

The construction of science in the New Zealand curriculum: The waste stream of curriculum policy making

Joce Jesson

Auckland College of Education

ABSTRACT

The release of the draft curriculum statement *Science in the New Zealand Curriculum* in 1992, the call for submissions and its final release in September, 1993 (MOE: 1993, hereafter the Document) was a rapid process. This Document emerged as the first part of the National Government's Achievement Initiative and the New Zealand National Curriculum. In a review of curriculum policy-making Elsmore and Sykes (1992: 157-215) present a new view of curriculum policy making, explaining the complexity and conflicting nature of curriculum policy. They conceptualise the process as a "garbage or waste stream model". In this paper I will use this model to concentrate on the political process of how this official curriculum came about and how various ideas were incorporated, excluded or changed. Various components fed the 'waste streams' of problems, solutions and ideologies supplying this Document. Some relate to educational ideas, some to political constraints and requirements, while others have definite ideological purposes. The presence of particular ideas is indicated by certain flags or key words, the original ownership and definition of which are a matter of either dispute or interpretation. I will elaborate this thesis below in regard to constructivism in a way which indicates how the Document, as the Minister's document, proclaiming its aim of increasing educational standards and technological understanding in the general population to boost the economy, came to be supported by a wide range of education groups who could have been politically opposed to its message.

Introduction

The release of the draft curriculum statement *Science in the New Zealand Curriculum* in 1992, the call for submissions and its final release in September, 1993 (MOE: 1993, hereafter the Document) was a rapid process. This Document emerged as the first part of the National Government's Achievement Initiative and the New Zealand National Curriculum. The Document generated a number of different responses in the science community, the education community, and in the public arena. It became the focus of the diverse elements of the New Zealand science education debate. Issues included exposing philosophical difficulties for science arising from the constructivist underpinnings of the document (uncovered in the term "Making Sense"), criticisms of the lack of specified content (Matthews, 1993a,b), and of criterion referenced assessment processes (Hanson, 1993). There were also arguments that it lacked originality, either as a new direction in science education, or in addressing the need for socially relevant science (Smythe, 1994: 8). Glimpses of other agendas emerged at the same time: the relationship of scientific knowledge to truth, difficulties in teaching science, curriculum as prescription or guideline, science as elite knowledge,

science as cultural literacy, education levels and standards, educational access and children's ability, education and the determinist State, and curriculum by regulation. Throughout 1993, major debate coalesced into attacking the links between the Document and 'constructivist' theories of learning and conflicts over process or content in science education'. 'Constructivism' had become the convenient catch cry by which to attack the Document, both as the official education policy statement of the National Government, for the direction it proclaimed and for all the perceived shortcomings of New Zealand science education. While the debate was clearly over constructivism in the science curriculum, was it really about the document, the Government's education policy, the policy process or the credentialling role of science education? Was the debate educational or political?

Questions emerged over the role of the curriculum writers. The writers were required to consult and yet they were also part of the debate. They were being cast in the role of impartial State officials whose role was to provide a series of politically acceptable and also achievable policy prescriptions. Yet they were also the agents of the Minister carrying out his wishes. It was unclear whether they were the professionals providing particular professional solutions and required to defend their views, contracted external consultants paid to produce to a predetermined brief, or experienced teachers developing curriculum ideas to share with other teachers and their students.

This confusion of roles was a function of the structure within which the curriculum policy development occurred. The Document was generally supported by much of the science-education community involved with compulsory schooling and general education. It provided space for teacher interpretation, requiring increased pedagogical and professional competency from teachers. It potentially strengthened the teachers' professional knowledge.

In a review of curriculum policy-making Elsmore and Sykes (1992: 157-215) present a new view of curriculum policy making, explaining the complexity and conflicting nature of curriculum policy. They conceptualise the process as a "garbage or waste stream model". In this paper I will use this model to concentrate on the political process of how this *official* curriculum came about and how various ideas were incorporated, excluded or changed.

