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NUMERACY IN SCHOOL GEOGRAPHY

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A thesis presented in partial  
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Russell James Stewart

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## ABSTRACT

Geography is taught in New Zealand secondary schools at three separate levels; fifth form, sixth form and seventh form. There appears at present to be little continuity in the teaching content of the subject, and in the development of practical skills, from fifth form through to seventh form.

Research is currently being conducted into geography teaching in New Zealand secondary schools with the intention of providing information with which to formulate a programme of curriculum revision aimed at integrating the geography syllabi from forms five to seven, with an emphasis on the sequential development of practical geographical skills. Many of the practical skills which have been identified in this research involve number operations and therefore require the student to be numerate. A definition of numeracy is proposed, and basic problems confronting students in their learning of mathematics - and so in their development of numeracy skills - are reviewed.

A brief analysis of past School Certificate Examination Geography papers is made in order to identify the types of numeracy skills which have been tested in geographical education. The results of a survey of geography students in New Zealand secondary schools serve to provide information on the experience of these students in studying geography and mathematics. Information on the extent of continuity of geographical

study is used to show that an integrated geography syllabus could be successfully operated. Although the incidence of the geography/mathematics subject combination is found to be relatively high, it is suggested that provision in the new integrated geography syllabus be made for formal instruction in numeracy skills.

A systematic analysis of the numeracy skills used in secondary school geography concludes this thesis, which has sought to show that it is necessary to identify and examine the types of numeracy skills which have been used in past geography examination papers, and which are therefore implicit in the existing geography syllabi, before proceeding to the formulation of an integrated syllabus for forms five to seven and to the programming of the sequential development of skills within this syllabus.

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PREFACE

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In presenting this thesis I am obliged to acknowledge the cooperation received from head teachers of geography departments in 92 New Zealand secondary schools.

During a protracted period of revision, my patience was matched by Mr Eric Archer of the Education Department at Massey University who provided helpful guidance.

R.J.S.

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## NUMERACY IN SCHOOL GEOGRAPHY

### 1. INTRODUCTION

#### 1.1 An Overview

In the New Zealand secondary school curriculum, geography is taught as a subject to students in the fifth, sixth and seventh forms. It is first offered at the fifth form level of study. Here its content, and to an extent the manner in which it is taught, is influenced by the requirements of a national external examination, School Certificate, which the student may sit at the end of his third year at secondary school.

At each of the sixth form and seventh form levels of study, the content of geography is again prescribed by the syllabi set down for separate external examinations; at the end of the fourth year (University Entrance Examination, in which internal accrediting may be exercised), and the fifth year (University Bursary and University Scholarship Examinations) of secondary school study.

The general picture, however, is not as clear-cut as this summary suggests. Fifth form geography is not a prerequisite for sixth form geography, and some students (see Appendix 16) may take geography for the first time in the seventh form. The introduction of single-subject passes in School Certificate has given rise to some students studying geography in the sixth form who have not gained a pass in School Certificate Geography, but who may have gained passes in three or four other subjects thereby entitling them to sixth form entry. And a so-called second-year fifth-form student may have passed School Certificate in geography

only and so be taking geography again in the fifth form together with the subjects in which he failed to pass.

In terms of popularity, geography in the fifth form is currently ranked third after English (which is compulsory) and mathematics. In the sixth form and seventh form, geography usually vies with biology and mathematics for second ranking (after English) in terms of the number of students taking the subject.

### 1.2 Geography in the Secondary School Curriculum

In this decade of the nineteen-seventies when change has been described as "an elemental force"<sup>(1)</sup>, the processes of formal education are coming in for increasing scrutiny in order that some assessment be made of their contribution in equipping young people for a future society that will be the product of present change. This examination of the relative worth of educational processes in some subjects has stimulated specialists within these subjects to seek to justify their inclusion in the school curricula, particularly when confronted with the possible replacement of these subjects by more practical studies on say consumer right or family relationships.

To this end, geographers have been prepared to provide support for the continuing inclusion of their subject in the secondary school curriculum. McCaskill (1967) has declared that "geography's special justification arises from man's own awareness of the earth-space and his curiosity about the arrangement and inter-

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(1) Toffler, A., 1970, 11.

action of the objects and forces that occupy earth-space. (2) According to Shortle (1971), geography ought to be concerned with "developing in pupils an understanding of the way in which man has changed his spatial environment, and ... an awareness of the need to maintain and improve the quality of the human spatial environment." (3) To generalise on the function of geographical education in the secondary school, it may be thought of as developing 'environmental literacy' in young people.

But there is more to justifying a subject's position in the school curriculum than deciding on its function and content. In common with other subjects taught in New Zealand secondary schools, the teaching of geography must be seen to achieve certain basic educational objectives. The standard means of evaluating achievement is by administering revision tests and examinations, whose results are expected to provide a reliable measure of the acquisition of knowledge and understanding, and the development of skills and attitudes: the educational objectives.

