Selective Mechanisms for General Science Education

A History of the Development of General Science Education in New Zealand, 1900-1943.

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To My Mother
A remarkable woman.

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Contents

List of Tables

Chapter 1 -The Thomas Report

This chapter will outline events that led to the setting up of the Consultative Committee on Post-Primary Education in 1942, whose findings are referred to as the Thomas Report.

1.1 Introduction

Free education has been the right of every New Zealand citizen since 1877 when free secular education was established in all state primary schools.[1] All children had to be given free education between the ages of five and fifteen, termed 'school age'.[2] Compulsory schooling was required for all children between the ages of 7 and 13 years, this was increased to 14 from 1901. Eligible children had to attend primary school for six sessions per week (choosing either a morning or afternoon session).[3] Teachers were required to deliver a prescribed curriculum consisting of: reading, writing, arithmetic, English Grammar and composition, geography, history, elementary science and drawing, object lessons, vocal music and for girls there was the additional subjects of: sewing, needlework and domestic economy.[4] The curriculum was designed to prepare candidates for the proficiency examination, which was the entry examination into post-primary school. Students sat the proficiency examination at the end of standard VI or form 2. Failure in this examination meant students had to stay at primary school until reaching the official leaving age and most primary schools had a standard VII.

Within the context of this study, the various types of post-primary schools have very precise definitions which must not be confused with the contemporary use of the term 'secondary school' which denotes universal post-primary education. 'Secondary

[1] Ian Cumming and Alan Cumming, *History of State Education in New Zealand 1840-1975*, Wellington: Pitman, 1978, p.103.
[2] ibid., p. 102.
[3] ibid., p.143.
[4] ibid., p. 102. Object Lessons were common in the nineteenth century and were first employed by the Mayos, a Protestant clergy man and his sister. The lessons involved the children looking at some object e.g. The refining of silver ore. The teacher would lead the class through a series of statements about the object such as: the ore is melted and the silver skimmed and the teacher asks the children: 'Now what is it that separates the impure substances for the silver?' to which the children respond in unison: 'The heat of the fire.' Many of these lessons ended up relating to religious education. David Layton, *Science for the People: The Origins of the School Science Curriculum in England*, New York: Science History Publications, 1973, pp. 23-6.

School' describes a single sex academic school primarily delivering a curriculum prescribed by external examiners, such as the University Senate. Some secondary schools developed alternative programmes for less academic students but the main focus of the school was on preparing students for external examinations. 'Technical High School' describes a co-educational fully funded state school which had to provide technical and manual instruction, and it is interesting to note that teachers were paid less in this type of school. 'Combined High School' describes a secondary school which offered a variety of academic and practical courses and was usually co-educational. 'District High School' describes a co-educational school which was an extension of a primary school, offering a practical curriculum based on the agricultural sciences. Therefore, the term 'post- primary school' encompasses a variety of schools, all of which catered for students beyond primary level and up to the age of 18 years.

1.2 Thomas of Timaru

The turn of the new century had seen demands made for the provision of free State post-primary education and the government provided funding for 'free places' provided certain conditions were met, namely the provision of technical and manual subjects. This led to an increase in the development of State Secondary, Technical and District High Schools. In 1913, William Thomas was appointed Rector of Timaru Boys' High School, a new State Secondary School. At the school's official opening Thomas announced that the school would provide a professional programme for those boys intending to proceed to University and a commercial and agricultural course for boys intending to stay only two years but wishing to pursue careers in the civil service or farming.[5] In New Zealand, State Secondary Schools, like Timaru Boys' High School, had been established to provide free single sex secondary education to all students who met entry requirements. For the 'professional' boys and girls, the curriculum was prescribed by external examinations such as the Public Service and University Entrance examinations. Thomas was concerned that external examinations

[5] George Guy, *Thomas of Timaru, The Life and Work of a Great Headmaster*, Christchurch: Pegasus Press, 1974, p.38.

constrained the school curriculum which he wanted to broaden with subjects such as: woodwork, art, elocution and music.[6] He commented that:

> Those who are interested in educational topics must know that England seems to be contemplating revolutionary changes in her system of education....Our present system is certainly full of defects.....But I am certain that we are too much cribbed and confined by the examination syllabus and that too much stress is placed on the written examination. We must more and more emphasize the fact that education aims at developing the emotional and spiritual side of a boy's life, and that the fruit of a wise education is seen in his inquiring attitude to life, his breadth of view, as well as in his store of knowledge.[7]

Efforts to reform the post-primary school curriculum had been blocked by the demands of the University Entrance Examination. This examination was administered by the University Senate and it served the task of selecting eligible students for entry to the university. But the examination had also become the hallmark of a completed education, demanded by employers and parents. Thus the subject requirements for the examination prescribed the secondary school curriculum. In 1924, Thomas recorded his objections to the domination of the UEE, demanding that it be awarded by accrediting so that schools could have more liberty in their choice of subjects.[8] He was supported by the Secondary Schools Association (SSA), which represented the interests of its teachers and principals, and together with the Department of Education campaigned to remove control of the examination from the Senate, details of which will be discussed more fully in Chapter 3.

In 1925 Frank Tate, Director of Education in Victoria, had been invited to New Zealand by the Department of Education to look into aspects of post-primary education.[9] Tate had made thirty-two recommendations. The key ones were: that

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[6] ibid., p.58.
[7] ibid., p.50, citing the *Timaruvian*, 1922.
[8] ibid., p. 58 citing *The Timaruvian* 1925.
[9] Frank Tate, *Special reports on Educational Subjects No. 16, Investigation into Certain Aspects of Post-primary Education in New Zealand*, Wellington: Govt. Printer, 1925.
Similarly, The Reichel Tate Report recommended some of the following: that the matriculation examination be abolished and replaced with the Intermediate Examination (16 years) and the School Leaving Certificate(18 years); that areas of the curriculum not examinable to be inspected (e.g.

primary education end at standard 6; that there should be a continuous education from primary to secondary; that there be an arrangement for standard 5 and 6 classes separate from the primary sector; that a review of public examinations be undertaken; that two examinations be held after 3 and 6 years in the post-primary school; that inspection of practical and laboratory work be undertaken along with oral examinations in languages; that accrediting of certificates be considered; that there be better post-primary teacher training; that all post-primary inspectors work more closely; that there be better articulation between primary and post-primary courses; that in the smaller centres Technical High Schools be built as the preferred post-primary school; that there be better regional organisation of school boards; that technical examinations be developed; that technical work be accredited for degrees and diplomas; and that art and applied art courses should be developed in schools.[10] While many of Tate's recommendations were supported by the 1930 Parliamentary Recess Committee on Educational Reorganisation in New Zealand, often referred to as The Atmore Report (Peter Fraser was a member of the committee), the Department of Education made limited progress in reforming the post-primary school curriculum. Technical and manual training had become available in most post-primary schools but the academic focus of the secondary schools was well entrenched, who paid lip service to practical work. Despite a period of fiscal constraint, the Department of Education revamped the Junior Civil Service Examination into the School Certificate Examination and from 1934 the Department of Education hoped it would become the leaving certificate for students who did not intend going to university. In the following year Thomas retired from Timaru Boys' High School marking an end to forty years in education.

In his retirement Thomas was invited by the newly formed New Zealand Council for Educational Research (NZCER) and the University Senate to look into aspects of Entrance to the University.[11] In 1935 the study was widened to include the ability of

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practical work); that the secondary schools board be responsible for administering their examinations; that the technical school examinations generate a Department of Education Certificate; and that the Department of Education issue outlines for courses - Reichel- Tate Report, Higher Education, AJHR, 1925, E-7a, pp. 90-91.

[10] Tate, pp. 74-76. The main recommendations have been summarized.

[11] W.Thomas, C.E.Beeby and H. Oram, *Entrance to the University*, NZCER: Wellington, 1939.

the UEE to predict success at University. Thomas invited the Director of the NZCER, Dr. C.E.Beeby, and a mathematician, H.Oram to assist him.[12] However he also intended pursuing a career in politics and in the 1935 general election, Thomas stood as a National Independent candidate urging that more attention be paid to: education for leisure; more music, art and handwork in the school curriculum; an extension of accrediting; and decentralisation of educational administration.[13] Thomas promoted citizenship through self help groups such as: Workers Educational Association and Women's Institutes.[14] But most importantly Thomas wanted educational reform.[15] He lost the election by 1,000 votes to Rev. Clyde Carr (Labour) but retained important connections with the Labour Party through his friendship with Professor Shelley, Canterbury University College of the University of New Zealand and ex President of the Christchurch Rotary Club(1923-24). Professor Shelley had been a regular visitor to Timaru Boys' High School during the previous ten years and had introduced Thomas to the Rotary Movement leading to Thomas becoming the first president of Rotary in Timaru in 1927.[16] Professor Shelley had been active in the Labour Party and he had helped write its education election manifesto for the 1935 election along with: Walter Nash, Henry E. Holland (died 1933), M.J.Savage, Clyde Carr, Terence H. McCombs, W.B. Sutch, Professor T.A. Hunter, P. Martin-Smith, C.E. Beeby, F.L.Combs and Arnold E. Campbell.[17]

After his election defeat Thomas devoted his time to his research for the Senate, publishing the results in 1939 entitled *Entrance to the University.* The report recommended urgent reform: that the University Entrance Examination should be abolished and replaced with an accrediting system and that the School Certificate

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[12] C.E.Beeby, *The Biography of an Idea: Beeby on Education*, Wellington: NZCER, 1992, p.100.
[13] Guy, p. 87.
[14] ibid., p. 86.
[15] ibid., p. 89 citing *Timaru Herald,* 25 November, 1935.
[16] ibid., p. 58.
[17] Cumming and Cumming, p. 254. Thomas Hunter was made Professor of Mental and Moral Philosophy in 1909 and in 1929 he was made Vice-Chancellor of the University of New Zealand, a position he held until 1947. Hunter was actively involved in the W.E.A and one of his early students was Peter Fraser. He was President of the NZCER from 1933 to 1953. Department of Internal Affairs, *Dictionary of New Zealand Biography Volume 3, 1901-1920*, ed. Claudia Orange, Auckland: Auckland University, 1996, pp.241-42.

examination be awarded by accrediting after a minimum of three years post-primary schooling.[18]

1.3 Abolition of the Proficiency Examination

While the Senate and the Department of Education continued negotiations for the reform of the UEE, the primary school was similarly constrained by the proficiency examination. The Minister of Education, Peter Fraser, announced in 1936 that from 1938 the proficiency examination would be abolished.[19] This would enable every child to progress to the post-primary sector enabling a quality education to be available for every New Zealander. Fraser, expressing his party's commitment to a more equitable New Zealand society reported in 1939 that:

> The government's objective, broadly expressed is that every person, whatever his level of academic ability, whether he be rich or poor, whether he live in town or country, has a right, as a citizen, to a free education of the kind for which he is best fitted, and *to the fullest extent of his powers[sic]*. So far is this from being a pious platitude that the full acceptance of the principle will involve the reorientation of the education system.
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> ... The present Government was the first to recognize explicitly that continued education is no longer a special privilege for the well to do or the academically able, but a right to be acclaimed by all who want it to the fullest extent that the state can provide. Important consequences follow from the acceptance of this principle. Schools that are to cater for the whole population must offer courses as rich and varied as are the needs and abilities of the children who enter them.....it means that the system of control must be such that the whole school system is a unit within which there is free movement.[20]

The words 'to the fullest extent of his powers' denote equality of opportunity, not education. Fraser was not the author of his statement but the Assistant Director of

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[18] Thomas *et al,* 1939, pp. 151-56.

[19] Peter Fraser (1881-1950) was considered a socialist and believed that education would play a key part in social reform. As Minister he restored funding to education and improved access to secondary education. Fraser had an authoritarian streak and dominated his government. Department of Internal Affairs, *Dictionary of New Zealand Biography Volume 4, 1921-40*, ed. Claudia Orange, Auckland: Auckland University, 1998, pp. 182-86.

[20] Report of the Minister of Education for the Year Ending December 31, 1938, AJHR, 1939, E-1, pp. 2-3.

Education, Beeby.[21] Beeby has commented that the above statement became his measure of all educational changes.

As a result of Fraser abolishing the proficiency examination, for the first time in New Zealand's educational history children of all intellectual abilities had access to post-primary education. The post-primary schools had to provide programmes more suitable to the non-academic student. Thomas had warned the secondary schools that: 'Changes in the organisation of Secondary schools are to come and there will also be big changes in the intellectual fare offered by the schools.'[22] Thomas, like many of his colleagues, believed that the post-primary curriculum had to be relevant to the needs of all students. Thomas was particularly supportive of education for citizenship 'We take it that democracy is the right type of government but we don't teach the children why it is.'[23]

Table 1.1 The Proportion of 12 to 18 year olds (excluding Maoris) attending Post-Primary Education in New Zealand in 1920 and 1939[24]

Year	1920	1939
Post-primary Population age 12>18	15,558	41,576
Total Population age 12>18	138,803	161,564
% of Post-primary Popn. age 12>18	11%	26%

By 1939, the post-primary school population had increased to 41,576 from 15,558 nearly twenty years before(refer Table 1.1). Thomas, along with many of his colleagues, deplored the paucity of subject choice for post-primary students and advocated better coordination between all sectors of post-primary education.[25] He had formed a strong belief in the value of technical education while at Timaru Boys' High

[21] Beeby, 1992, pp. 123-24.
[22] E2 1951/7a, E 29/2/7a part 1- Miscellaneous Education Systems. *Timaru Herald*, 29 June, 1938 'Need for Better Curricula'.
[23] ibid.
[24] Report of the Minister of Education for the Year Ending December 31,1919, AJHR, 1920, E-1, p. 32 and Report of the Minister of Education for the Year Ending December 31,1938, AJHR, 1939, E-1, p. 32.
[25] Guy, p. 48.

School and had introduced practical subjects into the school, such as: commercial and engineering courses. The Technical and District High Schools had developed to provide an education for the non-academic student by providing manual and technical subjects. By 1939 they had developed into a potent force in post-primary education (Refer Table 1.2). But they suffered, as did the secondary schools, from students being forced to attend post-primary school until attaining the official leaving age. For many this meant a stay of only two and a half years. Before relevant programmes could be developed for the non-academic student, the time they spent at post-primary school had to be increased. This was best achieved by raising the leaving age from 14 to fifteen years of age. Worldwide there had been demands made for increasing the school leaving age and in 1937 the UK had increased it to fifteen years. There was pressure on New Zealand to follow this trend.

Table 1.2 Percentage of Students enrolled in Post-primary Education in 1920 and 1939.[26]

Type of Post-primary School	Roll in 1920	Roll in 1939
Secondary School	9,196 (59%)	15,974 (38%)
District High School	2,157 (14%)	6,183 (15%)
Combined High School	-	3,126 (7.5%)
Technical High School	2,766 (18%)	10,282 (25%)
Private School	1,439 (9%)	6,011 (14.5%)

On April 4, 1940 Peter Fraser was elected as Prime Minister following the death of Michael Savage, H.G.R. Mason was appointed Minister of Education and Dr.C.E.Beeby became Director of Education. The previous year New Zealand had declared war on Germany and sworn its allegiance to Britain.[27] Mason intimated that the government intended increasing the leaving age but Beeby cautioned his Minister that raising the leaving age at this time was not possible due to the effects of the war on finances and staffing levels:

> The proposal to extend the school age generally to 15 years was considered in detail in 1936 ... it then appeared that the annual cost of education would be increased by about £211,500 ... the cost of putting the scheme into operation at the present time would be very considerably more than that which was

[26] AJHR, 1920, E-1, p.32 and AJHR, 1939, E-1, p.32.
[27] Cumming and Cumming, p. 268.

> calculated in 1936. A further consideration is the fact that war conditions have already taken a serious toll of the teaching staff... It would seem to be an inopportune time to raise the school leaving age above the present legal age.[28]

However, in 1942 Mason announced that the school leaving age would rise from 14 to 15 years from 1944.[29] This move had the political support of the country, as Mason commented:

> Owing to the war conditions there are an increasing number of young adolescents who are missing the discipline of a normal home, and it is essential that the school keeps its grip upon them during these very critical years.[30]

Raising the leaving age was only part of the overall plan and now a curriculum had to be developed to meet the needs of all New Zealand children. The content of the curriculum had to educate the child in becoming a good citizen and teaching the principles of democracy. Mason noted that the world crisis had created an urgency in this endeavour:

> It is simpler to teach hatred and prejudice and half crazy pride of race than it is to create love for freedom and tolerance and the quiet, decent virtues of the democratic way of life.[31]

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[28] E 1952/1b, E8/3/26. Memo from Dr.C.E.Beeby to Minister of Education, 17 Dec., 1940. The war had taken its toll on the teaching staff with an estimated 39% of her male teachers in active service. This equated to 61 secondary teachers on service overseas and 104 on service in New Zealand. Report of the Chief Inspector of Secondary Schools (Caradus), AJHR, 1943, E-2, p. 3.

[29] *Evening Star*, Wed. 24 March, 1943. 'The desire of the Minister of Education (Mason) to bring down a Bill to raise the school leaving age revives a prospect that has been suspended for 23 years.' E2 1952/1b, E8/3/26 - School Attendance. Letter dated 12 May 1941 from Mason, replying to a question about increasing the leaving age to 15 years from the NZWTA 'You know the difficulty about that, but first it means the staffing and the building. These two problems stand in the way and must be overcome before we can raise the school age to 15. It is the government's policy to raise it, but things have to be done in order. We cannot do anything immediately ... I cannot promise any result but realize the importance of the problem.' E2 1946/27a, E29/47/3 part 1-Resolutions and Remits of NZWTA, 1922-46. Letter dated 8 April, 1942. Memo from: Renyard for Director of Education, to Mr. Hocking, Government Youth Centre Christchurch requesting the leaving age be increased to 15 years: 'I regret therefore that it is not possible to put the regulation into force at the present time.' E2 1952/1b, E 8/3/26.

[30] Report of the Minister of Education for the Year Ending December 31, 1942, AJHR, 1943, E-1, p. 2. Mason comments on the raising of the school leaving age.

[31] Report of the Minister of Education for the Year Ending December 31, 1940, AJHR, 1941, E-1, p. 2.

After twenty years of protracted negotiations and discussion the University Senate agreed to the introduction of accrediting of the UEE by approved schools from 1944. The University was to sever its close relationship with the secondary schools and

> In effect the control of the post-primary curriculum will pass over from the University to the Department of Education and the change may well mark a turning point in post-primary education.[32]

The Department of Education hoped that now its own examination ' ...the School Certificate would take the place of the University Entrance Examination as the qualification ordinarily demanded by employers.'[33] The new School Certificate was to be awarded by external examination, after three years post-primary education and administered by the Department of Education. The possible examinable subjects were increased to include practical subjects such as woodwork and clothing.[34] The Department of Education announced it was time to develop a curriculum to meet the needs of the 'new strata of intellect' and to ensure that it includes '...experiences that fit each citizen, whatever his status or his powers, for life in a complex and rapidly changing democratic community.'[35] The Chamber of Commerce warned that it would be futile to increase the leaving age to 15 years if the student was not required to learn any more than they did at 13 or 14 years of age.[36] The *Otago Daily Times* commented that:

> We are about to extend compulsory education to the age of 15, and all intelligent teachers know what will happen - they will be faced with children who will be unable to reap any material advantage from the special curriculum devised for them ... The new vision proposes that our efforts should therefore be directed to giving these children, as well as all others, a broad basis of

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[32] E4/1/5. Memorandum from Beeby to Minister of Education, 23 October 1942. E4/1/5 is a Department of Education file. The National Archives have a record of receiving the file from the Department of Education but they can find no trace of its reclassification into their education series files. The transcripts of the documents from this file, referred to in this thesis, were obtained from Logan Moss, Waikato University, who had obtained photocopies of the file in 1989-90, prior to its transfer to the National Archives.

[33] ibid., Press release, 5 November 1942 (first of two versions).

[34] Thomas Report, p. 80.

[35] E2 1943/3b, E29/2/75 part 1 - Miscellaneous Education Systems, 1937-43. Beeby's copy for *Year Book of Education*, 1937 and AJHR, 1943, E-1, pp. 2-3.

[36] E2 1947/16a, E29/2/5 part 2- Miscellaneous Education Systems. 'School Pupils Decline in Quality Observed', a statement by the Chamber of Commerce. *Nelson Evening Mail,* 14 October, 1944.

> culture and knowledge which will serve to illuminate the inner man whatever his calling in life.[37]

Beeby noted:

> She will find herself, in consequence, driven to provide more widely varied courses than ever before if she is to maintain standards in the academic subjects and at the same time give something of educational value to the new strata of intellect for which she will have to cater.[38]

Mason commented: 'Not the least of the problems to be faced will be the devising of courses of study fitted to the needs and interests of the non-academic type of [the]14 year old[s].'[39]

1.4 The Thomas Committee

In 1942, Beeby asked Mason to convene a consultative committee to look into aspects of post-primary education including the structure of the School Certificate examination.[40] Beeby was determined that the changes to the post-primary curriculum would have to include a common core of subjects.[41] The idea of a common core had been suggested in 1936 by Frank Milner, Rector of Waitaki Boys' High School, at the annual meeting of the Secondary Schools Association. Milner's 'core' had included: English, social studies, general science, health, handwork, art and arithmetic.[42] Beeby suggested to the Thomas Committee that a common core as proposed by the SSA in 1936 might be useful for a common curriculum.[43]

Beeby wanted the consultative committee to advise the Minister both on policy and to focus '...public attention on the problem.'[44] Mason in a press release, probably prepared by Beeby, noted that: 'Freed from the burden of a narrow and irrelevant examination the schools will be able to devise courses having more relation to the

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[37] E2 1951/7a, E29/2/79 part 1. Editorial, *Otago Daily Times*, 4 September, 1937.
[38] E2 1943/3b, E29/2/75 part 1 - Miscellaneous Education Systems.
[39] AJHR, 1943, E-1, pp. 2-3,
[40] E4/1/5 Memorandum from Beeby to Minister of Education, 23 October 1942,
[41] C.E.Beeby, *The Intermediate Schools of New Zealand*, Wellington: NZCER, 1938, p. 236,
[42] Education Dept. , *The Post Primary School Curriculum: Report of the Committee appointed by the Minister of Education in November 1942*, 2nd ed., Wellington: Government Printer, 1959. (Chairman: W.Thomas), p. 6,
[43] E4/1/5. Initial Memorandum to the Thomas Committee dated 12 November 1942,
[44] ibid. Memorandum from Beeby to Minister of Education, 23 October 1942,

lives of the pupils and to the changing needs of the adult world.'[45] The Department of Education hoped to engage public support for its proposed changes by appealing to the universality and non selective nature of the new School Certificate, thereby providing for the non academic student such that 'The emphasis of the examination will be very different and for the ordinary child without marked academic abilities the education given can be much more real.'[46]

The consultative committee, commonly referred to as 'The Thomas Committee', excluded representatives from ' business, industry, and the professions...' because Beeby felt they would make '... the Committee very bulky: besides which most of the problems are very technical in nature.'[47] Beeby briefed the overall committee by memorandum, asking that they focus on three main areas as follows: the first area to involve identifying the chief aim of post-primary schools, secondly identifying the choice of subjects to be available for School Certificate and finally identifying the compulsory or optional nature of the subject.[48] With regards to the choice of subjects available for the School Certificate Examination, Beeby identified two options for the committee to consider: on the one hand the subject must prepare the student for further subject specialisation and on the other provide a common core of knowledge for 'intelligent participation in communal activities' and Beeby went on to suggest that the 'second seems to me, in the light of recent events, to be the more important.'[49]

The appointment of the Thomas committee personnel had been made on the recommendation of Beeby. The committee was further divided into sub-committees, with the science sub-committee consisting of: H.C.D.Somerset (Joint Secretary), Dr. E. Gregory (Otago School of Home Science), E. Caradus (Chief Inspector of Secondary Schools, Convenor), F.C. Renyard (Superintendent of Technical education), G.R.Ridling (Principal, Wellington Technical School), and others were co-opted as required. The Thomas Committee first met on 25 November, 1942 and deliberated for the following eighteen months, meeting as a full committee on six

[45] ibid. Press release dated 5 November 1942 (first of two versions).
[46] ibid. Press release dated 5 November 1942 (second of two versions).
[47] ibid. Memorandum from Beeby to Minister of Education, 23 October 1942.
[48] ibid. Initial Memorandum to the Thomas Committee, 12 November 1942.

occasions. Its two joint secretaries, H.C.D. Somerset and Arthur Campbell, were responsible for writing the report. It is not clear the actual input Thomas had into the report's writing, but correspondence between Somerset and Campbell gives some indication: 'Had a yarn to Beeby about the final report: he warns us against leaving any of the final write up to W.T.'[50] Campbell replies: 'Beeby gave me a similar warning about Thomas and the writing of the report. I think he is being a bit hard on him.'[51]

The Thomas committee also included the following: Edward Noel Hogben, Headmaster of Wellington College and President of the Secondary Schools Association, who had an interest in Social Studies; Emily Stephens Headmistress of Palmerston North Girls' High School, who had an interest in Languages; Irene Wilson, Headmistress of Queen Margaret College, Wellington, who appeared to have no specialist area; Arthur Campbell, Director of NZCER, who had an interest in educational theory, Social Studies and comparative education; Richard Gross, President of the Auckland Society of Fine Arts; Thomas Hunter, Vice- Chancellor of University of New Zealand and Dr. Selwyn Morris.[52] Gross and Morris were not on the original list of proposed members of the Thomas Committee. It would seem that their late inclusion was to ensure that there were representatives from Auckland on the committee.[53]

Most of the science sub committee had backgrounds in specialist areas of science as follows: H.C.D.Somerset, M.A.Education; Dr. E. Gregory, Ph.D. (Chemistry and Nutrition); E. Caradus, B.Sc. (Chemistry); F.C. Renyard, B.Sc; G.R.Ridling, Diploma in Agriculture.[54] Caradus had been an Inspector of Secondary Schools since 1937 and Director of Education for the RNZAF (1939-46), and he was Inspector of Post Primary Schools (1946 -48).[55] Dr Gregory had been a lecturer of Chemistry and

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[49] ibid.
[50] AAVZ W3418, Box 17. Memo, 4 May, 1943.
[51] ibid., 7 May, 1943.
[52] E4/1/5. Memorandum to the Minister of Education from Beeby, 23 October, 1942.
[53] ibid.
[54] Dr. G.H.Scholefield (ed.), *Who's Who in New Zealand and Western Pacific*, Wellington: A.H.Reed and A.W.Reed, 4th edition, 1944, pp. 101, 165, 290, 293, 318.
[55] ibid., p. 101.

