

Teaching of Science in the Universities with Special Reference to the Science Faculties at Vidyodaya and Vidyalandara Universities: A Report to the Chairman, National Council for Higher Education, 9-6-1968.

by

G. PONNAMPERUMA

*Director, Ceylon Institute of Scientific and Industrial Research;
Vice-Chairman, National Science Council*

1. Introduction

RESULTING from the approach made to me by Dr. G. P. Malalasekera, Chairman of the National Council for Higher Education, I visited Vidyodaya University on the 2nd of June, inspected the Science Faculty and had discussions with the Dean, Professor G. C. N. Jayasuriya as well as other departmental heads of the same faculty, listed at Appendix II. I had already visited the Science Faculty at Vidyalandara University on May 3rd and had discussions with Professor C. Dahanayake, Dean of the Faculty, as well as other members of the teaching staff, regarding the curricula, facilities available, progress and the prospects for the expansion of science teaching in this University. I subsequently had further discussions with Professor Dahanayake. Particulars of the present science teaching staff at Vidyalandara are in Appendix III.

2. Scope of the Report

2.1 The scope and purpose of the report requested have been stipulated in the N.C.H.E. Chairman's letter of 22nd May (Appendix I). The National Council for Higher Education is considering two alternatives regarding the "rationalisation" of science teaching in these two universities. These alternatives are:—

- (i) The amalgamation of teaching staff and facilities of both universities into a single Science Faculty at Vidyalandara, closing down the present faculty at Vidyodaya. At present better laboratory facilities are available at Vidyalandara where the faculty is inadequately staffed. At Vidyodaya the faculty is inadequately equipped but has a fuller complement of competent and qualified staff.
- (ii) Building up the science faculties in both universities by filling up the deficiencies in either place, viz. staff at Vidyalandara and laboratory facilities at Vidyodaya.

2.2. The arguments adduced in favour of the first alternative are: that it would be better to have one faculty, adequately staffed and equipped than two with deficiencies, and that the teaching of science should not be considered as "a sine qua non in all universities".

2.3. In support of the second alternative it has been argued that the teaching of science is an essential and integral part of a University and hence the necessary funds must be found if Vidyodaya is to fulfil its purpose as an University.

3. Science and the University Curriculum

3.1. The reasons mentioned above, which have been adduced in support of one or the other of the two alternative are a simplification of the issues involved. Before delving into what might be more cogent considerations, it is essential to clear the question which has been raised, as to whether the teaching of science could be dispensed with in a University, even at its inception. The question is analogous to a controversy which took place in England over one hundred years ago. The older universities had been mainly training institutions for "holy orders". Liberal education was confined to the humanities mainly. Higher education for mundane purposes was even despised.

3.2. In the meantime, Science which had been a pursuit of knowledge for its own sake, or a pleasurable diversion for "gentlemen" of leisure, was reluctantly admitted into the curricula of these older universities as an extension of Philosophy. Whatever its merits be, a century ago, such a controversy is an anachronism today. Science is the core of twentieth century humanism.

3.3 In the course of a century, the various disciplines of Science including Technology, took roots in universities. In England, the needs of a society changing with the Industrial Revolution gave rise to new universities such as London, Manchester, Birmingham and Sheffield, with emphasis on Science and Technology. Even these universities have been hard put by the challenge of a post-war society, and the Scientific Revolution of today's Space and Nuclear Age. New universities such as Sussex, Bristol, Aston, Southampton etc. have sprung up very recently with a new outlook on the teaching of science. In Ceylon, a developing country, committed to the principles of a democratic welfare state, a University without science would be an antithesis of the cultural, social and economic aspirations of a new and rising generation.

3.4. Higher education, discovery, invention and innovation are now inseparably involved. There is no longer a fixed corpus of knowledge to be handed down unchanged from one generation to another. Knowledge and truth are no more final, revealed or sacrosanct. They are continually being modified, enlarged and adjusted. Dogmatism may die hard. Science more than any other influence has the capacity to lift this oppressive blanket of inflexible mental attitudes, prejudicial to the progress of our young nation. Science is also a most powerful intellectual stimulant of our time. Divorced from it, culture in a modern age will be sterile.

3.5. Vidyodaya and Vidyalankara, before they were made into universities may have been seats of higher education for the clergy. Depriving either of them of its Science Faculty would neither be consistent with their present status or purpose as Universities, nor even with their traditional names VIDYodaya and VIDYAlankara. It would result in a retrogression of these institutions to a medieval status.

4. Practicability of Staff Amalgamation of the Two Universities

4.1. Amalgamating the two university faculties into one has been mentioned as a possible line of "rationalisation". It will be relevant in the first instance to consider the practicability of such an arrangement. Details of the Chairs which have already been filled in the various branches of science at Vidyodaya are shown at Appendix II and details of the present Science Faculty staff at Vidyalankara are shown at Appendix III. The staff strength in the two universities are summarised in the following table:

TABLE I

| VIDYODAYA | VIDYALANKARA |
|---|--|
| 1. Professor of Chemistry (Dean) (Prof. G. C. N. Jayasuriya) | 1. Professor of Physics (Dean) (Prof. C. Dahanayake) |
| 2. Professor of Zoology (Prof. A. C. J. Weerakoon) | 2. Professor of Chemistry (Prof. J. K. P. Ariyaratne) |
| 3. Professor of Physics (Prof. P. C. B. Fernando) | 3. Professor of Zoology (Prof. H. H. Costa) |
| 4. Professor of Botany (Prof. O. S. Pieris) | |
| 5. Professor of Mathematics (Prof. P. W. Epasinghe) | |

4.2. It will be seen that five Chairs—Chemistry, Physics, Zoology, Botany and Mathematics, have already been filled at Vidyodaya and three Chairs viz. Chemistry, Physics and Zoology have been filled at Vidyalankara. If the two faculties are to be amalgamated, three persons now filling Chairs in Science will become redundant. It will be impracticable to find "Chairs" for displaced Professors in Colombo or Peradeniya without seriously upsetting present staff and arrangements in these two places. Is it proposed to terminate their services? With regard to the remaining two Chairs, these are at present at Vidyodaya. If the proposal is to have one Science Faculty and that at Vidyalankara, can they be transferred compulsorily from one university to another? Problems arising from the termination of appointments could be overcome by appropriate

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compensation for loss of career. The more relevant consideration would be the loss to the country of competent and specialist scientific teaching personnel who are in scarce supply at the moment. It will, in fact, have the opposite effect of what the "rationalisation" was expected to achieve, viz. the best utilisation of scarce personnel. It is more likely that it would rather contribute to the "brain-drain" from the country, of specialists this country could scarcely afford to lose.

