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SCIENCE SERVICE COURSES

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IN Melbourne University some 700 students are involved with one or more science service courses. In terms of the fraction of the total student enrolment the position is much the same in other Australian universities. A service course may be loosely defined as one in which the teaching staff and students are drawn from different faculties. The paradigms are the first year courses in physics and chemistry usually given to students in the "professional" faculties such as medicine, engineering, dental, veterinary and agricultural science. Over the last few years we have witnessed a growing debate on the university's role, initiated in part by the Martin Committee's enunciation of the binary policy for tertiary education and their attempt to distinguish functions for the universities and advanced colleges. Inasmuch as they involve the conflict between the practical and liberal views of education, the service courses might have been expected to be at the centre of such debate. However they have so far been surprisingly untouched by it. Long the "poor relations" among university subjects, the service courses have too often been seen by the majority as something to be avoided, a trial to be endured by a junior lecturer before he moves on to the more satisfying major subjects. In view of the difficulties of teaching such courses this attitude is not surprising. It is unfortunate that this has been so, for in many ways, the service courses represent the sort of challenge with which the universities should be most concerned.

University staff are often urged by educationists to closely examine their aims and educational objectives when planning courses. When one seeks to determine the broad purpose of service courses it becomes clear that there is no general agreement to be had. It is informative to examine the problems of service courses in the light of what seem reasonable goals. Any discussion of goals and procedures for achieving them should take into account the sorts of undergraduates involved. The largely vocational outlook of Australian students in general has been demonstrated by Maddox[1] and Schonell *et al.*[2] This observation is particularly true of the professional faculties.[3] There is among academics some tendency to overlook this fact, or if not to overlook it, to have no definite policy in relation to it.[3] While the liberal view of education has dominated discussions of university teaching, the actual practice has often conformed, perhaps unknowingly, to much more utilitarian principles.[4] Whether or not it should be part of service course policy to oppose the vocational outlook of students is something that requires further discussion. As time passes the student body faced by the lecturer of a service course tends to be increasingly capable in terms of secondary school performance; this is particularly so in areas such as medicine and veterinary science where strict quotas are imposed; but with a basically narrow and career oriented outlook. It is understandable that such students feel that a requirement to study physics or chemistry in first year is a tedious imposition which only impedes their progress towards the final goal of professional qualification. Such students often complain that the chemistry and physics courses are not *relevant* to their needs. While it is debatable whether first year students are capable of clearly judging their needs, and what is relevant to them, it is undeniable that lack of interest is a very real problem and the major one facing the service course lecturer.

Undoubtedly the problem is partly one of appearances. The service courses often give the appearance of being separated from the main stream of the degree programme. They tend to be taught in different buildings, by staff who, the students are aware, do not belong to the same faculty as themselves. The departmental structure of Melbourne University, recently the subject of considerable criticism,[5] certainly contributes something to the service course problem. Given that lack of student interest is the main problem facing the service course lecturer, what should be his aims? What is the purpose of teaching basic sciences as part of professional courses? Three viewpoints are commonly encountered in answer to this question. The first is that physics and chemistry at first year level serve to acquaint the student with the scientific method.

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[1] Maddox, H. *Students Entering Applied Science in Colleges of Advanced Education*, Occasional Report (1), Education Research Unit, A.N.U. (1970) Section 9 (iii), p. 159.

[2] Schonell, F., Roe, E. and Meddleton, I., *Promise and Performance: A Study of Student Progress at University Level*, University of Queensland Press (1962), pp. 196, 197.

[3] Anderson, D. S. *The Person and Environment in First Year Medicine;* in French, E. L. (ed.) Melbourne Studies in Education 1961-62, M.U.P., p. 108.

[4] Beard, R., Healey, F. G. and Holloway, P. J. *Objectives in Higher Education*, Society for Research into Higher Education, London (1968).

[5] *Working Group—Report to Council*, University of Melbourne (1973).

