



UNIVERSITY OF JAFFNA, SRI LANKA
**PROFESSOR SIVAPATHASUNTHARAM
MAGESWARAN**

MEMORIAL LECTURE – 2004



**THE STATE OF TERTIARY
EDUCATION
IN SRI LANKA**

by

Prof. J. N. Oleap Fernando

*(B.Sc. (Cey); Ph.D. (Lond); DIC; CChem; Dip-in-Man (OUSL);
FRSC; FIChemC; FRACI; FNASSL)*

*(Senior Professor of Chemistry, The Open University of Sri Lanka,
Dean, College of Chemical Sciences, Institute of Chemistry, Ceylon,
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THE STATE OF TERTIARY EDUCATION IN SRI LANKA

Ladies and Gentlemen,

It gives me the greatest pleasure and honour to deliver the Professor Sivapathasuntharam Mageswaran Memorial lecture, 2004, this afternoon. Thanks to the common medium of English in which we studied both at school and University, we were indeed fortunate to have many good friends from both communities. Prof. Mageswaran was indeed one of my closest friends and I therefore consider it a great delight and an unprecedented privilege to have been invited to deliver this lecture. May I thank the University of Jaffna and in particular its Vice-Chancellor, Professor Mohandas, and Professor Mageswaran's devoted wife Rajeswari, both of whom were Chemistry students of mine at Colombo and Peradeniya respectively for having invited me to undertake this assignment.

Mageswaran entered the University of Ceylon at Peradeniya at the same time that I entered the University of Ceylon at Colombo in June 1962. At that time Special Degree Courses in Science were available only in Colombo; therefore, when Mageswaran became one of the four students selected to read Special Chemistry from Peradeniya he joined the balance eleven of us selected from

laboratory bench at Sheffield . Unfortunately when Mageswaran returned to Peradeniya in 1971 after obtaining his PhD from Sheffield, he had very little facilities at Peradeniya for continuing in the same area of Synthetic Organic Chemistry in which he had specialized at Sheffield.

Professor Vijaya Kumar, presently Dean / Science at Peradeniya and Chairman /Industrial Technology Institute delivering the first Mageswaran Memorial lecture in 1999 stated that had Mageswaran remained at Peradeniya he probably would have set up a vibrant Synthetic Chemistry group there; however Mageswaran instead decided to take up the challenge to develop the Department of Chemistry in his hometown at Jaffna when the University of Jaffna was set up as the fifth Sri Lankan University in 1975. Kumar goes on to record the fact that if Jaffna had not been transformed as the focal point of this continuing thankless war , Mageswaran would no doubt have set up that synthetic group in Jaffna. I fully and wholeheartedly agree with Kumar since Mageswaran was indeed one of the most reliable, dependable and hard working people whom one could have ever come across. He had the initiative to see a job done to excellent perfection. His love for chemistry made him an excellent teacher. It was his unfailing leadership and dedication which made this

department to survive the ravages of war and produce excellent graduates with a sound knowledge of Chemistry.

Delivering the second Mageswaran Lecture in 2000, Prof V.K.Ganesalingam stated that the University of Jaffna conferred on him posthumously the Honorary Degree of Doctor of Science as well as an Emeritus Professorship . Delivering the last Mageswaran Memorial Lecture your Vice Chancellor, Prof Mohandas, has referred to Prof Mageswaran as an academician with principles who dedicated his life to this University. Mageswaran worked to plan and played the leading role in building up this Department including this building itself which has been most aptly named Mageswaran Block in his honour. It is indeed very fitting that Mageswaran's students and well wishers graciously established a fund that enables the University of Jaffna to honour him annually and remember his yeoman services. I consider myself very fortunate to have thus got this opportunity to contribute to his memory and pay tribute to him by delivering this lecture this year at Jaffna.

Professor Mageswaran was indeed very deeply interested and involved in the development of the Chemistry Department at the University of Jaffna in the late seventies soon after its formation. Though only very little human & other resources were as usual available, Prof.Mageswaran, virtually single handedly took up the

challenges that confronted him with fortitude and courage. He was a great example to all of us. It was indeed that sense of devotion and commitment that he was able to spread around so much that many of his Chemistry colleagues from the other Universities readily responded to his numerous appeals and came all the way to Jaffna to conduct special Chemistry lectures. I myself came to Jaffna, sometimes in the midst of other pressing engagements in Colombo, for five years in succession from 1978 to 1982 in order to deliver such lectures. I had agreed to come in 1983 as well but unfortunately the security situation took a turn for the worse that I had to later decline Prof. Mageswaran's request even though he assured me in his customary convincing manner that danger to human life in Jaffna at that time was no worse than being killed in a road accident in Colombo.