4.3. Anyone conversant with higher university education will appreciate that the core of progress is, a dedicated teaching staff of quality, calibre, creative ideas, and with a capacity to adjust to changing needs. The mere setting up of buildings and equipment and filling posts will not achieve this end, as may be evident from an appraisal of past experience in Ceylon. At both Vidyodaya and Vidyalankara, schools of scientific teaching, with a new and original look, adjusted to the needs of the country, are emerging. A nucleus of excellent professorial staff capable of giving the new lead that the country needs, in Science, has been formed. This is the finest asset, which should not be liquidated. These staff members are not persons who cannot find more lucrative careers elsewhere. In fact, many of them have taken on the appointments at a sacrifice to themselves. It is extremely unlikely that the N.C.H.E. will succeed even in persuading them to transfer their activities elsewhere. If a decision is taken now to close down the Science Faculty at Vidyodaya, it will result in disbanding a group of excellent science teachers. Sooner or later if it is decided to re-open the Faculty, mere finance for buildings and equipment may not necessarily bring back such a group of persons.

4.4. Admittedly, there are vacancies still to be filled at both universities at Reader, Lecturer and Assistant Lecturer levels. There is an acute shortage of qualified scientists to fill existing positions, not only in the universities, but in all sectors of national activity. This is mainly due to the inadequacy of the output of science graduates in quality as well as quantity, despite forty-five years of science teaching at university college level and twentyfive years as an autonomous University of Ceylon. The universities as well as other activities require to take emergency measures to overcome this difficulty, e.g. by suitable scholarship and training programmes. This could, with careful planning, be achieved within a three or four year period. A temporary expedient is the recruitment of scientific personnel, now engaged in other spheres, on a 'visiting' basis. There are research institutes, and science—based Departments that will gladly collaborate in such a scheme. The Ceylon Institute for Scientific and Industrial Research is actually doing so. The present situation has arisen from unsatisfactory planning and development of university science teaching in the past. The present amalgamation proposal will defeat its own purposes. It may result in the elimination of the few higher qualified personnel at doctorate level, rather than provide a solution to the present shortage, which is mainly in the junior grades.

4.5. The other view point which has been expressed in favour of amalgamation appears to be based on an assumption that the existing laboratory facilities at Vidyalkara could be better utilised by centralisation there, than by the dispersal of resources into another unit at Vidyodaya. Vidyalkara has a larger laboratory floor area and more working benches and equipment. Vidyodaya on the other hand has done an extremely creditable job in converting a basement (originally intended for a garage), for laboratory purposes. The facilities are barely sufficient for an intake of twenty five students per year and are seriously limited by the unsuitability of the building. The facilities at Vidyalkara, although more extensive, shown many deficiencies in planning. Even with the improvisations done by the present teaching staff, they will continue to be unsatisfactory. Hence, the expectation that amalgamation will result in a more efficient unit may not materialise. Some day Vidyalkara will be faced with the problem of building another Science block, and utilising the floor space now occupied by the laboratories for other purposes. Even at Peradeniya, the internal design, layout, equipment and utilities of the Science blocks are most unsatisfactory. Here, the accent has been rather on the external architectural and landscaping effects, which are undoubtedly a creditworthy achievement. Sooner or later a new Science Faculty will have to be built even at Peradeniya—it is hoped—without ignoring the functional principles of laboratory design. It is unnecessary to comment on the laboratory buildings in Colombo.

4.6. I had the opportunity of examining the plans and designs, including internal and external layouts of the intended laboratory blocks at Vidyodaya. The new laboratories, when completed, will certainly be a substantial improvement on any of the laboratory buildings in the other Universities. The intended expenditure is approximately Rs. 5 million, comprising Rs. 3 million on buildings and Rs. 2 million on equipment, and phased over a two to three year period. It is certainly a non-extravagant investment for a planned intake of hundred students per year giving a total of four hundred students in the Faculty. In the absence of a single well—designed Science Block in any of the other universities, Peradeniya, Colombo or Vidyalkara, the setting up of the new laboratories at Vidyodaya merits special consideration.

5. The Current Shortage of Science Graduates and the Immediate Need for Expansion

5.1. To my mind, the primary consideration in the development of university education should be in relation to the fulfilment of economic, social and cultural needs of the country. The Government of Ceylon is spending a substantial slice of its annual budget on national education at all levels. In a welfare state this expenditure has to be considered as a national investment from which a useful return has to be rightfully expected. We are just attempting an economic break through, particularly in fields of agriculture and industry.

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The future of these and other sectors of the economy are being seriously handicapped by the continuing shortage of scientific manpower in respect of numbers and of quality.

5.2. To cite one example, at a recent conference of Chairmen of State Industrial Corporations, presided over by the Minister for Industries, this acute problem was highlighted. Considerable dissatisfaction was expressed with the inability of the Universities to respond to the needs of industrial development. Major industrial schemes now in operation, or under planning, are being held up by the shortage of graduates in Chemistry or Physics and in certain branches of Engineering. The conference decided to send students to universities abroad for their degrees in science! We are unable to find suitable graduates in science even for the purpose of taking advantage of specialised post graduate courses available from aid-giving countries and international organisations.

5.3. The supply of Science graduates is not merely a matter of numbers. Quality is an essential consideration. Appendix IV is a statement of the output of Science graduates from the University of Ceylon (Peradeniya and Colombo) for the 10 year period 1958-1967. Table II is an abstract showing the output of Special Science Graduates during this ten year period.