Nutrition at the University of Otago (1932-40), she was a member of the Social Science Research Bureau (1937-39), and a Professor of Home Science at the University of Otago from 1941.[56] She had also assisted Somerset in his research on *Littledene*. Hugh Somerset had been a part time WEA lecturer for Oxford Publications (NZ) from 1924 to 1936. He wrote *Littledene* in 1938, which was a study of a rural community (Oxford), he studied community and adult education in England, Europe and America under a Carnegie Fellowship and from 1938 he was the Director of the Feilding Community Centre.[57] Charles Renyard had been the Director of Masterton Technical College (1921-23) and was Technical Inspector of Technical Instruction.[58] Randolph Ridling was Director of the Wellington Technical College, Inspector of Manual and Technical Branch (Agriculture) of the Department of Education and a member of the NZCER.[59]

The Thomas Committee recommended that a compulsory core of subjects be taught to all post-primary students for the first three years. The core was to consist of: English language and literature, Social Studies, General Science, elementary Mathematics, Music, a craft or fine art, Physical Education.[60] For girls Homecraft was regarded as a craft. The Committee recommended minimum time allocations per subject and for School Certificate, the student had to have completed three years of post-primary schooling after which they would be accredited in the core subjects.[61] The School Certificate examination was to be sat by candidates in English and three other subjects of their choosing from the list provided. In science, students could sit the examination in general science, biology, chemistry, electricity and magnetism and finally heat, light and sound.[62] This is the first time that a subject called general science had appeared in a New Zealand curriculum. Its core requirements consisted of aspects of physics, chemistry, biology and geology.[63]

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[56] ibid., p. 165.
[57] ibid., p. 318.
[58] ibid., p. 290.
[59] ibid., p.293.
[60] Thomas Report, p. 12.
[61] ibid., p.13.
[62] ibid., pp.71-2.
[63] ibid., p. 36.

1.5 Reaction to the Thomas Report

The Thomas Report had been prepared amidst a period of world crisis, and New Zealand had been quite unique in continuing her educational reforms. The committee's interim report had not been favourably received by the public, and Thomas prepared a press release demanding from the public a '... cessation of hostilities until the official report was published.'[64] When the official report was printed there were only limited copies available for reading and comment. Organisations such as the SSA were sent copies for comment but were asked to return them upon completion of their report. Teachers had difficulties gaining access to the report but Mason commented that:

> ...We urge most strongly that the report be made available to teachers.... that everything be done to facilitate the holding of conferences .... that by the interchange of ideas, they may arrive at the best means of implementing the recommendations of the report of the consultative committee.[65]

In 1944 Mason convened a conference to discuss topical educational matters and the Thomas Report was on the agenda. Mason commented that: '... in general the strong balance of opinion indicated that the report of the committee could be accepted as a desirable basis for the new curriculum of post-primary school.'[66] However not all were happy with the Thomas Report, believing Beeby to be its architect, not the committee, and one letter to the *Otago Daily Times* commented that:

> I quite agree that academic pomposity and pedagogic arrogance, however backed by blatant self advertisement and juvenile tributes, are incapable of offering a sound defence of our so called "modern education". Everyone concerned with the question knows that it is the Department of Education, under the guidance of the Director, Dr. Beeby, which is cracking the whip. A good servant does what his master tells him.'[67]

Similarly the Private Schools were against the new mood in education with a representative commenting that:

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[64] AAVZ W3418, Box 44, Memo dated 26 July, 1943.
[65] ibid., 18 November 1943.
[66] E W2536, Box 4, Post Primary Curriculum Conference - Verbatim Report of Proceedings, 1944. Statement by Mason, 1944.
[67] E2 1947/16a, E29/2/5 part 2, *Otago Daily Times*, 24 August 1944.

> It is a totalitarian doctrine that education is a state monopoly. Except in the Axis countries, there is no precedent for a Government imposing a uniform syllabus and a timetable on schools.'[68]

They had also noted that the Department of Education had managed to gain control of the timetable in every school by dictating curriculum content and stating minimum time allocations, including an average of 2.7 hours per week for general science.[69] There was a call for caution, and that the demise of languages might be too high a price to pay for scientific and mathematical literacy.[70]

While Thomas defended the report, he offered a conciliatory note that in the light of criticism he hoped it would be adjusted:

> Our traditional academic education came from England and for many years we followed that traditional system here and we paid every attention to the reports on English education at the present moment.... but we decided that while some recommendations suited here others did not.[71]

The Thomas Report was to be constrained, as many reports of its type have been and continue to be, by social and economic considerations. Giving teachers greater freedom and flexibility increases the cost of education and without the necessary financial support, teachers will revert to maximizing the use of available resources by 'chalk and talk'. They will also be constrained by the aspirations of their pupils and parents who have consistently selected external examinations as the measure of a successful education. Parents placed increasing demands on the schools to prepare their children for the School Certificate Examination, just as there had been calls for the UEE, thus only the compulsory core and examinable subjects were taught.

The success of Thomas was always dependent on a supply of teachers who were both well educated and trained, and sympathetic to the new educational philosophy.[72] In the case of social studies and general science, sixty years later there is still no tertiary

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[68] E W2536, Box 4, Statement of the general case against the Report of the Consultative Committee with special reference to the position of the private schools.
[69] Thomas Report, p. 12.
[70] E2 1947/16a, E29/2/5 part 2. *Auckland Star,* May 24, 1945.
[71] E W2536, Box 4, Statement by Thomas, 1944.

precedents for these subjects. The content of these two subjects has been open to manipulation by educationalists. The failure of the Thomas Report to be anything more than a limited success was due to factors beyond its control: the public sense of education for 'getting on' was as strong sixty years ago as it is today.[73]

The Thomas Committee had recommended a compulsory core of subjects for all post-primary students, and the core included 'general science'. The committee had been established by the government to develop a curriculum to better meet the needs of the non-academic student but its members were all educationalists, with the majority showing a commitment to the educational philosophies of the New Education Fellowship. As will be shown, this adherence to the philosophies of the NEF had guided the educational reforms brought about by the Thomas Committee, introducing to post-primary schools a compulsory core curriculum.

[72] C.Whitehead, 'The Thomas Report - A Study in Educational Reform', *New Zealand Journal of Educational Studies*, 9: 1, 1974, p. 59.
[73] ibid., p. 62.

Chapter 2 - Looking Abroad for Guidance

This chapter will show that the Department of Education had a history of seeking guidance abroad on educational matters. In particular, educational innovations in England were usually duplicated in New Zealand.

2.1 Education for the Worker

The nineteenth century witnessed increasing demands for the provision of education to the working class. By extending free elementary education to all citizens, it was hoped that education would check crime, train the future voter and assist in preserving social order.[1] But the educator had to be cautious to ensure that the worker did not become over educated, thereby upsetting the social order. Based on the 'Three R's', the success of the elementary school's curriculum was to be measured by results, which gave rise to: rote learning, inculcation of facts and examinations.[2] The elementary educationalists were replaced by the practical educationalist who advocated manual and technical instruction in schools. The philosophical underpinnings to this new educational method depended upon faculty psychology, which suggested that the mind was divided into faculties or powers which could be trained. Thus training had to be provided to exercise the mind in the same way that physical exercise trains the muscles.

The practical educationalists suggested that worker education was synonymous with technical education and that modern secondary education should include manual and technical instruction.[3] Technical instruction was seen as including science and in particular training in the scientific 'method'. T.H.Huxley actively promoted technical education and in 1887 he addressed the inaugural meeting of the National Association for the Advancement of Technical Education and suggested that:

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[1] R.J.W.Selleck, *The New Education, the English Background 1870-1914*, Melbourne: Pitman and Sons, 1968, p. 12.

[2] ibid., p. 45.

[3] The practical educationalists favoured practical work such as: manual training, drawing, nature study and physical education. They believed that it taught eye hand co-ordination and relied on the faculty psychology of education as training of the different areas of the brain. They particularly promoted technical education and the importance of science in the curriculum using the heuristic methods of Professor Armstrong. According to the practical educationalists, science was important because of its connection to industry, seeing the child as the future worker. Selleck, p. 125 The philosophy of the

> ...at the present moment there is hardly a branch of trade or of commerce which does not depend, more or less directly, upon some department or other of physical science, which does not involve, for its successful pursuit, reasoning from scientific data. Our machinery, our chemical processes or dye works, and a thousand operations ...are all directly and immediately connected to science.[4]

In the same year, Huxley addressed the working men in South London, describing technical education as a '...sort of education which is specially adapted to the needs of men whose business in life it is to pursue some kind of handicraft...'[5] Huxley went on to add that technical education is simply '...a good education, with more attention to physical science, to drawing, and to modern languages than is common, and there is nothing technical about it.'[6]

In New Zealand, the 1877 Education Act had made provision for free elementary education for all children from the ages of 5 to 15 years, regardless of race. Provision was also made for secondary education under the 1877 Education Reserves Act, where land had to be set aside for secondary schools. Secondary schools under the Act were defined as secular, providing a liberal education consisting of: a study of English language and literature, Latin and Greek classics, French and other modern languages, mathematics, physics, and other branches of science.[7]

In 1881, a Royal Commission was set up in England to inquire into the provision of technical instruction in foreign countries. The impetus had come from a visiting American manual training expert, Calvin Woodward.[8] In 1884, the Royal Commission recommended the establishment of technical colleges.[9] The Commission's report also helped to raise public awareness of the lack of technical

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practical educationalist can be seen in the Director General of Education, Hogben, promoting the introduction of manual and technical training in post-primary schools in the early twentieth century.

[4] Cyril Bibby, *T.H.Huxley on Education*, Cambridge: Cambridge University Press, 1971, p.201.

[5] Bibby, p.157.

[6] ibid., p.159.

[7] Cumming and Cumming, p. 112.

[8] Selleck, p. 107.

[9] John Nicol, *The Technical High Schools of New Zealand: An Historical Survey*, Wellington: NZCER, 1940, p. 22.

instruction in schools and they had agreed with Huxley that technical education was simply a modern type of secondary education, which included

> ... instruction in the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries or employment's.[10]

In 1889, the Technical Instruction Act defined technical instruction as '...instruction in the principles of science and art applicable to industries' but this was not vocational training.[11] The Act also defined manual instruction as '... instruction in the use of tools, processes of agriculture, and modeling clay, wood and other materials'.[12]

New Zealand also adopted the practical educationalists' view of education, promoting technical and manual training. In 1885, the Premier of the Colony of New Zealand and the Minister of Education, Sir Robert Stout, sent a message to all Secondary Schools asking that the Board of Governors consider the importance of

> ... as much instruction as possible in subjects that have a direct bearing upon the technical arts of modern life...The state also expects the managers of Secondary Schools to bear in mind that the professions are likely to become over crowded unless something is done to create a bias towards industries and that our manufacturing industries will not be followed by our brighter and more intelligent youths if they are merely drilled in the ordinary subjects of a grammar school education.[13]

He continued that:

> If the secondary schools have become in any respect unpopular.... it may be because the people have not seen direct practical results flow from them. Were attention paid to technical education as well as to ordinary studies in

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[10] Board of Education, *Report of the Consultative Committee on Secondary Education with Special Reference to Grammar Schools and Technical High Schools*, London: HMSO, 1938, (Chair: W. Spens), p. 54 n.1. Defines technical instruction under the 'Technical Instruction Act 1889'.

[11] Report of the Director of Technical Instruction (Riley), AJHR, 1898, E-5B, p. 1.

[12] ibid.

[13] Report of the Minister of Education for the Year Ending December 31, 1984, AJHR, 1885, E-1 p. 117. Robert Stout (1844-1930) described as a Lawyer, politician, chief judge and university chancellor was elected to Parliament in 1872. From Herbert Spencer he derived a belief that the individual had to be responsible for their own lives. He believed in the notion of Darwinian socialism 'survival of the fittest' with poverty being the vehicle for selection. He left politics in 1879. Department of Internal Affairs, *Dictionary of New Zealand Biography, Volume 2, 1870-1900*, ed. Claudia Orange, Wellington: Bridget Williams books, 1993, pp. 484-487.

> secondary schools, the objections now urged against the endowing of high and grammar schools would probably not be heard.[14]

Stout reminded the secondary schools that:

> In other countries increasing attention is being paid to geometrical and mechanical drawing and the handling of tools, as useful subjects of instruction. The schools of this Colony might do good service by taking up these subjects as well as physics and chemistry.[15]

Stout's ideas were not taken up by the secondary schools, although some paid lip service to his ideals by introducing 'wood work'. Stout was defeated in 1887, which temporarily put an end to the call for technical education.

Such was the importance that Stout placed on the Technical Arts that in 1885 Arthur Riley was appointed drawing master at the Wellington School of Design. Riley had studied at the National Art Training School in South Kensington and in Wellington he taught industrial arts, which involved drawing and engineering. In 1898 Riley, as the Director of Technical Instruction to the Education Board in Wellington, visited Europe and upon his return to New Zealand he submitted a report to the Department of Education suggesting that if: 'New Zealand desires to maintain her position among British Colonies this question of technical education will need serious attention.'[16] Riley suggested that science programmes were useful for the '... cultivation of habits of accurate observation and methods of investigation.'[17] Riley also noted that in England, science was being taught using Professor Armstrong's heuristic method, which consisted of students investigating a particular facet of science to derive a law or principle.[18] Professor Armstrong's course was divided into topics, each devoted to a different aspect of science. One such topic involving the lever and the experimental discovery of its law required the student to:

> Construct a series of nags loaded with gravel, shot, or sand so that the weights of bag and contents are as numbers 1, 2,3, 4, 5, 6. Hang these by strings form

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[14] ibid.
[15] ibid.
[16] AJHR, 1898, E-5B, p. 1.
[17] ibid., p.8.
[18] ibid.

> the boxwood lever, making six experiments to discover the law. Show the use of adjusting weight, which slides along the lever.[19]

Professor Armstrong was a Fellow of The Royal Society, Secretary of the Chemical Society and President of the Chemistry section of the British Association for the Advancement of Science and had been very vocal in advocating a heuristic approach to science.[20] Riley returned to New Zealand with a copy of Armstrong's syllabus, which had been consequently responsible for the development of laboratories in schools.[21] Riley recommended to Parliament that manual and technical classes be introduced into New Zealand schools.

By 1899, more practical work was being undertaken in New Zealand's schools and George Hogben, Inspector-General of Schools, was keen to develop technical education as recommended by Riley.[22] The Minister of Education, reported that

> If our pupils are taught by direct observation of things, and if at the same time their constructive and creative activities are called into play, the different parts of their education are truly coordinated, because various subjects of instruction are all in a real sense, coordinated with nature.[23]

The Manual and Technical Instruction Acts of 1900 and 1902, made provision for the funding of manual and technical instruction.[24] By 1905, Hogben noted that progress

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[19] ibid., p.10.

[20] The heuristic method, as advocated by Professor Armstrong, provided the teachers of science with a definite method and a belief that the students had to be actively engaged in practical work in line with the practical educationalists. Professor Armstrong confidently claimed that science had to be taught because it developed the scientific way of thinking through its method. Selleck, pp. 126-27.

[21] Professor Armstrong adhered to the belief that education had to be practical and was cynical of the 'humanists' who promoted book learning. Professor Armstrong suggested that by 'doing' the student could ascertain the truth. E.W.Jenkins, *From Armstrong to Nuffield, Studies in Twentieth-Century Science Education in England*, London: John Murray, 1979, p. 43. Selleck suggests that the practical educationalist should be seen as a response to educational practices rather than as an educational theory. But none the less they adhered to the notion of faculty psychology. Selleck, pp. 138-39.

[22] George Hogben (1853-1920), described as an educationalist and seismologist. He believed that change had to come about via the educated classes. In 1889 Hogben was appointed Rector of Timaru High School where he introduced many advanced ideas into the curriculum such as more practical work and introduced shorthand, book-keeping, needlework and carpentry. In 1899 he was appointed Inspector-General of Education and he was determined to give teachers greater freedom. During his term in office he had managed to achieve free secondary education. Department of Internal Affairs, 1993, pp. 224-226.

[23] Report of the Minister of Education for the Year Ending December 31, 1898, AJHR, 1899, E-1, p.xvii.

[24] Butchers A.G., *The Education System- A Concise History of the New Zealand Education System*, Auckland: National Printing Co., 1932, p. 117.

was being made in the teaching of practical science but that some schools still lacked adequate provision of laboratories, including the larger schools:

> ...our efforts to secure sound technical education will be rendered futile if boys and girls do not receive while at school training in elementary scientific method by means of individual experiment and observation with their own hands.[25]

In agreement with the English Royal Commission, Hogben saw no '...real distinction between secondary and technical education.'[26] The Education Act of 1903, made provision for funding of manual and technical classes and for 'free' places in secondary schools to students who had passed the proficiency examination. Under the 1903 Act the Department of Education introduced regular inspections of all public schools which enabled the department to inspect the provision of practical classes. During this time there were 2265 boys and 1457 girls in New Zealand's secondary schools plus 1082 boys and 1014 girls in the secondary division of District High Schools.[27] District High Schools were perceived by Hogben to be ideally placed to develop a practical curriculum and he had the support of Frank Tate, Director of Education in Victoria, who suggested that: 'The District High Schools may be made a most effective aid in developing a good system of technical instruction.'[28] Despite Hogben's hope that these schools would develop a more practical curriculum focused on manual and technical instruction, it failed to materialize as they modeled their curriculum in the style of the secondary schools, which was in turn modeled on the 'old English Grammar School.'[29] Hogben especially wanted the science curriculum in these new schools to be relevant to the student, such that in every District High School there should be rural science '... plant life, elementary physiology, and physics and chemistry, so far as they touch the common facts of country life...'[30]

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[25] Secondary Education, Report of the General Inspector of Schools (Hogben), AJHR, 1905, E-12, p. 5.
[26] Butchers, p. 133.
[27] Cumming and Cumming, p. 150.
[28] Butchers, p. 133.
[29] ibid., p. 132.
[30] AJHR, 1905, E-12, p. 5.

In 1905, Professor Robert Scott, Professor in Charge of the School of Engineering, Electricity and Technical Science at Canterbury College, visited Europe and was impressed by the trade and technical schools in Germany and Britain.[31] Scott noted that there was extensive provision of State funded scientific education in Germany which he suggested was directly related to the country's prosperity '... present prosperity of the country is due in no small measure to the systematic instruction and research which is carried on in the great state supported institutions.'[32] He recommended that technical education consisting of: mathematics, foreign languages and a science was essential to educate the future directors or designers. Scott noted that if New Zealand wanted to develop into a prosperous industrial nation, like Germany or Britain, she had to introduce some form of technical education.[33]

2.2 The Growth of Technical Education

The early part of the twentieth century had seen a huge development in alternative styles of education which included: practical educationalists, social reformers, naturalists, Herbartians, scientific and moral educationalists.[34] Advances in educational psychology saw the demise of faculty psychology and a recognition that the child should be free to develop as an individual.[35] This lead to Professor Armstrong's heuristic approach being undermined by the rejection of transfer of training as an educational objective and replaced by the belief that education was for enriching the mind of the child.[36] According to the 'naturalists' the curriculum should be broad.

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[31] Scientific and Technical Education on the Continent of Europe, AJHR, E-15, 1905, p.1.
[32] ibid.
[33] Education Committee (report of the) on Scientific and Technical Education: Together with Minutes and Evidence, AJHR, 1905, I-14C.
[34] Boyd William and Wyatt Rawson, The Story of the New Education, London: Heinemann, 1965, pp. 36-56. The Herbartians believed that education was moral education and the curriculum should be broad. The teacher was to follow the five steps for organising instruction: preparation, presentation, association, generalisation and application. Thus to the Herbartian the child was made by the teacher. Selleck, pp. 227-264 and Jenkins, pp. 46-8.
[35] ibid., page 46.
[36] During the late nineteenth and early twentieth century, the naturalists began to gain prominence in education. This saw the rise of Montessori Schools where the teacher became a 'Director' and the children were lead to develop individually using self correcting learning. Boyd and Rawson, p. 23

One naturalist, Froebel, was concerned that new subjects should not be introduced to the child haphazardly but consideration had to be given to prior learning.[37] His ideas were introduced into England by Johann and Berthe Ronge who established a kindergarten in London for German children in 1831.[38] By the end of the nineteenth century one of the main ideas of Froebel 'to make the inner, outer' had been reinterpreted by the new educationalists to mean 'learning by doing'. Children were to be given the opportunity to 'explore' and indulge in free play. The emphasis on freedom led to the 'naturalists' taking an active interest in social reform, giving substance to their beliefs that the child had to be prepared for a better tomorrow.[39]

John Dewey adhered to the naturalist philosophy advocating education as a practical activity.[40] Dewey promoted 'project' or group work in classrooms, enabling the students to exchange ideas in an environment free from fear of reprisals. Dewey maintained that knowledge was active and could only be experienced or understood by 'doing', such as the child learning through exploration.[41] He also advocated the educational use of the 'scientific method' in problem solving activities to ensure the objective nature of the investigation.[42] School and life were interconnected, such that the school should not be a separate place where lessons are learned but part of the community. The naturalists maintained that the school curriculum should be

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The theories of Froebel and Pestalozzi were key factors in the rise of naturalism in education which advocated a broadening of the curriculum to include art, music and the humanities. Selleck, pp. 218-19.

[37] Selleck, p. 197.

[38] ibid.,p. 198.

[39] ibid., p. 219

[40] Towards the end of the nineteenth century there were many experiments in education particularly in America. Many of these educators tried to translate Darwinism into the classroom such as Dewey. Dewey's approach was to consider not only the individual but also the social goals in education. Thus according to Dewey the educator had the task of leading the child into the adult civilised world by personal experiences. G.H.Bantock, *Education in an Industrial Society*, London: Faber and Faber, 1963, p. 44. Dewey established a local school where the curriculum was based on manual occupations of everyday life. His work eventually became a philosophy for democracy published in: '*Democracy and Education*'. Boyd and Rawson, pp. 18-20.

[41] Bantock, p. 35. Selleck notes that Dewey was just one of a number of schools of 'New Education' along with: '...Herbartians, manual trainers, heuristic scientists, kindergartners, moral educationers and experimental psychologists.' Selleck, p. 58.

[42] ibid., p. 33. According to Selleck, there is no evidence to suggest that Dewey had any marked influence on education in England before 1914. Selleck notes that Dewey himself was not important in America until after the publication of his work entitled: ' *School and Society*' in 1899. Selleck, p. 208.

structured so that '... the stage of development of the pupils concerned must be related to the general environment in which they are being educated.'[43]

Sir Percy Nunn, Vice Principal of the London Training College, advocated education for the development of the individual and his book entitled: *Education: Its Data and First Principles* became the set text for all trainee teachers in New Zealand.[44] Nunn was responsible for supporting the view that science should be taught in schools because it was an essential humanity.[45] Under Nunn's guidance, science was to appeal to the student on the grounds of its sense of wonder, utility and systemising motives. Professor Armstrong, who was avidly against the science-for-all movement with its reduced emphasis on laboratory work, disagreed with Nunn and other 'naturalists'.[46]

At this time, New Zealand students who progressed to the secondary school tended to stay for on average two and a half years, which was less than students in England, Scotland, Germany or Switzerland.[47] The reasons for such a foreshortened period of secondary education reflected the age at which students gained proficiency, with some entering secondary education just prior to the official leaving age. The secondary system failed to take account of the course requirements for the non-academic students and only provided courses leading to the Junior Civil Service and University Entrance Examinations.[48] In 1910, the Minister of Education noted that the shortened stay at secondary school resulted from the community failing to acknowledge the value of a secondary education: '...absence in the community of a hearty thorough belief in the advantages of education, or, at all events, of secondary education.'[49] The

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[43] Spens Report, p. 78.
[44] T. Percy Nunn, *Education: Its Data and First Principles*, London: E.Arnold, 1921. Nunn's book was used extensively in training colleges and was said to encourage the focus of education on the individual. Professor Cavenagh criticised Nunn and suggested that '... individualism pushed to the limits becomes moral and intellectual anarchy.' The Aim of Education, an Extract from Professor Cavenagh's Contribution to the *Year Book of Education* 1936, *Education Gazette*, XV: 10, p. 172.
[45] Jenkins, p. 57.
[46] W.O.Lester Smith, *Education in Great Britain*, London: University Press, 1958, p. 5.
[47] Report of the Minister of Education for the Year Ending December 31,1909, AJHR, 1910, E-1, p.44.
[48] During the early development of secondary education in New Zealand, the curriculum had been focused on preparing students for the Junior Civil Service Examination and thereafter for the UEE which was sat after three or four years secondary schooling. The UEE was described by the University Senate, creating a tension between itself and the Department of Education. After twenty years of dialogue the Senate agreed to move towards accrediting the examination. Refer Chapter 3.
[49] AJHR, 1910, E-1, p.44.

Minister sympathised with parents who could probably see no advantage in the academic programmes of secondary schools and suggested that a vocational programme would encourage the boys and girls to remain longer at school. The type of course best suited to the non-academic student was considered to be the agricultural and domestic sciences. The Minister also noted that the District High Schools were paying too much attention to preparing students for the external examinations when courses should be relevant to rural and domestic pursuits.[50]

In 1913, regulations had come into force in Britain which established the 'Junior Technical Schools'.[51] These schools were to provide not less than thirty hours instruction per week and practical work was required in all relevant subjects. New Zealand established the 'Technical High School' in 1914 and required pupils to be given a minimum each week of: four hours instruction in English and history and civics, three hours of arithmetic or mathematics, two hours of drawing and girls had to take three hours of home science.[52] Meantime the secondary schools who claimed Manual and Technical funding were required to devote half of their class-time to practical activities, but inspectors noted that in fact much of the time was devoted to teacher demonstrations.[53]

In 1917, the New Zealand Minister of Education, Hanan, stated:

> All true education is the play of life upon life... If all curricula gave due recognition to subjects of real human interest and value, many forms of study inflicted on pupils by mere tradition would give way to something better... In this connection special mention might be made of the teaching of science in secondary schools... that all secondary pupils should for at least three years take general elementary experimental science....boys and girls would in the first place receive a sound training in the methods of science, and in the second place would apply those methods to something possessing a definite human value and interest.[54]

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[50] ibid., p. 45.
[51] Spens Report, p. 83.
[52] Nicol, pp. 121-122.
[53] E.J.Searle, *The Teaching of Science in Post-primary Schools*, Wellington: NZCER, 1958, p. 35.
[54] Report of the Minister of Education for the Year Ending December 31,1917, AJHR, 1918, E-1

Hanan, while supporting the notion of a more practical curriculum, was very keen to see a course of more general science developed which bore direct relationship to New Zealand's primary industries.[55] Like Hanan, the new educationalists had been claiming the importance of teaching the scientific method as an educational tool, but a report by the British Association for the Advancement of Science in 1917, suggested that the scientific method could only be used when considering scientific matters and was not therefore widely applicable to other areas of the curriculum.[56] Thus the end of the Edwardian period saw a developing discrepancy between the claims for science by educationalists, and by the scientific fraternity.[57]

During the early part of the twentieth century, advances in science, such as Einstein's Theory of Relativity, had shown that science was not an orderly progression of knowledge but that sometimes it progresses by the overthrowing of previously held theories.[58] The development of physical chemistry, which relied upon mathematical abstractions, cast further doubt on the scientific method as organised common sense. Students would have to be exposed to the intellectual constructs of science and the acquisition of scientific knowledge. Thus the approach of many, including Dewey, that the student should be put into the position of original discoverer became difficult to defend.[59] But there still existed amongst educationalists the belief that the true value of science in the curriculum was the teaching of the scientific method.

