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EDITORIAL

Woes of geoscience education in India

We often hear exasperated remarks on the poor saleability of our average geology graduates from very senior academics and prospective employers. Not so long ago, one of my distinguished friends from PRL lamented, even a CSIR Shyama Prasad Mukherjee fellow in earth science was not extraordinary enough for a junior research position in his department, not to speak of average NET /GATE qualified candidates. Frustration is writ large in the raised eyebrows and suppressed sighs of members of an interview board, be it UPSC board or other givers of entry level teaching, technical and/or research positions.

Instead of wallowing in the quagmire of such laments, let us look briefly at the facts that testify to the state of affairs that have overarching control on the curriculum, teacher appointments, and the quality of the trained manpower output in the field of geology. Let us also see whether a modicum of course correction is possible. I write this with the caveat that in spite of all the shortcomings of our system, there are a few brilliant graduates in each batch coming out from our colleges and universities. Our concern is the quality of *average* pool of existing and future manpower within the geosciences fraternity in India.

First, the undergraduate and graduate (masters) level courses in geosciences in Indian universities and affiliated colleges are supposed to follow the UGC prescribed norms (http://www.ugc.ac.in/oldpdf/model-curriculum/earth_sciences.pdf), till such time the Higher Education Commission of India contemplated by the Government replaces the UGC. Although the IITs are not bound by this norm, this is not remarkably different in core subjects in geology. The prescribed undergraduate and master's courses more or less cover core areas in geology, perhaps with a Lilliputian importance of the field geology. The diminutive presence of field geology is so hurting that concerned association of geoscientists (for example Federation of Indian Geosciences Associations (FIGA)) at its recent meeting advocated significantly better allocation of field geology credit hours in both the undergraduate and graduate levels (First Triennial Congress of FIGA, 8–10 November 2016, ISM Dhanbad). Remember that a professional exploration geologist is supposed to spend one-third to half of each year in her/his early career in the field or project site itself. The problem is not so much with course curriculum than with the way it is taught. For example, most of our undergraduates spend credit hours tinkering with classroom mineral, rock and fossil specimens to identify them within the confines of their lab classes, and supposedly recant the same in the semester exam, and forget these right after. Next semesters may not have the module at all, or have any module that requires the acquired skill. Here comes the utility of applying the skill and testing the same in a field course module, that puts the minerals and rocks in the context of a geological outcrop where a professional geologist worth the salt would spend her/his life time.

Second, let us consider how we recruit our college/university teachers. Barring the premier research institutes and IITs, the recruitment again largely follows the UGC prescription that the candidates qualify in CSIR-UGC NET. Unfortunately, the NET list of qualified candidates are of two standards: one for Junior Research Fellows (JRFs) and the other for lecturers. The abbreviation for the latter category (LS) is ironically similar sounding to 'less' and actually, those with lesser performance in the national eligibility test are listed under NET (LS). An analysis of the NET results (earth and atmospheric sciences) in the recent past clearly shows that an unreserved candidate scoring about 35–40%, has a fair chance of becoming an applicant for a lecturer position in a college. For reserved category positions, the cut-off is even less, and rules are that, half the jobs are reserved. Those with a better grade, namely under JRF list would possibly aspire for a research course in IITs, other centrally funded institutes, go for a GSI or other PSU jobs, or simply are bright and ambitious enough to move abroad. No doubt, we are left with Hobson's choice as far as geology teacher recruitment is concerned.

Third, whom do we recruit as junior geologists? Apart from a minuscule proportion of graduating geologists who are employed by private companies, bulk of the graduates aspire for jobs in GSI, ONGC, COAL INDIA, AMD and other public sector companies. Let us consider the case of GSI, one of the biggest recruiters. The recruitment is through UPSC Geologists' Examination usually conducted each year. Again, as the recent trends show, the cut-off (http://www.upsc.gov.in/sites/default/files/Cut_off_Combined_Geol_2016_Eng.pdf) for final selection post interview is pathetically poor, in the range

of 30–40% of the total allotted marks, for the unreserved category. Another aspect of this examination is that it reflects on the merit of our graduates. While the number of passing graduates would only be around one thousand per year, the number of applicants for the UPSC Geologists' Exam reaches up to twenty thousand in a given year. One can only imagine the number of failing graduates who queue up for the next year's UPSC exam.

