

What ails the Indian scientific research today? Is there any cure?

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Teaching, from time immemorial, has been considered as a noble profession in this country. We seem to have lost focus and clarity in the fundamental objectives of teaching and research. In addition, irrelevant syllabi and an out-dated examination system have further eroded the foundations. The four cardinal elements that constitute the pillars of the learning process are – teaching, research, discourse/discussion and publication. There are basic deficiencies and lacunae in all these four cardinal aspects that have a direct bearing on originality and creativity. Barring exceptions (some institutions as well as individuals), by and large, many of our teachers, even at the highest level, are woefully outdated about the contemporary frontiers of knowledge, even in their own fields, and they do not make any special effort in improving their teaching skills and methodologies. This is mainly due to lack of interest on the part of many teachers in the profession itself for various reasons. A pre-selection screening process to identify candidates who have the basic aptitude and interest in the teaching profession may, to an extent, help in getting better teachers. The present selection process does not take into account, in sufficient measure, the basic abilities required for teaching and the process is further diluted by many extraneous considerations, other than merit. This in turn has strongly impacted the quality of scientific research in many of our institutions, despite improved funding situation and resource base. This is a sad situation.

Due to such a faulty system, the present generation is neither able to contribute in any significant way towards new concepts or ideas, nor undertake any original work. We can proudly state that we are able to generate reasonable quantum of 'imitative research' of reasonable standard that is devoid of much originality or freshness at a closer scrutiny. This is also reflected in the small number of original patents of any global significance from our scientific organizations. Another factor of concern is the widening gap between academicians and professionals, which requires proper attention and remedial action. In an already deteriorated scenario, obviously the stu-

dents fail to develop innovative and original thinking. They are forced to develop only such faculties that suit the current examination system. Their full potential is not tapped and their growth as future researchers can only be termed as stunted. One cannot therefore expect any significant original research, under the prevailing conditions, however unpalatable such a conclusion is.

As such, even if they obtain doctorate degrees, they will not possess the needed foundation to be good research scientists/technologists. We are aware of the steps being taken, from time to time, by the University Grants Commission, Department of Science and Technology and various other Government organizations to improve our higher education and scientific research. It is also a fact that these steps are not producing the much needed results, as the very basics of teaching and learning is obliterated in most of our schools, colleges and universities. The remedial steps taken so far are purely cosmetic in nature and do not address the fundamental issues. Mere increase in the quantum of our spending does not ensure a qualitative improvement. Thus, in a nutshell, our colleges and universities are not geared to carry out original research.

To overcome this problem, we could introduce a pre-PhD on-the-job-training for a couple of years in the industry or in a research institution to orient the student properly. A good and effective PhD work can be carried out ideally only by students who are well taught/trained and thorough in fundamental concepts and applications. Research should bring out original thinking/creativity and innovation. The objective behind any PhD work ought to be proper application of concepts and techniques to solve a problem.

The award of a PhD degree is a beginning in the process of learning and research, and not a culmination. In our country, with problems of unemployment and under-employment of even academically qualified, jobs have higher priority over research. Thus the true spirit of research is jeopardized, and the student takes up research as an alternate job and not by choice. Lack of enthusiasm shown by meritorious students in selecting a career in basic sciences and research in

preference to professional courses acts as a road block in attracting the talented ones. The problem is further compounded when the research guide is also ill-equipped to inspire the student and utilizes him as a mere plank for the progress of his own career. Our scientific research is significantly affected due to lack of this basic quality and inbuilt urge on the part of both the student and the guide to do high quality research. Invariably, such an environment forces the young researchers to copy/imitate or adopt ideas from already existing materials, mostly from Western countries.

The PhD adjudication process in most of the Indian universities was modified a couple of decades ago from three external (foreign) examiner to one foreign and one Indian examiner as well as the guide. Later, in many universities, it was further diluted by introducing Indians as examiners in place of foreign experts. The guide is considered as the third examiner. In the process, in many cases, obvious manipulations started occurring. This mindless dilution of the examination process has eroded the sanctity attached to research work. The guides started propagating mutual admiration and mutual benefit schemes.

In essence, the basic objective of a PhD work is totally defeated. Many a times, the examiners fail to go through, in a rigorous way, the entire thesis material due to its bulkiness and their own incompetence in the field. A good study can be explained in a few pages. Initially, when there was original and genuine research, a PhD thesis used to be contained with a few pages. Nowadays, a bulky thesis (few hundred pages) has become a necessary evil and common feature, involving repetitious and unnecessary padding. The present-day researchers are made to believe that 'size' does matter. They think that bulk is good, bulkier is better and bulkiest is the best. But, in fact, if good material has to be properly conveyed, it should be within slimmer volumes.