Let me conclude my direct reference to my close friend Mageswaran by saying how much I valued his company and remember the long conversations and discussions we have had on numerous topics on several occasions. Mageswaran and Rajeswari were well known to my wife Mandrupa and son Oshan as well. We have stayed in Mageswaran's home here at Jaffna several times while Mageswaran and Rajeswari have been to our house at Moratuwa and stayed with us on more than one occasion.

My son even affectionately referred to Mageswaran as "Vegetable Uncle".

The rest of my memorial lecture I am delivering today will be in two parts :

In the first part I will be dealing with and making some serious comments about the state of tertiary education in Sri Lanka.

In the second part, I will be presenting a particular aspect of Chemical Education, which has caught my interest over the past few years.

PART I – Some Comments About The State of Tertiary Education in Sri Lanka

Particularly due to my great appreciation of what Mageswaran had done to this University, it was therefore my great pleasure and privilege to accept in October 2003 an appointment by the University Grants Commission to serve as its nominee on the Selection Board to select his successor to the Chair of (Organic) Chemistry. It was perhaps also fitting that the other UGC nominee appointed was another one of Prof. Mageswaran's (and my) close associates – Prof. Vijaya Kumar. Apart from serving on this Committee, I was indeed very happy

work, legal action, considerable heart-burn and consternation amongst University academics today. About 10 years ago, a trade union dispute arose at our Open University which from its inception had a very strong need to appoint permanent academic support staff, who are referred to as Educational Assistants. Since these posts were not categorized as Teachers, appropriate persons, but with mediocre qualifications as compared to probationary lecturers, were recruited as Educational Assistants; unlike probationary lecturers, such Educational Assistants were not required to obtain any post graduate qualifications for confirmation. These persons can be considered in effect as de-facto permanent Tutors and Demonstrators whose work did not necessarily require post-graduate qualifications. They could continue until retirement and end up even as Senior Educational Assistants without obtaining any further qualifications; however, there was no automatic opportunity to be promoted to the grade of teacher even if one did obtain post-graduate qualifications. Nevertheless, although a number of them who did subsequently obtain appropriate post-graduate qualifications were considered and given academic appointments on the existing cadre at both the Lecturer and Senior Lecturer levels after competing with outside applicants in terms of the usual schemes of recruitment. In order to resolve the on going trade union dispute that had existed for some time, the Open University recommended to the

UGC in the mid nineties that those Educational Assistants who were attached to academic departments and had obtained appropriate post-graduate qualifications acceptable for academic grades be promoted on a personal basis to the grade of Teacher without competition. Their cadre posts were to be transferred to the academic grade as personal to the holder. However, despite several requests, such a scheme of internal promotions even under these special circumstances were, for whatever reason, repeatedly refused by the UGC. The trade union problem therefore continued and even intensified over the subsequent years; even a supplementary recommendation by the Open University to permit automatic promotions of Educational Assistants, where appropriate, at least to the grade of Senior Lecturer on the available scheme of recruitment was firmly declined by the UGC fairly recently. However, immediately after the last April General Election, political factors intervened and by the end of April, a UGC Circular was suddenly issued permitting promotions for many Educational Assistants but on a very watered down basis, which if implemented would permit their appointment as Senior Lecturers which in a number of cases would have been with relatively low level qualifications. Surprisingly and unfortunately there was much political pressure brought in by the UGC and even the Ministry of Education to our Vice-Chancellor to expedite these promotions. Consequently, even Educational Assistants, not

attached to academic departments but to some of our regional centers, were also selected for appointment as Senior Lecturers sometimes even with irrelevant qualifications. Unnecessary political interference into Open University affairs has now resulted in a stalemate with several legal actions by both sides and the main problem still remains unresolved. It is very unfortunate that politicisation of our University system has been exponentially increasing so much in recent times that the entire academic outlook of our Universities is facing a very serious threat and coming across unprecedented challenges resulting in considerable demotivation and absolute frustration amongst the entire academic community.

The tremendous contribution of the Institute of Chemistry Ceylon towards Tertiary Chemical Education in Sri Lanka

Although Prof. Mageswaran living and working in Jaffna from the mid seventies resulted in a reduction of his contacts with Colombo, Professor Mageswaran used every possible opportunity to maintain such contacts particularly before such contacts became near impossible with the aggravation of the ethnic crisis after 1983. It was in this spirit that Prof. Mageswaran together with his wife Rajeswari decided to extend their whole-hearted academic support to our professional body of chemists,

the Institute of Chemistry Ceylon, when it ventured into uncharted waters and launched its **Graduateship Programme in Chemistry** in 1978/79. As some of you may be aware, the Institute of Chemistry Ceylon at that time started this four year programme to produce Graduate Chemists of a standard and level equivalent to that of a Special Degree in Chemistry awarded by a recognised University. Then Dr. & Dr. (Ms.) Mageswaran both traveled to Colombo on several weekends for several years in the period before 1983 in order to lend their support and provide their much needed academic expertise to the Institute of Chemistry Ceylon in order to make this unique programme a resounding success. Indeed it was the help and assistance rendered by many such qualified and devoted members of our Institute, working in Universities, Research Institutes, Service Institutions, Industry and in the private sector that has enabled this programme to become such a tremendous and unprecedented success that today our Institute, through its College of Chemical Sciences, has become the largest provider of Graduate Chemists in Sri Lanka. The programme has gone on uninterrupted for 26 years and has today become a very noteworthy and significant feature of the tertiary educational scenario in Sri Lanka. When the 22nd batch of Graduate Chemists pass out after the results of the final examination presently being conducted are released early next year, the total number of Graduate Chemists produced by our

