Mobile workshops for students – A novel programme for graduate medical education

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There is an urgent need to transfer fast-expanding new knowledge to graduate students to make our medical education globally competitive. This is difficult to achieve within the existing system, which is overburdened, perpetually short of resources and dictated by the existing rigid curricula. We describe here a highly cost-effective and novel approach of mobile workshops on human genetics for students, in which the programme moves from college to college taking new developments to the students' doorsteps. Similar programmes can be developed in other disciplines and for basic and advanced technologies for life sciences graduate students, especially in institutions located in 'remote' semi-urban and rural areas. This approach of mobile, non-formal education is highly suitable for developing nations and can be adopted internationally.

FRONTIERS of science and technology are changing at an unprecedented rate. To be globally competitive, it is necessary to continuously tune science and professional education to the latest trends. With few exceptions, our medical and health institutes face perpetual human and financial resource crunch, lack even the minimum infrastructure, their equipment is outdated and often non-functional, and libraries, the major source of new knowledge, are in a poor state. The teachers get little exposure to fast-expanding horizons of science and technology. These factors have resulted in a progressively increasing gulf between what is taught and what is known, and teaching is often outdated and unexciting to the young minds. Further, tremendous inertia in the educational system impedes innovations. By itself, the system may take several years to correct. From time to time, a few continuing medical education (CME) programmes are held for medical teachers. But there is little follow-up and their impact on teaching, if at all, is minimal. There is need to be more proactive and develop novel strategies for dissemination of the new knowledge, which is bound to influence future medical practice, to graduate and postgraduate students.

We describe here a novel mobile educational programme aimed at speedy dissemination of new knowledge to medical students, developed under the auspices of Moving Academy of Medicine and Biomedicine, Pune. Briefly, the concept has two components, namely (i) workshop for teachers to update their knowledge base and in the process generate local expertise, and (ii) workshop for students on the same topic conducted with the help of these teachers along with a few experts from the Academy (Figure 1). The module has been developed for human genetics.

So far six student workshops have been held: two in Mumbai and one each in Kolhapur, Dhule, Miraj (all in Maharashtra) and Belgaum (Karnataka). No pre- and post-workshop tests were administered at the first two workshops held in G. S. Medical College, Mumbai and the Government Medical College, Kolhapur. These two workshops have not been taken into account to measure the impact of the programme.

Thirty-eight teachers from different disciplines, mostly from government medical colleges spread all over Maharashtra attended the teacher update workshop, which was held in Pune during 4–6 April 2002. The workshop contents consisted of recent developments in clinical, laboratory and basic aspects in human genetics. The workshop was uniformly rated highly and the teachers liked the idea of student workshops.

Student workshops were held in conjunction with the host medical colleges. The participants, whose number was restricted to 100, were essentially interns or junior residents. But if the seats were available, college staff and even graduates and postgraduates in basic sciences were admitted. The evaluation of the impact was restricted to only medical students. Many participants in other categories did not take the tests. Each workshop was of two-days duration and had two components: (i) a core course common to all and (ii) special lectures, which varied from place to place depending on the availability of experts. The core course consisted of topics such as structure, function and regulation of genes and their transmission patterns, chromosome biology, clinical cytogenetics, congenital anomalies and malformations, Mendelian and non-Mendelian genetic disorders, laboratory diagnosis, include-

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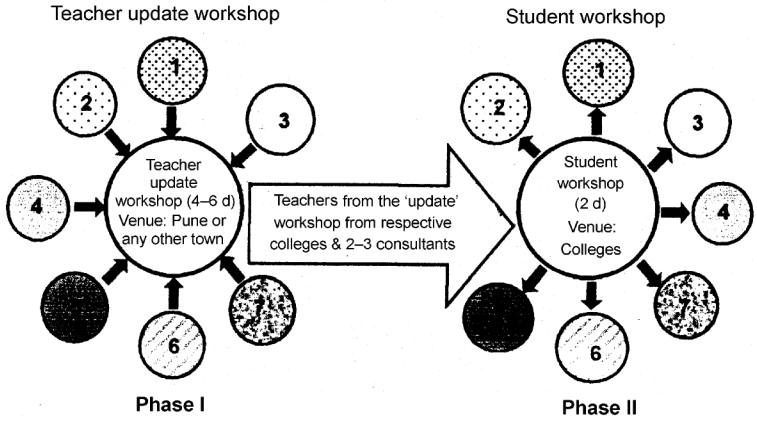

Figure 1. The concept of mobile workshops.