TABLE II
Output of Special Science Graduates for the Ten Year Period 1958-1967
—University of Ceylon (Peradeniya and Colombo)

| Field | Total No. Passing | No. of 1st Classes | No. of 2nd Classes (Upper and Lower) |
|----------------|-------------------|--------------------|--------------------------------------|
| 1. Physics | 38 | 4 | 10 |
| 2. Chemistry | 130 | 3 | 51 |
| 3. Mathematics | 68 | 20 | 15 |
| 4. Botany | 82 | nil | 37 |
| 5. Zoology | 62 | 8 | 33 |

Physics and Chemistry are two subjects critical for industrial development. In the ten year period there have been only three First Classes in Chemistry and only four First Classes in Physics. In Botany, a subject vital for agricultural development, there has not been a single First Class during this ten year period. A comparison of these results with the pre-war period of the old University College makes it questionable, despite twentyfive years of autonomous university status, what the improvement has been.

5.4. The extremely low number of First Class graduates can be explained by one of two assumptions: Either the Ceylon student is intrinsically of a lesser calibre than his counterparts elsewhere, or it means the inadequacy of teaching facilities. Even among the few graduates who have obtained Classes, it has been observed that they lack in practical aptitude, self-confidence, enthusiasm for original work, ability to think clearly and to relate their book learning to their environment. The difficulty of finding competent science graduates to fill teaching appointments in the University is one facet of this general problem, whose roots are the present inadequacy of University science teaching. On the other hand, the enormous output of graduates in Arts subjects, many of whom cannot even find a clerical job, is building up an explosive situation in the country.

5.5 Under these conditions, it is extremely difficult to see the RATIONALE in closing down an existing Science Faculty in any University, when the need is for expansion. It would be irrational to incur increasing expenditure in turning out unemployable graduates, whilst the country is being starved for the very critical skills it needs for its development. It is such creative development, effected with scientific manpower, which will in turn increase employment opportunities for other categories of graduates. The immediate need is for the extension of Science teaching at the Universities. Raising Vidyodaya and Vidyalankara, without the least possible delay, to the requisite level, is an obvious step towards fulfilling this need.

6. Adjustment of Science Curricula to Environment

6.1. Substantial progress has been made in the teaching of science in the national languages at school level. In fact, the proportion of students who have imbibed the principles of science in their own natural environment and in their mother tongue, is increasing. This places a tremendous responsibility on the universities to adjust themselves to the new needs of the country.

6.2. In these circumstances, the new approaches as to science teaching which are being developed at Vidyodaya and Vidyalankara fulfil an urgent national requirement. It is not only that the national language is freely used as an effective means of communication, the students of their own accord appreciate and are showing an enthusiasm for the study of English as a means to the enlargement of their knowledge. The implantation and the stimulation of interest in Science, not only in the student's own mother tongue, but in a manner related to his natural environment, have been effectively started both at Vidyodaya and Vidyalankara.

6.3. I was quite impressed by the new approach to Science teaching which I saw in both Vidyodaya and Vidyalankara. Without a lowering of standards, effective communication and stimulation of interest, adjusted to environment, is being rapidly achieved. This is exactly what the country needs at the moment. It is not practicable here, to go into the details of the curricular approach in

these two institutions. Many of the teaching staff of both institutions are experienced practical scientists. Besides teaching experience, they have been actively engaged in research or development work in various spheres such as agriculture, industry, fisheries, etc. and hence are able to appreciate the curricular adjustments necessary in the current context of national development. The students are given a sound practical bias, and are encouraged to relate their knowledge to phenomena observable in their own environment. They are also trained to be critical of, as well as have confidence in, their own work. The teaching of Botany and Zoology has been closely related to current problems in agriculture and fisheries, whilst that of Physics and Chemistry to industry and management. There is also a very close collaboration between different scientific disciplines in line with the more recent trends in university science teaching. Even in a subject such as Mathematics, a new look is evident, with its extension to Mathematical Statistics and data processing. Likewise, an outlook, adjusted to the developing needs of the country, prevails at Vidyalankara. In both places, the minds of the students are being purposefully research-oriented.

6.4. This does not mean that the approach to science teaching at Vidyodaya and Vidyalankara, could be standardised into one outfit. Each institution is developing its own approach and techniques which are not identical. They both have a practical environmental orientation in common. The varied approaches to science teaching are many. These different methods and approaches should have opportunity for trial and error and even for competition. Uniformity or standardisation of the methods of science teaching beyond certain limits would be prejudicial to progress. The developments at Vidyodaya and Vidyalankara will not only stimulate and enhance each other, but also Peradeniya and Colombo.

7. Future Planning and Programming

7.1. In considering the present and future programme, it is desirable to have in the forefront, certain criteria. These are:

- (i) Every University requires to have a Science Faculty for reasons already referred to, otherwise its designation would be a misnomer.
- (ii) The current economic development needs of the country require special priority. There is an acute shortage of special science graduates of quality for industrial and agricultural development and even for University teaching. Hence, there should be expansion to fill this deficiency. This can be achieved if Science Teaching is strengthened in all four Universities. A curtailment of existing facilities would be contrary to this objective.

- (iii) University Science teaching in the country requires to be given a new orientation related to environment. The competence of the Science teachers to adjust themselves to the new environmental demands and their enthusiasm for research, are all important considerations. Evidence of a new outlook is noticeable at both Vidyodaya and Vidyalankara.
- (iv) A new generation of science students, educated in the national languages in schools will be entering the Universities, from now onwards. Vidyodaya and Vidyalankara have adjusted themselves to the new situation.
- (v) The disproportionately large output of unemployable graduates in the Humanities, side by side with an acute shortage of Science graduates requires to be rectified, to justify the national expenditure on higher education. An effective means of achieving this is by developing Science Teaching at both Vidyodaya and Vidyalankara, complementary to Peradeniya and Colombo.
- (vi) The existence of several universities will enable the development of certain specialisations and of alternative approaches to the teaching of Science in each Institution. This will result in the stimulation of Science in all the universities.
- (vii) Important applied scientific disciplines necessary for development are still lacking in many of the universities. Examples are, Chemical Engineering, Electronics, Food Technology, Applied Bacteriology, Fuel Technology, Ceramics, Metallurgy etc. These would be the next line of expansion in the various universities once the basic sciences have been well established. Vidyalankara with its proximity to the Tyre Corporation at Kalaniya and Refinery and Fertilizer Projects at Sapugaskande and Vidyodaya with its proximity to the new Ceramics Factory at Piliyandala and the Steel Corporation at Athurugiriya have special advantages.
- (viii) In a country committed to the principles of a welfare state and free education at all levels, the extensions of opportunities, hitherto available only to a privileged few, to the large sectors of the population, is an important and relevant consideration. Curtailment or depriving Vidyodaya or Vidyalankara of Science will place students of these Universities, at an unfair disadvantage in career opportunities. It will also deprive the country of a pool of talent hitherto untapped.