In this model, various kinds of problems, ideas, and solutions; particular political and ideological contexts for intended political or social action, are 'dumped' by the interested participants (or policy advocates) into the mix of policy decision making. In the process of policy formation the identified political and social problems, their solutions and underlying political ideologies become separated from each other into three "waste streams". The component problems, solutions and ideology merge independently into a sort of 'primeval soup'. The mixing cause particular problems without a related political solution to surface; solutions argued do not reference to any clearly specified problem while the ideological beliefs underpinning the identification of both the problems and the solutions themselves become detached. As the policy making proceeds, ideologies, problems and solutions meld together in "unpredictable and opportunistic ways" and the finished "policies are set in motion" to meet varying legitimation requirements of the authorities. (Elsmore and Sykes, 1992: 190)

In terms of this model the 'curriculum-making community' produces its responses from a situation in which the 'mix in the garbage' or the "policy primeval soup" of problems, solutions and ideologies from various policy advocates is in effect constituted both arbitrarily and historically. The process of curriculum policy making is thus a highly political activity, the result of numerous varied and potentially changing power relationships, not the least of those concerned with matters of legitimation.

In contrast, the orthodox view held by many of the policy advocates and found in the curriculum literature eliminates the politics and portrays curriculum policy making as a purposeful, instrumental and non-political activity. Such views focus on the essential rationality and assumed predictability of both the process and the actors. Underpinning this is an assumption of some type of linear determinant or rational relationship between the various levels or a site of curriculum

formation. The decisions that are made at the State or authority level imply a logical implementation pattern (Table 1) with the double lines signifying what it is assumed will happen in schools. This is expected to result in particular societal outcomes as if bereft of political factors. The logic assumes both the totality of the sites and the linear and non contestable nature of the process. Policy makers make curriculum policy, teachers teach it, society changes and behind it all the shadow of the State provides the power of enforcement.

Government intentions	Official document	Teachers teach	students learn	assessment occurs	Individual outcomes	Societal outcomes
-----------------------	-------------------	----------------	----------------	-------------------	---------------------	-------------------

Table 1: The technical linear relationship assumed between policy intention and social outcomes.

Policy documents are never-the-less essentially political items. They have to be implemented in social systems of heterogeneous people, with their own ideas, beliefs and values. This means that as well as a vision of the future there is also a legitimation role which has to be considered in implementation. Government policy is more effectively implemented though persuasion than force. Although policy documents are productions for an ideal rather than a real world they contain within them expressions of all the various components of problems, solutions and competing ideologies, as the Elmore and Sykes model identifies. The messages in curriculum documents are held by the policy advocates to be self-evidently beneficial, totally predictive, and unquestionably resulting directly in real world action. Policy documents thus suffer from a confusion of *is* and *ought*. This is a matter I will return to later because it is a source of instability and the political challenge of policy. Due to curriculum policy making being considered a non-political activity through the 'primeval soup' process, the competing messages become blurred enabling them to be read in a number of ways.

The waste-streams and primeval soup of science in the national curriculum

I would like to use the 'waste stream' model and examine the specificity of the Document. Various components fed the 'waste streams' of problems, solutions and ideologies supplying this Document. Some relate to educational ideas, some to political constraints and requirements, while others have definite ideological purposes. The presence of particular ideas is indicated by certain flags or key words, the original ownership and definition of which are a matter of either dispute or interpretation. I will elaborate this thesis below in regard to constructivism in a way which indicates how the Document, as the Minister's document, proclaiming its aim of increasing educational standards and technological understanding in the general population to boost the economy, came to be supported by a wide range of education groups who could have been politically opposed to its message.

The political conditions behind the document

The production of the Document occurred in a unique political milieu. First, following the restructuring of the administration of education - the *Tomorrow's Schools* project - the curriculum development process became a contracted-out responsibility of the Learning and Assessment Policy Division of the Ministry of Education. This change created a split between policy and implementation in line with a number of other developments at the time of the State Sector Act. The Ministry of Education was responsible for advice on curriculum direction and funding while the New Zealand Qualifications Authority (NZQA) was responsible for the credentials. Curriculum development was no longer a direct bureaucratic responsibility but a contracted-out quasi-market matter within the constraints of a Ministerial defined policy direction. Consultation was no longer

an input mechanism for policy development but a means of settling implementation details (Jesson, 1995a: 145). Through *Tomorrow's Schools*, public schools were being established as autonomous bodies responsible for their decisions, including curriculum policy and development, under the governance of elected Boards of Trustees. The curriculum direction promoted by the 1984- 87 Labour Government, under the Hon. Russell Marshall, was largely a progressivist one of access and community involvement. This had been largely taken on board by the majority of teachers. The emphasis on devolving decision-making to the community (within broad contractual constraints) extended to curriculum through the incorporation of the language of equity, choice and flexibility.