professional body is expected to come close to 400 from the previous total of 365. Although the programme has been conducted in the premises of a private secondary school in Mt. Lavinia and therefore quite obviously needs an upgrade of quality, resources and expertise, it is very significant and noteworthy to record the extent to which a group of professionals, through its recognized professional body, has been able, without the time delaying road-blocks and bottlenecks ever present within the state bureaucratic system, to successfully conduct such a tertiary level programme. This programme has today come to be firmly recognised and respected largely due to the very high quality of the products that are produced by it. Though we still do not have a single full time academic, even on a contract basis, on our staff and all our attempts to recruit one in recent times has utterly failed, nevertheless, we have the advantage of having been able to obtain for the past 25 years the expert services from chemistry academics in 6-7 Universities and other experts in chemistry working in several research and service institutions and in the private sector; I also hope that very soon it would be possible for some chemistry academics from the University of Jaffna to also join the band-wagon of expertise to help your professional Chemistry Institute to enrich the programme even better. I am also happy to bring the happy news that our dream of having our own centre will very soon be realized when we

formally open next February our new headquarters already built and presently being furnished and receiving its finishing touches at Rajagiriya. This building will bring all Institute operations including the Office, Library, Lecture Halls, Laboratories, Computer Room and Instrumentation Centre into one location, where we can provide a much better coordinated service to our members and students. Mageswaran's active interest in the activities of the Institute of Chemistry Ceylon can be gauged from the fact that he attended our Annual Sessions in June 1990 after many years, when the war was temporarily suspended and transport services resumed. However, when Mageswaran was in Colombo the war resumed and he got stuck in Colombo for many weeks as a result. That was the very last occasion on which he was able to participate in an activity of the Institute.

Whither University Education in Sri Lanka?

While on the subject of the Graduateship Programme in Chemistry, I must use this opportunity to generalize on this subject and also make some further comments on the general direction of sponsored and state financed University Education in Sri Lanka.

Many problems awaiting solutions in all spheres of life in Sri Lanka are increasingly affecting the activities of our state

financed university system as well for many years. Regrettably it appears that the acute problems in the system are becoming even more acute and the solutions appear to be getting further and further away. There is currently a World Bank funded IRQUE Project with the objective of improving relevance and quality of undergraduate education in our conventional universities. There is also an ADB sponsored Distance Education Modernisation Project which is intended to improve the quality and access of Distance Education including the Open University of Sri Lanka. While these two projects are intended to, expected to and bound to make considerable improvements to the state of undergraduate and post-graduate education in Sri Lanka, I however have increasing apprehension and doubt as to whether at the end of the five year project periods, Sri Lanka would have achieved even an appreciable fraction of the desired outcomes. Why am I compelled to have such pessimistic expectations?

The first and primary reason for my doubt is the increasing politicization of our university system. We have even reached a situation in which the once exalted high position of Vice-Chancellor had been so debased, so politicized and made a puppet of the relevant political authorities that it is becoming increasingly difficult to even find three suitable applicants for such posts in many of our Universities. I referred to this matter

during my General Presidential Address to the Sri Lanka Association for the Advancement of Science in November 2001 and expressed my honest feeling that if we increasingly go along the way we have been doing over the past years and allow politics to dominate, then very soon state sponsored university education in Sri Lanka, particularly of the non fee levying type, might wither in Sri Lanka. I indicated on that occasion that current university reforms will remain effectively as a theoretical exercise in the presence of politicisation and a gross lack of all types of resources.

Three years later and after 38 years of continuous service to Sri Lanka's university system, I have great regret not only to record that my apprehensions and doubts are much greater today, but that I am now also of the opinion that fee levying state sponsored university education as typified in the Open University of Sri Lanka might also wither away due to similar and other reasons. We at the Open University have got so demotivated over several matters in recent times that many of our University academics are seriously questioning as to what is there for our Open University to celebrate during its proposed Silver Jubilee Anniversary Celebration next year. For the first time in our University history, our University is officially referred to as bankrupt. Leave alone other recurrent expenses, the Treasury is

reportedly now not prepared to meet the full salary bill of our permanent staff as it has been doing over the past 25 years. The Vice Chancellor had to go last week and plead with the Treasury for 20 million rupees to pay November Salaries since the Bursar had failed to get the Treasury to respond positively. What a tragic situation for a state financed distance study University ?