2.3 New Educational Fellowship

In 1921, the New Education Fellowship (NEF) was established in the United Kingdom by Mrs Beatrice Ensor.[60] It aimed to promote a new type of education more

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p. 5.

[55] ibid., p. 30.

[56] Jenkins, p. 51.

[57] This was even extended to the educationalists adopting the scientific approach to education - education was just a science. Such an approach involved the 'measurement' of educational attainment, IQ tests etc. and lead to the 'Child Study' movement. They produced evidence to suggest that faculty psychology was suspect. Selleck, pp.273-94.

[58] Jenkins, p. 50.

[59] ibid. pp. 50-51.

[60] Mrs Beatrice Ensor was born at Marseilles and educated in Italy. In 1910 she became the first women inspector of education at Glamorgan County Council. Later she became an inspector for the English Board of Education. After World War 1 she resigned and became the Managing Director of the Theosophical Educational Trust which had founded many private schools. Impressed by the

suitable to the changing world. The NEF had nine main educational objectives which were: education should be for the greater good of society rather than the individual, education had societal responsibilities through citizenship, education should stress equality, education should begin where the child is at, education should be holistic, education should only take place in an environment which encourages learning, education should stress the importance of the common good through inner discipline of freedom, education should include practical experiences for citizenship, and schools should be part of the community, not separate to it.[61] Adherents to the NEF philosophy believed that any reform of the education system would have to provide uniformity of content, teaching and philosophy, although according to Boyd and Rawson the NEF believed that liberty was important for both educators and its members.[62] Like Dewey, the NEF believed that the school should reflect the wider community:

> The school should not be isolated from the wider world, but should establish contact with all surrounding life and lead its members towards a vital awareness of the mutual responsibilities of human beings throughout the world.[63]

Educationalists began to see their role as instruments of social policy, and thus campaigned for the introduction of more relevant subjects into the curriculum such as demanding more science, more industrialisation, more practical activities and greater equality.[64]

Montessori schools, her group promoted co-educational education in a non sectarian but Christian school. Boyd and Rawson, p.67 For an analysis of the NEF refer to: W.A.C. Stewart, *Progressives and Radicals in English Education, 1750-1970*, London: Macmillan, 1972, pp. 353-77.

[61] A.E.Campbell (ed.), *Modern Trends in Education, The Proceedings of the New Education Fellowship Conference Held in New Zealand in July 1937*, Wellington: NZCER, 1938, pp. 496-97.

[62] Bantock, p. 59. See also Boyd and Rawson, p. 75.

[63] Campbell, 1938, p. 497.

[64] Bantock p. 56. It has been suggested by Nicholas Beattie, University of Liverpool, that the NEF were an 'odd group' who promoted education for the 'great and the good'. Its main centres of activity were Paris and London but the London based NEF were Anglo-Saxon in their preoccupation's and prejudices. The NEF conducted most of its work via conferences and journals. Therefore they appealed to the leisured upper classes who had time to attend these gatherings. While the NEF was essentially a sectarian organisation, Beattie notes that its conference in Cheltenham in 1936 began with a service in the Gloucester Cathedral addressed by the Anglican Bishop of Chichester and the conference itself was opened with a rendition of William Blake's 'Jerusalem'. The music leader made it clear that 'England' could mean any industrialised country. Nicholas Beattie, 'Freinet and the Anglo-saxons', *Journal of Comparative Education,* 28:1, 1998, p.3. The Elsinore Conference, which Frank Milner attended, lasted for up to two weeks with '... singing and dancing together, and many other ways in which the Conference became a life in common.' Boyd and Rawson, p. 87-88. See also:

Frank Milner, Rector of Waitaki Boys' High School, had been impressed by the Junior High Schools he had seen in the USA during an overseas trip in 1921 and recommended the establishment of such schools in New Zealand.[65] During the New Zealand General Council for Education Conference in 1922, it was suggested that Junior High Schools (form 1-4) be established as separate educational establishments and that three fifths of the curriculum be common to all post-primary students for up to three years. The Department of Education adopted a common core for these schools including time allocations: English (5), Arithmetic (3), Science (2), Geography (2), History and Civics (2), Drawing (1), Singing (0.75), PE (1.25).[66] By 1922 the first Junior High School had been established in Auckland, with the intention of providing a relevant curriculum for the student who intended to leave school at the age of 14 years.

The Director of Education in Victoria, Frank Tate, was invited to New Zealand in 1925 to report on certain aspects of the post-primary school system. Tate believed that the Junior High School was an exciting educational development in New Zealand, providing a broad education to those students who intended leaving school as soon as permissible and as such provided a transition from school to higher technical training.[67] He commented that: 'One of the most hopeful and instructive advances in public education in New Zealand is the establishment of the Junior High School at Kowhai...'[68] Tate noted that for the less academic student, moving to a post-primary school for only one or two years was probably a disincentive and that if the students could be kept at a school such as the Junior High School then they were more likely to increase their length of stay. Thus, by the end of the decade there were 10 Junior High Schools, of which nine were attached to post-primary schools. So the high schools effectively had intermediate departments.[69]

W.Carson Ryan, 'The Seventh World Conference of the New Education Fellowship: Education in a Free Society', *School and Society*, 44: 1134, 1936, pp. 366-67.

[65] Ian Milner, *Milner of Waitaki, Portrait of the Man*, Dunedin: John MacIndoe, 1983, p. 76.

[66] E2 1946/3b, E4/6/1- NZ SSA Conferences 1916-46. General Council for Education Conference March, 1922.

[67] Tate, p. 33.

[68] ibid., p. 31.

[69] Beeby, 1938a, p. 22.

Tate had noted that there were three main groups of students in the primary schools: the first group consisting of students whose parents saw the secondary school as preparation for the university, the second group consisted of students who intended leaving school and working as soon as the law permitted and the third group prepared to remain at school so long as it provided a worth while programme.[70] Thus the first group of pupils, according to Tate, should attend the secondary schools as already established. The latter two groups required something quite different such as the provision of manual and technical training.[71] Tate also warned that early subject specialization should be avoided and that the first two years of post-primary education should be common for these latter two groups of pupils, after which some form of specialisation could occur. Also, by retaining a common core of subjects in the first years of post-primary school, students in groups 2 and 3 could move, at a later date, into secondary schools. Thus Tate saw the Junior High School as meeting the needs of the less academic students.

Further support for the Junior High School was provided by the English Report on the Education of the Adolescent (Hadow Report) in 1926. The report recommended that education for the adolescent should begin at eleven years of age and continue until the child left school. Recognition had to be made of the educational needs of this group.[72] In addition, the school should reflect its local community such that a school located in an industrial area should develop a curriculum related to its local industries. Similarly, rural schools should be cogniscent of their relationship to agriculture.[73] The Hadow Report embraced the ideology of the NEF by advocating that education had to be for social individuality:

> A well balanced educational system must combine these ideals in the single conception of social individuality. The general aim should therefore be to

[70] Tate, p. 28.
[71] ibid., p. 29.
[72] Spens Report, p. 140.
[73] Jenkins, p. 97.

> offer the fullest scope to individuality while keeping steadily in view the claims of society.[74]

Frank Milner represented New Zealand at three international conferences in 1929: World Federation of Educational Associations (Geneva), The New Education Fellowship (Elsinore), and Workers Educational Association (Cambridge University).[75] Milner met Sir Percy Nunn, who endorsed the Hadow Report's recommendations that the early transfer to secondary education was of the utmost social importance reinforcing the concept of the Junior High School.[76] Thus it was with grave misgivings that leading educationalists viewed the decision of the Director of Education, T.B.Strong, in 1932 to change the Junior High Schools to Intermediate Schools.[77]

2.4 Examination Reform

In America, Frank Milner made contact with the Carnegie Corporation.[78] This resulted in a dialogue between the two countries, leading to the establishment of the New Zealand Council for Educational Research (NZCER) in 1933 with Professor T.A. Hunter its President and Frank Milner its Vice President.[79] The main aim of the NZCER was to conduct educational research and to engage in an exchange of ideas with similar institutes overseas. Dr. C.E.Beeby was appointed the first Director and when he took up the position he had a deep assumption that: '...education, properly understood, could change the world, and that research could change our concept of

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[74] Leicester Webb, *The Control of Education in New Zealand*, Wellington: NZCER,1937, p. 7. The NEF tried to incorporate the main themes of the New educationalists and advocated that education take account of the nature of the child whose education should include: drama, art and handicraft, along with co-education. Boyd and Rawson, p. 70.

[75] Milner, 1983, p. 147. The main subject of the conference was ' The New Psychology and the Curriculum'. The conference focused on the Dalton Plan, which had been developed by Helen Pankhurst, who lived in Dalton. She believed that the school had to be brought into line with everyday life by encouraging the development of the individual. She advocated freedom for students to express ideas, to work at their own pace and to follow their own interests. Pankhurst advocated project work and her ideas were adopted by progressive schools in England and Europe under the 'Dalton Plan'. Boyd and Rawson, pp. 38-9 and 85-88.

[76] Milner, 1983, p. 148.

[77] Cumming and Cumming, p. 249.

[78] Milner, 1983, p. 171.

[79] E2 1940/2a, E29/2/66 Education Systems Institute of Educational Research 1932-40.

education.'[80] Beeby brought a scientific approach to educational research.[81] One critic of Beeby's governance suggested that: 'These new educationalists would test, not piles of facts, but the mind itself and its natural aptitudes.'[82] In addition not all citizens were grateful for the Carnegie Corporation's benevolence. One concerned parent wrote: '... I think most emphatically that NZ should ponder long before it allows an organisation so potentially subversive of our customary ideas to become power in our education system.'[83]

In 1934, William Thomas, ex-Rector of Timaru Boys' High School, was invited by the University of New Zealand to research the history of the University Entrance Examination and to survey changing attitudes towards it.[84] The research was to be conducted under the auspices of the newly established NZCER. In 1935, the brief was widened to include an investigation into 'its efficacy in predicting success and failure at university.'[85] Thomas, believing he did not have the skills for evaluative research, invited Beeby and a mathematician, H.Oram, to join him. The work was undertaken with scientific rigor involving the collection of data, analysis and drawing of conclusions thereby ascertaining the relationship between the UEE and its ability to predict success at University.[86] Their research was published in 1939 and recommended the accrediting of the UEE.

During 1935 the Director of Education, N.T.Lambourne, had travelled abroad and reported that:

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[80] Beeby, 1992, p. 94.
[81] The scientific educationalists supported the child-study movement by offering scientific methods for the study of the child. Weight, height and tables used to measure the class progress, length of lessons were scientifically calculated. Scientific investigations into providing: adequate ventilation, print size and effect of fatigue on learning. Selleck, p. 283. The scientific educationalist went on to study teaching techniques, IQ tests, and the transfer of training. Selleck, p. 286. All of the above can be seen in some of the early research undertaken by the NZCER, under the directorship of Dr.C.E.Beeby. The following quote from Selleck reflects on the nature of educational research conducted by the NZCER in the 1930s:' ...the scientific educationalists most valuable assets... were his enthusiasm, his confidence, and his conviction that he held the key to the future... he pressed ahead without being upset by, often without being aware of, his shortcomings.' Selleck, p. 294.
[82] Dorothea Loughnan, *Report of Post-primary Education*, Auckland: Catholic Teachers Association, 1944, p. 24.
[83] E2 1940/2a, E29/2/66. Letter to the Editor, *Taranaki News*, 13 April 1925.
[84]Beeby, 1992, p. 100.
[85] ibid.
[86] Thomas *et al*, pp. 101-36.

> ...I endeavoured to gather all the information I could that would be helpful to New Zealand, especially in the matter of the reorganisation of the school system... After careful consideration... I am of the opinion that our system of education, primary and post-primary, is fundamentally sound, modern and well suited to our requirements. This is not to imply it is a perfect one![87]

Not everyone was in agreement with his satisfaction with New Zealand's education system. The member for Lyttleton, Mr.T.H.McCombs, stated that:

> The aim of the education system of New Zealand was wrong.... in comparison with the best American schools it was clear that far more time than was necessary was spent ... on spelling and arithmetic.[88]

The Minister of Education, Peter Fraser, replied that his Department was aware that the examination system had a stranglehold on secondary schools but they were looking at solutions: 'The question is has not the time arrived for removing all the examinations that act as a barrier to any child in its desire for education?...'[89] Fraser went on to note that:

> These problems which the Department is grappling with now, not in a self righteous spirit but in a humble way, looking to other countries of the world for advice and the benefit of experiment, and to those that have the knowledge in this country and who are able to help us.[90]

In 1936, Fraser abolished the proficiency examination under the Education Amendment Act, enabling students to move freely from primary to post-primary school, thereby increasing the roll in post-primary schools.

2.5 The NEF Conference in New Zealand

In 1937 the New Zealand Government and the NZCER invited members of the NEF to visit New Zealand. The NEF conference was fully supported by New Zealand's educational community, including the: Department of Education, University of New Zealand, NZCER, NZEI, Secondary Schools Association, Technical School Teacher's

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[87] E2 1936/4g, E12/1/7 Report of Director of Education on Overseas Visit, 1935-36.
[88] ibid., 'Debate on Education System - Directors Report', *Dominion* ,Wellington, 3rd June 1936.
[89] ibid.
[90] ibid.

Association and the Registered Private Schools Association.[91] In addition the office of the Minister of Education (Peter Fraser) '... made itself responsible for the transport of the delegates within New Zealand.'[92] The importance attached to the visit of the NEF delegates by the Department of Education, can be seen by the Minister of Education closing Primary Schools for the duration of the conference, so that teachers could attend.[93] Teachers recognised the importance being given to this group of educational idealists, who were seen as shaping the future direction of education in New Zealand.[94] Professor Hunter, Vice-Chancellor of the University of New Zealand, believed that the NEF held the pathway to educational reform in New Zealand: 'NEF groups are being formed in all the centres and it is hoped that these will become the growing points of new educational endeavour.'[95] Beeby was to comment some years later that in 1937 he was '... drawn into a new venture that was to mark a turning-point in New Zealand education and, incidentally, to alter the whole course of my life and my thinking on education.'[96] The NEF conference, according to Beeby, gave New Zealand an opportunity to 'catch up with the thinking of the outside world.'[97]

Dr. Kandel, an expert in comparative education noted that:

> One of the crucial problems besetting the world everywhere is that of secondary education. Its reorganisation and adaptation to modern times and the varied needs of the increased enrollments founder upon the rock of matriculation... Secondary education was developed for the few and for a minority planning to continue to a university - an education intended for a few, even assuming that it is sound, is not the best education for the large majority now continuing their post-primary education.[98]

Kandel's views were well received by the Labour Government which had its own focus on equality of opportunity for every New Zealander. Kandel also advocated

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[91] A.E.Campbell (ed.), *Modern Trends in Education, The Proceedings of the New Education Fellowship Conference Held in New Zealand in July 1937*, Wellington: NZCER, 1938, p.xii.
[92] ibid.
[93] ibid.
[94] ibid., p. xiii The number of teachers who attended the conference was 5,883.
[95] ibid., p. xiv.
[96] Beeby, 1992, p.103.
[97] ibid., p.106

decentralisation of educational administration but suggested that the best way for the new spirit to penetrate the educational institutions was via a process of consultation and discussion.[99] Some speakers were scathing of New Zealand's lack of coordination in post-primary education. William Boyd (Scotland) commented that:

> ... you have your primary school system and alongside it your jumbled mix-up in the secondary school system. ...Your High schools are of the academic type and are orientated towards the university... The children learn French and Latin which they soon forget; they learn abstract kind of mathematics which has not much to do with ordinary life of the people, and they also forget that. ... But if high schools are too theoretical in their outlook, the technical schools are too practical.... And then you add to your mix-up your district high schools, which by the way, are the best kind of post-primary schools you have.... you have to start and re-think your whole secondary school system. It is an incompetent muddle.[100]

Meanwhile, Cyril Norwood, former Headmaster of Harrow, maintained that the post-primary schools were not the training ground of the elite but they had to provide an education for democracy, with students receiving a certificate of competency as a preparation for citizenship.[101] Norwood strongly supported a general science course, which rather than focusing on developing expertise in one of the sciences, aimed to teach the child a sense of fact and law.[102] Science in an educational context, according to Norwood, would teach the skills of critical thought.[103] Education had become key to social reform and under the guidance of the NEF would be steered towards education for citizenship.

After the NEF conference, Fraser promised to provide a free liberal education to every child:

> This government firmly believes that a liberal education is the birthright of every child, and it will not cease from striving till all children enjoy that

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[98] Campbell, 1938, p.468.
[99] I.L.Kandel, *Types of Administration, with Particular Reference to Education Systems of New Zealand and Australia,* Wellington: NZCER, 1938, p. 89.
[100] Campbell, 1938, p. 484.
[101] ibid., p. 209.
[102] ibid., p. 210.

> rightful heritage.... it expects that they will use their technical skill and the culture which they acquire, not for mere selfish ends, but in the interests of good citizenship. The education of the future will be the preparation of boys and girls for a full, active, useful and enjoyable life, so that as adults they can serve the community efficiently and beneficially and help, ... to "Build Jerusalem" in our green and pleasant land.'[104]

Post-primary education had to prepare young adolescents to participate fully in a democracy and this was best achieved through a common curriculum.[105] Some saw Fraser's egalitarian model as a dumbing down of the education system such that:

> The danger lies in the false notions about the equality of man. All men are born equal in the sight of God; but the creator does not endow all men with equal powers of intellect. These are the basic facts upon which our social and education problems rest. The State... provides equal opportunity for all; but with that its power ceases - it can not enact or otherwise guarantee equality of achievement.'[106]

In 1938, at Fraser's request, Beeby was appointed Assistant Director of Education and after the retirement of N.T.Lambourne in 1940 became the Director-General.[107] Beeby, as Director of Education, noted that: 'There is attached to the secondary school, with its basic curriculum of English, Latin, French, Mathematics and physical sciences, an aura of social and intellectual superiority.'[108] Beeby suggested that: 'The New Zealand Technical High School is in no sense an institution for giving trade or

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[103] ibid., p. 211.
[104] E2 1951/7a, E29/2/79 part 1. Ministers Message on Education, *Press*, Christchurch, 8 December 1937.
[105] The beginning of Fraser's ideals for equality in education have roots on the Fabian Society and the Social Reformers of education. The social reformer believed that common education was the true leveler and should consist of a broad education to enable the child to realise his/her full potential. To this extent the introduction of games into the curriculum was deemed important for teaching participation, it also had the added advantage of bringing into the school, what had hitherto been a middle class privilege. The Fabians believed that education was simply a good thing and desirable for everyone. While there were similarities between the practical educationalist and the social reformer, the social reformer sought to bring about a brave new world where education would build the full human life not just bring education close to every day life. Selleck, pp. 152-74.
[106] E2 1951/7a, E29/2/79 part 1. Editor, *Otago Daily Times*, 4 September 1937.
[107] Beeby, 1992, p.109.
[108] E2 1943/3b, E29/2/75 part 1. An Article prepared for the *Year Book of Education*. 13 October, 1938.

specifically vocational training; it is rather, a secondary school with a realistic curriculum.'[109]

2.6 To the Fullest Extent of His Powers

Meantime, Labour had promised the country that if re-elected every child would have a right to free education and that post-primary schools would have to develop a more appropriate curriculum to suit the needs of all students to develop 'to the fullest extent of his powers'.[110] Fraser's annual report to Parliament for the year ending 1938 has been often quoted and used as a statement of the Labour Party's educational policy but it was written by Beeby, Assistant Director of Education:

> ...I wrote, out of my head, a page on its objectives for education as I imagined Fraser saw it. The first sentence of that statement came to be seen as the core of the government's policy in education....[111]

The ideas embodied in Beeby's statement came from: '...Shelley, some from the NEF Conference, some from Fraser himself and fragments, perhaps, from me and my reading.' [112] Beeby's ideas can be said to have come from the new educationalists who embraced a variety of beliefs and practices. Beeby suggested that 'Fraser's' statement became the basis for educational policy in New Zealand and '... it lay behind practically every new project that I was to propose over the next twenty years.'[113]

Beeby, like his predecessors, was concerned about the lack of co-ordination in post-primary education:

> There is a growing dissatisfaction with the idea of selection for higher education and a growing conviction that a youth has a right to continued education of some sort... because he is a citizen of a State that can provide an increasing amount of leisure for all.[114]

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[109] ibid.
[110] *National Education*, XX: 217, 1938, pp. 352-354 and AJHR, 1939, E-1, pp. 2-3.
[111] Beeby, 1992, p. 123.
[112] ibid., p. 125.
[113] ibid., p. 126.
[114] E2 1943/3b, E29/2/75, part 1. An Article prepared for the *Year Book of Education*. 13 October, 1938.

The Department of Education sought overseas advice on how best to bring about much needed unity and was advised by Dr. Kandel that the Technical High Schools served a useful social and economic function in line with the NEF.[115]

In 1942 agreement had been reached on the introduction of accrediting of the University Entrance Examination by schools and Beeby recommended to his Minister, Mason, that a consultative committee be formed such that:

> In effect the control of the post-primary curriculum will pass over from the university to the department and the change may well mark a turning point in post-primary education... In view of the extreme importance of the policy to be laid down I recommend that you set up a Consultative Committee on the Post-primary Curriculum, which will serve the double purpose of advising you on policy and of focusing public attention on the problems involved.[116]

In 1943, the Thomas Committee presented its report to the Minister of Education who commented that:

> In spite of the war, this has been a year of important educational advances. There has been a growing public interest in education, and an increasing demand for educational services from all sections of the community... There is evidence to show that much of this new interest in education both here and overseas springs from a growing understanding of the part education must play in the post war world.[117]

While the Minister was satisfied with the Thomas Report, others were less convinced:

> ... the Minister takes it for granted that the great majority of persons concerned with education agree to the main principles being put into practice in the schools. To quote Miss Newton, Wanganui Technical College: " Some time after a conference called in New Zealand in 1937 by an international body

[115] Kandel, 1938, p. 71.
[116] E/4/1/5 Memo to The Hon. Minister of Education from Beeby, 23 October 1942.
[117] Report of the Minister of Education for the Year Ending December 31,1943, AJHR, 1944, E-1, pp.1-2.

> known as the New Education Fellowship, a change came over the New Zealand Education Department."[118]

The Department of Education had closely followed, and in some cases adopted, overseas educational trends during the previous sixty years. This had particularly included the philosophies and practices of the new educationalists which came under the umbrella of the NEF. This led to growing demand for unification of the post-primary sector, with an emphasis on a broad curriculum including reduced subject specialisation.

[118] E2 1947/16a, E29/2/5 - part 2. 'Questions in Education', *Marlborough Express*, October 21, 1944.

Chapter 3 -Accrediting of the University Entrance Examination

New Zealand's secondary schools had a history of a close association with the University, by preparing pupils for the UEE. The secondary schools were seen as failing to provide an adequate education for the non-academic pupil and reform of the post-primary school curriculum was dependent on the University Senate agreeing to the introduction of accrediting of the UEE.

3.1 Entry to the University

It has been said that the history of modern education is indeed one of the history of certain examinations, and in New Zealand the history of post-primary education up to 1945, is a history of the decline of the University Entrance Examination. The decline of the UEE was inversely proportional to the rising popularity of equality of education, as championed by the new educationalists. Incorporated into the notion of egalitarianism was a belief that developing an educational profile of the student, such as a cumulative record card, was essential to gauge success at school. Within this context, accrediting of examinations by the school was seen as enabling a more holistic approach to assessment, as the teachers knew their students and it was believed could make fairer assessments than an examination. Thus freed from the burdens of examinations, it was hoped schools would develop programmes to better meet the needs of all their students, as suggested by the Thomas Report:

> We have set out to ensure, as far as possible that all post-primary pupils, irrespective of their varying abilities and their varying occupational ambitions, receive a generous and well balanced education.[1]

The examination began in the nineteenth century when entry requirements to university became more strict and the notion of 'patronage' was superseded by entry examinations as embodied in the political philosophies of the Whigs and Tories.[2] Thus in 1871 the University of New Zealand required that:

> Any candidate for Matriculation may be admitted as a Student in the University on producing to the registrar a certificate from some person to be appointed on that behalf by the Chancellor, that he has received systematic instruction in the

[1] Thomas Report, p.5.

> following subjects: English Grammar and composition; Arithmetic; Ancient and Modern History; and at least one of the following subjects: French or German languages; Greek and Latin languages; Algebra to simple equations inclusive; Geometry, first book of Euclid; Mental Philosophy and Logic; Natural Philosophy; Experimental Physics; Political geography; Physical geography; Jurisprudence.[3]

Students were prepared for the University Entry Examination (UEE) by the secondary schools, which had been modeled on the English 'Grammar School'.[4] The grammar school had a history, stretching back to medieval times, of a close relationship to university education. While the grammar school may not have been an ideal education, as Bantock suggests, it was none the less concerned about standards of learning, had purpose and awareness of certain values.[5] It was the secondary school's commitment to standards that provided a sense of 'quality assurance' to the public, with employers using its exacting standards to gauge aptitudes of prospective employees. Employers were no longer willing to employ the gifted amateur.

The University of New Zealand entrance examination was controlled by the University Senate who set the examination prescriptions.[6] The University Senate took account of the needs of professional bodies such that: entry to law was controlled by the Judges of the Supreme Court and entry to medical school by the General Medical Council.[7] By 1879 the entrance 'matriculation' examination had become a national examination and students could sit the examination in fourteen subjects, usually after four years post-primary schooling.[8]

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[2] Hugh Parton, *The University of New Zealand*, Auckland: Auckland University Press, 1979, p. 83.
[3] Thomas *et al*, p. 19 citing University Minutes, 1871, p. 67. Thomas notes that the above list was amended in 1875, listing the subjects as: Greek, Latin, English, arithmetic, Euclid, elementary chemistry, elementary physics, elementary natural science, a modern foreign language, geography and history.
[4] Throughout this chapter the University Entrance Examination is used to describe both entrance and matriculation. The term 'matriculation' ceased to be used after 1930. Parton, p. 86.
[5] Bantock, p. 91.
[6] Thomas *et al*, p. 17.
[7] ibid., p. 18.
[8] Parton, p. 85. The requirements of the University for entry to specified courses impacted on the breadth and content of the pot primary school curriculum. One such problem was the Medical Preliminary Examination which did not require a science subject until 1924. Thomas *et al*, p.40.

