

CURRENT SCIENCE

Volume 97 Number 5

10 September 2009

EDITORIAL

Teachers and Teaching

Teachers and mentors are remembered fondly on 'Teachers Day', which is observed on 5 September. Everybody remembers a favourite or influential teacher, especially as they grow older. Teachers are a diverse community. While primary and secondary school teachers deal with children in their formative years, high school teachers wrestle with the problems of groups of adolescents, in the difficult years when childhood recedes and adulthood beckons. The early undergraduate classes are almost an extension of high school; although college brings with it a sudden loosening of the constraints that sometimes seem so restrictive for teenagers on the verge of a transition. Teachers are to be found all the way up to the level of research degrees. Ph D's are earned under 'guides' and 'supervisors', who must really act as mentors and teachers. By this stage the relationships are more nearly equal, with experienced students transforming into valuable colleagues in research for their supervisors. Teaching is traditionally a term reserved for those who lecture, explain and inform in the confines of a classroom. For teachers, the blackboard and chalk were their traditional instruments; their only other requirement was a sheaf of well-thumbed notes or a prodigious memory, from which facts could be recalled at will. Times have changed in institutions of higher education, where visual aids and computers have invaded classrooms. 'Powerpoint' allows instructors to project in rapid fashion reams of information, while the internet provides an inexhaustible and valuable resource, after class, if used wisely. In the electronic age even teachers may need to change, as they move into a position where they must guide students to learn. In schools little has changed and hundreds of thousands of classrooms across India might well be described in Goldsmith's vivid verse, penned in the 18th century:

*'There in his noisy mansion, skilled to rule,
The village master taught his little school.
A man severe he was, and stern to view;
I knew him well, and every truant knew;
Well had the boding tremblers learned to trace
The days disaster in his morning face
Full well they laughed with counterfeited glee
At all his jokes, for many a joke had he;
Full well the busy whisper circling round
Conveyed the dismal tidings when he frowned.*

*Yet he was kind, or, if severe in aught,
The love he bore to learning was in fault;
The village all declared how much he knew;
'Twas certain he could write, and cipher too;*

.....

*In arguing too, the parson owned his skill,
For even though vanquished, he could argue still;
While words of learned length and thundering sound
Amazed the gazing rustics ranged around;
And still they gazed and still the wonder grew
That one small head could carry all he knew.'*

—The Deserted Village

Even as I write, a faint and distant memory appears of a high school teacher reciting Goldsmith, occasionally breaking into Telugu in conveying an interpretation which left even bilingual students puzzled and bemused. Memories of teachers, both kind and difficult, rarely fade. The mentors of later years, of course, remain with us to the very end.

Teaching has never been a financially rewarding profession. In a highly globalized and commercialized world, teaching careers are unattractive and few young and bright college graduates will opt to become teachers. At all levels, from school to the university, there is a growing shortage of trained, committed and enthusiastic teachers. The dramatic expansion of the higher education system, especially in the areas of science and engineering, has suddenly highlighted the great demand for faculty. It has been easy to create IISERs and IITs by decree; it appears harder to recruit faculty who will be both researchers and teachers. As the demand for increasing India's scientific productivity grows, so too will the demand for scientists in national laboratories where there is no teaching of note. The oft repeated demand by senior scientists, who influence policy, for 'more Ph Ds and more papers' is sharpening the divide between those who do only research and those who teach. The same quarters also lament the poor quality of science students, endorsing the need to strengthen the base of science teaching, especially in college at undergraduate level. While teachers seem to be wanted, they do not seem to be adequately compensated. Researchers have received many hastily conceived sops; based on the level of peer recognition, in a community in which the credibility of the rewards sys-