Furthermore, within our University set-up, if I take the B.Sc. Degree Programme of our Open University as a typical example, the number of B.Sc. Graduates passing out annually has sadly decreased over the past few years in contrast to the pattern that existed earlier upto 2000. Internal problems caused by trade union action by various grades of staff have postponed the commencement of our academic year from October, a few years ago, to March of the following year. This type of delay is unprecedented for the Open University of Sri Lanka.

For the first time in the history of our 60 year old University system, Vice - Chancellors of Universities are being removed from office by the President even a few months after their appointment. Many more have been and are being investigated and their official actions have been subject to Commissions of Inquiry. The respect for and respectability of Vice-Chancellors have reached an all time low. Members of

University Councils are being requested to resign consequent to the results of general elections.

Unfortunately our state financed universities are under constant political pressure to expand though effective government funding is shrinking. It is very sad and disappointing to note that the Government has proliferated and continues to proliferate half baked, quarter cream universities (recruited with half cream staff) throughout Sri Lanka without any consideration for resources, facilities and needs. To make matters really disastrous the South Eastern University was established in the late nineties at a distant outpost called Oluvil in order to cater to secretarian ethnic interests and to further political survival of the government in power. We are all aware how former Affiliated University Colleges which were established for the specific purpose of providing much needed middle level education and training, were overnight converted to fully fledged universities without any planning whatsoever. The absence of staff even in the existing universities is of no relevance or concern to our political masters when they decide to establish new universities. All that is necessary to establish a new University is for the Minister of Education to issue a gazette notification declaring the formation of a new university or campus and this procedure is considered so simple and trivial by our politicians. The Wayamba University of

Sri Lanka, for example was declared open during the Provincial Council election campaign in 1999. Is it not comical to note that almost 25 years after it was established, the Eastern University of Sri Lanka at Batticaloa does not have a single Professor in any of the science disciplines. Leave along Professors, there are so few academics staff even at Senior Lecturer level. The Chemistry Departments at the Eastern as well as South Eastern Universities do not even have a single Chemistry Senior Lecturer on their staff even to be appointed as Head of the Department. Whom are we trying to fool? What is the quality of the B.Sc. graduates passing out? I hope you are aware that the Eastern University produced two batches of three Chemistry Special Graduates each in the late nineties by housing them in a rented building in Colombo and having the entire course of the two year Special Chemistry lecture programme delivered over a period of 3-4 months by visiting University academics at the premises of the Open University and the Sri Jayawardenepura Universities respectively. Has the UGC or anyone else in authority ever bothered to find out the quality of graduates produced by these universities under such appalling circumstances and conditions. I have to report and record that the Institute of Chemistry Ceylon has not recognised the Eastern University Special Degree in Chemistry for admission to its membership since we find that the quality of the graduates are below required expectations. Even the third year B.Sc degree

awarded by Universities established over the past 10 years are not as yet recognized by the Institute since we have considerable doubt about the quality of the B Sc degree awarded..

It is quite true that there exists a Public Administration Circular 16/92 graciously issued by the benevolent Sri Lankan Government that directs "all appointing authorities to treat degrees of the same level awarded by different Universities coming under the purview of UGC as equivalent to one another". Such circulars take effect as soon as a new University is established by the publication of the Gazette notice referred to earlier. Such circulars are essential and necessary to enable the UGC to have its conscience clear when it allocates and admits virtually ignorant school leavers to half baked universities, However, a serious question arises as to how a country such as Sri Lanka with such a rich history and heritage of high quality education can tolerate this kind of academic tomfoolery.

There are now proposals to create even more universities – a University of Uva and a University of Technology are on the cards and have been officially announced with much pride. The foundation for the University of Uva was in fact laid last week despite the exiting Universities not been provided required funds even for their existence. Six new Universities were promised in

the election manifesto of the present government. The unfortunate tragic consequences of such unplanned and ill thought political exercises is that all other universities, including the well established Universities in the country are all compelled to suffer reduction in the resources necessary to maintain standards even at the existing levels. The new universities that have been established with meagre numbers of academics and grossly inadequate financial resources are also obviously unable to make a significant impact into the total student intake. Many students selected to such universities either do not come or find convenient transfers to other universities. Invaluable public funds are being wasted on infrastructure and other developments but with no tangible gain. It has been reported that Rs 1000 million has been approved to set up the new University of Uva. The human resources necessary for a knowledge based economy are however not available in the correct quantity or at the correct standards or at the correct time. Lack of adequate resources is indeed a serious hindrance not only to the new universities but also to the existing universities.