The second and perhaps most common argument is that physics and chemistry form the foundation on which will be built later studies more closely connected to the professional interests of the student. Advocates of this view tend to favour a selection of material for first year on the basis of its relevance to later years. The third argument takes account of the way in which members of the professions are increasingly confronted with the products of an expanding technology. The argument runs that the practising professional needs some background in basic physical science in order to be capable of assessing and using the newly developed equipment in his field, whether this be the latest fertiliser, a new antibiotic or a kidney or x-ray machine.

None of these views is entirely satisfactory as a justification of service courses nor is any completely in step with present practices. While it is certainly true that physics and chemistry can be vehicles for conveying scientific methods, it is doubtful whether this argument justifies the present large content of these in first year or the teaching of them as separate subjects. Moreover, an ability to apply scientific method does not automatically follow from a study of physics and chemistry; much depends on how the subjects are taught. As a justification of first year service courses and as a criterion of curriculum design, relevance is not a very satisfactory principle. The difficulties are practical. The requirement of relevance links first year material and later year practices in a way which restricts equally at both ends of the link. Whether or not the first year syllabus is relevant, or equally importantly, is seen by students to be relevant, depends very much on how later year material is taught. It is possible for instance to teach biochemistry in a way which draws heavily on basic physical and organic chemistry or alternatively it can be taught with less reference back to fundamentals. When it is realised that the time elapsed between the giving of the service course and the subject it is expected to serve, is often at least a year, the organisational difficulties are obvious. The argument that advancing technology demands some scientific background is another aspect of the gap between the academic and the pragmatic outlooks. The massive array of drugs available to the modern medical practitioner is sometimes cited as necessitating a quite extensive chemical background. This is a rather naive viewpoint not really supported by the facts. The chemical, pharmaceutical and paramedical companies annually spend millions of dollars on literature and advertising directed to those who administer their products. Their aim is to ensure that very little knowledge of the chemical nature of a drug is required in order to use it. It is probable that only a very small fraction

of G.P.'s understand the chemical basis of the medication they prescribe. The same would apply to other professionals privately practising. A teacher of chemistry to first year medical students deludes himself if he believes that many doctors make appreciable practical use of their chemical background.

Arguments such as the foregoing suggest that attempts to completely justify service courses on any or all of the more or less pragmatic grounds just mentioned are only partially successful. While it is undoubtedly true that all three arguments contribute something to a justification of service courses, and provide some indication as to how such courses should be framed, it is also true that if service courses continue to exist it will in part reflect a belief in the liberal ideal of university education.

No matter what the justification of service courses the lecturer normally faces a disinterested student group. How is this problem to be solved? The facile answer is to say that given goal oriented students it is up to the lecturer to demonstrate the importance of his material with well chosen examples from everyday life. While often this can be and is done there are considerable difficulties. One should not overlook the hierarchical nature of scientific knowledge; the fact that the extension of science tends to be vertical rather than horizontal. The concepts required to understand some natural phenomena are often built on a foundation of simpler concepts which must be mastered before relevance can be demonstrated. Relevance thus tends to be retrospective. At a time when relevance has become something of a catchcry, it is wise to exercise restraint. Students are not likely to be satisfied with a contrived and superficial pot-pourri, nor should the university seek to attract students by focusing on fashionable areas such as economic or environmental problems. Somewhere between topicality and remoteness there is a middle ground to be trod. The course should be attractive due to its intellectual demands rather than superficially gimmicky.

A fourth argument of a rather different sort to the previous three is sometimes advanced. Experience in a particular university over a number of years may show that performance in first year chemistry, for example, is a good predictor of later achievement in a particular professional course. This may or may not indicate that chemistry and the major subjects that follow involve similar skills. Whatever the case such an observation provides some sort of justification for the service course as a filtering procedure. It is unlikely that anyone would seek to entirely justify a service course on such grounds. Its effectiveness in this way might be entirely dependent on how it was taught and examined. It would be usual

for belief in the efficacy of the course as a selection procedure to be coupled to a belief in the basic relevance of its content. However when a course is found to serve well as a selection procedure it is less likely that the faculty using the course will seek to impose stringent requirements on its syllabus. The Veterinary Science Faculty at Melbourne have recently given consideration to selecting students at the end of first year rather than on entry to university. In so doing they appeared to be endorsing the value of first year physics and chemistry without requiring a tailored course.

