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IDENTIFICATION AND IMPLICATIONS  
OF SOME PSYCHOLOGICAL CHARACTERISTICS  
OF UNIVERSITY BIOLOGY STUDENTS.

A thesis presented in partial  
fulfilment of the requirements  
for the degree of

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C.B.J. HARPER.

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## PART I.

### Chapter 1.

### INTRODUCTION

#### The Problem and its Setting

The Report of the English Universities Central Council on Admissions reveals that in 1966 there were 1600 student vacancies in science and technological subjects in English Universities. As a contrast to this there were between 4,000 and 7,000 unsuccessful candidates for places in social sciences and arts subjects. The Times Educational Supplement (1967a) focuses attention on the fact that this imbalance inevitably leads to a discrepancy in entrance standards between subject areas; which means that while able candidates are accepted for non scientific subjects, sciences must perforce accept many lower grade entrants.

In further discussion (Times Educational Supplement 1967b) it is made explicit that the drift of students is not to arts subjects but to what are described as

"socio-economic" subjects. Although absolute numbers of students selecting science courses were rising, by approximately 10% per year, the proportions of these students who had "two or more 'A' level passes"<sup>1</sup> had actually fallen. Identification of factors contributing to this decline in quality and rate of expansion of the sciences, notably biology, is one of the main objectives of this study.

A recent New Zealand paper (Matthews and Collins, 1967) discusses what the authors consider to be an irregular distribution of talented university students among the various sciences. Particularly they are concerned about the paucity of the biology intake. Statistics can be selected (1966) to indicate bias in numbers graduating in the various subject areas in New Zealand. e.g. In 1964 213 persons graduated at bachelor level in English; only 52 in botany and 68 in zoology. Also in 1964 13 persons obtained Ph.D. degrees in chemistry, 2 in zoology and 1 in botany.

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1. "A" level is "advanced" level as contrasted with "O" or "ordinary".

From the same source (1966) the following table has been extracted to indicate numbers of students at the 6th form level studying the various subjects offered.

Table 1.

## SUBJECT ENROLMENT IN N.Z. 6TH FORMS JULY 1965.

Subject	Form VI b.		Form VI a.		Total
	Boys	Girls	Boys	Girls	
English	6527	4839	2164	903	14433
Languages	1525	3254	627	830	6236
Social Studies	133	100	25	28	286
History	2137	2682	558	423	5800
Geography	2938	3144	552	372	7006
Mathematics	4636	1753	1661	435	8485
Biology	3167	3505	801	491	7964
Chemistry	3559	1157	1465	376	6557
Physics	3366	546	1439	271	5622

Observations from this table can be made as follows.

1. English is a compulsory subject and thus it can be seen that in terms of total numbers in VI a, boys outnumber girls by

nearly three to one.

2. The biology enrolment at the VI b. level is greater than that of other sciences. However at VI a it is smaller than any other science. This change is in part attributable to the sudden decrease in the numbers of female students, but even so the male numbers also have declined sharply. If this trend continues into the first year of university study it would substantiate the claim of Matthews and Collins, although this is difficult to ascertain as it must be remembered that the subject subdivides at this stage into botany, zoology, agriculture, veterinary science, food technology etc.
3. Ratios between sixth form subject enrolments are not necessarily those apparent at the tertiary level.

On the evidence indicated so far, two suggestions might be made. Firstly that an imbalance exists in numbers of students majoring in the various faculty areas and secondly that a similar imbalance in ability levels is also apparent.

Closely akin to this is the evidence amassed by Hudson (1963a), which makes manifest the suggestion that the sciences are not attracting the divergent thinkers. This divergent/convergent dichotomy traces immediately back to Guilford (1950) who revived interest in the field. Getzels and Jackson (1962), McKinnon (1962) and Torrance (1965) to name but a few, have developed their own facets subsequently, adding to the sum total of knowledge of this topic.

Hudson's suggestion then has far reaching implications. Both he and Stenhouse (1965) point out that while science in the initial stages may tend to contain much of the factual knowledge which appears to attract predominantly convergent thinkers, at the research levels the divergent, original and flexible mental outlook is of prime importance. Certainly all science graduates do not engage in research, but this does not alleviate the problem as a majority of those who do not attain this level actually return to science as teachers at the divers stages. As can readily be appreciated a core of predominantly convergent teachers can do untold harm to their students both in repelling the creative thinkers and in fixing negative attitudes of those students who do remain.

The argument now returns to the work of Stenhouse (1965) who takes up this very point of science teaching; specifically biology teaching. In relating much of the previous research he provocatively expands several pertinent issues. To what extent are career structures determined too early and by "factors inimical to science"? Do specific methods of teaching or presentations attract either divergent or convergent thinkers? Are divergent thinkers subtly forced into 'convergent' moulds by social pressures?