I wish to quote below the reference to the principle recommended for the expansion of Universities in the National University Policy put out by the National Educational Commission in the late nineties:

“The location of a National University should be decided on the basis of national needs and viability, and not in a simple ‘one per province’ basis. The ability of a university to attract and retain high quality staff, maintenance of linkages with other organizations and the effects of a university on the economic activities of its locality are concerns of much high priority than the convenience of a small fraction of its student population. Furthermore, in locating a national university, a balance must always be struck between the need for a quiet and uncongested atmosphere based on educational considerations and the need for proximity to a relatively better developed urban centre on considerations of viability. It would be clearly counter-productive to locate universities on ethnic and other secretarian considerations. Universities are expected to bring students from a variety of backgrounds together so that they may interact and develop attitudes and values which are conducive to co-operation and peaceful co-existence.”

It does not need much imagination or thought to realize to what extent these lofty principles have been clearly contravened in the establishment of what I refer to as mushroom universities particularly over the past decade. There are consequently wide divergences in the standards of the academic and other staff that have to be recruited to such Universities

from the post of Vice Chancellor downwards. The UGC has even lowered the standards of post-graduate qualifications required for appointment as University teachers to all Universities in an attempt to solve the problem.

Non Government Sector participation in Tertiary Education

Through a plethora of international schools that have also mushroomed at nooks and corners throughout Sri Lanka, a small number of Sri Lankans including politicians who have the money to pay exorbitant tuitions fees, send their children for primary and secondary education in the English medium outside the conventional system. We also have higher educational institutions affiliated to foreign Universities which are also providing very high cost tertiary education to a few Sri Lankans. We also have a few parents, with the necessary funds and outside contacts, sending their children to Universities abroad either after their failing to obtain local university admission or in some cases even without attempting local admission.. The Sri Lankan Government graciously provides unlimited foreign exchange for all such educational pursuits. These openings have also encouraged and enhanced an exodus of even competent & qualified University academics, who wish to work abroad to earn money necessary for their children's education.

What are the end results? A small number of well to do parents including many politicians thus have unparalleled opportunities to educate their children at the tertiary level in the English medium within Sri Lanka or abroad and using Sri Lankan foreign exchange. A few children are thus given the elitist opportunity to commence their tertiary education much earlier, graduate and come back to compete for the limited jobs available sometimes even before their Sri Lankan classmates finished a major part of their studies at conventional Sri Lankan Universities. We are also well aware that many private sector and even some public sector institutions favour such foreign qualified graduates for employment particularly because they have been educated in the English medium. I ask in all seriousness – Is this the equity which the Sri Lankan education system boasts about through a national system with free education, free schoolbooks, free uniforms and what not?

Under these conditions is it not blind folly for successive governments not to have encouraged and nurtured a privately managed but regulated tertiary educational system to enable a much larger number of less affluent students to be educated within Sri Lanka at a much lower cost. We know that only a small percentage of those who qualify for university admission are

presently admitted to the conventional non fee levying Sri Lankan Universities. We are aware that Sri Lanka has one of the lowest enrollment rates to University education in the whole world. We also know that at present many students even with relatively good results are forced to repeat the A/L examination in order to secure a higher Z- score at a subsequent shy or seek alternate educational opportunities at a high cost or seek employment at a lower level. *Is this not a wastage of human resources? Is this not an unnecessary wastage of valuable productive time in the life of a student? Should we not take early remedial steps to officially provide and encourage, outside the non fee levying state sector, much needed educational opportunities which are heavily in demand in our movement towards a Knowledge Based Economy?*

The **Central Bank** in its Annual Reports has repeatedly recommended the setting up of new private Universities and other similar educational institutions since the present state University educational system is supposedly insufficient and outdated. The **ADB** has also recommended that the Government should phase out total control and ownership of university education, and allow participation of the private and non-public sector under state supervision. The **World Bank** has also made similar observations. Unfortunately positive action from the government

does not emerge; we get only empty rhetoric . What a sad and intolerable situation we are unfortunately in?

The Government as well as all sections of public have to realize the gross inability of the Government to enhance in any appreciable and productive manner the present expenditure on university education or , except at the grave expense of quality, increase in any satisfactory manner the number of students admitted to the non-fee levying state universities, either through the existing ones or by creating new universities.

However, outside the strictly private sector we have a number of highly recognized professional organizations that have come forward, without profit motives, to offer high quality professional programmes within their respective professions. These professionally oriented endeavors should be fostered and encouraged by the government since their objectives are more in keeping with that of the latter and it is an inherent responsibility of such professional bodies to provide good quality education at minimal cost to a wider clientele; they should often meet the running costs from the fees levied but some government assistance towards capital costs and providing bursaries for needy students would be much welcome. I therefore look forward to the

state playing the secondary role of catalyst in addition to the primary regulatory role referred to earlier.