Science subjects were divided into subject specialisms such as: elementary chemistry (non metallic elements and the atomic theory), physics (elementary mechanics of solids and fluids), and natural science (either zoology: the principles of animal physiology and the classification of animals, or botany: the principles of vegetable physiology and classification of plants.[9] Between the years 1885 and 1887 there was a separate matriculation for science, which required that the candidate pass in seven subjects which had to include English, arithmetic, algebra and Euclid.[10] In 1889, Ernest Rutherford, at the age of nineteen, sat the University scholarship examination in five subjects: Latin, English, French, Mathematics and science. He chose two science papers: mechanics and heat and light.[11]

3.2 Entry to the Public Service

By the end of the nineteenth century the Department of Education was conducting its own examinations for entrance to the teaching profession and the public service.[12] Students had to sit in three compulsory subjects: English grammar and composition, Arithmetic and Geography, with two other subjects being chosen from a list of thirteen.[13] The Junior Civil Service examination was sat at the end of Standard VII and its increasing popularity reflected a growing desire to pass the examination as a means to gaining better employment.[14] The standard of the examination was aimed at junior secondary school level. Both examinations became used for purposes other than their original intentions and the Junior Civil Service Examination was used by students to obtain employment in banking and other commercial businesses.[15] By 1912, the examination was: a test for entry to the civil service, the basis for primary teacher and

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[9] Thomas *et al*, pp. 42-43.
[10] Parton, p. 85.
[11] John Campbell, *Rutherford, Scientist Supreme*, Christchurch: AAS Publications, 1999, p. 66. Rutherford received the following marks in his scholarship examinations: Latin 54%, English 55%, French 72%, mathematics 78%, sound and light 66% and mechanics 76%. Rutherford, at the age of 19, was awarded a scholarship to University, which would meet the cost of his fees for three years.
[12] Thomas *et al*, p. 23.
[13] Roger Openshaw, Greg Lee and Howard Lee, *Challenging the Myths, Rethinking New Zealand's Educational History*, Palmerston North: Dunmore Press, 1993, p. 206.
[14] ibid., p. 207. During the ten years between 1888 and 1898 there was an increase of almost 300 candidates from 148 to 451.
[15] ibid.

pupil-teacher certification, the syllabus for the junior free place holders, entry requirement for senior free places and a school-leaving qualification.[16]

The Junior Civil Service examination could be sat either at primary (standard VII) or post-primary school. The District High schools were particularly strong in preparing students for the examination, as they were extensions of the primary school. However after the introduction of free places in secondary schools in 1902 and entry to secondary school assured to proficiency certificate holders, the examination was moved to the lower secondary school.[17] This caused the rolls in standard VII classes to decline resulting in a comparable increase in the post-primary school rolls. But students tended to only stay at school long enough to sit the examination and its prescription became the defacto curriculum in the junior secondary school because the Department of Education set the standard of teaching to equate to that of the examination requirements.[18]

Efforts to reform the post-primary school curriculum were frustrated by the controlling influence of both the examinations. At the turn of the century, the Inspector General of Education, Hogben, tried to introduce more practical subjects into the Junior Civil Service examination but parents saw them as inferior, preferring the academic subjects. None the less the examination became useful on two accounts: as a leaving certificate for the short stay pupil and as entry to the upper secondary school where the student would prepare for the UEE. In 1912 the examination was abolished and replaced by the Public Service Examination, which was only to be open to candidates who wished to join the civil service. By 1915 the public service began demanding matriculation (UEE) as a minimum entry requirement further devaluing the Public Service Examination.[19] In 1932 the examination was abolished and replaced in 1934 by the School Certificate Examination.

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[16] ibid., p. 213.
[17] ibid., p. 209.
[18] ibid., p. 211.
[19] ibid., p. 214.

3.3 UEE Under Scrutiny

In 1919, the Christchurch Recess Committee of the Senate conducted a survey to assess whether secondary schools would accept an accredited leaving certificate in place of the matriculation examination.[20] The response was overwhelmingly negative from secondary school principals, who felt that standards could not be assured between schools and that such a move would increase the power of the Department of Education over them.[21] The Department of Education was particularly in favour of the concept of accrediting, as it saw the opportunity to bring technical subjects into equal standing with academic subjects thereby reforming the secondary school curriculum. In addition there had been concern expressed over the allocation of marks to subjects, with Latin (500) and English (300) having a higher weighting than science (100) subjects.[22] This meant that a student only had to achieve 20% to pass English compared with science where a student had to achieve 40% to pass, thereby encouraging students to choose subjects with high mark total allocations. Thus accrediting of the examination was seen as enabling science and technical subjects to have equal standing with the humanities, as all subjects would be given equal weighting.

During this time the university continued to grow in popularity and by 1918 there were 2140 students, of which 48% were female and four years later this number had grown 42% to 3683.[23] Students had a wide variety of courses to select from but science was limited to three main degrees (excluding medicine and dentistry): 44 studying for a

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[20] The movement away from external examinations was a key feature of the New Educationalists. William Boyd, a member of the NEF, in 1933 noted that the Carnegie Corporation had conducted its own investigation to show that external examinations were unreliable. Boyd and Rawson, p. 94. In 1910 G.H.Hardy, the mathematician known for the Hardy-Weinberg equilibrium, critiqued the medical examinations in England and advocated that, while they were important, they none the less needed to be easier to pass. He was concerned that the examination system itself had become an end with students only being interested in the examination syllabus He noted that: 'It is often hard to ask your pupils to go on listening when you know that what you tell them will give them no credit in an examination to which they attach enormous importance and over which you have practically no control.' I.C.McManus, 'Examining the Educated and the Trained', *Lancet*, 345: 8958, 1995, p. 115.

[21] Thomas, *et al*, p. 69.

[22] ibid., p.47.

[23] Higher Education, AJHR, 1923, E-7, p5.

Bachelor of Science (11 were female), five female students were studying Home Science and five male students were studying Agriculture.[24]

In 1923 the Senate received a report on the 'accrediting' of the leaving certificate in lieu of sitting the examination.[25] The report suggested that after a minimum period of three years at an 'approved' school the candidate could be accredited with university entrance but that the Senate would retain the authority to withdraw the schools right to accredit. The Senate rejected the report by 14 votes to seven.[26] Later in the same year, the Board of Studies once again had to review the matter at the instigation of the Secondary Schools Association and they presented to the Senate a series of recommendations for the implementation of accrediting. They recommended that after a minimum of three years at an 'approved' school the Principal could issue the matriculation certificate in lieu of the examination and that schools could apply to the Senate to become eligible for accrediting, non accredited candidates could sit the examination. The SSA recommended that a Professorial Board should monitor the progress of accredited students at university and report to the Senate, and schools could have their 'approved' status rescinded by the Senate.[27] While the Board of Studies agreed in principle to the SSA's recommendations they recommended that the student had to pass the examination for entry to professional studies such as: engineering, medicine, dentistry, veterinary, L.L.B. and Law.[28] Professional bodies were concerned about the quality of accredited students and as the Chief Justice, Sir Robert Stout (formerly Chancellor of the University of New Zealand), noted on behalf of Judges in Wellington that:

> ... had we powers to accept what is called an "accrediting system" we should feel it our duty either personally to examine candidates or to appoint fit examiners to do so.[29]

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[24] ibid., p4.
[25] Parton, p. 88.
[26] ibid.
[27] Thomas *et al*, p. 178.
[28] ibid., p. 70.
[29] ibid., p. 71 citing Board of Studies Minutes, 1924, p. 9.

In 1925 the Report of the Royal Commission on University Education was presented to Parliament, often referred to as the Reichel-Tate Report.[30] The Royal Commission recommended that the matriculation examination (UEE) be abolished and two examinations be put in its place: one at 16 years and one at 18 years.[31] The Royal Commission suggested that the proposed new examinations be administered, not by the University but by a Secondary School Board, which should represent the views of all the interested parties except the Department of Education.[32] The Royal Commission suggested that the function of the university was to maintain an adequate standard of entrants who could profit from its teaching and that once the Universities allowed the secondary schools to examine their students, the schools would rise to the occasion and that secondary education should be a general education not as preparation for university study: 'External examinations, fixed syllabuses and indispensable preliminary subject requirements are founded upon distrust of teachers.'[33]

At the same time Frank Tate was invited to look into matters relating to the post-primary school and he was particularly concerned about the misuse of the UEE as a leaving certificate rather than as entry to university.[34] Tate quoted Professor Macmillan Brown (Chancellor of the University of New Zealand):

> The matriculation examination has been criticized on account of the effect it has on the teaching in schools. This is not a matter for which I think the University of New Zealand is to be blamed...What was intended to be an entrance examination to a degree course in the University has been misinterpreted, and has been changed to a sort of leaving certificate for the children of New Zealand.[35]

Similarly Tate quoted Frank Milner, the Rector of Waitaki Boys' High School:

> It has always been in my opinion that our secondary schools are too academic, too traditionally formal, to provide the full range of mental interests needed to retain their pupils.... Our system should provide a harmonious combination of

[30] AJHR, 1925, E-7a, pp. 90-91.
[31] The Spens Report agreed with these age divisions in post-primary education. Spens Report, p. 87.
[32] Parton, p. 86.
[33] AJHR, 1925, E-7a, p.90.
[34] Tate, p. 13.
[35] ibid., p. 13.

> the cultural and the practical and economic in one organic whole. False social prestige attaches to the academic side of education.[36]

The Chancellor of the University of New Zealand, Professor Macmillan Brown, was also concerned that should accrediting be introduced then New Zealand students would be denied access to Universities in Britain: 'The Universities at Home know well that however loose the examining may be as a test of ability or knowledge, accrediting is more apt to open the door to lower types of entrants....'[37] Tate recommended that special courses should be developed for students planning to leave post-primary school after three years and that a system of accrediting be introduced for the leaving certificate.[38] In 1928, 60% of students had left school by the end of their second year and only 21 percent remained for a fourth year.[39] Tate wanted recognition of the needs of the student who completed only a short post-primary education.

As a result the Entrance Board was established, which included representatives from the Department of Education, the University, and interested schools. The Board was under the auspices of the Senate and had responsibility for controlling the entrance examination and its syllabuses.[40] In 1927 the Entrance Board raised the standard of the examination by approving a new marking system where the student had to get an aggregate mark of 45 percent in five subjects and a minimum of 40 percent in English and a 35 percent minimum in one subject.[41] But despite the more rigid standards the numbers entering the university continued to increase and by 1928 there had been a 128% increase over the previous ten years, giving a total of 4878 students (30% female).[42] The numbers studying science subjects had also increased and now included: physics (441, 35% female), Chemistry (489, 15% female), Botany (98, 58% female) and Zoology (173, 29% female).[43] Since 1918 the numbers of students

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[36] ibid., p. 12.
[37] Thomas *et al.*, p. 74 citing Senate Minutes 1931, p. 43. Also see Parton, p. 89.
[38] ibid., p. 74.
[39] Report of the Minister of Education for the Year Ending December 31,1927, AJHR, 1928, E-1 p. 20.
[40] Thomas *et al*, p. 61.
[41] Parton, p. 86.
[42] Higher Education, AJHR, 1928, E-7, p. 2.
[43] ibid., p. 3.

completing the Bachelor of Science degree had increased by 88% to 364 and agriculture had increased by 81% to 26.[44]

In 1927 the Academic Board had asked the Entrance Board to consider the matter of teacher training in the post-primary sector.[45] The burden on teachers would be immense once the accrediting system was introduced and the Academic Board wanted to make sure that teachers had the capacity and training to undertake the task. In 1928 the Academic Board approved accrediting provided adequate safeguards were in place including the training of teachers and robust inspection of the secondary schools.[46] The Senate approved accrediting and invited the Department of Education to meet the financial costs of introducing the scheme. They declined.

In 1930 the Parliamentary Recess Committee on Educational Reorganisation in New Zealand (The Atmore Report) was released.[47] It made thirty recommendations.[48] The report suggested that a Board of Studies be convened and to include representatives from the University, Secondary Schools and the Department of Education. The Board of Studies was to consider all matters relating to secondary school studies, examinations and certificates. Approved schools would be able to accredit and those who failed would be able to sit the examination and schools had to take into account the record of the pupil in determining passes.[49] The committee had divided post-primary education into two stages: the post-primary school (Form 1-3) and senior post-primary school (forms 4-6). The report's recommendations were promptly shelved due to the state of the economy, which was in the grip of the depression.

3.4 The School Certificate Examination

In 1932, the Director of Education (Strong) abolished the Junior Entrance Examination (a modified form of the Public Service Examination), citing austerity measures which

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[44] ibid., p. 2.
[45] Parton, p. 88.
[46] ibid., p. 89.
[47] Recess Education Committee, Report of the, On the Education Reorganisation in New Zealand (Chair: Bodkin), AJHR, 1930, I-8a.
[48] 'The Atmore Report', *STA*, III: 1, 1936, p. 6.
[49] AJHR, 1930, I-8a, p.170.

enabled the development of the School Certificate Examination.[50] It was hoped that the School Certificate Examination would become the main leaving certificate for students who had completed three years of post-primary schooling.[51] Meantime the Senate had rejected accrediting of the UEE unless the Department of Education improved teacher training and increased the secondary school inspectorate.[52] Conversely the Department of Education wanted the Senate to meet the extra costs associated with accrediting. From 1934, the University Senate continued to administer the UEE and the Department of Education administered the School Certificate Examination, but two examinations were intimately connected as the prescriptions for each of the School Certificate subjects were as those for the UEE.[53]

At this time the average length of stay in post-primary school was two years and seven months with students leaving school sooner from Technical High schools, on average after two years and three months, and by the end of the second year 52% of all post-primary students had left school.[54] These figures indicate that students were now staying longer at post-primary school. There were 4912 University students of whom: 202 studied Botany (32% females), 645 studied Chemistry (15% females), 103 studied Home Science (all females), 478 studied Physics (15% females) and 269 studied Zoology (26% females).[55]

In 1934, Thomas was invited by the NZCER to research the history of the UEE and to conduct a survey of changing attitudes to the examination. The report was published in 1939 but advance copies became available in 1937. Meantime the Senate obtained a report on accrediting in Victoria from a New Zealand graduate, C.M.Gilray.[56] Gilray's report supported accrediting but made two serious criticisms: that small schools accredited too readily and that the schools had not made use of the curriculum freedom

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[50] Openshaw *et al*, p. 214.
[51] 'School Certificate Examination Regulations 1934', NZG,22, pp.954-5.
[52] Parton, p. 89.
[53] E2 1954/37a, E39/2/17 part 1 - School Certificate Examination Regulations. Science is described as requiring 4 hours per week for 38 weeks, for three years.
[54] Report of the Minister of Education for the Year Ending December 31,1932, AJHR, 1933, E-1, p.23.
[55] Higher Education, AJHR, 1933, E-7, p. 7.
[56] Parton, p. 89.

available to them.[57] Gilray also noted that an essential supply of trained teachers was essential for the process to work, and this endorsed the concerns that the Academic Board had about accrediting in New Zealand.[58]

The Secondary Schools' Association had endorsed accrediting at their 1928 conference and requested that some unification of the examination system was urgently required. By 1936 they were demanding that the School Certificate Examination should be the prerequisite to the University and that such a change would make it the preferred qualification sought by employers. Frank Milner recommended to the SSA that a common core be instituted into all post-primary schools thereby widening the ideals of post-primary education to give consideration to culture and aesthetics in education: 'The old philosophy of indoctrination is definitely rejected....in fact all the old phenomena of sickening regurgitation.'[59] Milner believed that the School Certificate Examination was a positive move towards liberalising the post-primary curriculum but

> The Tyranny and constriction of University requirements still remain. The external examination must be jettisoned altogether if our secondary education is to fulfill its spiritual objectives.[60]

Fraser, as Minister of Education, had restored among other things: provision for more handicrafts and manual training, provision of specialist rooms including science and manual rooms.[61] Like Hanan before him, Fraser wanted to break down the educational barriers that prevented students from gaining free access to secondary education and accordingly abolished the proficiency examination.[62] By 1938, the average stay in post-primary school was two years sixth months, a decrease over the previous five years, with 55% of all students having left school by the end of their second year, an increase.[63] Meantime the University science subjects had all experienced strong growth in numbers with: 111 studied Botany (42% female), 498 studied chemistry

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[57] ibid.
[58] ibid.
[59] Milner, 1936, p. 12.
[60] ibid., p. 1.2
[61] Cumming and Cumming, p. 256.
[62] ibid., p. 258.
[63] Report of the Minister of Education for the Year Ending December 31,1937, AJHR, 1938, E-1, p. 34.

(18% female), 94 studied Home Science (all female), 448 studied physics (15% female), and 286 taking zoology (22% female).[64]

Under the auspices of the New Educational Fellowship, there was a growing public awareness that developing broad educational objectives was more important than an examination orientated curriculum. The NEF(1929) and the Carnegie Corporation (1931) had both conducted inquiries about the role of examinations agreeing that they constrained the development of a broad relevant curriculum.[65] One member of the NEF, Rector Zalliacus (Finland), suggested that the University Entrance Examination should be separate from the leaving certificate.[66] Kandel, an American expert on comparative education, suggested that the examination system be replaced by tests, which would require only short answers testing the aptitudes of the pupils, the results of which would be recorded on the student's cumulative record card.[67] Kandel suggested that tests only record one aspect of the student's education and together with a record of mental, emotional and physical development the student record card could be used for educational guidance.[68]

Beeby, Director of NZCER, had been particularly critical of the cramping effect of the UEE on the secondary school curriculum and his analysis of results in the examination, as a predictor of success at University, showed that the teacher was as good as any examination at predicting success for a pupil in the University.[69] Beeby noted that: 'Only what is examinable is taught... A fixed syllabus of instruction thus not only fails to maintain a standard in any real sense, but actually is the prime cause for dropping standards.'[70] In 1938, Beeby (now Assistant Director of Education) suggested that the UEE standards had fallen over the years and that it could now be gained in three years rather than the stated four. The decline had been brought about, according to Beeby,

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[64] Higher Education, AJHR, 1938, E-7, p. 3.
[65] Campbell, 1938, p. 245. The first investigation had been conducted by the NEF in 1929 and they turned to the Carnegie Corporation, who undertook their own investigation. Campbell, 1938, p. 250.
[66] ibid., p. 252.
[67] ibid., pp. 243-45.
[68] ibid., p. 244.
[69] Thomas *et al*, pp. 101-136.
[70] C.E.Beeby, 'Examinations in New Zealand', *Year Book of Education*, ed. Harley V.Usill, London: University of London Institute of Education, 1938, pp. 225-240.

by popular demand of the UEE as a leaving certificate rather than its use as entry to the University such that:

> The fundamental causal factor seems to be the steady pressure of the bourgeois 'getting on' motive which dominates the secondary and higher education in this country... ambition that finds more satisfaction in certificates than in culture.[71]

According to Beeby, if the standards of the UEE could not be assured, then the examination had to be terminated and provision for mass education be found in technical education, which, he said: ' ... represents New Zealand's own solution of her own problems, her attempt to give to her children a broad based and realistic education at the same time that she gives a preparation for adult working life.'[72] Similarly the New Zealand Technical Schools believed that they had managed to break away from the control of the University and had 'proved to be a dynamic factor in the national education system.'[73] An article in the *Otago Daily Times* warned of the dangers of overreaction to formalism 'School must be a joy, our children must be happy; and the essential ingredient in the new prescription is the removal of everything irksome or difficult in any degree.'[74] The consequence, according to the article, is a general leveling down of the education system.

3.5 UEE Becomes Accredited

In 1937, copies of '*Entrance to the University*' were available in preliminary format which showed that: accrediting of the UEE be introduced, that a system of cumulative record cards be introduced, that the secondary inspectorate be increased, specialised training of post-primary teachers, the provision of vocational guidance, the leaving age be increased to enable the development of broader courses, that the School Certificate be accredited thereby providing information for the cumulative record.[75] The report had endorsed the views held by the NEF and the Carnegie Corporation with regards to

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[71] Beeby, 1938, p.234.
[72] C.E.Beeby, 'Technical Education in New Zealand', *Year Book of Education 1939,* ed. Harley V.Usill, London: University of London Institute of Education, 1939, p.702.
[73] H.M. Scott, 'Technical Schools and Reform, TSTA Presidential Address', *STA*, III: 3, 1936, p. 3.
[74] E2 1951/7a, E29/2/79 part 1. *Otago Daily Times*, 4 Sept. 1937.
[75] Thomas *et al*, pp. 151-56.

examinations. The Director of Education, Lambourne, suggested that a committee be formed to consider the report and the Senate agreed.[76]

In 1939, the Senate adopted general acceptance of the notion of accrediting of the UEE by approved schools only and listed ten conditions of their acceptance.[77] Some of the conditions included: that an approved school list be developed in consultation with the Department of Education, the system to be reviewed, that the UEE only be taken after four years post-primary education, that the Department develop specialist post-primary teacher training and that the Government provide grants for students to study at university.[78] It had taken twenty years for the Senate to research and select a system of accrediting which they found acceptable.

In 1941 the University Senate finally reached agreement with the Director of Education, Beeby, that accrediting of the university entrance examination begin from 1944 provided the department met the full costs of introducing the scheme.[79] Beeby, by his own admission had brought to the discussion an unshakable belief that:

> ...if equality of opportunity were ever to be a reality in the post-primary schools, both accrediting of the university entrance and reform of the School Certificate examination were vital...[80]

Beeby suggested that he was crucial in negotiating the impasse that had been preventing the much needed reforms because he was not only Director of Education but also *ex officio* member of the University Senate.[81] But as shown above, the Senate had in fact approved accrediting in principle in 1939 provided that the Department of Education met the financial burden of introducing the scheme.

3.6 Towards Equality of Opportunity

The problem facing the Department of Education was to now develop a curriculum which met the needs of students who intended staying at post-primary school for only a

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[76] Parton, p. 90.
[77] ibid.
[78] ibid.
[79] Beeby, 1992, p. 164.
[80] ibid., p.162.
[81] ibid., p. 162.

short period of time. In 1938, the UK Spens Report had recommended that post-primary school instruction '... should not consist to any considerable extent in courses which are only of value if the subject is carried further.'[82] The Spens Report was particularly critical of the value placed on information, such as knowledge recall and suggested that education should be more than fragments of information.[83] If the education system was to freed from the burdens of examinations then a curriculum had to be developed that would educate the whole child to be a member of a democratic society.

In 1942, the Minister of Education, Mason, announced that the government had agreed to meet the costs of accrediting the UEE, believing that it had hampered the secondary school curriculum by imposing an academic curriculum on a number of children for whom it was unfitted.[84] The Department was to revamp the School Certificate examination to become the main school leaving qualification and the Thomas Committee was convened to report on the matter to the Minister.[85] Mason noted, in 1943, that:

> For over 50 years the Secondary School have been largely dominated by the demands of the UE examination,, which has become... the hall mark of a completed secondary education... School Certificate will replace matriculation' as the accepted mark of a competed post-primary course. This involves the final acceptance of the principle that the post-primary school has two functions of equal importance- the first to prepare the few for higher education and the

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[82] Spens Report, p. 169.

[83] ibid., p. 172. An article in the *Otago Daily Times*, 21 August 1937, suggested that the Minister of Education (Fraser) intended to abolish the University Entrance Examination '... not because its function is being abused, but in order that all who wish to may attend the University.' E2 1951/7a, E29/2/79 part 1.

[84] Report of the Minister of Education for the Year Ending December 31,1941, AJHR, 1942, E-1, p. 2. The Chief Inspector of Secondary Schools (Parr) commented that with the proposed introduction of accrediting would enable the broadening of the school curriculum to allow technical subjects to be examinable as well as traditional academic subjects. Report of the Chief Inspector of Secondary Schools, AJHR, E-2, 1941, pp. 5-6.

[85] Mason saw the accrediting of the UEE as giving the secondary schools 'Educational Freedom and he saw two fundamental ideas for the Thomas committee to consider: manual training for all and the use of language. H.G.R. Mason, 'Address by the Minister of Education to the SSA Conference', *STA*, IX: 5, 1943, pp.11-12. Similarly the Director of Education (Beeby) told the SSA that the task was to develop a general secondary education which will involve a core of studies. The subjects chosen for the core will be based on citizenship. C.E.Beeby, 'Address by the Director of Education to the SSA Conference', *STA*, IX: 5, 1943, p.12.

> second to prepare the many for immediate participation in the life and work of the community.'[86]

The reform of the UEE had meant that the Department of Education had finally gained control of the secondary schools. Preparation for University would cease to be the core business of these schools, as they would now be required to prepare students for the School Certificate examination. The secondary schools had been integral to the changes but the private schools were less satisfied with Professor Anderson, representing the Catholic Schools, stating that:

> It is the culmination of a plan that has been built up step by step for the last thirty years... The technique is too familiar. we have seen it in Nazi Germany...keep people looking ahead for greater freedom to come, while you whittle away at the freedom they have.[87]

By 1948, 69% of eligible students entered the university compared with only 45% in 1935.[88] The increase was not due to the introduction of accrediting but ex-servicemen recommencing their study after the war and the government's provision of bursaries.[89] Success at university had not been assured by accrediting, one of the hopeful objectives of introducing accrediting, as analysis of first year results showed no distinction between the academic performance of those students who were accredited and those who sat the examination.[90] The Senate had stipulated that: ' ... the system be reviewed after experience of its working.'[91] In 1953, the Academic Board appointed a committee to review accrediting and to give consideration to alternative methods. The committee conducted a survey of schools who accredited and of the 176 respondents, 63% wished the system to be abandoned.[92] Parton notes the problem with 'social

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[86] AJHR, 1943, E-1. The SSA agreed with the Minister that in the new world the academic examinations and curriculum of utilitarian subjects would no longer be sufficient. The student had to be educated for healthy citizenship. E.Hogben, 'Presidential Address - A View of Education', *STA*, IX: 2, 1942, pp. 15-16.
[87] Loughnan, p. 23 citing Professor W. Anderson, *Flight from Reason in New Zealand Education*, Auckland: Auckland Catholic Teachers Association, 1944.
[88] Parton, p. 92.
[89] ibid.
[90] ibid.
[91] ibid.
[92] ibid., p. 94.

experiments' is that they tend to change the institution which are the subject of the experiment and that it is not possible to return to the initial situation.[93] Thus the experiment can never be shown to have failed and becomes the status quo. In the secondary schools this involved the development of internal systems for assessing student eligibility for accrediting, placing greater emphasis on course work compared to examination results.

The availability of bursaries and scholarships had been a key factor in students' ability to take up their study at university and by 1949 there were 1600 bursaries which all met tuition fees available.[94] While scholarships had been available since 1879, the increasing number had been in part brought about by government departments offering bursaries in: agriculture, engineering, fine arts, home science and science.[95] Generally these provided fees plus a boarding allowance tenable for four to five years. The government also funded 'Ordinary National Bursaries' for students who had gained a higher school certificate and included fees plus £30 for four years.[96] Students were induced to pursue careers which provided the greatest financial support resulting in vocational orientated courses taken in preference to a more liberal education.[97] In a perverse way, the bursaries became the essential inducement for tertiary study and while they were awarded for entry to the university, their administration and funding was controlled by the Department of Education and the parliamentary vote. Thus by gaining control of the post-primary education system, the Department of Education had also been able to manipulate the university.