8. Recommendations

Having regard to the above, the following recommendations are made:—

- (i) That the proposed expansion programme of laboratory facilities at Vidyodaya be proceeded with to enable an intake of hundred students per year into the Science Faculty for a maximum strength of four hundred.
- (ii) That Vidyalankara be given assistance in filling vacancies on its staff. This should be an immediate programme of training teaching staff abroad, combined with arrangements for “visiting lecturers” from outside.
- (iii) The new curricular developments now taking place at Vidyodaya and Vidyalankara directed towards industry, agriculture and fisheries should be encouraged and stimulated.
- (iv) Planning further stages of expansion should be considered at all the Universities to enable Science Teaching to extend into applied fields, which are of direct importance for the development of the country.

9. Summary

1. The question has been posed as to whether the two faculties of Science at Vidyodaya and Vidyalankara, could not be amalgamated into one Faculty and that at Vidyalankara. Adduced in support of amalgamation are the better deployment of available personnel and laboratory facilities. The other view is that Science should be taught in both Universities, laboratory facilities at Vidyodaya and staffing requirements at Vidyalankara, being suitably enlarged.

2. A question reminiscent of a controversy which took place in Britain over one century ago has also been raised. Should Science be regarded as an indispensable component of a University curriculum? The answer has been considered in a current and historical context. A university should reflect today and tomorrow and not look backwards on yesterday. This is a consideration particularly important for a developing country committed to the principles of a democratic welfare state.

3. Universities require to be oriented to social and economic needs of the country. The inadequate output of Science graduates is a principal set-back to economic development and hence to social and cultural development. At the same time there is a superfluity of graduates in the Humanities, for whom useful employment cannot be found. Peradeniya and Colombo are unable to cope with the increasing demand for Science graduates. Closing down an existing Science Faculty in any University will be a retrograde step.

4. A new outlook in university education in Science, oriented towards environment has been long overdue. The start which has already been made at Vidyodaya and Vidyalankara, fits into the immediate higher education needs

of the country, and is particularly suited to the present generation of University entrants, who have had their Science education in the national language. The extension of University education in Science to a larger cross section of students, particularly from non-urban areas, is also relevant.

5. The marginal costs of extending laboratory facilities at Vidyodaya relative to the national expenditure on higher education, is relatively small, staffing difficulties at Vidyalankara can be overcome with a more realistic and practical approach to the problem. Amalgamation of staff, may result in an elimination even of the few qualified persons available, and defeat its own purpose. It will disband a group of competent and dedicated university staff, with new ideas beneficial to the development of the country.

6. The new approaches to Science teaching at Vidyodaya and Vidyalankara will result in a stimulation of both teaching and research in all four universities. This in turn will facilitate further expansion of Science and Technology teaching, the need for which will progressively increase.

7. Both Vidyodaya and Vidyalankara show signs of a capability and new leadership in the advancement of Science, adapted to national needs. They should both be given the opportunity.

සම්පිංචනය

1. විද්‍යාදය හා විද්‍යාලංකාර විශ්වවිද්‍යාල දෙකේ විද්‍යා අංශ, ඒකාබද්ධකොට, එම විද්‍යා අංශය විද්‍යාලංකාර විශ්වවිද්‍යාලයේ පිහිටුවීම කළ නොහැකිවන්නේ ඇයිදැයි යන ප්‍රශ්නය මතු වී ඇත. මෙවැනි ඒකාබද්ධ කිරීමකට ඇති අවශ්‍යතාවය ලෙස, දැනට ඇති රසායනාගාර පහසුකම් හා නිලධාරී පිරිස, වඩා විධිමත් ලෙස ප්‍රයෝජනයට ගැනීමේ අදහස ඉදිරිපත් කොට ඇත. අනික් අදහස වූයේ, විද්‍යාව විශ්වවිද්‍යාල දෙකෙහිම ඉගැන්විය යුතු බවත්, විද්‍යාදය විශ්වවිද්‍යාලයට රසායනාගාර පහසුකම් සහ විද්‍යාලංකාර විශ්ව-විද්‍යාලයට ආචාර්ය මණ්ඩලය පිළිබඳ අඩුපාඩුකම් විධිමත් ලෙස සපුරාලිය යුතු බවත්ය.

2. බ්‍රිතාන්‍යයේ මීට ගතවර්ෂයකට පෙරදී ඇතිවූ, අතීතය සිහිගන්වන වාදයකට මුල්වූ ප්‍රශ්නයක් ද මෙහිදී මතුකොට ඇත. එනම් විශ්වවිද්‍යාල අධ්‍යාපන විෂයමාලාවට, විද්‍යාව අත්‍යවශ්‍ය අංශයක් ලෙස තිබිය යුතු ද යන්නයි. මෙයට පිළිතුර ඓතිහාසික සහ නූතන කරුණුවලින් ලැබී ඇත. විශ්වවිද්‍යාලයක් වර්තමානය හා අනාගතය කෙරෙහි අවධානය යොමුකළ යුතු අතර, අතීතය දෙස ආපසු නොබැලිය යුතුය. මෙසේ ප්‍රජාතන්ත්‍රවාදී රාජ්‍යයක්වී, එහි දියුණුව බලාපොරොත්තුවෙන්, එම දේශපාලන න්‍යාය-යන්ට නතු ව ක්‍රියාකරන, සංවර්ධනයවන ජාතියක් වශයෙන් හැඳින්වෙන අප, ඉහතකී ලෙස එම ප්‍රශ්නය දෙස බැලීම විශේෂයෙන්ම වැදගත් ය.