The policy direction for the centralised compulsory national curriculum, however, derives from the education section of the 1990 National Party Manifesto, reputedly written by Dr. Lockwood Smith. In contrast to Labour, National was promising both a return to more conservative values through the assertion of education standards and an increased level of technical and advanced education for the whole population. In particular, the manifesto promoted the idea that schools were to be both monitored and resourced through a national curriculum which promoted objective standards, compulsory subjects and defined skills. Compulsion and predetermined attainment standards assumed to provide a solution which would increase the levels of achievement of New Zealand children particularly in Maths, Science, English and Technology. The political problem was levels of achievement, the solution was compulsion and testing, with the ideological base a mixture of conservatism, vocationalism and decreasing State spending.

Following the 1990 elections this manifesto became translated into Government policy as the Achievement Initiative. Within the 'waste stream', certain key words act as flags to the incorporation of the Minister's required solutions of improved standards at all levels and efficient allocation of resources.

The Achievement Initiative has three main elements:

1. the establishing of clear **achievement standards** for all levels of **compulsory** education ...
2. the developing of **national assessment** procedures at **key stages** of schooling ...
3. the **allocating of resources** to schools to meet particular **learning needs**.

(Ed. Gazette, 16 April 1991) (my emphasis)

This declaration indicated to many involved in education, particularly those in primary, the potential for a re-run of the experience in the U.K. which had produced an opposition alliance involving local government, academics, teachers and parents. In order to head off such overt legitimisation difficulties, the new policy direction became amalgamated by the Ministry's officials with the developments for a National Curriculum framework already proceeding from the earlier Marshall established 1985-6 Curriculum Review (DE: 1987). This review had been largely supported by teachers.

To fit the new Minister's requirements, the National Curriculum Objectives Statement of this Achievement Initiative constituted four parts:

- The Principles,
- Essential Learning Areas (or subjects),
- Essential Skills, and
- Assessment methods. (Ed. Gazette, 1 May 1991).

The Principles that underpinned the National Curriculum Framework reflect ideas established in the earlier broad Curriculum Review begun in 1985 with some appropriate changes of key words. The Principles were thus a policy assertion of the way curriculum ought to be, which using the vernacular of policy advocates indicated *what it was going to be*. This can be seen in the section quoted below.

The {principles} seek to ensure that the national curriculum provides clear learning objectives; enables achievement and success for all learners, provides a balanced common curriculum which incorporates essential knowledge, understandings, skills and qualities, promotes equal education opportunity, enables progression and life-long learning, provides for relevant, challenging and enjoyable learning, is adaptable and responsive; and recognises the experiences and backgrounds of all New Zealanders. (Ed. Gazette, 16 April 1991)

This is a statement of aims for education for a country still believing in equality of opportunity. As Codd et. al. (1992) have noted, the Achievement Initiative was thus Janus-faced from its beginning. The Achievement Initiative could be seen, by those who chose to so read its Principles, as a re-statement of the possibilities of progressivist education. It also carried with it the Minister's National Curriculum objectives, the more conservative elements of measurable behavioural objectives. Both of these views, the progressive and the socially conservative, were jostling in the policy 'waste stream' to produce a more technologically literate society. Measurement was potentially being applied to both progressive and conservative components. Which view prevailed would be a matter of power and control and just who was asking what questions, as the following snippet demonstrates.

Schools will need to demonstrate that their learning programmes allow **all** of their **students** to have access to the full range of **Essential Learning Areas** and **Essential Skills**. They must show that the national curriculum objectives - **the achievement aims and objectives of the basics and other subjects** are part of their curriculum (Ed. Gazette, 1 May 1991). (My emphasis)

These ideas of 'a full education for all students' were moved (via their particular flags) into the policy brief drawn up by those in the Ministry of Education responsible for setting out the contractual requirements. This provided the terms of reference for selecting appropriate curriculum developers including those for the Science Curriculum.