I have said it on previous occasions and I say it again even more forcefully that the North Colombo Medical College (NCMC) that was commenced in the early eighties by the Ceylon College of General Practitioners should have been the flag-bearer prototype of many such private Sri Lankan Universities that would have been able to widen access, enhance equity and increase quality without sacrificing quality within the shores of Sri Lanka. Such an opportunity to provide medical education to a large number of Sri Lankan students at much lower cost within Sri Lanka and without any expenditure to the Sri Lankan Government should have been very welcome and may have even provided the impetus to establish a number of similar Colleges in diverse fields in Sri Lanka. Unfortunately, political pressures intervened and this pioneering splendid attempt had an artificial death when the NCMC was taken over by the Government as another medical faculty within the state system – thereby suddenly and without any planning increasing the state expenditure on higher education astronomically.

It is now accepted that the NCMC produced well equipped and qualified medical graduates who were much in demand. The

NCCM proved the point that the non governmental sector in the form of the College of General Practitioners was able to establish a very successful quality institution of repute within the few years of its existence.

Speaking about the involvement of the non government sector in tertiary level education, I have already referred to the pioneering role played by the Institute of Chemistry Ceylon, the professional body of Chemists in Sri Lanka in developing, conducting and nurturing Graduateship Courses in Chemistry (as well as a laboratory technicians certificate course) from the seventies.

Having been personally involved in this unique and pioneering Graduateship Programme (which was organized to provide a service, meet a real need and fill a lacuna in Sri Lanka's tertiary educational system) I can personally say with confidence that we were thus able to provide a new dimension to quality tertiary chemical education in Sri Lanka. The programme has gone on unbroken for 26 years and we have produced nearly 400 Graduate Chemists, a relatively large percentage of whom have obtained postgraduate degrees from Universities throughout the world and many of whom are making an important contribution to national development in Sri Lanka and abroad. The cost to a

student for this four year programme amounts to only about Rs.1 $\frac{1}{4}$ lakhs per student; the UGC estimate for the average expenditure on a conventional university student is over Rs.1 lakh per year. The Institute of Chemistry programme could in fact be followed by bright Chemistry undergraduates from some of the newer Universities at much lower cost to their Universities than it would be if they were to duplicate such courses in their own University without the necessary resources and for a few students.

As the second part of this Memorial Lecture, I wish to deal with an important aspect regards learning by students which I have come to recognize through an analysis of student performance in characteristic questions at examinations. The particular aspect which I wish to deal with today in the surprising inability of students to deduce and write down elementary and basic equation which they are well aware of but using different symbols. I will now proceed to elaborate on what I wish to present to you this afternoon.

PART II : Rote Learning and The Lack of Conceptual Learning by Students at All Levels Evidenced by Their Inability to Deduce Elementary and Fundamental Equations

ROTE LEARNING corresponds to attempted learning through a fixed mechanical way of study by memory alone without much deep thought or intellectual study. Such rote learning is found to a very large extent to be accompanied by student need merely to pass examinations with minimum study and effort and coincidentally at the last moment. Naturally such learning cannot be long lasting since there is little appreciation of basic and fundamental concepts that are essential for a true and long lasting learning. Thus rote learning is synonymous with an absence of CONCEPTUAL LEARNING which requires a more intellectual effort and a deeper understanding of the subject matter.

The increasing introduction of course units into student curricula and examination structures has had the unfortunate adverse effect of student emphasis and dependence on studying a smaller content of subject matter in order to pass the relevant course unit examination within a shorter time period without deep understanding

It is also found that many students of today, even attending conventional universities, are occupied simultaneously studying for a number of educational programmes. This naturally compounds the effective problem since such students are generally hard pressed for time and generally seek an easier way out. Such students are then occupied with a great deal of study material covering a number of related (or sometimes unrelated or slightly related) topics. The unfortunate consequence of this is that they often do not have adequate time to study any particular topic in a serious manner.

The problem is perhaps further aggravated amongst students studying in distance study and open learning institutions since we deal in such cases with those even in full time employment who may also register for far too many courses which they later find they cannot adequately cope with in the midst of the demand for time for studies and other involvements, of more adult students.

The unfortunate usual consequence of rote learning is often accompanied by what can be referred to as Surface Learning. In Surface Learning, many students are sometimes compelled to merely rush/glance through their lecture notes and study material at a surface level without deep understanding or thought or critical analysis. Quite often students are satisfied with merely

finding answers to questions appearing in past question papers without any proper or useful understanding of the subject matter. Examiners unfortunately, (unconsciously or otherwise), quite often aid and abet such rote learning and surface learning endeavours of students by often repeating past questions at subsequent examinations with little or minimal and some times zero change.

While memory power is no doubt also necessary and the ability to recall material quickly is often very useful, the type of surface and rote learning undertaken by modern day students is unfortunately so examination oriented that much of the material so memorized without adequate understanding is in practice very quickly forgotten perhaps as fast as it was learnt. Rote Learning is also actively encouraged in the tuition classes which many students attend as supplementary to conventional school work.

An important but unfortunate consequence of such rote and surface learning is that many students find themselves unable to apply in day to day life the material they have so "learnt". After all it is said that true Education is what one remembers after one has forgotten every thing that one has been formally taught. True Education in this context refers to the ability to apply the basic

principles of what has been taught in a new context or environment.