tem is rather low. Election to two of India's four academies, recognized for this purpose, provides the favoured few an addition to their salaries until they retire from the fray. Recipients of CSIR's Bhatnagar prize are also rewarded similarly; a curious case of providing continued compensation for the recipient of a cash award. There is no requirement for evidence of continued productivity. Unsurprisingly, large sections of faculty in national institutions are now obsessed with election to Academies, especially if they are barred by age from aspiring for the Bhatnagar prize. In such an environment there are few takers for academic programs that may serve long term goals. The unhappiness of teachers, even in the best of our institutions like the IITs, was evident on 'Teachers Day' when faculty protested even as some of their most committed colleagues were honoured by the students. The present protests follow the government's order outlining the pay formulae to be followed, as a fall out of the 6th Pay Commission. Inevitably, every Pay Commission leaves most beneficiaries unhappy; a ten-year cycle which unfailingly stirs up resentment and discord amongst those paid by the public exchequer. Each Commission must appear to be broadly consultative, going around the country raising expectations, most often to unreasonable levels. Every Commission must also leave its mark, introducing apparently innovative measures which are invariably greeted with suspicion and hostility. The 6th Pay Commission, whose recommendations are to be implemented from the beginning of 2006, has been no exception. 'Pay bands and grade pay', increments that need to be computed and 'performance linked incentives' are features that have been widely discussed. Commissions are always followed by special committees, almost as surely as night follows the day. For many central institutions of research and higher education, the waiting time before the dust settles will almost take us to the halfway mark between the 6th and 7th Pay Commissions. These debates on compensation address only the high end of the academic profession. Improvements in salary structures and recruitments in colleges and universities in different states are slow and vary significantly. Retirement ages of faculty and benefits also differ, adding new dimensions to the problems faced by teachers across the country. At school level the shortage of teachers, who are competent and knowledgeable, will continuously increase as the profession is perceived as unrewarding and unattractive. The problem of a shortage of faculty in the sphere of higher education will undoubtedly become even more severe as the new institutions grow in student strength.

Concerns about science education are global as evident from the discussions that have been going on in the United States for the past few years. A National Academies Committee on 'Prospering in the Global Economy of the 21st Century' produced a report in 2005, dramatically titled 'Rising Above the Gathering Storm'. The title evokes memories of Winston Churchill's famous volumes on World War II. The report itself is intended to draw a

blueprint for 'energizing and employing America for a brighter economic future'. There are four principal recommendations which address school education ('10,000 teachers, 10 million minds'), research ('sowing the seeds'), higher education ('best and brightest') and economic policy ('incentives for innovation'). In a hark back to the days of the launch of the *Sputnik*, 'the committee notes that the nation is unlikely to receive some sudden "wake-up" call; rather the problem is one that is likely to evidence itself gradually over a surprisingly short period'. The American drive to increase the number of science and mathematics teachers is based on an ambitious plan to provide the highest quality undergraduate education to those who wish to become teachers. Financial incentives are proposed for both the students and the universities that educate them. There are also ambitious plans to strengthen skills of existing teachers through summer institutes and master's programs in science and mathematics. Interestingly, summer internships and 'inquiry-based learning' are suggested even for high school students. There are major proposals for expanding research funding and promoting early career researchers.

In considering the requirements for science and mathematics teaching, two recent editorials in *Science* offer insights. Both refer to the drive to strengthen science, technology, engineering and mathematics (STEM) education in the United States. Maxine Singer asks a key question: 'How to develop and cultivate great STEM teachers?' She notes that many teachers have no STEM qualifications and argues that scientists must 'work to help develop STEM teacher education programs that are rigorous and relevant for teaching students who have grown up in the internet era'. She notes that 'STEM teachers must . . . be considered vital members of the professional scientific community' (*Science*, 2009, **325**, 1047). The need for galvanizing science departments at research universities by transforming teaching methods and shifting the focus to 'how students learn, pedagogy issues, and evidence of learning' is highlighted by Carl Wieman (*Science*, 2009, **325**, 1181).

The driving force for current interest in STEM teaching is the need to move ahead in a highly competitive global environment. Norman Augustine who chaired the National Academies Committee ended his statement before a US Congressional Committee (2006) quoting a poem by Richard Hodgetts, that he notes 'summarizes the essence of innovation'.

*'Every morning in Africa, a gazelle wakes up
It notes it must outrun the fastest lion or it will be killed.
Every morning in Africa a lion wakes up
It knows it must outrun the slowest gazelle or it will starve.
It doesn't matter whether you're a lion or a gazelle –
when the sun comes up, you'd better be running'.*

Teaching and teachers will help us run faster.

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