The Ministry intends to let contracts to assist in the development of the **government's achievement initiative in science** The Curriculum Statement will describe the **aims for science education** together with **levels of achievements** for those aims (Ed. Gazette, 1 May 1991). (My emphasis)

The contractual constraint included in the Ministerial directive was that the Document be written with eight levels of achievement, each having specified learning outcomes and appropriate examples of assessment. Given the political climate surrounding education at the time and with the experience of England and Scotland, a confrontation between the Government and teachers over the curriculum did not auger well politically for implementing any new curriculum. What was required was a document which would put the Minister's requirements into a form which would at least be accepted and taken on board by teachers. It required a Document which teachers and the parents in the mainly primary school Boards of Trustees would feel they could agree with.

The other layer in the Document contains a theory of teacher development. As the education jargon had it, real curriculum change only occurred through teacher development. What was required was a document which legitimated the new curriculum direction for technological and scientific literacy to the schools, the teachers and the community, ie. the electorate. We need to keep in mind the various aspects of that shifting legitimation role which was an important function for this Document.

Contracting writers

The initial call for tenders for curriculum writers specified that potential contractors have a familiarity with recent research in science education and an in depth knowledge of the current syllabuses as well as the earlier draft Form 1-5 syllabus in Science (Ed. Gazette, 1 May 1991). The draft had been undertaken during the previous regime and was at the time sitting unsigned and not accepted on the new Minister's desk (MOE, 1990). A 'familiarity with recent research in science education' in New

Zealand tended to mean work done within a 'constructivist' paradigm such as that at Waikato University. Within recent years this work had moved from a consideration of cognitive matters towards investigating various approaches to teaching. The contract brief established a continuity between the Ministerial requirements, the new orthodoxy in science education, some pedagogical innovations occurring in classrooms around the country and theories about teacher professional development.

In addition the successful contractor was required to identify, form, and manage a working group of science educators (ie. teachers) from junior primary to senior secondary levels covering both rural and urban schools (Ed. Gazette, May 1991). This group, in the jargon of education, were considered to be exponents of 'best current practice'. It was a model which validated the idea of 'effective teachers' as curriculum leaders and recognised the role of professional responsibility. To monitor the process a Ministerial policy advisory group was formed. (This did not occur until the end of 1991 which meant that the Document was largely written before the Minister's Advisory Body came together).

The time constraints

The original requirement as advertised in May 1991 was that all the work including the consultation was to be completed within six months (Ed. Gazette, 1 May 1991). In September 1991 a progress statement on curriculum issued by the Ministry required the drafts be trialed in schools during 1992, ready for implementation in 1993. The uncertain political environment and the industrial climate surrounding schools throughout 1992 increased the importance of legitimating persuasion through the Document.

The curriculum writing group, working under tight time constraints, produced a draft in which a pedagogical process designed to meet the objectives was illustrated through a number of suggested topics, various activities and possible assessment tasks. The conflict in its purpose between mandated requirement and a permissive teachers' guide to practice continued throughout the Document. The behaviourist framework of specified Achievement Objectives are provided for each contextual strand at every level. These form the constraints for implementation in schools. These various achievement levels are slotted together into a developmental model with each classroom assumed to contain children performing at a number of these levels of achievement, increasing the pedagogical decision-making involved in the establishment of each unit of work. This makes the objectives difficult to assess by outside monitors in the classroom.

To provide both feedback and teacher involvement during the tight politically-required timeline, a number of education groups were incorporated into the feedback process. The largely secondary Science Teachers Association, NZSTA, (now NZASE²) became part of the consultation process, circulating and commenting on various drafts as they were developed (Ed. Gazette, 15 Nov 1991). This support legitimated the Document for these science teachers and moved the focus of the Document for teachers from its specified regulatory outcomes towards viewing it as a permissive statement of aims.

NZEI and PPTA the teacher unions were also supportive of permissive curriculum developments. Throughout the *Tomorrow's Schools* reorganisation PPTA, the secondary teachers union, had actively pursued a 'search and rescue operation' for curriculum, fearing that it had been allowed to fall through the cracks (Capper 1992). During the second half of 1992, PPT A declared a moratorium on curriculum, as a weapon in their on-going industrial dispute about the employment contract and the salaries bulk funding of schools. The moratorium slowed down the curriculum development process and played havoc with the Minister's tight time-lines. Coincidentally this enabled more time for teachers to become familiar with the presented ideas and increased its legitimisation role as a Document for teaching science to **all** children. The Document gained more support from the two major interest groups with potentially the most power to actively oppose

curriculum developments: PPT A and NZASE. The support for teacher professionalism had also been made at the time by those opposed to the teachers' actions in the industrial arena (Education Forum, 1992).