We have however realised from repeated experiences at examinations over the past few years that rote learning by students who are heavily influenced by memory power has been clearly demonstrated by their inability to answer what can be well accepted as very basic, elementary, fundamental and straight forward questions but set in an alternative form.

As a typical example, one could cite a very traditional question set at the GCE (Advanced Level) or equivalent University Entrance Examination:

Write down the expression for the pressure of an ideal gas in terms of the root mean square speed that can be derived from the kinetic theory of gases.

It has been repeatedly observed that
$$P = \frac{\overline{mnc^2}}{3V}$$

which is the well known correct answer can usually be reproduced by memory (by rote learning devoid of conceptual learning) by perhaps 60 – 75% of a typical class.

We have set the same question subsequently for a similar group of students in a different form as follows:-

Read the following passage and answer the question given below.

“ A gas molecule has a mass a . Its relative molecular mass is W .

x molecules (y mol) of this gas occupy a vessel of volume G at a temperature T .

At this temperature the mean speed of gas molecules is b while the root mean square speed is d .

There are no inter molecular forces between the gas molecules. Volumes of the gas molecules can also be considered to be negligible”

Using some or all the symbols given in the above passage but no other, write down an expression for the gas pressure (p).

Two striking differences that can be clearly identified in the latter form of the question are

- (i) more symbols than required are given requiring the student to “pick out” the correct symbols
- (ii) the symbols given are different to the usual ones traditionally learnt/memorised by the student

The correct answer using the alternate “new” symbols is

$$P = \frac{axd^2}{3G}$$

by identifying that V , m , n and $\frac{1}{C^2}$ in the memorized “traditional” equation should be replaced by G , a , x and d^2 respectively.

It was very revealing though shocking to note that the fraction of students who were able to correctly replace the well known traditional symbols by the new symbols given in the question was extremely small.

As I indicated earlier, more data than necessary has been given in the question. The student is therefore expected to “pick up” the required data only and rewrite the equation using the alternate symbols. The inability of many students at the GCE (Advanced Level) to be able to do so correctly was very revealing and is clearly attributable to rote learning and surface learning. After all, the relevant equation is a very basic one pertaining to the kinetic theory of gases.

I have set similar questions at examinations at various levels at several Universities and parallel institutions. It is very disappointing though revealing to note that quite a number of students studying even in the fourth (final) year at University are

unable to answer similarly structured questions correctly even though the response required is a mere substitution and should be easily within their grasp. The important conclusion is that application of rote learnt material in a slightly modified form/context becomes a huge problem for such students. Such a situation existing even amongst undergraduates admitted to University after a very competitive examination is more than tragic.

Let us now consider the following alternate question set at University (first year) level.

d molecules of a gas (relative molecular B) at temperature N occupies a volume Q . The mass of a molecule of the gas is a . The mean speed of the molecule at this temperature is x . Intermolecular interactions and the volume of gas molecules can be assumed to be negligible.

Boltzmann Constant = D

*Using some of the symbols given in the above passage **but no other** write down expressions for*

- (i) The Avogadro Constant, N_A*
- (ii) The Gas Constant, R*

- (iii) The mean square speed $\overline{C^2}$
- (iv) The pressure exerted by the gas
- (v) The value of ZR where Z is the compressibility factor of the gas

Once again it is found that many students are unable to write down the correct answers using the alternative symbols as indicated below:-

$$(i) \text{ Avagadro Constant} = \frac{B}{a}$$

$$(ii) \text{ Gas Constant} = D \frac{B}{a}$$

$$(iii) \text{ Mean Square Speed} = 3 \frac{DN}{a}$$

$$(iv) \text{ Pressure} = \frac{dDN}{G}$$

$$(v) ZR = \frac{DB}{a}$$

Let us consider another example of a question I have set at University (second year) level:

The traditional question in terms of conventional symbols can be written as follows:

Starting from the thermodynamic equation

$$dA = PdV - SdT$$

$$dG = VdP - SdT$$

write down the two Maxwell type relationships that are relevant. The correct answer which can be easily derived by double differentiation or written down by inspection or written down by memory are,

$$\left[\frac{\partial P}{\partial T} \right]_V = \left[\frac{\partial S}{\partial V} \right]_T \quad \text{and} \quad \left[\frac{\partial V}{\partial T} \right]_P = - \left[\frac{\partial S}{\partial P} \right]_T$$

This same question has been set using the alternate “non traditional” symbols as follows:-

The thermodynamic properties C, L, M, E, X and Y are relevant to a given closed thermodynamic system. The following two thermodynamic expressions are found to be valid for this system:

$$dC = -MdY - XdL$$

$$dE = YdM - XdL$$

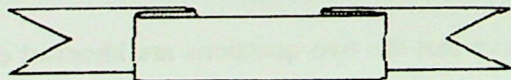
Write down the two Maxwell type relationships that are relevant to the said expressions.