The secondary school curriculum had been constrained by the demands of the UEE, which demanded a high level of academic competence and failed to acknowledge advances in technical education. As the university moved out of the secondary schools, the Department of Education took the opportunity to restructure the whole post-primary sector to take account of modern educational philosophies and practices. These changes placed importance on the development of general education for the

[93] ibid., p. 91.
[94] ibid., p. 101.
[95] ibid.
[96] ibid.

masses by broadening the curriculum. Subjects were realigned to emphasise the acquisition of skills. No longer was the content of courses to provide a foundation for tertiary study The specialist subjects, such as the separate science subjects, were replaced with more general subjects such as general science. With no tertiary precedents, the content of these courses was open for political and social manipulation as we will see in the following chapters.

[97] ibid.

Chapter 4 -General Science: Education for the Masses

This chapter will show that education for the 'masses' was to be something quite different from the academic selectivity of the grammar school, and general science, with its focus on method, was seen as symbolising the new ideology

4.1 Science in Education

Modern science can be said to have begun in the 1600s with the establishment of The Royal Society of London, which provided a vehicle for scientists to exchange ideas and disseminate information. The Royal Society of London was very clear about what was and what was not science, such that science excluded: '...religion, rhetoric, metaphysics, politics and morality.'[1] The establishment of such institutions helped to define the '...content boundaries and procedures of science.'[2] However during the seventeenth and eighteenth centuries science was very much an activity of the educated wealthy class, with their activities confined within their respective research programmes and institutions.

The industrial revolution had heralded a marked change in science as its work was seen as being useful, such as in the textile industry where the work of the chemist was essential for the development of dyes and mordants.[3] Such was the case with Louis Pasteur who was a professional scientist, and at the age of thirty-two was appointed Professor of Chemistry at the University of Lille in 1854. He divided his time between research and teaching.[4] In 1855, Pasteur was invited by a leading industrialist to investigate problems associated with the production of alcohol from sugar beet. This resulted in Pasteur being the first to fully understand the nature of fermentation and led to his developing pasteurisation as a sterilisation process. The work of scientists such as Pasteur, has led the public to perceive science as a way of knowing the world, thereby empowering science.[5]

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[1] Everett Mendelsohn, 'Knowledge and Power in the Sciences', in *Science under Scrutiny*, ed. R.W.Home, Holland: Reidel Publishing, 1983, p. 32.
[2] ibid., p. 33.
[3] ibid., p. 34.
[4] Patrice Debre, *Louis Pasteur*, translated by Elborg Forster, Baltimore: Johns Hopkins Press, 1994, p. 82.
[5] Mendelsohn, p. 35.

By the mid nineteenth century, civil scientists in England were receiving public remuneration for their work, and the German chemist, Liebig, had noted that only scientific work of practical use is respected in England.[6] At this time associated institutions of the civil sciences were formed such as the Geological Survey, the Mining Records Office, the Museum of Practical Geology, the Government School of Mines and the Royal College of Chemistry.[7] Lord Lytton suggested that there were three types of scientific endeavour: the first was pure science, the second was the understanding of the scientific principles for the applications of science and the third was the utility of science.[8] While the useful science brought improvements to the lives of the citizens, the pure and applied sciences became University based disciplines. Mendelsohn suggests that one only need consider the architectural layout of a university campus such as Oxford or Cambridge where the older buildings surround a central quad, reflecting the interconnectedness of the liberal subjects, and the science block will generally be the newer, larger building apart from the main buildings.[9] It has been suggested that Science brought to the University, research as the *modis operandi*.[10]

As scientific knowledge and understanding increased at a rapid pace, international laboratories with centres of excellence developed all over Europe. Berlin and Bonn became the centres of chemistry and St. Petersburg the centre for physiology.[11] Science could no longer be the work of a gifted amateur but that of a specialist who was actively involved in research, thereby creating a social elite.[12]

In England the civil service began to grow as a consequence of centralised control of social services such as Health and Education in the nineteenth century, and this led to increasing employment for the middle class.[13] The employment sector demanded an educated work force of people who had acquired educational qualifications. Thus the growing middle class began to realize that to acquire better jobs, educational qualifications were essential, especially in the burgeoning civil service, leading to the

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[6] Layton, 1973, pp. 18-9.
[7] ibid., p. 19.
[8] ibid., pp. 18-9.
[9] Mendelsohn, p. 38.
[10] ibid., p. 38.
[11] Debre, p. 143.
[12] Mendelsohn, p. 40.

development of the public service examinations.[14] The demand for technically and commercially literate workers helped to liberate the school curriculum, particularly in science, from its abstract formalism by introducing more practical work.

During this time, secondary school education was seen as something quite exclusive and the teaching of science in elementary schools had been constructed in two quite opposite ways by Richard Dawes, Dean of Hereford and John Henslow, Professor of Botany in the University of Cambridge. Cambridge Professor Henslow, the Rector at Hitcham, could see many advantages for the teaching of systematic botany by showing a sense of order in nature and by association, enforcing his religious beliefs.[15] Professor Henslow's botany classes required the students to identify, dissect and classify plants using strictly scientific terminology. Such was the expertise of Henslow's students that Darwin requested they provide samples of seeds similar to those found on the shores of the Azores.[16] Darwin also paid the girls sixpence for collecting seeds for him.[17] Henslow and his son in law, Robert Hooker, who promoted the teaching of botany, and Huxley, who promoted the teaching of zoology, wanted to reform science education to exercise the mind through the development of critical thinking. By the end of the nineteenth century science education had moved towards teaching the theoretical underpinnings of science by focusing on its abstractions.

New educationalists, such as John Dewey were against the abstract nature of most school programmes and campaigned for the development of technical and manual subjects.[18] Science, it was suggested, should be taught with the child as discoverer and within a problem-solving context. Science programmes began taking account of Percy Nunn's 'wonder, utility and systemisation' motives for scientific endeavour, thereby awakening the passions of the student and emphasising its practicality within a humanistic context.[19]

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[13] Webb, p. 109.
[14] Bantock, p. 62.
[15] Layton, 1973, p. 63.
[16] Adrian Desmond and James Moore, *Darwin*, London: Michael Joseph, 1991, p. 424.
[17] ibid., p. 423.
[18] Jenkins, p. 47.
[19] ibid., p. 57.

Since the nineteenth century, science has transformed the lives of the western world through its developing utility. Science has managed, through its applications in technology, to build the motor car, provide electricity to most homes, improve communications through the telephone, enable mass production of textiles and provide medicines such as antibiotics. Science was believed to be a method, a way of solving problems, to ascertain truth, and its work was essentially useful. Thus science became synonymous with progress, improved efficiencies and innovation. A society which adhered to scientific principles was seen as progressive and schools were to be the vehicle for delivering a modern, essentially scientific education which would require the curriculum to be centred around science. The opportunity for reform of the science curriculum raised the important question as to what might be the purpose of science be in our education system:

> ...is our science the road to culture and enriched living or is the science teacher forgetting that science should be taught for the benefit of youth rather than for preserving the science?[20]

4.2 Science as Manual and Technical Training

In 1891, New Zealand had a population of 630,000 of whom approximately 30,000 were employed in the manufacturing industry.[21] Technical education initially was provided on the basis of local initiative, and by the end of the century the Wellington School of Design, Dunedin and Auckland Technical Schools, Canterbury School of Engineering, Lincoln School of Agriculture, and the Otago School of Mines had all been established.[22]

Science was taught with direct relevance to the requirements of the UEE, which promoted abstract formalism and theoretical understandings, this was partly because the main sciences taught were the physical sciences. By the beginning of the twentieth century, the optimism that western society held for science was such that it was considered that everything was knowable and that science held the pathway to further

[20] 'School Science', *STA*, 1: 3, 1934, p. 2.
[21] Nicol, pp. 1-2.
[22] ibid., pp. 31-44.

industrial, and concomitantly, economic 'power'.[23] As science continued to provide improvements in the quality of life through its utility, the State and science became codependent: science became increasingly supported by the State and science in return provided economic benefits for the State. This led to the promotion of manual and technical training in schools, and under the revised Manual and Technical Instruction Act (1900) funding was provided for practical classes. The Act also gave inducements for agriculture to be taught, as capitation could be paid at a rate of one and a half times greater for country schools compared to town schools.[24]

The Inspector General of Education, Hogben, was particularly supportive of introducing agriculture into the post-primary curriculum because of its relevance to the student:

> ...a first hand knowledge of the elementary scientific principles underlying the common facts of life, with emphasis upon applied science (including agriculture and commerce) in the case of boys and upon domestic science and art in the case of girls.[25]

Hogben also saw vocational opportunities in teaching agricultural science:

> I would have in every boys' secondary school ... an agricultural course provided. I would also have what might be called a course in applied science.... In the case of girls I would have domestic science or home science courses. ... I also hold this: If you want to get a training in science, it does not matter what the specific subject is, provided that the method of training is right. It is as good, for instance, to teach him to find the specific gravity of milk, ... as to teach him to find the specific gravity of sulpuric acid or of alcohol... What I say is that you can get a training in scientific method from subjects of agricultural knowledge as well as from other subjects...'[26]

But despite Hogben's plea for more agriculture, the vast majority of secondary schools pupils were still studying the physical (39%) or natural (29%) sciences, with only 3% studying the agricultural sciences.[27] In addition, agriculture did not appeal to the

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[23] Mendelsohn, p. 41.
[24] Nicol, pp. 53-4.
[25] Butchers, p. 129.
[26] AJHR E-12, 1912, p. 38.
[27] Report of the Minister of Education for the Year Ending December 31, 1912, AJHR, 1913, E-1,

middle class sense of 'getting on', with farming communities wanting their children to obtain professional or commercial employment. The introduction of Agriculture as a school subject also lacked support from agricultural scientists, who claimed that it did not provide an adequate preparation for a later scientific study of farming.[28]

Although Hogben had encouraged the introduction of more practical work into the school curriculum, the Minister of Education, Hanan, commented in 1918 that:

> ... special mention must be made of the teaching of science in secondary schools. At present chemistry, physics, or sections of physics, agriculture, botany, home science and other science subjects are taken up. Though in connection with these subjects there is more experimental work done than formerly, there is still a great amount of formal or abstract teaching of science, and even the experimental work is often of a very mechanical character.[29]

Hanan went on to suggest that some form of general experimental course would be more fitting, such as boys being required to focus on agricultural science and girls on domestic science. Hanan believed that science teaching had to focus on the scientific method and that by its applications it would provide human value and interest.[30] Hanan's vision for science was not however the general science programme suggested five years later by the Secondary School Association.

During World War 1 it was realised that there was 'widespread ignorance of common scientific facts among both officers and men' reflecting an inability to forecast the weather and similarly an inability to fully understand the rationale for anti-gas training.[31] In a world dependent upon technological expertise, schools were seen to have a responsibility in providing a basic education in common scientific phenomena. This led to the beginning of the general science movement, which was promoted by Sir Richard Gregory of the British Association for the Advancement of Science. Science had to be relevant and relate to everyday experiences of the student. This led to a growing awareness of the educational opportunities provided by teaching the scientific

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p. 35.
[28] Searle, p. 22.
[29] AJHR, E-1, 1918, p. 5.
[30] ibid.
[31] Jenkins, p. 53.

method. Education generally was under scrutiny and it was at this time that the University Senate embarked upon its investigation into the possibility of accrediting the UEE.

In 1923 the New Zealand Secondary School Association science sub committee recommended that specialisation in science should be avoided until the sixth form and that a general course would help to retain the students' interest in science:

> The romance of science and its inspiration are killed by the present approach to science viz. physical measurements. The side of human achievement should be stressed, and science considered along with literature and art as an historic expression of the human spirit. Accuracy in detail will come with growing interest in and appreciation of the methods of science.[32]

The committee also suggested that a course in general science, focusing on the scientific method, would be advisable for students who were not planning to continue their science beyond the secondary school. They appealed to Nunn's motives, suggesting that a general science course should be practical and relevant by relating to the world of the child.

4.3 The General Things of Science

The 1930s saw a change in societal attitudes towards science and the scientific community. The public began to criticize science and in particular were critical of the political decision by scientists to make and use the atomic bomb.[33] Scientists could no longer claimed that they had a value free or altruistic positioning especially in view of their collaboration with the arms industry. The responsibilities for science education were enormous, with public health issues being added to its role in providing a humanistic education. The growing numbers of scientific workers, who were members of professional associations, believed that modern civilization had evolved from the discoveries of science and that the method of science as used in the life sciences, such as observation and investigation, were crucial for instilling an open inquiring mind

[32] E2 1946/3b6, E4/6/1. Report of the Secondary School Association Recess Committee, 1923 on Science. It is interesting to note the committee included: Strachan, Caradus and Armor.
[33] Mendelsohn, p. 41.

which '...can overcome prejudice and habitually make decisions in accordance with facts'.[34]

Science, it was suggested, had the ability to reform education because it was capable of delivering objectives that had wide application through a skill based education. Scientific training would provide the pathway to employment as society placed increasing emphasis on general knowledge and adaptability.[35] It was suggested that the test of how much a pupil had learned should be:

Has the pupil gained such a knowledge of the scientific method that he will confidently attack any reasonably simple scientific problem that is presented to him? By "problem"

> ... I mean the working out of some simple investigation that is in the nature of a problem. There is nothing that so quickly rouses intense interest in science as elementary research... Simple research methods will... [instill]the development of intelligent interest in science, the rousing of a spirit of eager inquiry, the opening of the mind to the messages that science has for the world of work, the encouragement of perseverance and initiative.[36]

Therefore science could not only provide the basis to a general education but, through its methods, a standard way of thinking.

Educational reform of the post-primary sector focused on developing programmes to better meet the needs of the growing numbers of non-academic students who were entering the post-primary schools. Science had shown its usefulness in the manual and technical training programmes, particularly in the Technical High Schools, by liberating the curriculum to include more practical work. Not only did science involve the development of critical thought and precision but by enabling the student to conduct their own investigations, it was believed, that the scientific method would enable the development of a 'scientific mind' through problem solving and inquiry.[37] For the non-academic students, greater emphasis had to be placed on investigative

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[34] W.R.B. Oliver, 'Science as the Basis for Culture', *New Zealand Science Review*, I: 1, 1942, p.7

[35] Lucie Smidt, 'Significance of Vocational Education in our Time', *Year Book of Education 1939,* ed. Harley V. Usill, London: University of London Institute of Education, 1939, p. 552. Refer also Beeby, 1939, p. 696. Beeby suggested that technical education was the vehicle to deliver an education focused on generalized skills and principles.

[36] T.B.Strong, 'Instruction in Science', *Education Gazette*, XI: 10, 1932, p. 160.

[37] Strong, 1932, p. 160.

work by incorporating everyday contexts, something akin to Dawes's science of everyday objects.[38] This was science for citizenship, whereby the child would gain a basic understanding of science to enable them to participate in a democratic society by developing a commitment to truth and objectivity.

The Director-General of Education, T.B.Strong, supported the movement towards practically based science programmes, claiming that the schools had a responsibility to ensure they developed manipulative skills in their pupils. Strong demanded that regardless of the branch of science being taught, the objective had to be training in the scientific method.[39] Accordingly, 'As far as possible, the child should be led to discover scientific facts for himself and to make reasonable inferences from his investigations.'[40] The economic depression of the 1930s had placed a high value on practical problem solving skills, and Strong believed that science education was essential for revitalising New Zealand's primary industries:

> New Zealand is passing through a period of industrial depression... and one very reasonable and commonsense method of dealing with the situation is to endeavor to make the land produce more at the lowest possible cost. No doubt farmers are coming more and more to realize the assistance they can receive from science in the problem facing them at the present moment.... The Department therefore trusts that every effort will be made to give a sound scientific training to the pupils on whose knowledge and right attitude towards the science of agriculture will largely depend the future prosperity of the country.[41]

Economic salvation would require a change to science programmes in schools and that this would not be by:

> ...slavish adherence to the text book, not by merely working through set experiments or working always to known or set results, and least of all by the

[38] ibid.
[39] T.B.Strong, 'Science Instruction in Schools', *Education Gazette*, XI: 10, 1932, p.180.
[40] T.B.Strong, 'The Teaching of Science', *Education Gazette*, XI: 8, 1932, pp. 124-125.
[41] ibid.

> cram methods of teaching that regard time spent in practical work as largely wasted![42]

Strong advocated a more investigative approach to science teaching, hoping to make the subject matter more relevant by developing curiosity in the student to ask questions and by showing its utility.[43] From this basic understanding of the methods of science, it was suggested that rationality and objectivity are taught:

> ...if everyone concerned in an industrial undertaking, whether connected with the land or with the factory, were to adopt the scientific attitude of mind towards his work, the success of many of our industries would no longer be in doubt.[44]

As the emphasis in science education moved from content to process, a groundswell of support developed for the introduction of general science and its potential to deliver the objectives of a general education for citizenship. A general education would have to take into account the community within which the student lived:

> What is wanted, then, is a general education capable at once of taking on many different forms and yet of representing in all its forms the common knowledge and common values on which a society depends.[45]

However, with no university precedents, debate centred around the content of such a course. The science sub-committee of the Secondary School Association recommended that a course in general science be developed for the third and possibly the fourth form by introducing biology.[46] Conversely, the Chairman of the New Zealand Institute of Chemistry, Mr Glendenning, suggested that general science should be based on chemistry because '... there is no manufactured article of any kind to-day which has not come under the hand of a chemist at some period or other in its evolution.'[47]

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[42] Strong, 1932, p. 160.
[43] ibid.
[44] ibid.
[45] Report of the Harvard Committee, *General Education in a Free Society*, Cambridge: Harvard University press, 1950, p. 58.
[46] 'General Biology in Secondary Schools, Report of the Sub -Committee', *STA*, II: 2, 1935, p. 6.
[47] 'Chemistry and the Schools', *Education Gazette*, XII: 6, 1933, p. 106.

In 1936 Professor Lancelot Hogben, of the Education Section of the British Association for the Advancement of Science, promoted general science as culturally important by suggesting that science had to educate for citizenship by developing critical thought: 'The place of science in the education of the citizen is to enlist him in the constructive task of using the new powers and inventions wisely.'[48] In contrast to the SSA and Glendenning, Professor Hogben suggested general science should be '... a selection from the competing claims of specialist disciplines' and that:

> If the educationalist is to make a constructive contribution to the social problems of the present time he will have to forfeit the luxury of false modesty in his dealings with the claims of specialists.[49]

According to Professor Hogben, the content of general science should be the story of:

> ...man's conquest of time reckoning and space measurement, of the search for materials and substitutes, the liberation of natural sources of power, and the struggle against hunger and disease.[50]

4.4 The Science Masters Association (UK)

In 1936, the Science Masters Association (SMA) developed a general science course emphasising its cultural importance.[51] They noted that the content of a general science course should consist of subject matter that had wide appeal to the students and highlighted scientific relationships.[52] The course should be taught using problem solving techniques and highlighting the interrelationships between the branches of science it was to be divided into.[53] Sir William Bragg, President of The Royal Society and Director of the Royal Institution, commented that:

> ...if we are to continue living in a democratic community, we must understand each other, and know something of the contribution of everyman to the general welfare of society. In order to understand the complexities of modern life, it is necessary to have a background of scientific knowledge...[54]

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[48] 'Science and Citizenship', *STA*, III: 6, 1936, p. 8.
[49] ibid.
[50] ibid. Professor Hogben was considered a radical educationalist but he failed to change the direction of science teaching in the UK because it was too difficult to translate his lofty ideals into an examinable curriculum. Jenkins, pp. 140-41.
[51] Jenkins, p. 82.
[52] ibid., p. 83.
[53] ibid., p. 84.
[54] 'The Teaching of General Science', *Education Gazette*, X: 7, 1936, p. 108.

The SMA suggested that general science was essentially useful and practical knowledge:

> The study of science is a mental discipline, and enables one to assess evidence, suspend judgment, to think logically; the man who has been taught to weigh copper sulphate to two decimal places will probably weigh the blandishments of rival politicians with equal care.[55]

But Professor Armstrong, at the age of 88, strongly disagreed with the direction the SMA were advocating, and he stated that the purpose of teaching science was its method, which could be taught by any specialist science study. Professor Armstrong made a stringent attack on the educationalists who sacrificed science to general education:

> Looking back, as I do over full seventy years of scientific achievement, the progress is wonderful beyond all description, the increase in knowledge borders on the inconceivable. The schools alone remain unmoved.... The cookery-book stuff you are called upon to teach is not worthy of you.... You are not yet at the polished-flint stage of understanding your work. Some real grasp of the method and purpose behind all experimental inquiry must be given to your pupils- some understanding of the world as we know it; some proper knowledge of ourselves to guide us in our lives; some reverence of nature.[56]

While in principle the notion of a popular course in science would be more useful to the large majority of the population, translating these ideals into a curriculum document was quite different and according to the SMA:

> ... general science should be taught at least up to the age of sixteen; but there is divergence of opinion as to aims, content of syllabus, and methods of presentation of the subject.[57]

In 1936, a group of Auckland Chemistry and Physics teachers prepared a report on secondary school science in which they concluded that they did not support the introduction of general science.[58] They agreed with Professor Armstrong that training in the scientific method should be undertaken by studying the specialist sciences, but

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[55] ibid.
[56] ibid.
[57] ibid.
[58] 'Science in Secondary Schools', *STA*, IV: 1, 1937, pp. 12-13.

'to suggest a wide prescription in science...[would] prove to be the worse possible training in scientific method'.[59] Science was culturally important, they suggested, because of its method, such that a student could '... go into the world equipped to see and notice the problems facing him and trained to think about and analyze those problems.'[60] In addition they saw the popularising of science as advocating that only things which are interesting need be taught.[61] However most educationalists agreed that the scientific method was the basis upon which science should be included in the school curriculum even though the content of the course was more debatable.

The success of teaching general science also depended on a suitably qualified teaching profession and the University Senate had highlighted the paucity of adequately trained post-primary teachers in their reluctance to agree to accrediting until the Department of Education instituted a post-primary teacher trainee programme. Professor Hamley, Professor of Education at the University of London, suggested that for a teacher to be adequately trained to teach general science they would need to have studied general science and a specialist science, and have undertaken research, but more importantly they must believe that it is worth teaching.[62] Thus no specialist teacher should be compelled to teach it.[63]

4.5 General Science for the Non-academic Student

By the 1930s the western world was experiencing huge growth in demands for education and in particular post-primary school education. Students were staying at school longer and organisations such as the NEF were vigorously campaigning for an increase in the official leaving age. In 1936, the school leaving age in New Zealand was 14 and the average length of stay at post-primary school was two years six months.[64] Between 1926 and 1936, the post-primary roll grew by 22% and by 1936, 57% of all primary school students were entering the post-primary sector, with many

[59] ibid.
[60] ibid.
[61] ibid.
[62] ibid.
[63] ibid.
[64] C.E.Beeby, 'The Education of the Adolescent in New Zealand', *The Year Book of Education 1937*, ed. Harley V. Usill, London: University of London Institute of Education, 1937, p.229.

leaving during the first two (refer Table 4.1).[65] With thirty percent of pupils leaving in the first year, twenty percent in the second and twenty eight percent during the third year, it was difficult for students to acquire a comprehensive education, as most courses were designed for completion at the end of the third or fourth year when the UEE or School Certificate examinations were sat.[66] Thus over half of the post-primary population was in school because of compulsion rather than the acquisition of qualifications, and Beeby noted that 'The wastage of money and effort is incalculable.'[67]

Table 4.1 The Primary and Post-primary School Populations 1926-1940[68]

Year	Primary	Post-primary
1926	253,255	26,014
1930	253,731	31,868
1936	249,732	33,455
1938	246,337	36,831
1940	245,187	37,058

Adherents to the NEF philosophy wanted to develop a general education for the students who would not stay at school beyond the formal years. One of the barriers to progress was seen to be the UEE and moves were afoot to accredit the examination. Thus in line with overseas countries, the Minister of Education, Peter Fraser, announced that he proposed to increase the school leaving age to 15 years.[69]

The visit in 1937 by the NEF helped to focus attention on the key issues facing the post-primary schools including: the stranglehold of the UEE on the secondary school curriculum, the lack of status of the Department's School Certificate Examination, and a rapidly increasing post-primary population. The following year the Report of the Consultative Committee on Secondary Education (Spens Committee) was published and it had supported the views of the Science Masters Association that general science be incorporated into the post primary school curriculum on cultural grounds.[70] The

[65] E2 1943/3b, E 27/2/75 part 1. Copy of the article for the *Year Book of Education,* 1937.
[66] ibid.
[67] Beeby, 1937, p.229.
[68] The New Zealand Official Year Book, 1930, p. 225 and 1942, p. 144.
[69] Campbell, 1938, p. 317.
[70] Jenkins, p. 82.

Spens Report suggested that no student should specialise in science before the age of 16 years:

> We do not believe that more specialisation than we have indicated is necessary or desirable before the age of 16, and we believe that it is desirable before children settle down to the formal study of certain branches of science that they should first be given a bird's-eye view of the wider field.[71]

The report referred to science in terms of its value to society as a whole, suggesting that there is a body of scientific knowledge which should be known by the average citizen.[72]

In New Zealand the Director of the NZCER and New Zealand's representative on the NEF, Beeby, agreed that it was not enough to open the doors to the children of the labouring class, education had to be more than just 'getting on' and climbing social ladders, but learning for its own sake such that:

> The passion for examinations, the rigid following of syllabuses, the over-intellectualization of the schools and the whole undignified scamper for "results" follow directly from the giving of educational opportunity to social groups without any tradition of intellectual culture.[73]

In addition, he noted that general science was essential within the new educational focus because it was concrete, rational and essentially a practical activity based subject, teaching the principles upon which '... the industrial state is built' and containing aspects of both vocational and a general education.[74]

4.6 The Royal Society

By the beginning of the 1940s, evidence can be found that The Royal Society became concerned about the teaching of science: 'The science taught in schools has therefore little relation to the present and future needs of the average pupil.'[75] The President of The Royal Society, J.E. Holloway, suggested that science was about a quest for knowledge whereby 'Our interest and appreciation of a thing is not diminished but

[71] Spens Report, p. 250.
[72] ibid., p. 243.
[73] Beeby, 1937, p.220.
[74] Beeby, 1939, p. 697.

enhanced as we get to know more about it.'[76] Thus the main aim of science, according to Holloway, was to ascertain truth through scientific investigation.[77] Science was seen as being altruistic, working for the good of humanity and essentially classless, therefore its role in education, according to Holloway, might be to engender a sense of equality.[78] The Royal Society believed that the focus of science teaching programmes did not truly reflect science as an investigation to ascertain truth.[79] The Royal Society supported the growing belief that the best vehicle for delivering science programmes was through general science, with the inclusion of biology.[80] While this is very surprising, as The Royal Society championed pure scientific endeavour, they none the less considered a knowledge of science was important for society.