A multi-purpose document

What is the stated purpose of this Document? Science is proclaimed as being for all children, including those with special abilities in science (and presumably those ordinary mortals with no special ability), those with special learning needs, as well as the particular interests of girls and Maori. The Document promotes what is now being called an inclusive education predicated on concepts of equality of access. Science education is seen to contribute "to the growth and development of all students, as individuals, as responsible and informed members of society and as contributors to New Zealand's economy and future" (MOE 1993: 9). Education will deliver the required economic growth for both the nation and its individual citizens. Such a demand provides the political rationale for education.

The Document has a specific and more definite purpose. It is to be the national science curriculum for all levels of schooling and for all children, from J1 to Form 7, from 5 year old boys to 18 year old women as well as a measure of achievement levels. The science content of the curriculum, in the traditional sense of the content of the disciplines of science, is contained within four contextual or discipline strands. These are Making Sense of: ... the Living World, the Physical World, the Material World, and Planet Earth and Beyond. Interweaving these are two integrating strands which relate to scientific process and history and ways of thinking: Making Sense of the Nature of Science and its Relationship to Technology, and Developing Scientific Skills and Attitudes. Each of these six strands are derived from, and have embedded in them, the National Curriculum Framework of Essential Skills, which extends throughout schooling. This blurring of primary and secondary school differentiation in one curriculum has now come to be called the *seamless curriculum*.

The Document is not a prescription or even a syllabus. The individual school programmes or courses of study are to be developed within the chartered responsibilities to the State by each school's Board of Trustees, whether public, integrated or private. While there is a legal requirement for schools to develop programmes to implement these Achievement Aims, the Document is a guide for teachers' practice and a motivator for improving teaching performance at school level.

Acceptance of this Document by teachers was assisted through the political message that ongoing professional development would be provided for teachers in the task of deepening their curriculum skills. Classroom teachers examining the Document during the consultative phase were relieved to find the wide range of exemplars and suggestions for teaching. The content of existing courses would still be incorporated. Teachers' views in this are essentially pragmatic: what is it I am required to do? how is it different from what I do now? can I do it? what do I need?

Constructivism is just one of the ideas behind the Document, flagged by the words such as 'making sense'. Constructivist words make the Document appear user-friendly for teachers. Constructivist related ideas are loosely defined applying equally to an investigation-based or activity-oriented pedagogy, as well as allowing teacher choice of the learning programmes.

There are a number of other potentially contradictory ideas present in the Document. Overall it is a 'behaviourist' document which has mandated Achievement Aims and specified learning objectives. Such a behaviourist framework implies a top down prescriptive logic to be followed. This portrays teachers directly as the State's agents putting into place the required knowledge and values. Such a regulatory model needs some form of monitoring or policing: an audit agency, national examinations, supervision and inspection and a restriction of choice. It is often interpreted as an anti-professional proletarianising one in which teachers as operatives cannot be trusted to deliver the goods without detailed supervision.

The mandated requirements are met and evaluated within various topic contexts using a variety of practical activities and assessment tasks chosen by the teachers. Suggested learning activities promote the investigation-centred pedagogy claimed to be derived from constructivism (Matthews, 1993b). Equally however they might be limited recipe-type activities or even demonstration procedures within a traditional classroom. The difference in interpretation is a matter of the pedagogical decisions and levels of teaching skill. This approach increases the importance of teacher's knowledge and power at the same time requiring higher levels of teacher knowledge. It signals high demands for teacher in-service and professional development.

Solving various educational problems

As well as the Minister's requirements for national curriculum objectives, essential skills, specified achievement aims, and clear learning outcomes, the Document also was required to solve a number of other concerns or problems. The education of children at primary, Forms 1 and 2 and junior secondary; the development of *science for all* were examples of such concerns. According to the beliefs of teachers working in this area, the problems of science at this level are solved if science education is interesting, involving and about hands-on real-life activities. Science education in this view was a matter of generating ongoing enthusiasm both for science and for a technological world. This perspective can also be seen as a means of developing a functional literacy in science as part of mass culture.