3. විශ්වවිද්‍යාලයක් සකස්විය යුත්තේ, එම රටේ සාමාජික හා ආර්ථික අවශ්‍ය-තාවයන්ට අනුකූලවයි. එසේ අවශ්‍ය ප්‍රමාණයට වඩා අඩුවෙන් විද්‍යා උපාධිධාරීන් බිහිකිරීම වනාහි ප්‍රධාන වශයෙන් එම රටේ ආර්ථික දියුණුවට බාධකයක් වන අතර, මේ නිසා එම රටේ සාමාජිකය හා සංස්කෘතික සංවර්ධනයට බාධා පැමිණේ. එසේම මෙකල අවශ්‍ය ප්‍රමාණයට වඩා වැඩියෙන් (කලා) උපාධිධාරීන් රැසක් සිටීම සහ ඒ අයට ප්‍රයෝජනවත් වන සේ රකෂා සැපයීම ද, අපහසුවී ඇත්තේය. මේ අතර ජේරාදේණිය සඳහා වැඩිවන ඉල්ලුම පිරිමසාලීමට අපොහොසත්ව ඇත. කරුණු මෙසේ නම් දැනට යම්කිසි විශ්ව විද්‍යාලයක පවත්නා විද්‍යා අංශයක් වැසීම වනාහි ප්‍රතිගාමී ක්‍රියාවක් වන්නේය.

TEACHING OF SCIENCE IN THE UNIVERSITIES

4. විශ්වවිද්‍යාලයයක ඇති විද්‍යා අධ්‍යාපනයේ අළුත් මුහුණුවර, එහි පරිසරයට අනුකූලව සකස්විය යුතුය යන අදහස පෙර සිට පැවැතෙන්නකි. මෙවැනි සැකැස්මක් දැනටමත් ක්‍රියාත්මක කොට ඇති විද්‍යාදය සහ විද්‍යාලංකාර විශ්වවිද්‍යාල දෙක, රටේ වහා අවශ්‍යව ඇති උසස් අධ්‍යාපන අවශ්‍යකම්වලට ගැලපෙන ලෙස සකස්වී ඇති අතර, සාමාන්‍යවෙන් විද්‍යා අධ්‍යාපනය ලබාගෙන විශ්වවිද්‍යාල ප්‍රවේශ පත්වල සිටින වර්තමාන ශිෂ්‍ය පරපුර කෙරෙහි විශේෂයෙන්ම උචිත ලෙස කටයුතු පිළියෙල කොට ඇත. මෙසේ විශාල ශිෂ්‍ය සමූහයකට, විශේෂයෙන්ම නාගරික නොවූ ප්‍රදේශවලින් එන ශිෂ්‍යයින්ට, මෙසේ විශ්වවිද්‍යාලයක විද්‍යා අධ්‍යාපනය පුළුල් කිරීම නිසා යහපතක් සිදුවෙයි.

5. විද්‍යාදය විශ්වවිද්‍යාලයේ රසායනාගාර පහසුකම් ඇතිකිරීම සඳහා යන වියදම් ප්‍රමාණය, උසස් අධ්‍යාපනය සඳහා වැයවෙන මුළු ජාතික වියදම් ප්‍රමාණය සමඟ සසඳනවිට එය සාපේක්ෂව ලෙස සුළු ගණනකි. එසේම විද්‍යාලංකාර විශ්වවිද්‍යාලයේ ආචාර්ය මංඛලය පිළිබඳ අඩුපාඩුකම් පිරිමසාගැනීම යන ප්‍රශ්නය දෙස යොමුරූපව සහ විධිමත්ලෙස බැලූවිට එය විසඳාගත හැකිවනු ඇත. විශ්වවිද්‍යාල දෙකේ ආචාර්ය මංඛල ඒකාබද්ධ කිරීම නිසා දැනට සිටින, එසේම සුදුසුකම් ලබා ඇති ටිකදෙනෙකු වුවද, එම කටයුත්තෙන් ඉවත්වී යෑමට ඉඩ ඇති අතර, එසේ වුවහොත් එයින් බලාපොරොත්තුවූ ප්‍රධාන අරමුණ ද ඉටුනොවනු ඇත. තවද එයින් රටේ සංවර්ධනය සඳහා උපකාර කරගත හැකි අළුත් අදහස් උදහස් දරණ ඉතා දක්ෂ, හැකියාවක් සහ විශ්වවිද්‍යාල කටයුතු කෙරෙහි ඇපකැපවී සිටින ආචාර්යවරුන් කිහිප පොලකගේ අනාගත සේවය නොලැබී යනු ඇත.

6. විද්‍යාදය සහ විද්‍යාලංකාර විශ්වවිද්‍යාල දෙකේ විද්‍යාව ඉගැන්වීම පිළිබඳ දැනට ඇති නව සැලැස්මවල් සලකනවිට, එය විශ්වවිද්‍යාල සතරේම, විද්‍යාව ඉගැන්වීම සහ පර්යේෂණ පැවැත්වීම කෙරෙහි නව ප්‍රබෝධයක් උදකිරීමට හේතුවනු ඇත. එසේම එය කාර්මික විශේෂඥභාවය ලැබීම කෙරෙහි, ආරම්භක අවස්ථාවක් වනවා පමණක් නොව, එයින් කාර්මික විද්‍යා ඉගැන්වීම් තවදුරටත් පුළුල්කිරීම සිදුවන අතර, මේ සඳහා තවත් අවශ්‍යතාවක් ද ක්‍රමයෙන් වැඩිවනු ඇත.

7. ජාතික අවශ්‍යතාවන්ට අනුකූලවන පරිදි, විද්‍යාව දියුණුකිරීම පිළිබඳ අළුත් නායකත්වයක් සහ ඒ පිළිබඳ හැකියාවක් පෙන්වීමේ ලක්ෂණ, විද්‍යාදය සහ විද්‍යාලංකාර විශ්වවිද්‍යාල දෙක මගින් අප හමුවේ තබා ඇත. එම නිසා විශ්වවිද්‍යාල දෙකටම එය සඳහා අවස්ථාවක් ලබාදීම වටී.

