion, why should a faculty take teaching seriously and not devote more time to research. I feel that unless the system starts recognizing good teachers and gives extra credit to good teaching and punishes those who are not taking teaching seriously, teaching in IISERs will suffer in the long run.
5. Problem solving is an important aspect of learning, because one understands the subtlety of many of the concepts only when one solves prob-

lems. While tutorials are regularly held in the first to fourth semesters, the same seriousness is missing in the fifth to eighth semesters. This is rather unfortunate. I feel that all courses should always have one tutorial hour per week and one should make sure that students are indeed trying to solve the problems before the tutorial hour and only then clear their doubts during the tutorial hour.

6. Laboratory training is extremely important for a student and one must make sure that the students take the desired number of laboratory courses.
7. In recent years, the GoI has started opening more and more IITs and now three more IISERs have been added to the existing five. There are several issues involved. First, since the Government budget is limited, such mushrooming would imply that the budget of the individual IISERs will decrease. My concern is that a stage should not be reached when not much money will be available to faculty members for their day-to-day research needs. There are also concerns as to whether enough quality manpower is available to teach in

these institutes. Another issue is regarding the number and type of jobs available for students coming out of IISERs. We now expect that about 800–1000 students will come out of IISERs every year and within next few years this number will be closer to 1500. Are there enough jobs for these graduates? In this context it should be noted that in the last few years almost all the states (barring West Bengal) have either stopped or are recruiting negligible number of faculty members in the state universities and colleges. I think unless IISER training is made more broad-based so that more students can join industries, we might be creating a pool of well-trained people with either no job or jobs not commensurate with their ability.

8. This year the IISER programme is completing ten years. May be it is now time to take a fresh look and make the required course corrections.

*Avinash Khare is in the Physics Department, Savitribai Phule Pune University, Pune 411 007, India.
e-mail: khare@physics.unipune.ac.in*