The influence of the external examinations system in New Zealand secondary school education cannot be overlooked. Most pedagogical endeavours are ultimately directed each year towards an external examination, and it is often from the previous year's examination format and content that the teacher discovers what was expected to have been taught.

### 1.3 The Geography Syllabus

With the end of the formal external examination

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(2) McCoskill, M., 1967, 85.

(3) Shortle, D., 1971, 52.

system perhaps in sight, the attention of geographical educators and curriculum planners is turning towards the reorganisation of the current three separate geography syllabi taught in the secondary schools. This move represents a serious undertaking for certainly the future direction of geographical education in New Zealand rests on the nature and structure of the integrated syllabus that evolves from this planning work, and on its acceptance by practising teachers. The part played by a particular syllabus in achieving educational objectives is an important one. It can be illustrated by means of a simple syllogism. Given a major premise that a prescribed syllabus forms the basis on which an examination is structured, and given the minor premise that the examination is so designed as to evaluate the relative achievement of educational objectives, then the conclusion to be drawn is that these objectives are implicit within the syllabus.

The most active agency in the field of revision of geography syllabi in New Zealand is the Board of Geography Teachers' Curriculum Group. Research has been carried out by this Curriculum Group in a number of fields to gather together background information on which to base syllabus revision. By the end of 1974, five major reports had been presented:

- 1) Present Skills Required in Geography Syllabi
- 2) The Origin and Destination of Geography Students
- 3) Summary and Research Findings on Skills in Senior Geography
- 4) The Qualifications of New Zealand Geography Teachers
- 5) Teachers' Perception of Geographic Skills

#### 1.4 Skills Required in Geography

Of the three reports issued by the Board of Geography Teachers which have been concerned with the identification of skills in geography teaching, the first - Present Skills Required in the Geography Syllabi - sought to enumerate the types of skills found in geographical education. The aim here was to provide a frame of reference from which a sequential development of skills scheme could be formulated and then programmed into syllabus revision plans for secondary school geography.

Although this particular report did not define the term 'skill', it is apparent from the content of the report that it was interpreted in a comprehensive light, and that in fact all geography teaching involves the imparting of knowledge and understanding through the medium of skill development. When, for example, the skills required in University Entrance Geography are identified, as listed below, there remains little else taught in sixth form geography that is exclusive of these five groups:

##### Sixth Form Geography Skills<sup>(4)</sup>

- i) academic skills
- ii) practical skills
- iii) intellectual or thinking skills
- iv) social skills
- v) evaluation or examination skills

Since the development of skills plays an integral part in geographical education, and because present research into curriculum revision is concerning itself with the evaluation of skills, it is pertinent to

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(4) from the Report on Skills Required for University Entrance Geography, BOGT Curriculum Group Report, July 1973.

examine in more detail the nature of the skills required in learning geography. For the purposes of this work, however, general attention will be directed towards 'practical' or 'mechanical' skills, and particular attention towards skills involving numeracy.

### 1.5 Practical Skills in Geography

The Board of Geography Teachers, in their Curriculum Group Report of July 1973, identified a set of practical skills at each of the three levels of geographical study in the secondary school.

For School Certificate Geography the skills were listed as:

- sketch maps
- graphs
- topographical maps
- photographs
- setting out (of map work, and in following instructions)
- cross sections
- use of terminology
- field work

The practical skills required for University Entrance Geography were identified as:

- i) graphicacy
  - maps
  - photographs
  - diagrams and cross sections
  - landscape sections and sketches
  - models
- ii) literacy
  - terminology
  - paragraphs
  - case studies
  - quotations
- iii) numeracy
  - mathematical concepts
  - graphs
  - raw statistics

And the mechanical skills for seventh form

geography were listed as:

- sketch maps
- Graphs
- topographical maps
- aerial photographs
- field work
- measurement
- cartography
- diagrams

The practical and mechanical skills identified by the Board of Geography Teachers in this report are derived in each instance from syllabus prescriptions and from the content of past external examination papers. But where the examination is set in an expository essay form, as for Bursary and Scholarship Examinations, neither the examination nor "the syllabus preamble sheds ... light on the specific skills required"<sup>(5)</sup>, and the level of skill attainment is not prescribed. The problem here is that there is little prescribed guidance at present for geography teachers at any of the three levels of geography instruction as to the nature of the practical skills required, and the level of attainment expected in the performance of these skills.

The practical skills in secondary school geography, as they have been identified in the report of the Board of Geography Teachers, contain a relatively large quantitative element. Maps, in plotting properties of location and distribution, are essentially quantitative tools. The drawing of graphs and the interpretations made from graphs and from data matrices (or tables) require an appreciation of scale, quantity and number. Field work which commonly involves the collection of numerical data requires the subsequent measurement and analysis of these data. To this extent, therefore, it

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(5) BurrIDGE, S.F., in BOSE Curriculum Group Report, July 1973.

is evident that practical skills in secondary school geography require a facility not only with words but also with numbers.