Appendix I

National Council of Higher Education,
202, Bauddhaloka Mawata,
Colombo 7.
22nd May, 1968.

I am most grateful to you for the cordiality which you showed me when I visited you the other day and your readiness to help. As I mentioned to you, the problem regarding which I need your advice and assistance refers to the teaching of Science in our universities, more particularly Vidyodaya and Vidyalankara.

Vidyodaya has been teaching Science for several years now. It has no satisfactory buildings and the equipment it has is inadequate. It has a keen staff.

Vidyalankara started teaching Science only during this academic year. It has a fine building for the purpose, a fairly large supply of equipment and a small but competent staff. Much of the teaching is done by visiting lecturers.

The National Council of Higher Education has, among its functions, the task of "rationalization" of courses of study in our universities, effecting economies wherever possible by preventing unnecessary duplication of departments of study, and by ensuring that such staff as is available especially where vacancies remain unfilled because of lack of personnel is used to the best possible advantage of university education in the country.

With these considerations in view, there is a section of opinion in the Council which feels that the teaching of Science should not be regarded as a *sine qua non* to be taught in all universities from their very inception; that courses in Science could be introduced, if necessary, at a later stage; that in the present situation the national interest could best be served by amalgamating the two Faculties—of Vidyodaya and Vidyalankara—into one Faculty and by confining the teaching of science to Vidyalankara only. It has the better buildings and equipment, and the transfer of the Vidyodaya staff (or such of them as may be necessary and willing) would greatly strengthen the Faculty. These members feel that it would be better to have one or two university Faculties with adequate buildings, staff and equipment than several Faculties with various deficiencies, among the deficiencies being the lack of a sufficient number of properly qualified staff. Only a limited number of scientists are available as teachers, and these will have to be distributed, without a single Faculty being adequately staffed.

The other view is that the teaching of Science is a *must* in every university, that in Vidyodaya there exists a nucleus which would and should be developed and that, if this view is accepted, Government should be asked to provide the necessary buildings and equipment, such development being phased over a period of years. If necessary, staff should be recruited from outside Ceylon. Even as it is, teaching is not entirely in swabhasha. Outside teachers could therefore be usefully employed.

It would be very helpful in coming to a decision on these matters if we could have your observations on them, after you have visited the two universities and met the authorities of the universities and the staff in the Faculty of Science.

I am writing to the Universities to say that you will be visiting them on Sunday, June 2nd, and that you will arrange with them times suitable for your visit.

Yours sincerely,

(Sgd.) G. P. Malalasekera.
Chairman.

Dr. G. Ponnampereuma,
Director, C.I.S.I.R.,
P. O. Box 787,
Colombo.

Appendix II

VIDYODAYA UNIVERSITY OF CEYLON PROFESSORIAL STAFF—SCIENCE FACULTY

1. **Professor G. C. N. Jayasuriya**—B.Sc. (Cey.), Ph.D. (Sheffield), F.R.I.C.
Professor of Chemistry and Dean, Faculty of Science.
1st Class Honours in Chemistry (Ceylon).
Teaching Experience: (a) Faculty of Science, Ceylon University
(1948-1968) (b) Faculty of Medicine, —do—
(c) Faculty of Science, Vidyodaya University
(d) Sheffield University and Washington State University
Research Officer—M.R.I., 1949-62
Head Division of Biochemistry—M.R.I. 1962-65
Post Doctoral Fellow at Washington State University 1955-56
2. **Professor A. C. J. Weerakoon**—B.Sc. (Lond.), Ph.D. (Glasgow), F.R.E.S. (Lond.).
Professor of Zoology
2nd Class Honours in Zoology (London)
4 years in Ceylon Civil Service
Teaching Experience: (a) Faculty of Science, Ceylon University
(about 20 years) (b) Faculty of Science, Vidyodaya University
Asst. Director, Fisheries Department, in charge of its Fisheries Research Institute
—about 4 years.
3. **Professor P. W. Epasinghe**—B.Sc. (Cey.), Ph.D. (Lond.), D.I.C.
Professor of Mathematics
1st Class Honours in Mathematics (Ceylon)
Teaching Experience: (a) Faculty of Science, Ceylon University
(about 10 years) (b) Faculty of Science, Vidyodaya University
4. **Professor P. C. B. Fernando**—B.Sc. (Cey.), Ph.D. (Cantab.)
Professor of Physics
2nd Class Honours in Physics (Ceylon)
Teaching Experience (a) Faculty of Science, Ceylon University
(about 15 years) (b) Faculty of Science, Vidyodaya University
Post Doctoral Research Fellow of University of California 1965-66
5. **Professor O. S. Peries**—B.Agr.Sc. (Melbourne), Ph.D. (Bristol), M.I.Biol.
Professor of Botany
Plant Pathologist, Rubber Research Institute, Agalawatte for several years
Consultant to R.R.I. of Malaysia and Ceylon
Joined Vidyodaya University as Professor of Botany—1.1.68

(Source: Dean of Faculty of Science, Vidyodaya University)

Appendix III

SCIENCE FACULTY STAFF VIDYALANKARA UNIVERSITY, KELANIYA

1. Academic Staff Professors

- (1) Physics — C. Dahanayake,
B.Sc. (Ceylon), 1st Class, Ph.D. (Bristol)
- (2) Chemistry — J. K. P. Ariyaratne,
B.Sc. (Ceylon) 2nd Upper, Ph.D. (Cantab.)
- (3) Zoology — H. H. Costa,
B.Sc. (Ceylon) 1st Class, Ph.D. (Wales)

All these have been teaching at the University of Ceylon, before coming here.

Lecturers :

- Grade I — S. B. P. Wickramasooriya,
B.Sc. (Ceylon) 1st Class, M.Sc. (Ceylon)
Head of the Department of Mathematics.
- Grade II — H. Somadasa,
B.Sc. (Ceylon), Maths, 2nd Upper, Ph.D. (Wales)

Further information on all the above staff members can be had at the NCHE office.