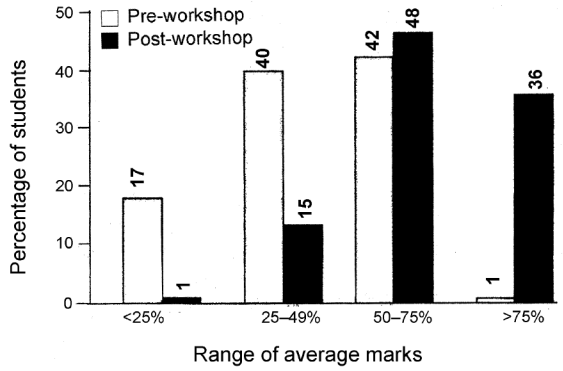

Figure 2. Impact of the workshop as judged by the number of students in various categories (for explanation see text). Numbers on the top of the bars denote the percentage distribution of students in different categories in the pre- and post-workshop tests.

ing neonatal screening, prenatal diagnosis (both invasive and noninvasive procedures) and pedigree charting. Topics for special lectures were interaction of genes and environmental agents, polygenic disorders, community and population genetics, genetic counselling, ethics in genetic research, genetherapy, human genome project and its implication to medicine and health, cloning of mammals, stem-cell therapies, including therapeutic cloning, pharmacogenetics and pharmacogenomics, genomics and drug development, DNA fingerprinting and genetics in forensic medicine, and special therapies like bone-marrow transplantation. Four to five special lectures were delivered at each workshop.

The impact of the workshop was assessed through administration of pre- and post-workshop tests consisting of the same set of 30 multiple-choice questions (MCQ), based only on the core course. Each student thus served as his/her own control. Distribution of questions was 43, 37 and 20% for clinical, basic and laboratory topics respectively. No negative marking was done. Evaluation of the impact of the programme is based on the observation on 102 students, who took both the pre-and post-MCQ tests in the 4 medical colleges (Table 1).

Based on the scores in the pre-workshop test, a measure of baseline knowledge of human genetics, students were divided into four groups (Figure 2). Pre-workshop performance of the students was rather disappointing. Fifty-seven per cent scored less than 50% marks, indicating that they had only modest knowledge of genetics. Only one student could score more than 75% marks. In the post-workshop test, performance improved in all the groups. The number of students scoring less than 50% was reduced to 16%, which is an improvement of more than 300%. At the other end of the spectrum, about one third of the students scored more that 75% marks (Figure 2); of these 25% scored more than 85% marks (data not shown). A shift to the right with improvement at both the ends is evident from these data, indicating that the workshop was highly effective in improving the students' knowledge of human genetics. This was also evident when the data were analysed on the basis of the absolute marks scored by each student. Except three students, all others showed improvement. Overall improvement in marks was 21.6% (Table 1). Wilcoxon signed rank test was applied to compare the pre- and post-workshop scores statistically. Improvement both overall and at the individual college level, was highly significant (Table 2; $P < 0.01$). The best scores were seen in the clinical spots, but the over-all performance in the pre-workshop MCQ, even in this category, was just over 50%. Students hardly had any idea about pedigree charting. The worst performance was regarding laboratory aspects (Table 3).

The cost of such programmes should be a prime concern, especially in developing nations where resource crunch is maximally felt in the education and health sectors. Creating infrastructure for each emerging discipline is time-consuming and expensive. Just the monthly salary of two mid-level faculty members in medical colleges in India is roughly Rs 60,000, which is the average cost of each workshop that benefits about 100 participants. Thus the amount spent per participant was Rs 600, of which Rs 200 was spent in providing him/her free reading material

Table 1. Impact of workshops on performance of students

Groups based on pre-workshop test (%)	No. of students	Mean ± SD marks scored		
		Pre-workshop	Post-workshop	Improvement (%)
<25%	17	16.6 ± 6.826	45.6 ± 13.668	29
25–49	41	37.4 ± 7.039	63.5 ± 14.195	26.1
50–70	31	58.1 ± 5.521	73.1 ± 10.311	15
>70%	13	71.0 ± 2.183	83.0 ± 5.007	12
Overall	102	44.5 ± 18.515	65.9 ± 16.606	21.6

Table 2. Performance of students in various colleges

Workshop date	College	No. of faculty members		No. of participants*	Mean ± SD		Wilcoxon signed rank test *P*
		Local	Outside experts		Pre-workshop	Post-workshop	
February 2003	Shri B. H. Government Medical College, Dhule	4	12	19	26.0 ± 11.242	54.0 ± 14.903	<0.01 (HS)
February 2003	J. N. Medical College, Belgaum	5	13	24	48.5 ± 15.975	70.0 ± 13.160	<0.01(HS)
July 2003	L. T. Medical College, Mumbai	4	14	19	48.3 ± 15.037	74.0 ± 12.618	<0.01(HS)
November 2003	Government Medical College, Miraj	5	15	40	49.5 ± 19.011	65.7 ± 17.777	<0.01(HS)
	Overall	18	54	102	44.7 ± 18.471	66.11 ± 16.508	<0.01(HS)

*Actual number of students who attended the workshop was much higher. Observations on only those who took both the pre- and post-workshop tests were analysed and shown here. HS, Highly significant.

in the form of a 250-page, well-illustrated, multi-authored book on human genetics. In terms of international currency, less than US $15 was spent per participant. This is obviously the cheapest and perhaps the fastest mode of disseminating new knowledge to medical students, especially in developing societies. Two components make the programme cost-effective: (i) participation of local faculty in the workshop and (ii) getting experts from nearby institutions. For example, for the workshop in Miraj, experts from Hyderabad and Pune–Mumbai region were invited. Further, they were given only two-tier AC train fare.