It is at this juncture, where with the imbalance and misdirection of intellectual and creative talent, plus the possibility of social pressures towards conformity established, that the studies of student failure carried out by Parkyn (1959 and 1967), Sanders (1961) and others add information to the problem in its generalized form. Unfortunately Parkyn and Sanders did not extend their studies to include convergent/divergent variables, nor did they investigate personality correlates, although to a limited extent Small's (1966) work relates personality factors to the larger field of analysis.

Universal acceptance is accorded the fact that not only New Zealand but also other countries have this

problem of the optimum direction, application and development of adolescent talent. We need to be more cognizant of the factors which guide pupils into the various academic paths and determine success therein. Are these artificial forces or do the abilities and interests of the child provide the major weighting? Matthews and Collins (1967) find that in 6th forms in some schools there are subjects which are mutually exclusive because of timetable and staffing difficulties. The implication in both the Times articles and Stenhouse's writing also is that canalizing factors tend to be circumstantial and to operate at too early an age.

That here is a vast problem area is undeniable. Particularly is this apparent when one envisages both longitudinal and cross sectional perspectives. Longitudinally there is the period of late adolescence and early adulthood encompassing 6th form secondary school years and initial university years of study. In many ways this is the most critical time of life when major decisions affecting vocation selection and levels of aspiration must be made. The cross sectional perspective must explore variables within the student himself, external variables and investigate the multiplicity of resulting inter-relationships.



This then is a brief overview of the precincts of this thesis. It derives from official statistical documents and from research data on divergent thinking, personality and university performance brought into perspective by the hypotheses of differential selection of personality type and differential modification of personality type, put forward by Stenhouse. Most of the data obtained bear upon the "selection" rather than the "modification" hypothesis - but the main objective has been to obtain data which would help to fill the informational hiatus between the work of Parkyn, Small and others (who have worked with a university population but who have not investigated the divergent thinking factors likely to be significant) and Hudson, Getzels and Jackson and others (who have studied the divergent thinking factors but only among school populations).

## Assumptions Made

Implicit in the work of Parkyn, Small, Sanders and Hudson, is the assumption that there exist students who, although they do not in fact pass units of a degree, are on a theoretical basis judged capable of doing so. This must remain an assumption only, as in no way can one prove that student 'X' was capable of accomplishing something which under existing conditions he did not do. If he is taken through a course a second time, given specific guidance and wise counselling, and he manages to pass, one has merely proved that he was capable of passing at a second attempt but not that a first attempt pass was possible.

A second and subsidiary assumption which must be made is that it is beneficial for the student, and for the community, that he should realize or actualize his potential academic strengths and that intellectual wastage should be restricted to a minimum. Similarly there can be no absolute certainty that student X would lead a happier or more productive life if he were channelled into an academic or professional vocation by initial examination success.

It is only by making these two assumptions explicit as basic premises that one can justify research into relevant data which may furnish further information. Such knowledge as this however is vitally necessary for vocational guidance personnel, student counsellors and teachers, and, at the economic and organizational level, for education administrators and curriculum advisers.

### Significance of the Study Area

The suggestion is that this present research, whether it be judged good research or poor research, at least has the quality that it probes an important and significant sphere. While one cannot prove that one field is more important than any other, the following two quotes are included as reinforcement for this suggestion.

The progress of science and the growing complexity of our civilization put increasing pressure on the individual to fit himself for an ever more skilled role in his daily work, in his duty as a citizen and in his private life in the community. (Currie G.A. in Parkyn 1959).

The goals of modern societies are political and social as well as economic. Human resource development is a necessary condition for achieving all of them. A country needs educated political leaders, lawyers, trained engineers, doctors, managers, artists, writers, craftsmen

and journalists to spur its development. . . . If a country is unable to develop its human resources it cannot develop much else.

Both for reasons of national economic development and the personal fulfilment of the individual it becomes obvious then that a greater knowledge and understanding of the late adolescent, early adult student, and his environment, is to be desired. Once this proposition is accepted, a commencement can be made towards a more detailed analysis of some of the major factors which may be relevant.

To enable these to be selected on an objective basis, a criterion was established; variables were admitted only if previous research had indicated them to be productive themes to pursue. On these grounds five variables central to the problem area were selected to form an operational framework throughout the thesis. They are -

1. Intelligence (AH.5. test)
2. Convergent/divergent thinking (open ended tests)

3. Personality (16PF factors)
4. Subject experience (6th form biology)
5. Social characteristics (age and sex)