In 1941 The Royal Society sent a letter to the Department of Education:

> That the council of The Royal Society of New Zealand having regard to the importance of scientific education and understanding in the community, requests the Honorable Minister of Education to convene a committee ... to prepare a report on the matter.[81]

They were concerned about: the lack of provision of science courses for students who left school before obtaining a leaving certificate, the lack of biology teaching and the training of science teachers. Mason replied on 17 April 1942, before the Thomas Committee had been either proposed formally to the Minister or convened:

> The prescriptions in science subjects are being widened so as to meet the needs of those who will receive no further teaching of formal science and a syllabus in general science is proposed. The general syllabus will include the biological sciences. The draft syllabuses have already been sent to post-primary schools in order that criticism and comments can be obtained before prescriptions are

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[75] J.E.Holloway, 'Science Teaching in New Zealand', *Transactions and Proceedings of The Royal Society of New Zealand*, 71, June 1941, p. XLVI.
[76] J.E. Holloway,' Essential Spirit of Science', *Transactions and Proceedings of The Royal Society of New Zealand,* 71, June 1941, p. XXXII.
[77] ibid., p. XXXVI.
[78] ibid., p. XXXVII.
[79] ibid., p. XLVI.
[80] *Transactions and Proceedings of The Royal Society of New Zealand*, Vol. 72, 1942-43, p.XX.
[81] E2 1949/25b, E4/10/15. Conference on Post-primary Education 1922-49. Letter from The Royal Society, 17 June, 1941.

> finalised.... [therefore it]does not appear that a committee [needs to]be convened.[82]

On the 12 May, 1942 The Royal Society was asked to comment on the enclosed copy of the proposed general science syllabus but they were asked to return the draft immediately after their meeting on the 20th of the month as '... the Department is anxious to finalise the syllabuses at as early a date as possible.'[83]

The Thomas committee recommended that general science be introduced as part of a cultural core and students could sit the School Certificate examination in anyone or combinations of: general science, biology, chemistry, electricity and magnetism and finally heat, light and sound.[84] The general science core was to be studied for the first three years of post-primary school and the course was to consist of aspects of physics, chemistry, biology and geology.[85] On the 11 October 1943 the President of The Royal Society sent a letter to the Director asking on behalf of its Standing Committee whether it could meet with the Thomas Committee for a talk on the syllabus. 'The Royal Society is anxious to help if it can...'.[86] They were invited to make submissions to the committee, but there is no evidence to suggest that they did do so.

In 1944 Mason convened an Education Conference, and at a session devoted to the Thomas Report, Dr. Archey, a member of The Royal Society Standing Committee, expressed concern that general science was not a science in its own right, and supported the study of the specialised sciences in line with the Spens Report who had advocated a general course up to form 3 and specialised study thereafter.[87] He noted that the proposed course in general science was too broad and content driven, taking away the opportunity for true investigation:

> It will tend to inculcate a dependence upon scientific authorities instead of deriving scientific plans from study and observation and I submit that a pupil

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[82] ibid., Letter from Minister of Education, 17 April, 1942. The memorandum to Mason from Beeby recommending the establishment of the Consultative Committee on Post-primary Education, 23 October 1942, E4/1/5.
[83] E2 1946/21b E26/19/27 part 1- Secondary Education: Courses of Study and Instruction, 1933-46. Letter from the Botany Division of The Royal Society asking for a copy of the draft general science syllabus, 8 May, 1942 and the reply from Caradus, for the Director, 12 May, 1942.
[84] ibid., 71-2.
[85] ibid., p. 36.
[86] E4/1/5. 11 October 1943. Letter from The Royal Society.

> will better develop the method and understanding of the method of science and define the problem of science by following the other sciences or those related sciences in fuller degrees.[88]

Dr. Archey agreed with Professor Armstrong that:

> The study of science is not the acceptance of facts. It is a method of study.... should be based on experience and the plans or the results should be derived from a scientific examination of its results.[89]

Thomas replied, that students would be able to develop the scientific method when they study the specialist sciences.[90] The Royal Society was less than satisfied and requested a Royal Commission be established to look into the matter but this was declined.[91] One of the joint secretaries, Somerset, commented that he had doubted the wisdom of general science but he noted that overseas comments on the report had been favourable.[92]

4.7 The School Certificate Regulations

From 1945 the leaving age was to be fifteen years, the previous year accrediting was introduced into approved schools and the modern form of the School Certificate examination was introduced. The School Certificate regulations for general science noted that:

> It can not be stressed too strongly that observations and experimentation form the backbone of an effective course of science teaching. ...A liberal interpretation of the main lines of study will be allowed. It follows that the content and order of the course will vary from school to school according to the environment of the pupils.[93]

Teachers were to be given freedom to interpret the curriculum document and to take account of their local community. In 1945 Mason justified the introduction of a

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[87] E W2536, Box 4. Dr. Archey replies to Thomas Report, 1944. See also Spens Report, p. 250.
[88] ibid.
[89] ibid.
[90] ibid., Thomas replies, 1944.
[91] *Transactions and Proceedings of The Royal Society of New Zealand*, Vol. 76, 1946-47, p.XII In 1946 The Royal Society passed the following resolution: That the council of The Royal Society recommends in view of the increased impact of science on society and the economic life of the community in New Zealand, that a Royal Commission be set up to investigate and report on the whole question of scientific education in New Zealand.
[92] E W2536, Box 4 Somerset's Comments, 1944.

compulsory core curriculum, which included general science, as having been brought about by the increasing number of pupils entering post-primary education and to ensure that the needs of both academic and non-academic pupils were met within the revised School Certificate Examination.[94]

General science can be said to have been introduced to supplant the specialist science courses in academic secondary schools thereby making all post-primary education a general education. If the secondary schools had been able to continue in their former traditions, as suggested by Tate, there would have remained a division in both ideology and delivery. The rebranding of science into an all encompassing term of 'general science', had conceptually moved the subject from its academic formalism and by default its associations to the secondary school. This was because general science in New Zealand, had no academic or examination history, was non hierarchical, stressed the interrelationship of the subject and focused on broad educational outcomes. It fitted neatly Beeby's vision for educational reconstruction:

> ... the present government was the first to recognise explicitly that continued education is no longer a special privilege for the well to do or the academically able, but a right to be claimed by all who want it to the fullest extent that the State can provide... schools that are to cater for the whole population must offer courses as such and varied as the needs of the abilities of the children who enter them ... courses that will best cater for their abilities.[95]

The Thomas Report, in recommending that general science be made compulsory up to the fifth form, was undoubtedly influenced by the Science Masters Report (1936), the Spens Report(1938) and the Norwood Report (1943),[96] In addition one NEF advocate, Dr. Kandel, had strongly advocated a general science programme to make science relevant to everyday life by including biology and nature study.[97] The UK Norwood Report (1943) had supported the findings of the Spens Report noting that: 'We have

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[93] E2 1954/37a, E39/2/17 part 1.
[94] E2 1947/34b E39/4/6 part 1, Regulations - Post-Primary Instruction, 1945-47. Statement by the Minister of Education on the Curriculum for Post-primary Schools, 26 April, 1945.
[95] AJHR, E-1, 1939, p.3.
[96] AAVZ W3418, Box 17. Memo from Campbell to Somerset, 23 February, 1943. Campbell informs Somerset that he is sending him Part I of the Science Masters Report and that Elizabeth Gregory has Part II.

studied with considerable care the case for General Science and the case against it... In our view, it holds out great promise and is much to be encouraged'.[98] Jenkins suggests that the reason for the increasing popularity of general science during the Second World War was not its contribution to a general education but more probably reflected the lack of qualified teaching staff to offer the specialised sciences.[99]

In 1948 Campbell, Director of the NZCER, reflecting on the past fifteen years in education, claimed that the idea of revival of education in New Zealand had risen out of the depression and the 1935 Labour Government who believed that there had to be the provision of 'equalisation of educational opportunities...'[100] Campbell suggested that active encouragement was given, during this time, to those who desired a new spirit in education as represented by Percy Nunn, Cyril Burt and Susan Isaac (NEF).[101]

Unlike New Zealand, England had experienced large-scale physical destruction of her schools during the war and post war rebuilding placed a premium on a new idealism. England looked to take advantage of the increasing number of careers in the scientific and technology community by providing specialist science classes and abandoned the concept of general science as the preferred delivery of science programmes in post-primary school.[102]

The introduction of compulsory general science into the curriculum of post-primary schools in 1945, which included the three main sciences, actually broadened the curriculum, thereby framing a compromise between the academic and humanistic interest groups. While the notion of a common course of study adhered to the notion of education for citizenship, a belief of the new educationalists, tensions arose in translating the idealism into classroom reality. Teachers constrained by their own specialist science paradigms, school culture and ignorance of research science relied upon the School Certificate Examiners to prescribe the course and students were

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[97] Kandel, 1938, p. 67.
[98] Jenkins page 87 citing the Report of the Committee of the S.S.E.C. (1941), *Curriculum and Examinations in Secondary Schools*, London: HMSO, 1943 p. 109.
[99] Jenkins, p. 89.
[100] A.E.Campbell, 'New Zealand', *Year Book of Education 1948*, ed. G.B.Jeffery, London: Evans Bros., 1948, p. 183.
[101] ibid.

prepared, as many years before, for the external examination. But perhaps the most significant change for science educators had been the introduction of compulsory biology, a course designed to fulfill social objectives, which will be explored in the next chapter.

[102]Jenkins, p. 99.

Chapter 5 -Biology as Social Objective

This chapter will show that the development of biology programmes in the post-primary school was to educate the community to understand and act upon health advice. Thus failing to acknowledge the diversity of the biological sciences.

5.1 The Cell Theory

Biology is a nineteenth century academic concept. Prior to this time it had been segmented into medicine (anatomy and physiology), natural history and botany.[1] The natural history of animals was studied as part of natural theology, thereby providing evidence for the concept of 'design' in nature. In the early part of the nineteenth century microscopes were manufactured in England, France, Germany and Austria and became standard equipment for laboratories. During this time there was a group of German biologists who wanted to explain life in a reductionist physico-chemical way.[2] They hoped that the living organism could be reduced to laws and principles in line with the physical sciences, which had become dependent on mathematical proof. In the nineteenth and twentieth centuries a biological revolution was to show that biology was not a single subject but had two distinct areas: functionalism, which included botany and zoology, and evolution. The functional biologist is interested in laws, predictions, aspects of quality or quantification and functional aspects. In contrast the evolutionist is interested in quality, historicity, information and selective values.[3] Thus in the nineteenth century biology was mainly taught in secondary schools as either botany or zoology, where biology was taught it consisted of components of both only.

During the early part of the nineteenth century, the cell became the focus for biological research but before a comprehensive theory of cells could be developed three things were required: proof of cells as constituents of animals and plants; evidence of the cell membrane, nucleus and cytoplasm; and evidence of cell

[1] Ernst Mayr, *The Growth of Biological Thought, Diversity, Evolution and Inheritance*, Cambridge: Belknap Press, 1982, p.36.
[2] Mayr. p. 655.
[3] ibid., p. 77.

reproduction.[4] In the 1830s Matthias Schleiden, a German botanist, recruited Theodor Schwann, a zoologist, to his research programme and they showed the connection between the plant and animal kingdom because they both had nucleated cells.[5] Although there were flaws in the work of Schwann and Schleiden, there was one enduring feature of Schwann's work namely the concept of the cell as a functioning unit. As all living matter consists of cells this led to the term 'biology'.[6] However, they were unable to explain the method by which new cells were produced and Schwann maintained that they formed from free material, a process akin to crystallization. Observation of the cell, which had been made possible by the development of the compound microscope, led researchers to observe the cell membrane and in 1845 van Mohl described the cell fluid as a proto-plasma.[7] Huxley used the term protoplasm in his address entitled 'The Physical Basis of Life' in 1868 and it has been suggested that the word became so popular that it was immortalized in the words of the Mikado, when Pooh-Bah announces: 'I can trace my ancestry back to a protoplasmal primordial atomic globule.'[8] Thus the theory of the cell now had two parts confirmed and it was to be the latter part of the century before the final part was discovered, cell reproduction.

In the late nineteenth century there were huge advances in the production of microscopes, fixing and staining techniques leading to the study of cells and in particular the nuclei.[9] In 1869, Frederick Miescher, a Swiss physiologist and organic chemist, discovered that the nuclear material contained nucleic acid and his work had its roots in organic chemistry, which was to become biochemistry. The improved microscopy techniques enabled the nucleus to be observed during cell division leading to Roux's hypothesis, in 1882, that during mitosis the genetic material is conserved so that the two daughter cells are genetically identical.[10] Wilhelm Roux enquired into

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[4] Stephen Toulmin and June Goodfield, *The Architecture of Matter*, Harmondsworth: Penguin, 1965, p. 396.
[5] ibid., p. 397.
[6] Mayr, p. 656.
[7] Toulmin and Goodfield, p.400.
[8] ibid., p. 401.
[9] ibid., p. 118.
[10] ibid., p. 677.

the selective value of this complicated process.[11] Roux's hypothesis was to emancipate biology away from its attachment to physical explanations to something more akin to an 'Aristotelian' or 'Teleological' approach.[12]

5.2 Evolution

The mid-nineteenth century was dominated by evolution causing biology to segment into two distinct parts: functionalism and evolution.[13] The functional biologists aligned themselves with the physical sciences by describing physiological processes within the boundaries of physics and chemistry.[14] The evolutionary biologists aligned themselves with the work of Charles Darwin who had described evolution in 1858 as consisting of both adaptation and diversity. Darwin believed that the causes of evolution were twofold: an inexhaustible supply of genetic variation and a differential survival rate of individuals within each generation. Darwin believed that natural selection was dependent upon genetic and environmental interactions.[15] Darwin's theory of common descent was readily adopted by biologists: 'Darwin's theory of common descent was one of the most heuristic theories ever proposed.'[16] His work led to the development of comparative anatomy as zoologists, anatomists and embryologists tried to determine the relationship between characteristics and ancestry.[17]

During the nineteenth century science was believed to be an inductive process whereby from a series of observations a question is asked, leading to the formation of an hypothesis. In the physical sciences the proof would depend on the results collected from a designed experiment.[18] However in biology, and in particular evolutionary biology, along with astronomy and geology, the test can only be conducted by observing 'nature's' experiments. Thus there is a methodological gap

[11] ibid., p. 678.
[12] ibid., p. 678.
[13] ibid., p. 114.
[14] ibid., p. 114.
[15] ibid., p. 117
[16] ibid., p. 117.
[17] ibid., p. 117.
[18] ibid., p. 29.

between the physical and the natural scientists, and an even bigger gap between functional and evolutionary biologists.

Darwin's work was criticized because it was not inductive and not based on experimentation.[19] His work showed that biology differs from the physical sciences in terms of developing theories because his method asked 'why' questions and then looked back to find the answers rather than forward.[20] Darwin's experiments had been conducted by 'nature' and from his hypothetico-deductive methodology he could speculate about the process and its significance. Thus Darwin's work was dependent on deductive reasoning and he was to find support for his ideas in the work by Henry Bates on mimicry.[21] Mimicry involves some otherwise palatable species mimicking the colouration of an unpalatable species. The closeness of the two species is dependent on natural selection, which results in the mimic becoming more physically similar to the original species because, the more similar the mimic to the unpalatable species the less likely it is to be eaten. Bate's work, in 1862, was a fine example of natural history research and provided Darwin with the much needed evidence to support his second theory, that evolution occurs by natural selection.

The Darwinian revolution required people to rethink their concept of the world and themselves. They could reflect that: the world was constantly evolving, creationism was implausible and cosmic teleology wrong, and began to accept the truth of the common descent of all organisms, natural selection and population dynamics asserted.[22] Thus Darwin dealt with the subject of evolution from a scientific rather than a theological view point, which led to a battle between the two main ideologies of the nineteenth century: natural theology and objective science, with his ideas refuting creationism. Darwinism was promoted by T.H.Huxley who campaigned vigorously for secular education, promoting objective science as its epistome and in this he had the support of Cambridge Professor John Henslow.

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[19] ibid., p. 521.
[20] ibid., p. 521.
[21] ibid., p. 522.
[22] ibid., p. 501.

5.3 Professor John Henslow

In the late 1830s two very talented scientists, Richard Dawes and John Henslow, became involved in education. In 1817 Dawes became a fellow, mathematical tutor and bursar of the recently established Downing College.[23] In 1825, Henslow was appointed Professor of Botany at Cambridge. In the late 1830s both were offered positions as Rectors: Henslow at Hitcham in Suffolk and Dawes at King's Somborne in Hampshire.[24] These positions carried a stipend enabling both men to live comfortably and Dawes severed his links permanently with Cambridge. Both men established village schools for the poor, with Dawes teaching a humanistic curriculum with an emphasis on acquisition of language and an understanding of the science of common things through observation and the conducting of simple experiments.[25] Dawes focused on the utility of science and 'Here was no crumb of upper-class education charitably dispensed to the children of the labouring poor. Instruction was related to a culture which was familiar to the students providing opportunities for the use of reason and speculation by drawing upon observations which pertained to everyday life.'[26] This was precisely the type of science education which would produce the scientific workers for the civil sciences, incorporating workshop skills and a little knowledge of science.[27]

Henslow, who was himself a research scientist, believed that science education should consist of the principles of induction and deduction. Henslow's view of science education entailed observation and inferences from the fact, thereby emphasising the training of the mind through scientific inquiry.[28] Together with Huxley, Henslow believed that the benefits of teaching science lay not in the conclusion but in the methods employed to get there, the process of science. Science was to be taught in an

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[23] Layton, 1973, p. 35.
[24] ibid., p. 36.
[25] ibid., p. 43.
[26] ibid., p. 53.
[27] David Layton, Science in the Schools: the First Wave - A Study of the Influence of Richard Dawes, *British Journal of Educational Studies*, 20: 1, 1972, pp. 38-57. Layton points out that: Dawes science was essentially concerned with educating apprentices and reached its peak in the late 1850s. Thereafter science lost its importance in the elementary school curriculum brought about by reduced expenditure on scientific apparatus, low status in the examination system and reduced numbers of trained science teachers. It was not until 1882 that science reappeared.
[28] Layton, 1973, p. 59.

objective rational manner, divorcing it from political, religious and economic interests. Science was 'pure', something apart from the everyday world and by applying scientific methodology 'truth' could be uncovered. Henslow focused on systemised botany, with his students classifying plants on the basis of homologous structures enabling an understanding of the inductive laws of science. In 1856, Henslow's work became known to the Department of Science and Art who thought it had potential in elementary school teaching. In comparison, Dawes saw science as a creative process of discovery and that scientists were constrained in their use of data by their respective paradigms.[29] By the end of the nineteenth century, Henslow's systemised botany with its focus on the inductive scientific process, had become the preferred model for the development of science teaching.

5.4 T.H.Huxley

Thomas Henry Huxley was a school master's son from London who aimed to pursue a career in medicine. At the age of twenty-one he signed on to the *HMS Rattlesnake* as a surgeon's mate and became so engrossed in discovering marine life that science took over from medicine. But Huxley's trip was quite unlike Darwin's voyage, for the latter had sailed as a paying companion to the captain. Huxley sailed as the ships surgeon amongst a hostile crew and a ship unfitted for scientific discovery.[30] In 1851 Huxley returned from four years aboard the *HMS Rattlesnake* and at the age of twenty-seven he was out of money and looking for work.[31] Huxley was unable to write up his research, as the Admiralty refused to provide funding. He was angry that England wanted science on the cheap. In 1854, Huxley began a teaching position at The Royal School of Mines and a year later began his famous working mens' lectures,

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[29] ibid. , p.173.

[30] Adrian Desmond, *Huxley: From Devil's Disciple to Evolution's High Priest*, London: Addison Wesley Longman, 1997. The nineteenth century saw a wave of scientific exploration by sea faring naturalists with Darwin following in the footsteps of Joseph Banks, Alexander Humboldt and Aimee Bonpland. They were followed by Joseph Hooker (*Erebus*), Alfred Russell Wallace and Henry W.Bates (*Mischief)* and Thomas Henry Huxley on the *HMS Rattlesnake*. Raby notes that these voyagers changed the European view of the planet by making them aware of the multiethnic nature of man and the changing nature of the world by celebrating its variety. Raby describes the individual voyages of these Victorian travellers and more. Peter Raby, *Bright Paradise: Victorian Travellers*, USA: Princeton University press, 1997.

[31] Desmond and Moore, p. 403. During the ships stop over in Australia Huxley met his future wife, Henrietta, but it took him seven years to raise the funds to bring her to England.

'sick of the dilettante middle class.'[32] After the publication of Darwin's '*Origin of the Species*' in 1858, Huxley put the 'sting in its tail'.[33] Huxley openly tried to wrench science from ecclesiastical control asking whether England should play a part in this revolution of thought:

> That depends upon how you, the public, deal with science. Cherish her, venerate her, follow her methods faithfully and implicitly in their operation to all branches of human thought, and the future of this people will be greater than the past. Listen to those who would silence and crush her, and I fear our children will see the glory of England vanishing like Arthur in the mist.[34]

Huxley could see the benefits in educating people to understand the rudiments of health and hygiene thereby ensuring a commonsense approach to disease management. He warned that ignorance of an understanding of biology meant

> ....that an educated man can be found to maintain that a slaughter house in the midst of a great city is rather a good thing that otherwise?...Why is it that quackery rides rampant over the land?... Why is all this, except from the utter ignorance as to the simplest laws of their own animal life, which prevails among even the most highly educated persons in this country?[35]

As a physiologist of some note, Huxley was very much aware that the biological sciences were making far greater advances in the nineteenth century than the physical sciences. The work of the research physicists and chemists had become framed in theoretical abstractions, and the public was unable to understand their work. Yet the average person could understand advances in biology, particularly if they could benefit personally from its progress, and Huxley's interpretation of evolution offered hope to the masses. Thus, he believed that biology would have more popular appeal

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[32] ibid., p. 411.
[33] Desmond, 1997, p. 256. See also Sherry Lyons, Convincing Men They are Monkeys, in *Thomas Henry Huxley, in Science and Letters: Centenary Essays*, ed. Alan P. Barr, Athens: University of Georgia Press, 1997. Lyons said that the sting was put in the *Origin* by Huxley applying it to Humans. Lyons goes on to suggest that Huxley's rationale for trying to convince men they were monkeys was part of a larger campaign ' to replace the power and moral authority of the church with that of the temple of science.' Lyons, p. 97.
[34] Desmond and Moore., p. 489.
[35] Bibby, 1971, p. 55.

than the other sciences because it was just 'trained and organized common sense...'[36] He suggested that 'Biology needs no apologist when she demands a place - and a prominent place - in any scheme of education worthy of the name.'[37]

By the late nineteenth century, Huxley was determined to introduce biology into schools, and as a keen vivisectionist and experimenter, he wanted biology to be practical. He believed that the study of physiology would enable students to carry out many of their own investigations: 'The beating of one's heart and its connection with the pulse may be noted; the influence of the valves on one's own veins may be shown; the movements of respiration may be observed... The prick of a needle will yield, in a drop of one's own blood, material for microscopic observation...'[38] Consequently Huxley suggested that biology should be taught at all ordinary schools and a programme should consist of elementary human physiology and botany.[39] However, there were two aspects of a zoology programme thought inappropriate for students: the use of dissections in teaching and the teaching of reproduction.[40] It was thought that the girls would find dissections unpleasant, and this reflected Huxley's belief that women were biologically inferior to men. So they were encouraged to pursue the botanical sciences. Huxley had tried to reform the botany syllabus by introducing plant morphology, anatomy and physiology.[41] Huxley's promotion of physiology rather than evolutionary biology, highlighted his commitment to inductive methodology.

Huxley promoted the theory of evolution by natural selection as a means for the lowly down trodden masses to overcome prejudice and aspire to greater heights.[42] Under the tutelage of Huxley, the laws of natural selection would be translated into Social

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[36] Bibby, 1971, p. 53 Lecture given on 22 July, 1854 to the Society of Arts Exhibition, entitled: 'On the Relation of Physiological Science to other Branches of Knowledge.' For a more recent collection of Huxley's works see: T.H.Huxley, *The Major Works of Thomas Henry Huxley*, ed. Alan P. Barr, Athens: University of Georgia Press, 1997.
[37] ibid., p. 56.
[38] Bibby, 1971, Huxley on Elementary Instruction in Physiology (1877), p. 155.
[39] ibid., Essay on the Study of Biology (1876), p. 153.
[40] Jenkins, p. 118.
[41] ibid., p. 108.
[42] ibid., p. 508.

Darwinism, with the consequence that in society only the fittest would survive.[43] Huxley gave 'dignity on lowly parentage and promised better things.'[44] Huxley promoted the interconnectedness between his professional and social interests by suggesting that the stability of the state depended on both science and Darwinism.[45] Huxley had maintained that science was just organised commonsense and that the 'vast results obtained by science were won by no mental process other than those practised by everyone of us, in the humblest and meanest affairs of life.'[46] The methods of science could be employed to provide a means of attaining the 'truth' and objectivity. By distancing science from ideology, he was able to appeal to the scientist and science as independent and neutral arbiters with regards to social and political problems. Thus the ideologically neutral Darwinism was employed by Huxley to provide evidence that the 'inferior' could not compete in an open society.[47] The theory of evolution was nothing more than an insight into organic origins. Huxley instead used it as a guide for living and he was determined to make evolutionary theory yield social benefits which were beyond its scope.[48] The Darwinian Revolution, the theory of common descent, had provided a scientific revolution affecting not only science but also society.

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[43] Evelleen Richards, Huxley and Woman's Place in Science, *History, Humanity and evolution*, ed. James. R.Moore, Cambridge: Cambridge University, 1989. Richards has suggested that recent scholarship has begun to undermine the traditional historiographic distinction between Darwinism and Social Darwinism by arguing that Darwinism was 'social' from the start and that 'Social Darwinism' was a discourse which attempted to divorce science from ideology. Richards suggests that the process, it would seem, actually began with the 'young guard' Darwinians with Huxley at the helm. See also: James Moore, Socializing Darwinism: Historiography and the Fortunes of a Phrase, *Science as Politics*, ed. Les Levidow, London: Free Association Books, 1986, pp. 38-80.

[44] ibid., p. 508.

[45] Richards, p. 276. Huxley privately, according to Levine, was suspicious of speculation such as that in *Origins* believing that Darwin's theory was not science. Thus in Huxley's text books evolution was excluded. George Levine, Huxley, the Most Powerful Sage of Them All, *Victorian Studies*, 42: 1, 1998, p. 101. Huxley privately did not endorse evolution but publicly he used it to professionalise science away from privilege and inheritance. His relationship to the working class declined when he failed to adhere to any social reform and he was seen to support power to the professional, not to the people. Desmond, 1997, p. 334.

[46] Jenkins, p. 49

[47] Richards, p. 277

[48] John R. Durant , Evolution, Ideology and the World View: Darwinian Religion in the Twentieth Century, in *History, Humanity and Evolution*, ed. James. R. Moore, Cambridge: Cambridge University, 1989, p.362.

5.5 Demand for Practical Science

By the end of the nineteenth century the New Zealand Director General of Education, Hogben, wanted agriculture to be taught in schools, but there was strong opposition from both teachers and pupils. Agriculture, when it was taught, tended to be viewed as a vocational course for the rather 'dull boys' and Lincoln Agricultural College demanding its students have a training in the basic sciences not agriculture. Hogben was determined that science had to be practical and relevant to the student and that secondary schools had to provide opportunities for students to conduct individual practical work such that

> ... it should be obvious, moreover, that the science subjects chosen should as far as possible have relation to the surroundings or future of life of the pupil; in every country district high school, for instance, elementary physiology, and physics and chemistry so far as they touch on the common facts of country life and rural pursuits - should form the main basis for scientific training.[49]

Hogben wanted local industry to be reflected in the schools choice of science subjects with results which would include that agricultural science was studied in the rural community and geology in the mining centres.[50] Hogben's legacy was to ensure that practical work, as opposed to teacher demonstrations, became the norm in most science classes.