Feedback from students was obtained using a simplified, qualitative questionnaire in which they were asked to comment on whether the workshop was beneficial to them. If so whether they would like to have similar workshops on other topics. They were also asked to comment on the contents of the course, quality of lectures and the reading material provided to them. Without exception, students felt that they were benefited by the workshop and were keen to have more of such workshops on other emerging topics. Some of the topics suggested were oncology, immunology, organ transplantation, emergency medicine and molecular medicine. The reading material was highly appreciated.

Most medical colleges in India have a dismal record in research, the mother of new knowledge. A recent ICMR study[1] shows that 20% of the 156 medical colleges included in the study, had not published a single research paper during 1990–94. With a few exceptions, even the published articles were in low-impact journals. Graduate medical education (MBBS) in India has remained static and over a period has become restrictive and totally examination-oriented. It may therefore take several years before new developments, which are occurring at a fast rate, become part of the formal teaching. To fill in this gap, routine teaching will have to be supplemented with non-formal education programmes focused on the recent advances in medicine and biomedicine. This article describes a novel and highly cost-effective method to achieve this objective.

As mentioned earlier, a number of workshops/symposia/seminars are held every year under the programme of CME for medical teachers, mostly in our major cities under the auspices of national funding agencies and academies. Our approach is unique in many respects: (1) This is the first organized programme directed to medical students. (2) Teacher update, which acts like a CME, is intended to generate expert manpower to support student workshops. (3) This combination of teacher update and student workshop should update teaching in the subsequent years and the benefits of the programme are likely to be long-lasting. (4) Finally, we move from place to place taking knowledge updates to students' doorsteps, with special emphasis on colleges with modest infrastructure located outside major cities, in the process improving awareness about the recent trends in medical fraternity in 'remote' areas.

There are studies in the West that describe the types of learning activities preferred by medical students, especially close to the examination period[2]. But they are with reference the routine formal curriculum-oriented teaching. No information is available on the response of students to non-formal educational activities like mobile workshops. Before embarking on the project, most teachers had serious doubts about the success of the pro

Table 3. Student response to individual questions before and after the workshops

Type of the question	Positive responses out of 102		Improvement* (%)
	Pre-workshop	Post-workshop	
Clinical			
Garrod's discovery (history)	20	66	45
Clinical laboratory correlation	47	61	14
Clinical laboratory correlation	46	64	19
Gene transmission pattern	32	49	17
Signs in genetic disorders	58	83	24
Signs in genetic disorders	76	94	18
Signs in genetic disorders	70	86	16
Signs in genetic disorders	48	86	37
Signs in genetic disorders	65	94	28
Spot (picture) – Duchenne muscular dystrophy	84	98	14
Spot (picture) – Retinoblastoma	84	100	16
Spot (picture) – Haemophilia	11	38	26
Pedigree charting (spot) – symbol used	29	64	33
Mean	51.5	75.7	24
Laboratory			
Cytogenetics	28	61	30
Spot blood smear (haemoglobinopathy)	48	76	26
Chromosomal anomaly (spot-picture)	57	86	27
Karytype abnormality	58	80	21
Sex chromatin anomaly – spot (Buccal smear)	12	16	4
FISH spot	19	25	6
Mean	37	57.3	20
Basic			
Mitosis	76	93	17
Population genetics	43	70	26
Clinical cytogenetics	38	50	12
Mitochondrial inheritance	45	89	43
Molecular biology DNA structure	75	92	17
Autosomal dominant inheritance	16	26	10
Autosomal recessive inheritance	37	58	21
Sex-linked inheritance	18	26	8
Inherited chromosomal abnormalities	40	68	27
Genes in polygenic disorders	16	32	16
Spot (nondysjunction)	43	66	23
Mean	40.6	61.5	20

*These figures are derived by multiplying the final number by 100/102.

gramme. They strongly felt that students were only examination-oriented and would not be attracted by such informal teaching programmes, which are outside their curricula. That this was a myth is borne out by the success of the workshops.

The concept of mobile educational programmes for medical students is equally applicable with suitable modifications to other disciplines. On the same line mobile technology workshops imparting hands-on training to young, budding scientists and technocrats, especially at institutions located in 'remote' semi-urban and rural areas can be envisaged, speedily creating the much-needed human resources for emerging biomedical, pharmaceutical and biotechnology industries. In turn this would result in the improvement of science and technology standards in the hitherto neglected rural sector.

The module of mobile workshops as the means of quick transfer of new knowledge to the student community developed by us should be useful to developing nations and can be adopted internationally.

1. Sen, N., In conversation: Interview with C. P. Thakur, Union Minister for Health and Family Welfare, Government of India. *Curr. Sci.*, 2002, **82**, 1420–1423.
2. Bloomfield, L., Harris, P. and Hughes, C., What do students want? The types of learning activities preferred by final year medical students. *Med. Edu.*, 2003, **37**, 110–118.

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