Assistant Lecturers :

- W. T. Weerakoon — Graduate, Institute of Mechanical Engineering-London;
Mechanical Engineering
Graduate—Tokyo; formerly Irrigation Department.
(Department of Industrial Management)
- D. Rajapakse — B.Sc. (Ceylon) Chemistry, 2nd Upper.
- U. P. Samarasekera — B.Sc. (Ceylon) Physics, 2nd Upper.
- E. F. W. Fernando — B.Sc. (Ceylon) Zoology; awaiting results of M.Sc. (Ceylon)

(Source : Dean of Faculty of Science, Vidyalankara University)

Appendix IV

Output of Science Graduates—University of Ceylon (Peradeniya and Colombo) for the Ten Year Period 1958—1967

| Course | Class | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | Total No. of Classes for Period |
|--|-------|------|------|------|------|------|------|------|------|------|------|---------------------------------|
| Science (Bio-Science and Physical) | 1 | 8 | 6 | 4 | 1 | 6 | 11 | 3 | 5 | 7 | 1 | 52 |
| | 2-U | 2 | 2 | 2 | 1 | 4 | 10 | 7 | 4 | 4 | 2 | 38 |
| | 2-L | 4 | 5 | 6 | 8 | 10 | 9 | 13 | 4 | 19 | 10 | 88 |
| | 3 | 45 | 61 | 85 | 78 | 70 | 109 | 104 | 141 | 123 | 169 | 985 |
| Total No. of passes for each year | | 59 | 74 | 97 | 88 | 90 | 139 | 127 | 154 | 153 | 182 | 1,163 |

Special Science—Distribution among subjects

| Subject | Class | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | Total No. of Classes for Period |
|---------------------|-------|------|------|------|------|------|------|------|------|------|------|---------------------------------|
| Botany | 1 | — | — | — | — | — | — | — | — | — | — | — |
| | 2-U | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | — | 13 |
| | 2-L | 5 | 2 | 3 | 5 | 1 | 2 | — | 1 | 3 | 2 | 24 |
| | 3 | 2 | 1 | 8 | 5 | 5 | 4 | 9 | 2 | 4 | 5 | 45 |
| Total for each year | | 8 | 6 | 12 | 11 | 7 | 7 | 10 | 4 | 10 | 7 | 82 |
| Chemistry | 1 | — | — | 1 | — | — | 1 | — | — | — | 1 | 3 |
| | 2-U | 2 | 4 | 2 | 2 | 2 | 2 | — | 3 | 3 | 3 | 23 |
| | 2-L | 2 | 4 | 2 | 3 | 3 | 5 | 3 | 2 | 1 | 3 | 28 |
| | 3 | 3 | 6 | 6 | 5 | 8 | 3 | 11 | 9 | 7 | 18 | 76 |
| | | 7 | 14 | 11 | 10 | 13 | 11 | 14 | 14 | 11 | 25 | 130 |
| Mathematics | 1 | 3 | 1 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 20 |
| | 2-U | 1 | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 9 |
| | 2-L | — | 1 | — | 1 | 1 | 1 | 1 | 1 | — | — | 6 |
| | 3 | 6 | 5 | 3 | 4 | 4 | 1 | 3 | 1 | 2 | 4 | 33 |
| | | 10 | 7 | 7 | 9 | 8 | 4 | 7 | 4 | 5 | 7 | 68 |
| Physics | 1 | 1 | — | — | — | — | 1 | 1 | — | 1 | — | 4 |
| | 2-U | — | — | 1 | — | — | — | — | 1 | 1 | 1 | 4 |
| | 2-L | 1 | — | — | 1 | 1 | — | 1 | 1 | — | 1 | 6 |
| | 3 | 1 | 3 | 3 | 4 | 1 | — | 2 | 3 | 4 | 3 | 24 |
| | | 3 | 3 | 4 | 5 | 2 | 1 | 4 | 5 | 6 | 5 | 38 |
| Zoology | 1 | 4 | 2 | — | — | — | — | — | 1 | — | 1 | 8 |
| | 2-U | 2 | 3 | 7 | 3 | 4 | — | 2 | — | 2 | — | 23 |
| | 2-L | 1 | — | 1 | 2 | 3 | — | — | 1 | 1 | 1 | 10 |
| | 3 | — | — | 1 | — | — | 2 | 6 | 8 | 1 | 3 | 21 |
| | | 7 | 5 | 9 | 5 | 7 | 2 | 8 | 10 | 4 | 5 | 62 |

Appendix V

NOTE ON RESEARCH AT VIDYODAYA UNIVERSITY

We should like to point out that it is because we are firmly of opinion that the quality of a University teacher and the quality of University courses are closely dependent on his engaging in research in his special field that we have persisted in encouraging research in this Faculty. Despite severe limitations imposed on us by the shortage of staff, scarcity of equipment, lack of funds and inadequate library facilities, we have nevertheless undertaken a certain quota of research activity, as specified below:

In the Department of Biological Sciences, investigations

- (1) On the nature of "Leaf Scorch Decline"—a disease of coconut trees. (in collaboration with the C.R.I.)
- (2) On the Ecology of *Eupatorium odoratum*, with a view to controlling this important weed of coconut estates.
- (3) On the food value of certain bacteria for the soil protozoan, *Acanthamoeba*.
- (4) On culturing *Astasia* and *Naegleria*—a flagellate and an amoeba isolated from decaying leaves.
- (5) On experimentally induced variations of mitotic patterns in certain parts of the developing Amphibian tadpole.
- (6) On the fauna, especially insect, associated with the aquatic weed *Salvinia*.
- (7) On the microbiology of locally processed fish with a view to improved production techniques.
- (8) On the prawn fishery of the lagoons, with special reference to "Ja-kotu" fishery of the Bolgoda.

In the Physics Department a modest effort has been made to initiate research into the investigation of the low frequency natural electromagnetic spectrum at the equator. These investigations are of current importance as they amount to ground based explorations into outer space. A telluric detector made in our laboratories has been set up in the Vidyodaya Campus. At the Commonwealth Consultative Research Committee meeting held in February 1968 in Colombo, it was decided that the Vidyodaya Campus may be a suitable site for the setting up of a magnetic observatory.

The Chemistry Department has collaborated with the C.I.S.I.R. in an investigation of plant phenolic compounds by chromatographic methods.