There are a number of ways in which service courses might be improved. Organisation of an entire degree programme or section thereof by course teams, independent of faculties and departments, has much to recommend it. This practice has been adopted by the Open University of Great Britain. Apart from the usual departmental structure mentioned earlier, the major obstacle to this sort of innovation is the present low status of teaching in most universities. The handling of a service course is essentially a teaching problem and as such lacks respectability. There is no great academic merit in the content of a service course. A course in chemistry to agricultural science students does not provide an opportunity to display great expertise in either chemistry or agriculture. Nor is such a course directed toward further study in chemistry or to the recruitment of students into chemical postgraduate work. Given the present climate of universities it is simply not in the best interests of any lecturer to devote the sort of time needed to the proper planning of a service course. It is this problem more than any other that needs to be squarely faced by the university if the best results are to be achieved in the service courses.

Another possibility worthy of investigation is that of spreading the time currently devoted to physics and chemistry in professional courses more evenly throughout the degree programme rather than concentrating it in the first year as is the usual practice. This procedure would have the merit of weakening the present student attitude to service courses, namely that they are obstacles to be surmounted before one is allowed to proceed with the real thing.[6] It is not the purpose of this article to deal with technical aspects but the following two examples indicate what might be done. Most existing chemistry service courses include material on solubility equilibria and phase equilibria. In dental science courses these two sections might be relocated so as to coincide with work on the formation and prevention of dental caries and with work on dental materials. There would certainly be difficulties with

[6]Anderson, D. S., *op. cit.*, p. 100.

such a procedure, not the least of these being questions of time-tabling, but despite these some sort of trial seems worthwhile.

Another innovation at present being tried at Melbourne is a teaching method based on small discussion groups rather than conventional lectures. Students are issued with somewhat compacted lecture notes and devote the time normally spent in lectures to discussing these in small groups of about 15. The groups submit a brief written report on difficulties encountered to the lecturer who then deals with these in seminars for the whole class. By introducing the social factor and also, hopefully, an element of controversy, it is hoped to stimulate student interest. Initial efforts in this direction indicate that the method is at least as efficient as the traditional lecture method and is preferred by the students. It has the virtue of providing students with the opportunity to formulate and articulate concepts in the company of their peers. If one of the aims of a service course is to encourage a scientific way of thinking, then the evidence is that this is more likely to be achieved in a free discussion environment than by conventional lectures.[7]

The future of service courses is uncertain. As the knowledge explosion continues the pressure on professional faculties to do away with service courses in favour of more specialist material will increase. As a first step it is likely there will be attempts to reduce the size of service courses and to more rigorously define their syllabuses in an attempt to increase their *usefulness*. Such moves will raise again the whole question of the proper emphasis in university education. The thesis of this article is that to look upon service courses *only* from the point of view of usefulness is not enough. They must be justified partly by reference back to the liberal ideal of education. There are good arguments in favour of all members of a technological society having some scientific education. This is particularly true of those whose professional activities will overlap with technology. The last few years have shown us how interwoven are the industrial, medical, agricultural and environmental problems of a modern society. The value of service courses should not be sought in immediate usefulness. Rather they should be seen as contributing toward the creation of a scientifically literate professional group in the community. The task facing those who would preserve service courses is clear. They cannot hope to gain the full co-operation of their students merely by appeal to the students' career outlook. They must accept the challenge of convincing students that their subject is worthy of study in its own right. And after all, isn't this what the university is supposed to be all about?

[7]Bligh, D. A., *What's the Use of Lectures?* Published D. A. and B. Bligh (1971).