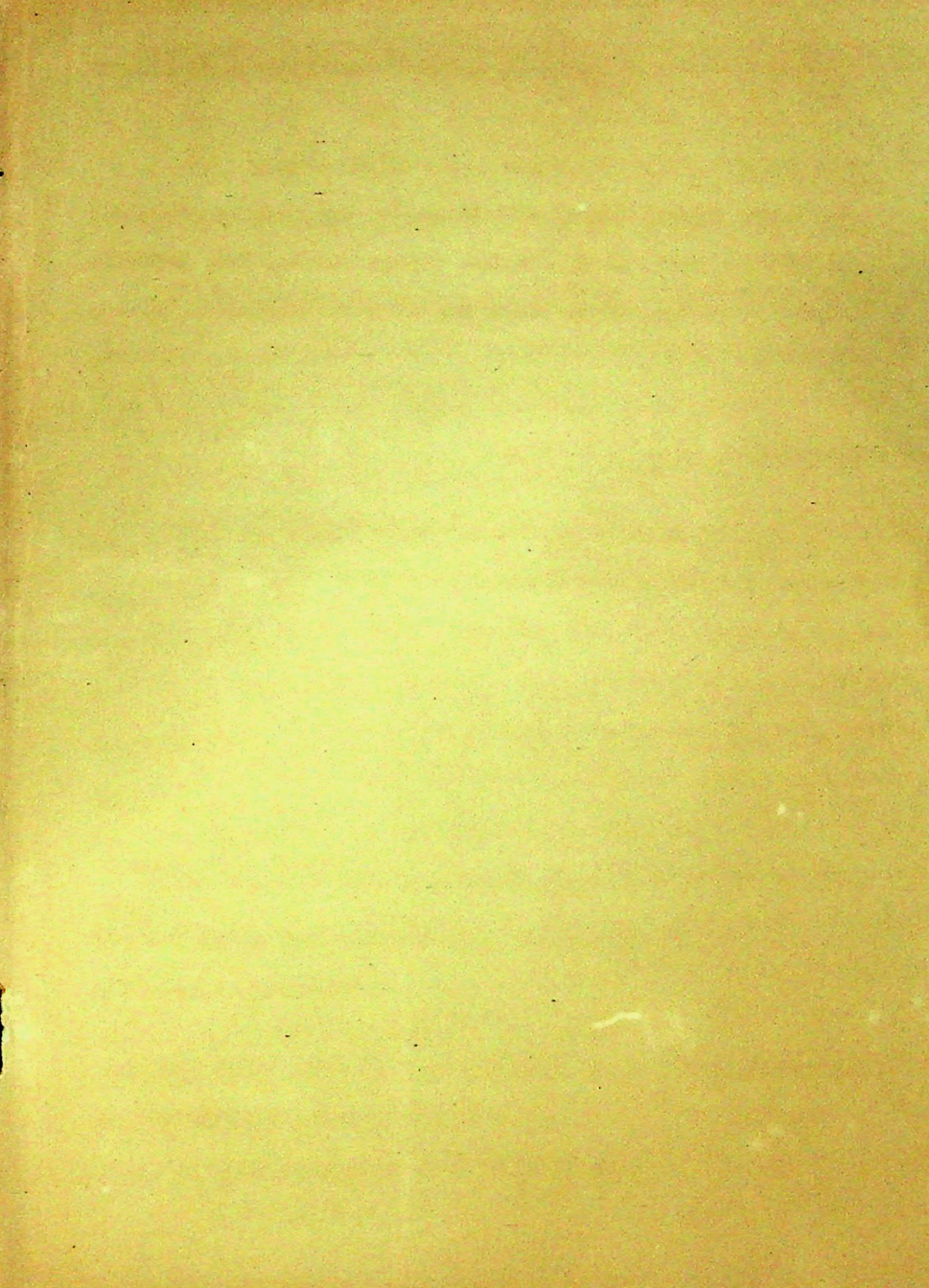
You will observe that the two questions are identical except that the traditional thermodynamic symbols of A, G, P, V, S and T have now been replaced by C, E, M, Y, X and L.

This is a question once again where one could expect the students to write the correct answer fairly easily by inspection or by a simple double differentiation. However, it is revealing but disappointing to note that the number of students who were able to deduce the correct answer using the alternate symbols was disappointingly small.

Conclusion

May I in conclusion thank the University of Jaffna for having kindly given me this unique opportunity to pay a tribute to my good friend, batch mate and colleague, Mageswaran, who has done so much to build up your Chemistry Department to its present state. He has set us a great example for hard work and commitment. My wife and I are also very pleased to have been able to use the opportunity to visit Jaffna after 22 years and we hope that conditions will be such that we can come to Jaffna more regularly in the future.





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