How ready are the newly recruited junior geologists? It is a standard practice that newly recruited junior geologists undergo year-long in-house training in the field, in various branches of applied geology and mineral exploration, to make them apparently ready for their real job, clearly testifying to their initial shortcomings.

Just as we recruit the future exploration geologists for the professional organizations, so do we make choices for Geology teachers at college and university departments following the UGC norms. These lecturers even do not undergo any on-the-job training and carry out their teaching job to the best of their average abilities from the very beginning.

Another serious concern is the student attention/interest to class room teaching which plagues not only just tertiary level geoscience education but across the board in various disciplines. A recent survey on student participation and keener learning interest by Pearson India and Spire Research and Consulting shows declining trend of student engagement from high school to college/university level (*The Statesman*, Kolkata Edition, 16 October 2016). While a teacher may sincerely work toward a better learning experience, 'an actively engaged learner is one who proactively puts in efforts for learning, asks questions and participates in activities both inside and outside the classroom'.

Having claim to the partial diagnosis, we ought to look for a possible course correction. I run the risk of being repetitive but my suggestions are as follows. Given the reservation policy, we can hardly reset the norm for initial recruitment, but insist on better grades for the unreserved 50%, and do away with the two-tier listing of NET qualified graduates. Teaching and research go hand in hand at tertiary level. In my opinion, student participation would also improve if we can also involve undergraduates in research projects. This would require that the young teacher is also qualified for and has the intrinsic ability for continued research. We cannot just wish away this lot, who are probably in the age bracket 30–50 years, and are in the payroll as undergraduate teachers. But we surely can devise strategies for teacher benchmarking, just as professional academic societies award chartered geologists status when the members attain certain professional standards of domain knowledge, possess demonstrable skills, strive for regular upgradation of the same and maintain certain ethical standards. Unfortunately, unlike secondary education system in our country we never insisted on teacher training or benchmarking for tertiary level teachers. There, UGC approved summer or winter schools for college and university teachers provide some remedy. However, mere attendance in such courses often pass as qualified training when it comes to career advancement. We may try to design something similar to Technical Education Quality Improvement Programme (TEQUIP) for teachers in sponsored engineering/technological colleges, which AICTE and the governing ministry sponsor and monitor. Mentoring of freshly recruited and young teachers of geology can also proceed better if the senior faculty in top institutes/universities or premier research institutes take up the job. This can proceed only on a voluntary basis with institutional support including the highest academic bodies who are supposed to regulate the tertiary education system. The funders like the Ministries of Ocean and Earth sciences, Science and Technology and Mining need to play a constructive role here by identifying sponsoring/mentoring institutes, even senior faculty and earmarking some fund. On a micro level, the junior teachers can spend a stint with a senior teacher as a summer intern, with support from the employer institutes.

As it involves serious and prolonged field work in the career of a professional geologist, the master's programme should preferably include a pan-India geological traverse, familiarizing the student trainee with the basic geological framework of India, essential for any sustainable mineral exploration programme. Organization of such extensive field work-based project for the students is possible only through sincere coordination of different college and university departments, under the UGC/HECI umbrella, with institutes/universities at different regions of India taking care of the different legs of the field work. This will also foster values of national integration in the participants.

Finally, a simple word on student engagement. In my experience, learning by rote has become a *de facto* practice. To engage students in the real learning experience one needs to be a little innovative and practical. All undergraduate course modules should have exposure to real life issues, whether it is urban or rural. One needs to encourage students to see for themselves how principles of basic geology relate to such issues, for example, bed rock degradation and soil formation, how petrophysical properties influence groundwater percolation, why some soils are more clayey than others, why rare earths are so important in our everyday life, how common use technology like ground-penetrating radar helps resolving fine scale structures of alluvial cover, perched water table, and so on. The potential is enormous, and reward for the innovative teacher is a precious little, love and respect from generation of students.

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