There was also a contractual requirement from the Ministry of Education for equity, to make sure that the interests of Maori and girls were incorporated. In the Ministry of Education jargon, the Document needed to show the *removal of barriers to achievement* (Ed. Gazette, 15 Nov 1991). This is an example of a self-evidently beneficial and predictive outcome held by its advocates as being able to be implemented in the real world.

Table 2 sets out some components of disparate educational ideologies. These ideas can be found throughout the Document. There is no real consistency in the way the various bits are put together.

Educational Ideology	Theory of learning	Pedagogy	Form of assessment	Social outcome
<ul style="list-style-type: none"> • Education as natural growth • Socialisation 	<ul style="list-style-type: none"> • Deweyan • Constructivism 	<ul style="list-style-type: none"> • Pure enquiry • Experiential • Socialised instruction 	<ul style="list-style-type: none"> • Diagnostic and formative. • Individual projects 	<ul style="list-style-type: none"> • Better democracy • Social cohesion • Social equity
<ul style="list-style-type: none"> • Education as performance • Instrumental 	<ul style="list-style-type: none"> • Behaviourism • Empiricism 	<ul style="list-style-type: none"> • Specified objectives • Guided discovery • Learning by doing 	<ul style="list-style-type: none"> • Meeting achievement objectives 	<ul style="list-style-type: none"> • Individual benefit • Functional literacy • Economic gain
<ul style="list-style-type: none"> • Education as civilised culture • Intrinsic worth 	<ul style="list-style-type: none"> • Rationality and training of faculties • Inculcation into the discipline 	<ul style="list-style-type: none"> • Demonstration • Expository • Transmission and direct instruction. 	<ul style="list-style-type: none"> • Summative • Direct testing of knowledge. 	<ul style="list-style-type: none"> • Social separation • Elitism • Individual economic gain

Table 2: Some of the educational components of the Science Curriculum Document primeval soup.

Being an official statement of State policy various other problems and solutions to do with the function of schooling in society become important. In this way the Document takes on a legitimisation role. Since it is a Science Document the formation process also encompasses various problems and solutions which derive from advocates of science. These science policy advocates have various understandings of the purpose of science education (Table 3).

Role of science	Function/ of science education	Accepted Solution	Function/ of schooling	Societal solution
Body of knowledge	Transmission of culture	Increased knowledge	Credentiailling	General scientific literacy and understanding
Creation of knowledge	Selection mechanism	Entry to a discipline	Social cohesion	Technological understanding and advancement
A way of seeing	Scientific understanding	Scientific literacy	Socialisation	Social equity
Instrumental	Access to power	Economic return	Individual achievement	Economic development

Table 3: Some of the science primeval soup components for science education. (Read up and down not directly across)

Using the 'primeval soup model', instead of a direct imposition of expert scientific opinion, each of these separate components of various solutions and problems relating to science becomes detached from its ideological base and goes into the mix with the other problems, solutions and beliefs relating to education.

Out of all this emerged the final Document with many of the components in Tables 2 and 3 in some form or other - their presence flagged or implied by particular key words. The layout of the Document was determined by Ministerial decree for political purposes but the content and the choice of pedagogy is a matter for individual school choice.

Providing spaces for teacher interpretation and incentives to upskill

The required achievement aims and learning outcomes at each level were written with a broad brush, providing the room for teacher choice and the potential for professional decision-making. Implementation required professional skills as well as a strong background in science content. A higher degree of pedagogical understanding was needed from many secondary teachers and higher levels of science content knowledge in primary teachers. Both were necessary in order to adapt and develop various aspects of scientific knowledge and to put this into appropriate activities for children as well as develop a structured and challenging programme of learning which could meet the varied demands set by different communities. In effect the Document produced a demand for massive teacher up-skilling.

An example; the Achievement Aims of the strand *Making Sense of the Living World* requires that gradually from age 5 through to 18,

In their study of the living world, students will use their developing scientific knowledge skills and attitudes to:

1. gain an understanding of order and pattern in the diversity of living organisms, including the special characteristics of New Zealand plants and animals (MOE, 1993: 52).

This contains the potential for a great deal of implied ecological knowledge and understanding that is to be gained by age 18.