World War 1 became a watershed for science teaching, as the soldiers' ignorance about common scientific principles gave a new purpose to educational reform. Survival in warfare demanded a basic understanding of common scientific principles and its applications. School science courses had to be more relevant to the pupils with material for practical work to be taken from the students' own environment. It was argued that for girls it should come from the home and in the case of the rural community from agriculture. Nature study was seen to awaken the interest of the elementary student by appealing to their sense of wonder. In England biology became a School Certificate subject in 1918 but the Thomson Committee (1918) stressed that they did not see the introduction of biology as a science option for girls but would

[49] AJHR, 1905, E-12, p.5.
[50] Report of the Minister of Education for the Year Ending December 31, 1906, AJHR, 1907, E-1,

rather they undertook more study in the physical sciences.[51] This had been helped by the development of coeducational schools in the early part of the century, enabling girls to study the physical sciences, which were considered a good basis for specialised study in biology.[52] In New Zealand, biology was not available as an examinable subject until 1934 when the School Certificate Examination was introduced, but students had to wait until 1937 for a prescription to be written.[53]

5.6 Biology as Useful Knowledge

During the 1920s the promotion of biology was usurped by greater demand for general science, with biology seen as forming part of a united study of science. The general science movement, which had begun in the UK, had spread to New Zealand and its supporters promoted the importance of a general course in science as part of a general education. The biological studies of the past, principally zoology and botany, were realigned under general science to deliver a basic understanding of health and hygiene. This change had been brought about by the rise in sexually transmitted diseases during and after World War 1. In England a programme to educate its citizens in basic health and hygiene practices had failed due to the public's limited understanding of basic biology. In 1925, the British Social Hygiene Council was formed and also promoted the teaching of biology in schools.[54] The group anticipated that schools could teach students about the pathology of disease in their biology programmes. To allay concerns that biology would become associated with sex education, the British Social Hygiene Council actively promoted the teaching of biology as a science. Their journal 'Biology' provided teachers with ideas for laboratory work.[55]

The demand for biology in schools increased during the 1930s. This was in part due to the developing pharmaceutical industry, with its expansion into research, which created opportunities for biology graduates and awakened its vocational

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p. XX.
[51] Jenkins, p. 120
[52] Searle, pp. 45-6
[53] Biology had appeared briefly as a UEE subject in 1882 but was deleted in 1888.
[54] Jenkins, p. 132.
[55] ibid., p. 134. The *Education Gazette* during the 1930s regularly contained practical advice for the teaching of biology in New Zealand schools.

possibilities.[56] Biology was useful knowledge through its applications to farming, horticulture, pest control and healthy living and it had the potential to be the science for the non scientist. So the physical sciences could be studied by students who wished to pursue careers in science but that humanities students would be better served by studying biology, which would provide useful knowledge such as the teaching of hygiene and physiology.[57] Such divisions were frowned upon as biology was seen as being relevant to every student by providing a ' ... valuable knowledge of the human body, of facts of sex, and of reproduction are accumulated and assume proper proportions'.[58]

The SSA recommended that biology should form part of a general science programme in recognition of its contribution to the life sciences.[59] In 1935 a sub committee of the SSA considered the neglect of teaching biology in secondary schools and recommended that biology be incorporated into a general science programme. They were very much against early specialization in science because the main purpose of secondary education should be to '....awaken the interest, and satisfy the craving for knowledge of the many rather than to provide early specialization for the very few.'[60] However the biology was still very focused on functionalism, zoology and botany, failing to take account of the advances in evolutionary biology.

5.7 Biology for Citizenship

The 1930s were also characterised by a rise in the biology for citizenship movement, in part due to the concern over the rise of Fascism, Nazism and Bolshevism.[61] The group called itself the 'Association for Education in Citizenship' and were determined to show that biology education would act as a bridge between the fundamental and social sciences through the contemplation of biological problems. A series of lectures was delivered entitled 'Science and Citizenship'. They were supported by the Science Masters Association (UK), and some of them were reprinted from time to time in the Education Gazette in New Zealand. The lectures agreed that the content of the

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[56] Jenkins, p. 119.
[57] 'Science in Secondary Schools for Girls', *Education Gazette*, XI: 5, 1932, p. 76.
[58] ibid.
[59] 'General Biology', *STA*, II: 3, 1935, p. 15.
[60] ibid., p.6.
[61] Jenkins, p. 135.

biology curriculum should give prominence to the role of biology in meeting human need.

The citizenship movement wanted society to be aware of the benefits that science had brought the individual. In an address to the British Association for the Advancement of Science, Professor Lancelot Hogben of the Education Section of the Association, stated that: '... the use and misuse of science intimately affects the every-day life of every citizen in a modern community.'[62] Professor Hogben attacked the control by the Universities of the school curriculum which was too academic and far removed from the reality of the student such that: 'It has few, if any, explicit contacts with the social applications of biological discoveries or with everyday experiences of children brought up in congested urban centres...'[63] According to Professor Hogben, natural science can claim a place in the school curriculum because in the age of hydro-electric power and aviation, science has changed the world and so is important in a cultural context.[64] During the same year it was suggested in the *Year Book in Education* that the teaching of biology was important to citizenship:

> ...biology is that most obviously related to the problems of government; its significance with regards to questions of public health, problems of population and social hygiene make its study in proper hands an admirable training for citizenship. It is probable, however, that the importance of these human aspects of biology are only just beginning to be realized and are only comparatively rarely stressed.[65]

According to Professor Hogben, science had a role to play in educating the 'citizen and statesman' but the decision to include a non-specialist science programme was the responsibility of the educationalists not the scientist.[66]

The importance of a true understanding of biology for citizenship lay in '...an understanding of physiological principles and the value of personal hygiene and

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[62] *STA,* III: 6, 1936, p. 8.
[63] ibid.
[64] ibid.
[65] Eva. M. Hubback, 'Training for Citizenship in the UK', *Year Book of Education 1936,* ed. Harley V.Usill, London: University of London Institute of Education, 1936, p. 532.
[66] *STA*, III: 6, 1936, p. 8.

household hygiene will affect social hygiene in the widest sense.'[67] Biology had the potential to enable the principles of diet and nutrition to be understood, to teach the understanding of the mind enabling the student to distinguish '...emotion, prejudice and reason.'[68] It was even suggested that social evils spring from biological causes. The administrator of a colony might do better to understand the 'biology of his territory and its inhabitants' and the local magistrate should have knowledge of the disease of the mind.[69] A study of biology should involve the student understanding the interrelationships of all organisms and recognizing the similarities rather than differences and 'as he grows older he will be forearmed, in some measure, though perhaps unconsciously, with the knowledge that should help him, as opportunities occur or are sought out, to put the essentials of good citizenship into practice.'[70] From their biological studies citizens would be able to grasp their position in the hierarchy of living organisms and see themselves as higher beings thereby being able to distinguish between good and evil.[71] Biology as a subject could be included in the post primary school curriculum because it was culturally important.

5.8 Biology as part of General Science

In New Zealand by the late 1930s there was a growing awareness of the cultural importance of biology: '... chemistry and physics fail to guide the majority of pupils and adults along lines that led to a greater understanding of the problem that concerns them namely "How to live"'.[72] A Biology course would encompass botany, health, hygiene and nutrition, so its inclusion could be justified, along with all subjects that it is useful knowledge, provides a mental discipline and a necessary part of culture.[73] The Director of Education, Beeby, suggested that in a democracy one must educate to understand and thus 'amongst the sciences biology must, at all stages, play an

[67] Alan Peacock, 'School Biology and Citizenship', *Education Gazette*, August 1, 1936, p. 132, see also 'School Biology and Citizenship', *Education Gazette*, August 1,1936, p. 132.
[68] ibid.
[69] ibid.
[70] ibid., p. 133.
[71] ibid.
[72] Davis B.M., 'Biology in New Zealand Schools', *Education Gazette*, XX: 2, 1941, p. 2.
[73] 'Biology in New Zealand Schools', *Education Gazette*, XX: 3, 1941, p. 34.

increasing part.'[74] The importance schools attached to biology can be seen in the increasing numbers of students studying it (refer Table 5.1).

During this time tertiary study in the biological sciences was confined to botany or zoology. In 1937 there were 111 students studying botany of whom 47 were female and 286 studying zoology of whom 63 were female.[75] These figures had increased by 12% for Botany and 40% for Zoology in the previous ten years.[76] The comparable figures for the physical sciences show that in 1938, 498 students studied chemistry and 448 studied physics. This was an increase of only 2% over the previous ten years. By 1948 all of the sciences exhibited a dramatic growth in student numbers with Botany having an 80% increase on 1938, Zoology 67%, Chemistry 66% and Physics 62%. In addition, 1948 saw the appearance of a separate subject of biology, which had 38 students on the course of which 39% were female.[77]

Table 5.1 Percentage of High School Students studying Science in 1931 and 1941[78]

		High School		Combined Schools		Technical Schools	
Science	Year	Boys	Girls	Boys	Girls	Boys	Girls
Chemistry	1931	40.6	0.6	41.8	-	11.4	7.0
	1941	45.1	1.4	36.7	0.4	16.9	7.3
Biological	1931	1.8	3.8	0.2	1.2	3.3	0.5
	1941	1.1	8.9	5.5	9.3	4.1	2.0
Domestic	1931	0.1	64.7	2.0	72.7	0.7	77.5
	1941	0.7	66.2	4.5	85.7	2.3	73.2
General	1931	34.0	29.8	33.6	25.9	29.6	6.3
	1941	26.0	20.6	27.6	1.6	19.0	10.6
Magnetism/ machines	1931	12.5	-	12.4	-	31.1	3.7
	1941	11.3	0.1	18.2	-	31.9	-

All shaded squares show an increase in percentage of pupils studying the science during the period 1931 to 1941. The horizontal shading indicates the subjects which have recorded a decrease in the number of students studying the subject.

The New Zealand Association of Science Workers (NZASW) supported 'biology for citizenship' movement hoping it would make the boy or girl a responsible member of

[74] C.E.Beeby, 'Education for Democracy', *Year Book of Education 1940*, ed. Dr. F.H.Spencer, London: University of London Institute of Education, 1940, p. 377.
[75] Higher Education, AJHR, 1938, E-7, p. 3.
[76] ibid., and Higher Education, AJHR, 1928, E-7, p. 3.
[77] Higher Education, AJHR, 1948, E-7, p. 4.

the community.[79] Accordingly, the key ingredients of a biology programme were nutrition, physiology of plants and animals, biology of human and social relations, heredity, public health and hygiene and economic biology.[80] The science workers were concerned that a boy could go through his entire schooling without learning anything about biology. Their survey showed that boys had more hours available to the main science compared to the girls. Thus they recommended that biology be given equal time to that of Chemistry and Physics, but they recognized that in the short term the lack of qualified teachers would hamper its inclusion because university graduates of the biological sciences were specialists rather than generalists, as degrees couldn't be taken in general biology. Similarly, the Auckland Science Teachers noted that 'for a start at any rate optional courses are desirable in many schools the general instruction of biology, say, would for some years not be easy, owing to difficulties of staffing and equipment.'[81]

By the beginning of the 1940s the proficiency examination had been abolished and large numbers of non-academic students were entering the post-primary schools creating pressure to develop courses suitable for them. Thus general science was being widely accepted as a course in science for students who did not intend completing specialised study in science. If reform of the science curriculum was to occur then many felt that biology had to become a compulsory subject. In 1941 the New Zealand Women's Teachers Association sent four remits in relation to science to the Minster of Education, Mason, for his consideration. They were: that the biology become part of teacher training (remit 10); that biology be given a definite place in the secondary school curriculum (remit 11); that biology is necessary for general culture and should be taken by all pupils (remit 12); and finally that teaching of hygiene be compulsory to all pupils (remit 13).[82] In reply Mason pointed out that biology did have a place in the curriculum (remit 11) such that 149 candidates presented for UEE Biology in 1940.[83] He also noted that, General Biology had been available as a

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[78] Murdoch, *High Schools of New Zealand*, NZCER: Wellington, 1943, p. 122.
[79] 'Science Teaching in Schools', *NZ Science Review*, 3: 3, 1945, pp.6-7.
[80] ibid.
[81] *STA*, IV:1, 1937, p. 12.
[82] E2 1946/27a, E29/47/3 part. Minutes of NZWTA Annual Meeting 1941.
[83] ibid., Reply from Minster to NZWTA, 4 September, 1941.

School Certificate subject since 1934 but girls had been prevented from taking it due to their compulsory cooking courses.[84] Mason was reluctant to make biology compulsory (remit 12):

> The Department would prefer that instruction be given in a group of sciences including biology or some form of general science. The whole problem is linked up with the present UE requirements of a foreign language. If a change is made in this direction, and this is recommended, it will not be difficult to find the time in secondary school for the group of science subjects which the department desires.[85]

Students had been required to sit the UEE in one of four foreign languages: Latin, Greek, French or German. In the 1930s a student had to pass in five subjects of which: English, mathematics and a foreign language were compulsory. If a student did not pass either Greek or Latin he/she had to pass in a science.[86] Similarly, in Law Latin was demanded as one of the compulsory subjects and for dentistry the student had to pass in one of the foreign languages and physics or chemistry or home science.[87]

The matter of introducing compulsory hygiene and health (remit 13) into the curriculum was rejected by the Minister of Education as he was reluctant to increase the number of compulsory subjects. However, he noted that girls had to take Home Science for two years and it included these topics:

> Home science, including elementary general science relating to the home and domestic hygiene, not less than one unit, together with one or more of the following in conjunction with economical management: Plain cooking, handy work, needle craft and garment making, home nursing.[88]

Mason passed the remits to the Minister of Health for comment who replied that: 'I shall be glad to discuss with you at any time the possibility of inaugurating in schools

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[84] E2 1945/6a, E29/2/61, part 1. Letter from the Australian and New Zealand Assoc. for Advancement of Science, 4 February, 1935 and a reply from Lambourne, Director of Education that he supported Biology but changes were hampered by the Public service examination.
[85] E2 1946/27a, E29/47/3, part 1- General Resolutions Urging reform in the Education System, 1930-45. Reply from the Minister to NZWTA, 4 September, 1941.
[86] Thomas *et al*, p. 39.
[87] ibid., p. 41.
[88] E2 1946/27a, E29/47/3, part 1. Reply from the Minister to NZWTA, 4 September, 1941.

courses in biology, hygiene and other subjects which might concern my department.'[89] The remits were finally passed to the Thomas Committee and the Health Revision Committee for their consideration.[90]

5.9 Compulsory Biology

In 1943 the Thomas Report recommended that general science be a compulsory core subject and that biology form an integral part of the course. The content of the course was decided by the science sub committee who were guided by the Science Masters Association Report. The SMA had divided the general science course into the three main areas of physics, chemistry and biology and the Thomas Committee adopted their recommendations for content. Biology consisted of botany and zoology with cell biology being incorporated into a study of living things.[91] The main focus of the programme was health, nutrition and reproduction, thereby reinforcing the belief that biology was a functional science. A member of the Thomas Committee and President of SSA, E.N.Hogben, noted that biology had the potential to meet important social objectives of education such as the delivery of health and recreational programmes to assist in the development of healthy citizenship.[92]

By focusing on functional biology there developed a mistaken belief that all biology relies on quantitative methodologies, thereby making it suitable for a general education. It was suggested that biology teaches a reliance on observation, whereby students would be encouraged to develop intellectual honesty and confidence in nature's laws, and develop a willingness to order their lives accordingly.[93] In addition, biology had the merits of teaching the young adolescent how to use plants for their own benefit, to develop the study of plants as a hobby and to stimulate an interest in applied science by encouraging reading.[94] The *Auckland Star* reported that:

> The teaching of biology is one (debatable point). Many educationalists are strongly of the opinion that this is an essential in developing a healthy attitude

[89] ibid., Reply from Minister of Health, 12 September, 1941.
[90] ibid., Letter to Miss Cornes, President NZWTA, 5 January, 1943 from the Minister of Education.
[91] Thomas Report, p. 37.
[92] *STA,* IX: 2, 1942, pp. 15-16.
[93] *Education Gazette*, XX: 2, 1941, p. 12.
[94] ibid.

> towards moral problems. Others are equally opposed to the suggestion....It seems to be held by the majority that the change is basically sound.[95]

The content of biology programmes had been manipulated by educationalists to meet societal demands that a basic level of understanding and competency in matters relating to the human body was an essential requirement for responsible citizenship. Just as Huxley had appealed to science as neutral arbiter in social and political matters, so too did educationalists appeal to biology to help define citizenship. The introduction of biology into the post-primary school failed to acknowledge recent developments in the biological sciences, instead highlighting its unity rather than its diversity. Three important fields of contemporary biological study show its diversity: ecology, ethology and molecular biology.[96] Ecology predominantly focuses on behavioural problems and thus natural selection. Ethology considers species specific behaviours that have genetic links such as courtship behaviour. Finally, molecular biology is an ever-expanding branch of biology which considers the biology of molecules, their modifications, interactions and evolutionary history.[97]

Biology is a term used by educationalists to define the study of living things in relation to humans. It fails to represent the diverse field of biological scientific endeavour by focusing on functional biology and the use of quantitative analysis. It fails to acknowledge the importance of values and ethics in science. There are similarities in the development of both biology and general science post-primary school programmes, where science has been taken out of its specialist paradigms. The gap between the claims of science by scientists and those by educationalists, will be discussed in the next chapter.

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[95] E2 1943/3b, E29/2/75, part 1. 'Soft options', *Auckland Star*, 27 October, 1943.
[96] Mayr, p. 120.
[97] ibid., p. 122.

Chapter 6 - Science is Science

This chapter will show that current school science programmes give a mistaken view of science as an inductive-deductive process. General science requires a supply of teachers who are adequately trained in the background ideas of science and until that happens it will be described by the teachers own scientific specialism and the external examination prescriptions.

6.1 Teachers of General Science

Science teachers have struggled since the Thomas Report to balance the core requirements of the curriculum and the demands by students and parents to be prepared for external examinations. The Thomas Report had hoped that freed from the external examinations, as discussed in chapter 3, the schools would be able to develop science programmes which the adolescent would find interesting because they are affected by the achievements of science, and also that the 'scientific method' could be useful in a wider context.[1] Fifteen years after the Thomas Report, E.J.Searle, Lecturer in Education at Auckland Teachers' College, noted that the teacher was constrained in developing an innovative approach to science because of the large class sizes, infrequent access to classes and their own inadequate training.[2]

After 1945 all science teachers, graduates in a scientific discipline, were required to teach general science, but with no university precedent [training in this subject] the teachers were constrained by their specialist science paradigm. In the development of general science little account was taken of the importance of trained teachers, the needs of the large numbers of non-academic students entering the post-primary sector were paramount. In the absence of qualified teachers general science was reduced to the specialist subjects of physics, chemistry and biology with the School Certificate Examination reinforcing these divisions. Science teacher training programmes have tried to refocus the science graduate into developing an epistemology of science as process. Recently both Professor Ivan Snook, Professor Emeritus of Education at Massey University, and Dr. Michael Matthews, former Professor of Science Education at the University of Auckland, have expressed concern about teacher

[1] Thomas Report, p. 34.
[2] Searle, p. 251.

training programmes which emphasise science as process and downgrade the importance of scientific knowledge, such that 'One might ask whether the vision of good science teaching in New Zealand has gone forward at all in the last sixty years?'[3]

Matthews noted that most people would agree that '...intelligent, knowledgeable and engaging teachers, who are interested in children and know how to manage classrooms and teach creatively, are crucial in good education.'[4] The qualities of a good science teacher must undoubtedly be passion, enthusiasm and extensive knowledge of their subject.[5] Professor Ivan Snook suggested that if scientific knowledge is not valued in the classroom then it will be seen to be 'irrelevant' to life.[6] If subject competence is not valued in appointments and promotion of teachers then it will not be valued in the classroom. Professor Snook suggests that '...a full understanding of the content to be taught is the prime requirement of all teaching.'[7] It must therefore be said that no science teacher in New Zealand is currently qualified to teach general science or as suggested by Professor Hamley, be made to teach it.

6.2 Examinations Dominate Again

The Minister of Education, Mason, announced in 1942 that

> Freed from the burden of a narrow and irrelevant examination the schools will be able to devise courses having more relation to the abilities of their pupils and to the changing needs of the adult world.[8]

Mason was referring to the University Entrance Examination which was to be awarded by accrediting from 1944 after a long protracted discussion with the University Senate. Fifteen years later Searle noted that:

> ...as long as the post-primary school continues to be dominated by the School Certificate and University Entrance examinations with their restrictive

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[3] Michael Matthews, *Challenging New Zealand Education*, Palmerston North: Dunmore Press, 1995, pp. 133-36 and Ivan Snook, The Logic of Science and the New Zealand Curriculum, The Roger Osborne Memorial Lecture, SCICON 2000, Palmerston North, 2000, p. 9.
[4] Matthews, p. 195.
[5] Snook, p. 9.
[6] ibid.
[7] ibid. The Spens Report had recommended that Science Teachers have three sciences in their degree as preparation for teaching general science and that the physical scientists will need to study biology and the reverse for the biology graduate. Spens Report, p. 252.
[8] E4/1/5. Press Release, 5 November, 1942.

> syllabuses, science teachers will be unable to make their fullest contribution to the education of the adolescent.[9]

Thus the teacher continued to prepare students for the external examinations, just as they had done for the previous sixty years. This was a concern raised by a report on accrediting in Victoria by C.M.Gilray, as discussed in chapter 3, that teachers failed to take advantage of the freedoms given to them by the accrediting of the UEE. The requirements of the School Certificate examination prescribed the content and treatment of general science in the lower school, just as the UEE had. With the School Certificate General Science examination, divided into sections of biology, chemistry and physics, so too were the core curriculum requirements.

The Thomas Report had proposed that most students would sit one of the specialist sciences in the School Certificate examination, not necessarily general science. Searle noted that general science was being adopted as the main fifth form science and recommended that general science be removed as a School Certificate subject such that:

> ...some general science should be available for those who can still be satisfied with it, but the more able pupils will want something more precise and systematic. Where general science is done, it should be non-examinable. Its direction should be determined by the interests of the teacher and pupil.[10]

He went on to add that by the fourth form (Year 10) 'some formal study of a particular science should be begun with some - the more able pupils - because by then it will be wanted by them.'[11] But adoption of his recommendation was the exception rather than the rule. By the end of the twentieth century general science had become the main science for fifth form (Year 11) students, with able students sitting one or more of the specialist sciences in addition to, rather than instead of general science. The Thomas Report had failed to free the schools from the constrictions of the external examinations and science was still taught as if the subject matter was 'all-important, with little comprehension of its richer potentialities in education.'[12]

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[9] Searle, p. 246.
[10] ibid., p. 249.
[11] ibid., p. 248.
[12] ibid., p. 251.

6.3 Making Sense of the World

The Thomas Report had hoped to reform the content of science to make it more relevant to the student since '...the course should be based on the child's experience...', and similar sentiments are to be found in the current science curriculum which recommends the teacher develop everyday contexts for the delivery of its key objectives.[13] By making the content of science more relevant to the student, it was hoped that they would be able to 'make sense' of their world. The new educationalists and the NEF had been very determined to free the curriculum from abstractions and develop a more child centred approach to learning as advocated by Dewey. As already shown, science teaching was constrained by the requirements of the School Certificate Examination which emphasised knowledge recall and placed little emphasis on investigation in science as advocated by Professor Armstrong.

The current science curriculum encourages the development of science programmes to meet the needs of individual students. Teachers are asked to develop programmes within four main areas: Making Sense of the Living World, Making Sense of the Material World, Making Sense of the Physical World, and Making Sense of Planet Earth and Beyond. Thus, it was hoped, teachers would have the freedom to develop innovative programmes. But the divisions have proved contentious, with Matthews interpreting 'making sense of the world' as allowing the student to construct scientific knowledge as a way of understanding.[14] But Matthews notes that science does not always make sense. In a recent address, Professor Ivan Snook commented that 'making sense of our world' means that the student must be able to build onto the understandings it already has.[15] This relates to Herbart, a philosopher in the nineteenth century, who said that a child can only learn something if it can latch onto ideas it already has in its head, which he called 'apperceptive masses'.[16] Professor Ivan Snook warns that this does not mean that children can construct the knowledge in any way they choose, but they must be able to distinguish between science and other forms of knowledge.

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[13] Thomas Report, p. 35.
[14] Matthews, p. 82. See also: B.Bell and R.Baker, *Developing the Science Curriculum in Aotearoa*, New Zealand: Addison Wesley, 1997. It is not the intention of the author to analyse the debate but the reader should be aware of the tensions surrounding the document.
[15] Snook, p. 3.

The problem with the current science curriculum is that it tries to give students an insight into the world of the scientist, but because it appeals to everyday experiences to help the child understand the world, it removes the abstractions of science from their paradigm.[17] The child is taught within a context of 'relevant to', making the science simplistic and requiring a multiplicity of separate justifications and no sense of the power of a theory, even a tentative one, to connect and discipline these ideas. Richard Dawes had developed the 'science of common things' approach to teaching science. Albury has suggested that this ontological commitment in science teaching programmes creates dogma, preventing the development of critical thinking and misses a vital opportunity to have the student experience both the explanatory power of theory, and how it can be open-ended and generally mutable, without collapsing into an anything-goes relativism.[18]

6.4 Why Teach Science ?

The Thomas report suggested that general science had to be taught as preparation for citizenship, and that the content of the course was described according to societal needs rather than those for science. But as already discussed in chapter 2, the translation of ideals into curriculum content presents a discrepancy between the claims of science by scientists and educationalists. The curriculum document should provide practical guidance to the teacher and provide boundaries for the content of education.[19] However the curriculum document is not free from particularistic commitments. Professor Ivan Snook cautions the teacher to read the curriculum document within an understanding of society's traditions, cultures and 'political debates overt and covert'.[20] This is wise advice with regards to the Thomas Report.

While we no longer believe that education is just for citizenship, Professor Ivan Snook has suggested six reasons for including science in the core curriculum: developing

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[16] ibid.
[17] Randall Albury, 'Science Teaching or Science Preaching? Critical Reflections on School Science', in *Science Under Scrutiny: The Place of History and Philosophy of Science*, ed. R.W.Home, Dordrecht: D. Reidel, 1983, p. 164.
[18] ibid., p. 165.
[19] Snook, p. 2.
[20] ibid.

critical thinking - the scientific attitude, understanding that science is in fact 'sciences', scientific knowledge, recognising the importance of the relationship between science and society, that science aims at truth, and finally the role of ethics and values in science.[21] While he would agree that science does not have the monopoly on most of the above, only a study of science can impart scientific knowledge. Science should be taught, according to Alan Chalmers, Associate Professor in Philosophy and History of Science at Flinders University, so that the student can '...become acquainted with and take advantage of what has been learnt, both theoretically and practically'.[22] According to Chalmers the science teacher should not diminish the value of hard won content of science which has impacted on our lives.