All four Departments of this Faculty namely Mathematics, Physics, Chemistry and Biology are in the process of developing a new curriculum suitable for producing graduates in science who can play a significant role in the economic development of this country. Some members of our Faculty are actively participating in the curriculum Revision Projects at G.C.E.(O) and (A) Level initiated by the Ministry of Education.

(Sgd.) G. C. N. Jayasuriya
Dean, Faculty of Science.

20.5.68.

Appendix VI

NOTE ON THE FACULTY OF SCIENCE VIDYALANKARA UNIVERSITY

Meeting the Needs of Ceylon

The Faculty of Science offers programs of education designed to meet the needs of Ceylon's industrial, scientific and teaching communities. The student after graduation will be called upon to build many roads between the world's storehouse of scientific knowledge and its ultimate application in Ceylon. His education is planned to suit the needs of a building nation with full awareness that the scientist is an important worker in the growth process.

A Ceylon scientist may be asked to search out economically feasible products for a new industry which are then delivered to an engineer for mass productions, or to work with an existing industry to raise the quality and quantity of production. He will be called upon to carry out tasks ranging from laboratory applied research to decision making of top management. He will primarily be a creative person always seeking something new, something better, whether he is in a laboratory, a factory, or in the chair of management. He will need strength of purpose, good character, leadership training and experience in addition to his scientific knowledge.

Many graduates will become science teachers in the lower and middle schools where they will share the moulding of the future of young men and women. To motivate and inspire future scientists demands an interpretation of nature in terms of the practical and realistic world of children's experience. This is a mechanistic world of seeing, feeling, and doing. It needs an applied science approach with overtones of creativity and enjoyment plus active participation.

The University graduate must become intimately familiar with the English international language as a means of written communication. In the years ahead as Ceylon draws closer to the world community, scientists, engineers industrialists and educators will more and more tap the reservoirs of world knowledge circulated in thousands of weekly magazines and monthly journals plus tens of thousands of annually published books. An education that stops after graduation will have missed its mark; the graduate should learn that, in the words of Carlyle, "The true University is a good collection of books" and be able to continue his own education through reading as well as other means. By means of international English the Ceylon graduate will join with the scientific and industrial countries in most of the world.

Modern management methods are a vital factor in Ceylon's University education. Not only are they needed for industry and government but also most institutions in a just and prosperous society need men and women skilled in management technique to that they may function smoothly and efficiently yielding a maximum product or service at a minimum cost.

In a nation which is beginning to build an industrial base of production, experience including industrial practice must be supplied as part of education. The man at the top cannot properly direct and manage the activities of those below him unless he himself is also able to carry out, albeit roughly, the duties of subordinates and he will not move ahead without the confidence obtained from practical experience. In essence, before the young graduate can fully take over his technical duties in society, a bridge of properly directed practical experience must be built between the end of education and the beginning of industry. To do this, an industry-internship program is incorporated into the curriculum.

Goals of Technological Education

Science is part of the path to industrialisation, a possible means to control or provide for the impending over-population. Most of the paths of technical advancement have already been laid out by development in other countries. It does not require great insight to predict that the Ceylonese scientists and technologists will probably find their most useful role among the following:

- (a) *The improvement of agriculture*—farm chemistry, stock breeding production of farm tools, general mechanisation.

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- (b) *Development of natural resources*—mining, forest products, fisheries, and hydro-electric power.
- (c) *Transportation*—railways, shipbuilding, roadbuilding, road material research, marketing facilities.
- (d) *Communication*—equipment installation and maintenance, radio and television education, education through the printed medium.
- (e) *Public Health*—production of medicines, instruments, research.
- (f) *Housing*—research and production of building materials.
- (g) *Clothing*—developmental research in new textile fibres, factory management.
- (h) *General Industry*—new ideas for new production, improvement of inefficient factories, development of Ceylon raw materials.

Elements of Technology

The primary motive of technical education is an economic one. It strives to provide maximum utilisation of resources with a minimum wastage of human labour. As the economic entrepreneur (state, as well as private) strives to create economic and business machinery to improve the distribution and utilisation of goods, so the engineer creates mechanical machinery to produce these goods in the most efficient way. At another level, the scientist, attempts to unravel the secrets of nature and make them available to the engineer. The scientist, the engineer, the economic entrepreneur, all form links in a dynamic chain which transforms the natural wealth of the earth into material wealth for use by mankind. Rarely, very capable men can accomplish all these things themselves, but most often many men must work together in trust and co-operation to build productive enterprises.

All three of these professions require a similar motivation of creativity, the will to produce, the desire to push forward in their respective fields. If this motivation is not behind technical education, if the students of science, of engineering, of economics, of management do not have a purpose directed towards a common social goal then the result of education is like a sailboat on a windless sea—unmoving and at the mercy of the storms.

Dean, Faculty of Science, Vidyalandara University.

Appendix VII

Vidyodaya University of Ceylon,
Nugegoda.
10th December, 1967.

The Secretary,
Vidyodaya University,
Nugegoda.

Dear Secretary,

The following 4—year estimate for the Science Faculty is based upon—

- (a) our getting new Laboratories,
- (b) implementing a new 4 year programme,
- (c) an ultimate intake of 100 students per year.

Laboratories

The new Laboratories are being designed. Plans are not complete and thus the actual cost cannot be given. The following figures are very approximate indeed.

| | | | | | |
|---|----|----|----|-----|-------------|
| Cost of building | .. | .. | .. | Rs. | 3,000,000/- |
| Cost of services and laboratory furniture | .. | .. | .. | .. | 2,000,000/- |

Equipment

| | | 68/69 | 69/70 | 70/71 | 71/72 |
|-----------------------|----|---------|---------|---------|---------|
| (a) Mathematics Dept. | .. | 100,000 | — | — | — |
| (b) Physics Dept. | .. | 200,000 | 100,000 | 100,000 | 100,000 |
| (c) Chemistry Dept. | .. | 200,000 | 200,000 | 100,000 | 100,000 |
| (d) Biology Dept. | .. | 200,000 | 100,000 | 100,000 | 100,000 |

Yours sincerely,
Dean, Faculty of Science.