At level one (Junior Primary), this Achievement Aim becomes the achievement objective that:

Students can:

1. share their experiences relating to the living world and group the living world according to some of its attributes, *eg. living, non-living, plant animal, ...* (p. 54)

How deep the sharing of the understanding of the ecological world from these children is to be and which experiences the teachers draw from or provide is a matter for the individual schools. The resources of the school, both intellectual and physical, become critical differentiators. This same Achievement Aim becomes extended as we move up the levels so that by level 6 (Form 5) it is expected that:

Students can:

1. Investigate and describe examples of different types of helpful and harmful micro-organisms, *eg. bacteria/fungi, viruses and diseases ...* (p.64)

Here there is more direction yet the choice of the specific content, its depth and the assessment of this objective is still largely a matter for school and teacher decision-making within prescriptions set by the assessment bodies such as NZQA.

The writing party wrote each objective for experienced practitioners who were confident in their professional decisions and strong in their pedagogical and scientific understanding. The content of each particular programme thereby resided with the teachers and the resources available. The suggested learning activities and accompanying assessment examples found in the Document were just that - examples of possibilities in programme design. They were not State determined requirements.

In this account I have provided some explanation as to the formation of the Document and why the organised teachers supported it. The Document was a permissive statement. It continued a model that had been developed for primary schools. Incorporated were a number of varying problems and solutions. It legitimated teachers' professional status and allowed political space for the interpretation of the various key words.

The teachers of senior science subjects had a potential concern over the content for those progressing on to further education in science subjects. This concern was addressed to the satisfaction of the NZASE through the Achievement Aims and the achievement objectives found in both the contextual and integrating strands. A more pressing issue for senior secondary schools was their credentialling function. This was now a responsibility of NZQA who were promoting internal assessment as a separate process - part of an integrated framework of qualifications (Jesson, 1995b)

Preserving science from mass society

I will now consider the interests of those opposed to this Document. Although the Document was not intended as an assessment prescription, the silence in the prescribed content and assessment for senior secondary schools was behind much of the criticism which arose from the academic science community and some of the senior science teachers. They had accepted the changes of the new education structures. For them schools had a selection role to play as the gate-keepers of science. Science education for this group is typically only about secondary schools. Much of the Document (levels 1-4), on the other hand, related to primary school science education.

Their policy advocates sought, albeit between the lines, a 'science education for some' rather than 'science education for all'. They needed to see this view specified in the Document in traditional terms as assessable content. This view assumed the technician model of curriculum development with science as a strongly-framed collection code (Bernstein, 1971) assessed to be accessible to a few. This view had been the motivating force of the earlier secondary syllabuses which had developed under a strong centralised State.

With the abolition of the UEB and the formation of the NZQA the curriculum development process for senior secondary schools had been fragmented. External assessment in secondary schools had been moved from the Universities to the NZQA, which promoted an ideal of assessment in which everyone might succeed. This credentialling shift threatened the continuation of the selective tradition.

What was being offered in the Document, which was the Ministry of Education responsibility, was a model of science education as a much more weakly-framed even integrated code in which the specific content and processes chosen for the curriculum enacted rested with the teachers and even the children, rather than arising from university defined credentialling. The exact content of a course, its assessment and so the understanding required for entry to the discipline, was therefore potentially a matter of 'mass culture'. Science through this could no longer claim its traditional status as high culture. Science itself was under threat.

There was some attempt by the writing group to incorporate various components of this view as permissible possibilities. This did not prove sufficient to placate these external policy advocates. So the debate moved back to the public arena. Various components of the science 'waste stream' were promoted for an alternative policy position reinforcing credentialling. This produced the confusion of the 'constructivism' and assessment debate.

Debates over whether the Document was a process or content one to a large extent missed the point. All science concepts are contextually bound and it was this which the Document recognised by giving the choice of the contexts and thus the selection of the content and processes to the teachers. It was possible to continue to teach the existing programmes within its set aims. The Document acted as legitimising the new structures, setting out broad constraints, recognising professional skills. In contrast to other aspects of the education changes, the constraints on curriculum were broad with democratic ideals of accessibility and inclusion having priority over gate keeping or directly economic ideals for education.

Public criticisms of the Document have died down in the public arena with the establishment of specific curriculum documents for senior courses in Biology, Chemistry and Physics and the various unit standards. NZQA and its unit standards model of assessment has now become the target. The possibilities of teacher interpretation at senior levels has been reduced to providing more interesting and effective ways of credentialling.