PhD acquisition should provide a person with the needed confidence to contribute to the enhancement of knowledge. Unfortunately, due to reasons cited above, in our country this sacred profession of

knowledge acquisition and dissemination, which is the essence of any research, has become eroded with time. Proper propagation of knowledge is possible only when PhD holders conscientiously satisfy themselves about their worth as learned scholars. It is generally agreed that the PhD degree is the first step in acquiring basic confidence to do good research. However, many a times, it has been proved that even non-PhD contributions are good, stressing that mere possession of a PhD degree may not produce the needed quality results. Since academic degree alone is not a mandatory factor for good scientific contribution, we have to give due importance to the quality of research results. Many learned and eminent personalities have always stressed that a good result comes out of proper basic training, dedication, commitment and hard work.

It is not out of place to state that all our leading institutions (including the elite ones) have not made any major discovery or development, which is acclaimed universally as unique in the post-independence period. Gone are those days when Raman, Ramanujam and Jagadish Chandra Bose brought into light the in-built capabilities of Indian scientists, through their path-breaking research contributions. They achieved results as they had the basic qualities to carry out high quality research, even without any significant support from the Government. I am pained to state that present-day researchers have failed in delivering results, despite the large investments by a country like ours, where malnutrition, hunger and lack of basic facilities plague the lives of a large population. We owe it to ourselves to reform our archaic methods of functioning which sap all originality and creativity. We should create a more congenial atmosphere for our youngsters to pursue science as a career that is rewarding in all respects. Due recognition and importance to fundamental (basic) research is a must. Our scientists should also be made accountable as they can significantly address the problems faced by our society. In short, an R&D pursuit

should be accountable and such studies alone should be encouraged at all costs.

The following steps are suggested in overcoming the existing hurdles and to foster greater originality and creativity in our research endeavours:

1. Infusing the spirit of entrepreneurship amongst teachers and researchers needs to be given top priority by both universities and research organizations. In turn, both these professionals should work with utmost devotion and with a 'feel-good' factor, for the good of a large number of people and themselves.

2. The management should create an atmosphere to attract the best talent, to take up science by choice. Merit alone should be the criterion for selecting teachers and researchers, irrespective of caste, creed or even nationality. Countries which have followed such a policy have done themselves proud in the long run in terms of scientific achievements.

3. Hire and fire scheme should be in place.

4. Few countries in the world can match the skill and manpower of India. We can become world leaders in many areas of scientific endeavour, if we successfully reform ourselves and create an environment for good research in fundamental as well as applied areas.

5. The principal aim of any applied research activity ought to be its techno-commercial viability and it should be industry-oriented. In the advanced industrialized nations, research from the universities and centres of higher learning contributes directly to industrial innovations and hence is widely sponsored. Their Master's and doctoral degree programmes in sciences and engineering are creative, innovative and cater directly to the industrial and societal needs. These principal elements that constitute research have led to commercial success stories. The gap between academicians and professionals is small in countries like the US. This is a point to be noted.

6. A considerable number of Indian scientists, technologists and engineers, in general, are individually competent.

However, we fail to act as a team. In today's world, teamwork is an essential ingredient for success. We have to introspect in this regard and rectify accordingly. We have to develop packages that contain expert inputs from researchers, teachers, consultants and managers. Such efforts should be coordinated by the right type of motivation and by promotion of team spirit.

7. India is poised to become a major offshore hub for business process outsourcing based on its winning combination of 'low cost and high domain expertise'. Industry expertise and cost are the most important criteria for this purpose. One has to further tap this specific Indian resource. Success lies in a wise human resource management in the selection and placement processes of the right kind of persons for right kind of jobs. The huge intellectual human capital that exists in India should be used optimally for the benefit of mankind and for our own progress.

In conclusion, the statement of the Nobel laureate, Hans Krebs is relevant. He observed that 'the way to impress upon governments, the value of scientific exploration would be to do away with vast amounts of wasteful and gratuitous research', which he described as 'occupational therapy for the University staff' (American Physical Society Meeting, 1970). Hence the pursuit of any scientific or intellectual endeavour should serve the societal needs. Otherwise it is a waste of effort and loss to the state exchequer directly, and to the tax payer as well as to the underprivileged indirectly.

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