School science programmes must give students an idea of the kind of thing that science is. Too often the 'wow' in science is stressed but the caricatures of science are misleading and depict science as a logical process outside of its social context. The stories of science fail to acknowledge the importance of prior learning, serendipity and debate in scientific endeavour. This was shown in a recent study of William Harvey by the author.[23] Often referred to as the father of modern anatomy, his work is usually described as a 'wow moment' with Harvey 'discovering' in 1628 that the blood circulated around the body. However Harvey's description of the circulatory system in humans (published in 1628) was the result of nearly twenty-eight years of research.[24] A detailed study of Harvey's research programme highlights aspects of the nature of science.

Harvey had been constrained in his work by adopting the teachings of Galen (130-200AD), which formed a Kuhnian paradigm. A Kuhnian paradigm describes the activities of 'normal' science and usually has a great work or exemplar which provides the framework for the research. The scientist must accept without question

[21] ibid., pp. 5-8.
[22] Alan Chalmers, 'A Role for History and Philosophy of Science in Science Teaching', unpublished, July, 2000.
[23] Lyn Nikoloff, 'Science is Not an Inductive Process', unpublished, 1999.
[24] ibid.

the exemplar.[25] Before Harvey could make progress in his understanding of the main action of the heart he had to discard the teachings of Galen and then, according to Kuhn, a scientific revolution would occur, involving a period of instability until another paradigm is formed. Harvey went on to form a Lakatos research programme with the heart as a pump its hard core.[26] In a Lakatos research programme the work is conducted in the protective belt around the hard core and usually has methodologies available to the research programme. Lakatos suggested that two defining rules are necessary for a research programme: the negative heuristic rule states that the hard core of the research programme can not be altered or amended in any way and the positive heuristic rule states that the protective belt maybe amended so as to keep the hard core consistent with experimental results.[27] Thus for Harvey there was no 'wow' factor in his work. Before his great achievement he was constrained by the Galen paradigm. After it he was the first to work in his own, new, heart-as-pump research programme. In between was a period of struggle lasting over twenty years. A true understanding of Harvey's research programme has to occur within an understanding of its social context and his own long battle with ideas.

Too often school science programmes give a misleading understanding of the nature of science as an inductive-deductive process by placing undue emphasis on the importance of 'science-as-method'.[28] This was particularly prevalent in the views held by early educationalists such as Huxley, Armstrong and Dewey as discussed in chapters 2 and 5. In addition the New Zealand Department of Education had a number of Director's who adhered to this mistaken belief including: Hogben, Strong and Beeby. Induction depends upon three main points: that a large number of observations are made, that they are collected in a variety of conditions and that no observations are in conflict with the suggested law.[29] In the absence of a clear definition or indication of the number of observations required, or how many variable conditions must be tested, it is left to the research scientist to define the parameters of

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[25] Thomas S.Kuhn, *The Structure of Scientific Revolutions*, Chicago: University Press, 1962, p. 11.
[26] Nikoloff, p.37.
[27] Alan Chalmers, *What is This Thing Called Science?,* Australia: University of Queensland, 2nd Ed, 1982, pp. 80-82. Chalmers suggests that the positive heuristic is difficult to define but is essentially an indication of what scientists should do rather than what they should not do.
[28] Thomas Report, p. 36. The general science course was to include 'A simple study of living things, with more detailed study of selected plants and animals'.

the experiment. Inductive reasoning suggests that after making a 'number' of observations, in a variety of conditions, a general 'truth' can be made which can then be used for deductive reasoning. But science is not an inductive process and all those who adhere to this belief, such as educationalists, have a mistaken view of the nature of science. The actual work of the scientist can be said to occur within a paradigm or research programme, as shown above.

Chalmers suggests that if we accept that science is an inductive-deductive process then its reliability is dependent on the facts, which are derived from observations. There are two main problems with the 'science-is-proven-from-the-observable-facts' scenario. Much of science is built up from theories which are not derived from observable facts because they, at the time, were unobservable e.g. electrons and genes.[30] In addition observable facts are not infallible but contain error. Science is more than a derivation of facts from observations; it involves the development of theories which await confirmation or to be overthrown by new ones. Science never starts from scratch, except in new areas of science, and so scientists do not behave as discoverers but work within their paradigm or research programme. There is no 'wow' in science but slow progress, as methodical as possible, but often passing through periods of painful confusion and doubt..

Chalmers warns the science teacher not to diminish the value of hard won scientific facts, and that science programmes must teach the content of science which has impacted on our lives. Science has a superior place in society's consciousness endowing science with societal and educational responsibilities. This was particularly important in the development of biology programmes as described in chapter 5. Chalmers also notes that there are experiments which survive changes in theory, and so experiment in science is one of its key components, sometimes providing the answers before the theory is developed and these experimental findings may even survive a 'scientific revolution'.[31] Students should be made aware of the importance of experimentation in science but it is naive to suggest that the hard won facts of

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[29] Chalmers, 1982, p. 4.
[30] ibid.
[31] Alan Chalmers, *What is this thing called Science?*, Indianapolis: Hackett Publishing Co., 3rd Edition, 1999, pp.193-209.

science are derived from general methodologies. The sciences have evolved methods specific to the science incorporating sophisticated intellectual constructs and the methods themselves are sometimes what is up for challenge and revision.

Science has moved western culture from its reliance on witchcraft and superstition to understanding the physical processes which shape the world by use of empirical methods. It has also enabled humans to manipulate their world in a manner that even sixty years ago was inconceivable. Decisions have to be constantly made as to the value and ethics of scientific endeavour. Both Chalmers and Snook agree that science programmes must teach the students to distinguish between science and other forms of knowledge. But if we allow science programmes to be broadened to include cultural practices then the door is open for astrology and creationism to claim a place in our science programmes. Chalmers has suggested that:

> The main aims of teaching science in schools is to acquaint students in an introductory way with the methods and content of the various sciences....to give students a good idea of the kind of thing that science is, both as a special kind of knowledge and as a practice relating to other facets of society.[32]

Albury has suggested that by bringing science into conflict with common sense knowledge, such as cultural practices, neither are devalued but limitations are set on the applicability of each.[33]

[32] Chalmers, 2000, p.1.
[33] Albury, p. 169.

6.5 Conclusion

To the educational reformer, equality of opportunity could mean the chance for every child to be encouraged to extend themselves or as De Tocqueville so aptly described it '...leading the mind to untried thoughts'. [34] Alternatively, it could aim to make all children the same as the Thomas report suggested:

> Reform depends in the last analysis on the existence of a public which will think of education less as a means of individual advancement, and more as a means of creating an educated community.[35]

Once again, De Tocqueville warns that the consequence of equality of opportunity for uniformity could mean that the '...human mind would be closely fettered to the general will of the greatest number.'[36] Such sentiments are voiced by Lester Smith, who suggested that the aims of educational reconstruction in Britain should have been to '...furnish a democratic society with a culture which, while rich in its diversity has an ethical pattern ... a standard mind.'[37] The Thomas Report supported the notion of a standard mind in education, suggesting that the child be prepared: '... for a place in our New Zealand society as worker, neighbour, homemaker, and citizen.'[38] The development of a standard education requires standardised assessment methods, and the Thomas Report was constrained, as reports before and since, by societal demands that post-primary schools prepare students for external examinations.

New Zealand's educational history can be described as either a slowly evolving process or as 'punctuated' evolution, where great events or decisions cause radical changes to educational philosophy or direction. The central thesis in this study suggests that education in New Zealand has been a slowly evolving process, accommodating the changing needs of a maturing country and economy. Historically secondary education in New Zealand had been copied from the English model, as an education for the burgeoning middle-classes. The content of this education was based on tradition rather than the needs of the student. By the end of the nineteenth century

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[34] Bantock, p.43 citing De Tocqueville.
[35] Thomas Report, p. 6.
[36] Bantock, p.44 citing De Tocqueville.
[37] Smith, p. 18.
[38] Thomas Report p. 5.

as the world began to benefit from scientific discoveries and understanding, then cogniscence was taken of its potential contribution to education. Perhaps the new educationalists thought that scientific education could take the child along a pathway of discovery.

Since the introduction of general science into the post-primary curriculum sixty years ago there is still no specialised training for teachers in this important curriculum area, a training that must stress the background ideas of science and thereby emphasise the importance of science in education. The history of developing general science education in New Zealand shows that various selective mechanisms impacted on the development of the course. Thus it is wise advice to understand the introduction of general science within a broader context such as society's 'traditions and cultures, and political debates overt and covert.'[39]

[39] Snook, p.3.

Bibliography

1. Primary Sources

1.1 Manuscript

1.1.1 National Archives -Department of Education Files

E2 1936/4g, E12/1/7 - Report of Director of Education on Overseas Visit, 1935-36.

E2 1940/2a, E29/2/66 - Education Systems Institute of Educational Research, 1932-40.

E2, 1943/3b, E29/2/75, part 1-Miscellaneous Education Systems, 1937-43.

E2 1945/6a, E29/2/61, part 1- General Resolutions Urging Reform in the Education System, 1930-45.

E2 1946/3b, E4/6/1 - NZ SSA Conferences 1916-46.

E2 1946/21b, E26/19/27 part 1 - Secondary Education: Courses of Study and Instruction, 1933-46.

E2 1946/27a, E29/47/3 part 1- Resolutions and Remits of NZWTA, 1922-46.

E2 1947/16a, E29/2/5 part 2- Miscellaneous Education Systems.

E2 1947/34b, E39/4/6 part 1- Regulations - Post-Primary Instruction, 1945-47.

E2 1949/11b, E28/2/42 part 1 - School Books.

E2 1949/25b, E4/10/15- Conference on Post-Primary Education, 1922-49.

E2 1950/7b, E29/2/44 part 1 - Education Systems Overseas, 1922-50.

E2 1950/20a, E29/47/20 - Resolutions and Remits, 1940-50.

E2 1950/29c, E4/10/26 - Conferences and Congresses, 1940-40.

E2 1951/7a, E 29/2/79 part 1 - Miscellaneous Education Systems.

E2, 1952/1b, E 8/3/26 - School Attendance.

E2 1952/12a, E26/19/8 - Secondary Education Courses of Study, 1927-52.

E2 1954/37a E 39/2/17 part 1- School Certificate Examination Regulations.

E W2536, Box 4 - Post Primary Curriculum Conference - Verbatim Report of Proceedings, 1944.

E 4/1/5 - The Consultative Committee on Post-primary Education - Memorandum from Dr.C.E.Beeby, Director of Education.

1.1.2 National Archives -NZCER Files

AAVZ W3418, Box 17.

AAVZ W3418, Box 44.

1.2 Printed - Government

1.2.1 Appendices to the Journal of the House of Representatives

Report of the Minister of Education for the Year Ending December 31, 1984, AJHR, 1885, E-1.

Report of the Director of Technical Instruction (Riley), AJHR, 1898, E-5B, pp.1- 8.

Report of the Minister of Education for the Year Ending December 31, 1898, AJHR, 1899, E-1.

Report of the General Inspector of Schools (Hogben), AJHR, 1905, E-12.

Scientific and Technical Education on the Continent of Europe, AJHR, E-15, 1905.

Education Committee (report of the) on Scientific and Technical Education: Together with Minutes and Evidence, AJHR, 1905, I-14C.

Report of the Minister of Education for the Year Ending December 31, 1906, AJHR, 1907, E-1.

Report of the Minister of Education for the Year Ending December 31,1909, AJHR, 1910, E-1.

Education Commission (Report of) Together with Minutes of Proceedings and Evidence, AJHR, 1912, E-12.

Report of the Minister of Education for the Year Ending December 31, 1912, AJHR, 1913, E-1.

Report of the Minister of Education for the Year Ending December 31,1917, AJHR, 1918, E-1.

Report of the Minister of Education for the Year Ending December 31,1919, AJHR, 1920, E-1.

Higher Education, AJHR, 1923, E-7.

Reichel-Tate Report, Higher Education, AJHR, 1925, E-7a.

Report of the Minister of Education for the Year Ending December 31,1927, AJHR, 1928, E-1.

Higher Education, AJHR, 1928, E-7.

Recess Education Committee, Report of the, On the Education Reorganisation in New Zealand (Chair: Bodkin), AJHR, 1930, I-8a.

Report of the Minister of Education for the Year Ending December 31,1932, AJHR, 1933, E-1.

Higher Education, AJHR, 1933, E-7.

Report of the Minister of Education for the Year Ending December 31,1937, AJHR, 1938, E-1.

Higher Education, AJHR, 1938, E-7.

Report of the Minister of Education for the Year Ending December 31, 1938, AJHR, 1939, E-1.

Report of the Chief Inspector of Secondary Schools (Parr), AJHR, 1939, E-2.

Report of the Minister of Education for the Year Ending December 31, 1939, AJHR, 1940, E-1.

Report of the Chief Inspector of Secondary Schools (Parr), AJHR, 1940, E-2.

Report of the Minister of Education for the Year Ending December 31,1940, AJHR 1941, E-1.

Report of the Chief Inspector of Secondary Schools (Parr), AJHR, 1941, E-2.

Report of the Minister of Education for the Year Ending December 31,1941, AJHR 1942, E-1.

Report of the Chief Inspector of Secondary Schools (Caradus), AJHR, 1942, E-2.

Report of the Minister of Education for the Year Ending December 31, 1942, AJHR, 1943, E-1.

Report of the Chief Inspector of Secondary Schools (Caradus), AJHR, 1943, E-2.

Report of the Minister of Education for the Year Ending December 31,1943, AJHR, 1944, E-1.

Report of the Minister of Education for the Year Ending December 31, 1947, AJHR, 1948, E-1.

Higher Education, AJHR, 1948, E-7.

1.2.2 Various Publications

New Zealand Gazette, 22, pp.954-5.

The New Zealand Official Year Book, 1930 and 1942.

New Zealand National Review, 25: 2, 1943, pp. 18-21.

1.2.3 Reports

Education Dept., *The Post Primary School Curriculum: Report of the Committee appointed by the Minister of Education in November 1942*, 2nd ed., Wellington: Government Printer, 1959. (Chairman: W.Thomas).

Tate Frank, *Special Reports on Educational Subjects No. 16, Investigation into Certain Aspects of Post Primary Education in New Zealand*, Wellington: Government Printer, 1925.

1.3 Articles and Books

1.3.1 Articles

Anderson W., *The Flight from Reason in New Zealand Education*, Auckland: Auckland Catholic Teachers Association, 1944.

Loughnan Dorothea, *Report of Post Primary Education*, Auckland: Catholic Teachers Association, 1944.

1.3.2 Books and Reports

Board of Education, *Report of the Consultative Committee on Secondary Education with Special Reference to Grammar Schools and Technical High Schools*, London: HMSO, 1938, (Chair: W. Spens).

Council for Curriculum Reform, *The Content of Education: Proposals for the Reform of the School Curriculum*, London: University of London Press, 1945 (Chairman: J.A. Lauwreys).

Mason H.G.R., *Education: Today and Tomorrow*, Wellington: Government Printer, 1944.

Ministry of Education (NZ), *Science in the National Curriculum*, Wellington: Learning Media, 1993.

Science Masters Association, *The Teaching of General Science, Part 1*, London: John Black, 1936.

1.3.3 NZCER Publications

Beeby C.E., *The Intermediate Schools of New Zealand*, Wellington: NZCER, 1938.

Campbell A.E., *Educating New Zealand*, Wellington: NZCER, 1941.

Murdoch J.H., *High Schools of New Zealand*, Wellington: NZCER, 1943.

Nicol John, *The Technical High Schools of New Zealand: An Historical Survey*, Wellington: NZCER, 1940.

Searle E.J., *The Teaching of Science in Post Primary Schools*, Wellington: NZCER, 1958.

Thomas W., C.E. Beeby and M.H. Oram, *Entrance to the University*, Wellington: NZCER, 1939.

Webb Leicester, *The Control of Education in New Zealand*, Wellington: NZCER, 1937.

1.3.4 Journal Articles

Education Gazette, 1932-44.

National Education, 1938 and 1946.

NZPPTA Journal, 1959.

STA, 1933-44.

NZ Science Review, 1942-45.

Transactions and Proceedings of The Royal Society of New Zealand, 1941-47.

1.3.5 Lectures

Chalmers Alan, 'A Role for History and Philosophy of Science in Science Teaching', Keynote Address at SCICON 2000, Palmerston North, 2000, unpublished, 2000.

Snook Ivan, 'The Logic of Science and the New Zealand Curriculum', The Roger Osborne Memorial lecture, SCICON 2000, Palmerston North: unpublished, 2000.

2. Secondary Sources

2.1 Books

Albury Randall, 'Science Teaching or Science Preaching? Critical Reflections on School Science', *Science under Scrutiny: the Place of History and Philosophy of Science*, ed. R.W.Home, Dordrecht: D.Reidel, 1983, pp. 159-172.

Bantock G.H., *Education in an Industrial Society*, London: Faber and Faber, 1963.

Barlow Nora (ed.) *Darwin and Henslow, The Growth of An Idea*, London: John Murray, 1967.

Beeby C.E., 'The Education of the Adolescent in New Zealand', *The Year Book of Education 1937*, ed. Harley V. Usill, London: Evans Bros., 1937, pp. 219-38.

_____, 'Examinations in New Zealand', *The Year Book of Education 1938*, ed. Harley V. Usill, London: Evans Bros., 1938, pp. 225-240.

_____, 'Technical Education in New Zealand', *The Year Book of Education 1939,* ed. Harley V. Usill, London: Evans Bros., 1939, pp. 696-702.

_____, 'Education for Democracy', *The Year Book of Education 1940*, Dr. F.H.Spencer, London: Evans Bros., 1940, pp. 377-81.

_____, *Biography of an Idea, Beeby on Education*, Wellington: NZCER, 1992.

Bell B., and R.Baker, *Developing the Science Curriculum in Aotearoa*, New Zealand: Addison Wesley, 1997.

Best S. and Kellner D., *Post modern Theory Critical Interrogations*, MacMillan: London, 1991.

Bibby Cyril, *T.H.Huxley on Education*, Cambridge: Cambridge University, 1971.

Boyd William and Wyatt Rawson, *The Story of the New Education*, London: Heinemann, 1965.

Bronowski J., *Science and Human Values*, New York: Harper Brothers, 1956.

Butchers A.G., *The Education System- A Concise History of the New Zealand Education System*, Auckland: National Printing Co., 1932.

Campbell A.E. (ed.), *Modern Trends in Education, The Proceedings of the New Education Fellowship Conference Held in New Zealand in July 1937*, Wellington: NZCER, 1938.

_____, New Zealand, *The Year Book of Education 1948*, ed. G.B.Jeffery, London: Evans Bros. of Education, 1948, pp.183-87.

Campbell John, *Rutherford, Scientist Supreme*, Christchurch: AAS Publications, 1999.

Chalmers Alan, *What is this thing called Science*?, Australia: University of Queensland, 2nd edition, 1982.

_____, *What is this thing called Science?*, Indianapolis: Hackett Publishing Co., 3rd Edition, 1999.

Cumming Ian and Alan Cumming, *History of State Education in New Zealand 1840-1975*, Wellington: Pitman Publishing, 1978.

Debre Patrice, *Louis Pasteur*, translated by Elborg Forster, London: John Hopkins, 1994.

Department of Internal Affairs, *Dictionary of New Zealand Biography, Volume 2, 1870-1900*, ed. Claudia Orange, Wellington: Bridget Williams Books, ed. Claudia Orange, 1993.

_____, *Dictionary of New Zealand Biography Volume 3, 1901-1920*, Auckland: Auckland University, 1996.

_____, *Dictionary of New Zealand Biography Volume 4, 1921-40*, Auckland: Auckland University, 1998.

Desmond Adrian and James Moore, *Darwin*, London: Michael Joseph, 1991.

Desmond Adrian, *Huxley: From Devil's Disciple to Evolution's High Priest*, London: Addison Wesley Longman, 1997.

Doll William E. Jr., *A Post-modern Perspective on Curriculum*, New York: Teachers College Press, 1993.

Durant John R., 'Evolution, Ideology and the World View: Darwinian religion in the Twentieth Century', in *History, Humanity and Evolution*, ed. James. R.Moore, Cambridge: Cambridge University, 1989, pp. 355-374.

Feyerabend Paul, *Against Method*, London:Verso, 1994.

Guy George, *Thomas of Timaru, The Life and Work of a Headmaster*, Christchurch: Pegasus, 1974.

Harre Rom, 'History and Philosophy of Science in the Pedagogical Process', *Science under Scrutiny: the Place of History and Philosophy of Science*, ed. R.W.Home, Dordrecht: D.Reidel, 1983, pp.139-157.

Hirst Paul H., *Knowledge and the Curriculum, A Collection of Philosophical Papers*, London: Routledge, 1974.

Hirst P.H. and R.S.Peters, *The Logic of Education*, London: Routledge, 1991.

Hook Sydney, *John Dewey Philosopher of Science and Freedom*, New York: Barnes and Noble, 1967.

Hubback Eva. M., 'Training for Citizenship in the UK', *The Year Book of Education 1936,* ed. Harley Usill, London: Evans Bros., 1936, pp. 528-539.

Huxley T.H., *The Major Works of Thomas Henry Huxley*, ed. Alan P. Barr, Athens: University of Georgia Press, 1997.

Jenkins E.W., *From Armstrong to Nuffield, Studies in Twentieth-Century Science Education in England*, London: John Murray, 1979.

Kandel I.L., *Types of Administration, with Particular Reference to Education Systems of New Zealand and Australia,* Wellington: NZCER, 1938.

Kuhn Thomas S., *The Structure of Scientific Revolutions*, Chicago: University Press, 1962.

Lambourne W.S., 'Recent Developments in New Zealand Education', *Year Book in Education 1936*, ed. Eustace Percy, London: Evans Bros., 1936, pp. 673-79.

Layton David, *Science for the People: The Origins of the School Science Curriculum in England*, New York: Science History Publications, 1973.

Lee Gregory, 'Origins of the Common Core Curriculum', in *The School Curriculum in New Zealand: History, Theory, Policy and Practice*, ed.Gary McCulloch, Palmerston North: Dunmore Press, 1992.

Lyons Sherry, 'Convincing Men They are Monkeys', in *Thomas Henry Huxley, in Science and Letters: Centenary Essays*, ed. Alan P. Barr, Athens: University of Georgia Press, 1997.

Matthews Michael R., *Science Teaching: the Role of History and Philosophy of Science*, New York: Routledge, 1994.

Matthews Michael, *Challenging New Zealand Education*, Palmerston North: Dunmore Press, 1995.

Mayr Ernst, *The Growth of Biological Thought Diversity, Evolution, and Inheritance*, Cambridge: Harvard University, 1982.

Mendelsohn Everett, 'Knowledge Power in the Sciences', *Science under Scrutiny: the Place of History and Philosophy of Science*, ed. R.W.Home, Dordrecht: D.Reidel, 1983, pp. 31-48.

Milner Ian, *Milner of Waitaki, Portrait of the Man*, Dunedin: John McIndoe, 1983.

Moore James, 'Socializing Darwinism: Historiography and the Fortunes of a Phrase', *Science as Politics*, ed. Les Levidow, London: Free Association Books, 1986, pp. 38-80.

McGeorge Colin, 'The Moral Curriculum: Forming the Kiwi Character', in *The School Curriculum in New Zealand: History, Theory, Policy and Practice*, ed. Gary McCulloch, Palmerston North: Dunmore Press, 1992.

Nunn T.Percy, *Education: Its Data and First Principles*, London: E.Arnold, 1921.

Openshaw Roger, Greg Lee and Howard Lee, *Challenging the Myths, Rethinking New Zealand's Educational History*, Palmerston North: Dunmore Press, 1993.

Parton Hugh, *The University of New Zealand*, Auckland: Auckland University Press, 1979.

Raby Peter, *Bright Paradise: Victorian Travellers*, USA: Princeton University Press, 1997.

Report of the Harvard Committee, *General Education in a Free Society*, Cambridge: Harvard University Press, 1950.

Richards Evelleen, 'Huxley and Woman's Place in Science', *History, Humanity and Evolution*, ed. James.R.Moore, Cambridge: Cambridge University, 1989, pp. 253-284.

Scholefield G.H. Dr. (Ed.), *Who's Who in New Zealand and Western Pacific,* Wellington: A.H. and A.W. Reed, 4th Edition, 1944.

Scholefield G.H. Dr. (Ed.), *Who's Who in New Zealand and Western Pacific*, Wellington: A.H. and A.W. Reed, 5th Edition, 1951.

Selleck R.J.W., *The New Education, the English Background 1870-1914*, Melbourne: Pitman and Sons, 1968.

Smidt Lucie, 'Significance of Vocational Education in our Time', *Year Book of Education 1939,* ed. Harley Usill, London: University of London Institute of Education, 1939.

Smith Lester W.O., *Education in Great Britain*, London: Oxford University Press, 3rd Edition, 1958.

Stewart W.A.C., *Progressives and Radicals in English Education, 1750-1970*, London: Macmillan, 1972.

Toulmin Stephen and June Goodfield, *The Fabric of Heaven*, Middlesex: Penguin, 1963.

Walker Eric. C., 'Post-Primary Education and Citizenship', *The Year Book of Education 1939*, ed. Harley Usill, London: Evans Bros., 1939.

Wood F.L.W, *The New Zealand People at War - Political and External Affairs*, Wellington: Government Printer, 1958.

2.2 Articles

Beattie Nicholas, 'Freinet and the Anglo-saxons', *Journal of Comparative Education,* 28:1, 1998, p.3.

Holmes Ernest J., Teaching Biology in the Thirties, *Journal of Biological Education*, 16: 4, 1982, pp. 242-46.

Jenkins E.W., Some Sources for the History of Science Education in the Twentieth Century, with Particular Reference to Secondary Schools, *Studies in Science Education*, Vol. 7, 980, pp. 27-86.

Layton David, 'Science in the Schools: the First Wave - A Study of the Influence of Richard Dawes', *British Journal of Educational Studies*, 20: 1, 1972, pp. 38-57.

Levine George, 'Huxley, the Most Powerful Sage of Them All', *Victorian Studies*, 42: 1, 1998, p. 101.

McManus I.C., 'Examining the Educated and the Trained', *Lancet*, 345: 8958, 1995, pp.1151-54.

Ryan W.Carson, 'The Seventh World Conference of the New Education Fellowship: Education in a Free Society', *School and Society*, 44: 1134, 1936, pp. 361-67.

Whitehead C., 'The Thomas Report - A Study in Educational Reform', *New Zealand Journal of Educational Studies*, 9: 1, 1974.

2.3 Unpublished Thesis

Lee Gregory, *From Rhetoric to Reality*, Doctorate of Philosophy Thesis, University of Otago, 1991.

Nikoloff Lyn, Science is Not an Inductive Process, unpublished, 1999.