Concerns about 'constructivism and science education' and of implied falling standards in University courses are important as interest concerns. The identity of the scientists and the preservation of their traditional disciplines (in particular, physics) appeared intimately connected to the continuation of the selective nature of schooling. Hence their concern when the Document did not reflect their beliefs. While the document writers focused on pedagogy, the scientists focus was on content, assessment, and the outcomes of the process.

Here I would like to note a particular irony. Not only was the structure of education changing but the function and process of science itself was also shifting. The scientism of economics was being visited on the scientists. Scientists as an occupational group were being made subject to a model of behaviour through the imposition of required outcomes. No longer were notions of pure knowledge the bench mark of excellence but economic rationalism was now concerned about notions of sale and return on investment as the measure of excellence. Science was no longer considered important for its intrinsic worth or contribution to civilised culture, but for its instrumental and economic use. Science itself was thus being converted by economic forces into mass-culture. Pure science had poor market value. University science courses were becoming foundation courses for applied vocational programmes such as planning, engineering, computing, or resource management. Universities themselves were under threat from Polytechnics.

The major assumption of all the various advocates of curriculum policy was that education has a societal outcome: that education was a driving force and can actively change society. So that

among all the various problems and solutions there continued general agreement about increasing the populace's appreciation of and skills in science and that this was achievable and self-evidentially beneficial. The intention of all the various advocates was to produce a population with an increased technological awareness and understanding of science. The ends appeared similar. The problems raised and the solutions they sought differed. The differences were political.

The Document *Science in the New Zealand Curriculum* is a product of a changing State form in New Zealand education. It emerged through a fragmentation of policy formation, writing and implementation. Out of the 'primeval soup' which produced it there is much in common with earlier New Zealand primary curriculum policy documents. It is utilitarian, pragmatic and infinitely hopeful. Perhaps in a society increasingly again being structured by wealth, the Document's major legitimisation role was just a means of keeping hope in accessible education alive for teachers. The hope was that education could make a difference and that they were professionals still able to make decisions about their students.

Acknowledgements

Note: My thanks go to Alan Burton, Mavis Haigh, the various members of the writing team and my Department colleagues for the discussions which helped me write this paper. Needless to say the interpretations are my own. Useful feedback came from the reviewer of this paper for which I am grateful.

Notes

1. Notes taken by this author during seminars on 'constructivism' during 1993
2. New Zealand Association of Science Educators.

References

- Bernstein, B. (1971) On the Classification and Framing of Educational Knowledge, in Young, M.F.D. (Ed) *Knowledge and Control*. London: Collier-Macmillan.
- Capper, P. (1992) Curriculum 1991, in Manson, H. (Ed) *NZ Annual Review of Education 2*. Wellington: Victoria University of Wellington.
- Codd, J., McAlpine, D. and Poskitt, J. (1992) *The Reform of Student Assessment in New Zealand: Whose agenda? What Effects?* Deakin: Paper presented at AARE/ NZARE Joint Conference.
- Department of Education (1987) *The Curriculum Review*. Wellington: Department of Education (DE).
- Elsmore, R. and Sykes, G. (1992) Curriculum Policy, in Jackson, P. (Ed) *Handbook of Research on Curriculum: a project of the AERA*. New York: Macmillan, 157-215
- Education Gazette (1991-1993) Wellington: Ministry of Education.
- Education Forum (1992) *Better Teachers for Better Learning*. Auckland: Education Forum.
- Jesson, J. (1995a) The PPTA and the State: from militant professionals to bargaining agent. A Study of Rational Opportunism, *Ph.D. Thesis*. Auckland: University of Auckland.
- Jesson, J. (1995b) Curriculum in New Zealand: policy by dodgems?, *Educational Review*, 47, 2 (in press).
- Hanson, M. (1993) High Schools enter a make believe world, *NZ Herald*, 10 August.
- Matthews, M. (1993a) Curriculum reform degrades science, *NZ Herald*, 26 August.
- Matthews, M. (1993b) *Constructivism in New Zealand Science Education*, Paper presented at University of Auckland.
- Ministry of Education (1993) *Science in the National Curriculum*. Wellington: Learning media, MOE.
- Ministry of Education (1990) *Science 1-5 Draft Syllabus statement*. Wellington: Learning media, MOE, CRIS, 1-5.
- Smythe, K. (1994) *Developmental Network*. Newsletter No. 2.